

SECTION 02072
DEMOLITION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Remove existing paving and site structures where noted on drawing and restore remaining portion of drive/streets to remain to match adjacent areas.

1.02 RELATED WORK

- A. Section 01005 - Administrative Provisions
- B. Section 01500 - Construction Facilities and Temporary Controls
- C. Section 01700 - Contract Closeout: Project record documents.

1.03 SUBMITTALS

- A. Submit demolition and removal procedures and schedule under provisions of Section 01300.

1.04 EXISTING CONDITIONS

- A. Conduct demolition to minimize interference with adjacent building areas or utilities. Maintain protected egress and access at all times.
- B. Provide, erect, and maintain temporary barriers and security devices.
- C. Identify existing elements to remain where indicated on construction drawings, if any.

PART 2 - PRODUCTS
Not Used

PART 3 - EXECUTION

3.01 PREPARATION

- A. Erect and maintain temporary barricades to protect adjacent streets (see 01500).
- B. Protect existing items which are not indicated to be altered.

3.02 EXECUTION

- A. Demolish in an orderly and careful manner sawcutting as required for clean break from existing to remain. Protect existing paving.
- B. Immediately remove demolished materials from site.
- C. Do not burn or bury materials on site. Dispose of debris from demolition at approved waste dump areas, to comply with Parish requirements. Upon completion of work, leave areas of work in clean condition.

END OF SECTION

**SECTION 02230
CLEARING AND GRUBBING**

PART 1 - GENERAL

- 1.01 DESCRIPTION:** This item shall consist of clearing and grubbing including the disposal of materials, for all areas within the limits designated on the plans or as required by the Engineer.

Clearing and grubbing shall consist of clearing the surface of the ground of the designated areas of all trees, stumps, downed timber, logs, snags, brush, undergrowth, hedges, heavy growth of grass or weeds, fences, structures, debris and rubbish of any nature, natural obstructions of such material which in the opinion of the Engineer is unsuitable to remain beneath the foundation of the proposed construction. Included shall be the grubbing of stumps, roots, matted roots, foundations, and the disposal from the project of all spoil materials resulting from clearing and grubbing by burning or otherwise. Any marketable timber shall be the property of the Contractor.

1.02 RELATED WORK

- A. 02300 Excavation and Backfill for Buildings
- B. 02900 Sodding

1.03 REFERENCES (Not Applicable)

1.04 DEFINITIONS (Not Applicable)

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 RESTRICTIONS ON BURNING

- A. General: Burning operations shall meet all requirements of the Louisiana Department of Environmental Quality, the State Fire Marshal and local fire control agencies.
- B. Outdoor burning, in other than rural park or rural recreation area, of trees, brush, grass and other vegetable matter from such area will be allowable in land clearing and right-of-way maintenance operations so long as the following conditions are met:
 - 1. prevailing winds at the time of the burning must be away from any city or town, the ambient air of which may be affected by smoke from the burning;
 - 2. the location of the burning must be at least 1,000 feet from any dwelling other than a dwelling or structure located on the property on which the burning is conducted;
 - 3. care shall be used to minimize the amount of dirt on the material being burned;
 - 4. heavy oils, asphaltic materials, items containing natural or synthetic rubber, or any materials other than plant growth which produce unreasonable amounts of smoke may not be burned; nor may these substances be used to start a fire;
 - 5. the burning may be conducted only between the hours of 8 a.m. and 5 p.m. Piles of combustible material should be of such size to allow complete reduction in this time interval; and
 - 6. the burning must be controlled so that a traffic hazard is not created.

- 3.02 LAYOUT OF WORK:** Layout of work will be as specified in the General Requirements of these specifications.

- 3.03 CLEARING:** The areas to be cleared shall be completely stripped of all trees, logs, stumps, brush, vegetation, rubbish or other perishable or objectionable matter. Such individual trees as the Engineer may designate or mark within any clearing area shall be left standing and uninjured. All trees not required to be moved shall be carefully protected.

Material without value shall be piled in the limits of the right-of-way or easement and burned or otherwise disposed of in such a manner as not to injure any trees or other property on the right-of-way or abutting property.

Trees, brush, stumps, etc., not burned shall not be deposited on adjacent lands, but shall be disposed of lawfully in spoil areas obtained by the Contractor.

It shall be the Contractor's responsibility to remove, load, haul, and dump all materials required to make the right-of-ways and sites ready to construct the facilities as planned.

3.04 GRUBBING: All stumps, roots, and other objectionable materials within the area designated for clearing and grubbing shall be removed and disposed of.

The Contractor shall root rake the entire area within the limits shown on the plans. All tubular roots from any palmetto plants on the site shall be removed before any embankment work commences.

PART 4 - MEASUREMENT AND PAYMENT

4.01 CLEARING AND GRUBBING

- A. Measurement:** No measurement will be made for clearing and grubbing work as a separate item, but shall be included in other items as specified.
- B. Payment:** Clearing and Grubbing payment will be paid for in the various bid items as specified.

END OF SECTION 02230

SECTION 02281
TERMITE CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Soil treatment below slabs-on-grade for subterranean insects.
- B. Soil treatment at interior and exterior foundation perimeter, for subterranean insects.

1.02 RELATED WORK

- A. Section 02200 - Backfilling: Backfill materials.

1.03 REFERENCES

- A. EPA - Federal Insecticide, Fungicide and Rodenticide Act.

1.04 QUALITY ASSURANCE

- A. Applicator: shall be licensed and bonded within the State of Louisiana per State Statutes.
- B. Applicator: Company specializing in soil treatment for termite control.
- C. Materials: Provide certification that toxicants conform to requirements of authority having jurisdiction.
- D. Material Packaging: Manufacturer's labels and seals identifying content.

1.05 REGULATORY REQUIREMENTS

- A. Conform to State of Louisiana requirements for application licensing and authority to use toxicant chemicals.

1.06 PRODUCT DATA

- A. Submit product data under provisions of Section 01300.
- B. Indicate toxicants to be used, composition by percentage, dilution schedule, and intended application rate.
- C. Submit manufacturers installation instructions under provisions of Section 01300.

1.07 PROJECT RECORD DOCUMENTS

- A. Submit documents under provisions of Section 01700.
- B. Accurately record moisture content of soil before treatment, date and rate of application, areas of application, diary of meter readings and corresponding soil coverage.

1.08 WARRANTY

- A. Provide five year warranty for material and installation under provisions of Section 01700.
- B. Warranty: Cover against invasion or propagation of subterranean termites, damage to building or building contents caused by termites; repairs to building or building contents so caused.

- C. Inspect work annually and report in writing to Owner.
- D. Owner reserves right to renew warranty for an additional year after initial 5 year warranty.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Cyper TC Insecticide, by Control Solutions, Inc. 5903 Genoa-Red Bluff Rd, Pasadena, TX 77507
- B. Demon, by Zeneca
- C. Prevail, by FMC
- D. Dursban T-C - Dow Elanco
- E. Tenure - DowElanco
- F. Dragnet FT - FMC
- G. Tribute - AgrEvo
- H. Durban 75WG- DowAgro Sciences
- I. Prelude (Torpedo) - Zeneca
- J. Substitutions: Under provisions of Section 01600 and Instructions to Bidders, Article 4.3 Substitutions.

2.02 MATERIALS

- A. Toxicant Chemical: Waterbased emulsion, uniform composition, synthetic dye to permit visual identification of treated soil, of the generic chemical chlorpyrifos.

2.03 MIX DILUTION

- A. Dilute toxicant chemical in accordance with manufacturers recommendations.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify the soil surfaces are unfrozen, sufficiently dry to absorb toxicant, ready to receive treatment.
- B. Beginning of application means acceptance of soil conditions.

3.02 APPLICATION

- A. Apply toxicant immediately prior to installation of vapor barrier under slab-on-grade or finish grading outside foundation walls.
- B. Apply toxicant in accordance with manufacturer's labeling instructions.
- C. Apply extra treatment to structure penetrations, pipe, ducts, and other soil penetrations.
- D. Apply as a coarse spray to ensure uniform distribution.

- E. Coordinate soil treatment at foundation perimeter with finish grading and landscaping work to avoid disturbance of treated soil. Retreat disturbed treated soil.
- F. Within 12 months after initial treatment of the outside of the foundation, the perimeter shall be trenched and treated as required by label and labeling. The licensee shall report the completion of the application to the outside of the foundation, to **the Louisiana Department of Agriculture and Forestry** on the Termite Perimeter application form. Rodding will be acceptable where trenching may damage flowers and/or shrubs. Maximum distance between rod holes shall be 4 inches.

3.03 RETREATMENT

- A. If inspection identifies the presence of termites, retreat soil and retest.
- B. Use same toxicant as for original treatment.

END OF SECTION

**SECTION 02300
EXCAVATION AND BACKFILL FOR BUILDINGS**

PART 1 - GENERAL

1.01 DESCRIPTION: This item covers excavation, disposal, placement, and compaction of all materials within the limits of the work required for building construction, drives, parking, drainage or other purposes in accordance with these specifications and in conformity to the dimensions and typical section shown on the plans.

1.02 RELATED WORK

A. 02230 Clearing and Grubbing

1.03 QUALITY ASSURANCE

A. **Codes and Standards:** Perform earthwork complying with requirements of authorities having jurisdiction.

B. **Testing and Inspection Service:** The Owner will employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing. The Contractor shall coordinate his work with the laboratory and cooperate in the performance of the testing work.

PART 2 - MATERIALS

2.01 SOIL MATERIALS

A. **General:** Provide approved soil materials from off-site when sufficient approved soil materials are not available from excavations.

B. **Select Fill:** Imported select material shall be an AASHTO A-2-4 through A-2-6 classification with a Plasticity Index (PI) less than 20. The material shall be placed in 10" thick loose lifts and compacted to 95% of standard Proctor density when tested in accordance with AASHTO T99.

PART 3 – EXECUTION

3.01 GENERAL: Before beginning excavation, grading, and embankment operations in any area, the area shall be completely cleared and grubbed in accordance with Section 31 11 00 of these specifications.

The suitability of material to be placed in embankments shall be subject to approval by the Engineer. All unsuitable material shall be disposed of in waste areas on-site as directed by the engineer. All waste areas shall be graded to allow positive drainage of the area and of adjacent areas. The surface elevation of waste areas shall not extend above the surface elevation of adjacent usable areas, unless specified on the plans or approved by the Engineer.

Those areas outside of paved areas in which the top layer of soil material has become compacted by hauling or other activities of the Contractor shall be scarified and disked to a depth of 4 inches.

3.02 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Provide erosion control measures to prevent erosion or displacement of soils and discharges of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Select fill limits shall extend a minimum of five (5) feet outside the building's limits.

3.03 DEWATERING

- A. Prevent surface water and subsurface or groundwater from entering excavations, from ponding on prepared subgrades, and from flooding the project site. Pump, bail or grade these areas to provide positive drainage and protect subgrades and foundation soils from softening and damage by rain or water accumulation.

3.04 EXCAVATION

- A. Excavate to the indicated elevations and dimensions within a tolerance of plus or minus 0.10 foot. Extend the excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction.
- B. Do not disturb the bottoms of excavations. Excavate by hand to final grade prior to placing concrete reinforcement. Trim bottoms to required lines and grades to leave a solid base to receive other work.
- C. No excavation shall be started until the work has been staked out by the Contractor and the Engineer has been consulted regarding the elevations and measurements of the ground surface. All suitable excavated material shall be used in the formation of embankment, subgrade, or for other purposes shown on the plans.
- D. When the volume of the excavation exceeds that required to construct the embankments to the grades indicated, the excess shall be used to grade the areas of ultimate development, or disposed of as directed. When the volume of excavation is not sufficient for constructing the fill to the grades indicated, the deficiency shall be obtained from borrow areas.
- E. Site grading shall be maintained so that the surface is well drained at all times. When necessary, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the work.

3.05 SUBGRADE

- A. Preparation of the building area subgrade shall be as follows:
 - 1. Remove existing pavement, topsoil and waste in a manner acceptable to project Owner. Replace with select fill as stated herein.
 - 2. Scarify the exposed subgrade a minimum of six inches in depth and recompact to the density specified below.
 - 3. Maintain the moisture content of the existing subgrade soil to a tolerance of 2% below to 2% above the theoretical optimum moisture content.
 - 4. Compact the existing subgrade to 95% of the density defined by ASTM D 698 (Standard Proctor).

3.06 APPROVAL OF SUBGRADE

- A. Notify the Engineer or his representative when excavations have reached the elevation of the required subgrade.

If the Engineer or his representative determines that unforeseen unsatisfactory soil is present, continue excavation and replace with compacted backfill or select fill material as directed. Additional excavation and replacement material will be paid according to the Contract provisions for changes in work. Wet soil that is suitable for subgrade shall be dried and compacted without replacement at no direct pay.

- B. Reconstruct subgrades damaged by weather conditions or construction activities, as directed by the Engineer.

3.07 UNAUTHORIZED EXCAVATION: Fill unauthorized excavation under foundations or wall footings by extending the indicated bottom elevation of concrete foundations or footings to the excavation bottom without altering the required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to the Engineer. Fill unauthorized excavations under other construction as directed by the Engineer.

3.08 STORAGE OF SOIL MATERIALS: Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust and saturation due to rainfall. Stockpile soil materials away from the edge of excavations.

3.09 PLACEMENT OF SELECT FILL

- A. Placement and compaction of select fill:

1. Place select fill on tested and accepted compacted subgrade in thin loose lifts not to exceed eight inch thickness.
2. Maintain moisture content of select fill soil within 2% below and 2% above its theoretical optimum moisture content.
3. Compact each lift to 95% of the density defined by ASTM D 698 (Standard Proctor) for the select fill soils.

- B. Maintain adequate drainage of the disturbed areas during construction to reduce moisture fluctuations in the subgrade. Such measures may include ditches, sumps and/or well points.

3.10 BACKFILL

- A. Backfill excavations promptly, but not before completing the following:

1. Obtain the Engineer's acceptance of construction below finished grade including, where applicable, damp proofing, waterproofing, and perimeter insulation.
2. Concrete formwork removal.
3. Removal of trash and debris from excavation.
4. Removal of temporary shoring, bracing, and sheeting.

- B. Compact backfill to 95% standard proctor density at all areas below paving.

3.11 GRADING

- A. Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

- B. Finish the building subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.12 FIELD QUALITY CONTROL

- A. Allow the independent testing laboratory to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.
- B. When testing agency reports that subgrades, fills, or backfills are below the specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained.

- 3.13 DISPOSAL OF SURPLUS AND WASTE MATERIALS:** Transport surplus satisfactory soil to designated on-site storage areas. Stockpile or spread soil as directed by Engineer. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off-site.

PART 4 - MEASUREMENT AND PAYMENT

- 4.01 EXCAVATION AND BACKFILL:** No separate measurement or payment will be made for excavation and backfill. All materials and labor associated with this work shall be included in the price bid for associated items of work.

END OF SECTION 02300

**SECTION 02510
WATER DISTRIBUTION SYSTEM**

PART 1 - GENERAL

1.01 DESCRIPTION

This item shall consist of water pipe and fittings, together with fire hydrants, valves, valve boxes, etc. necessary to construct the water distribution system for the project. Included shall be the furnishing and installation of all materials, testing and disinfecting, in accordance with these specifications and in conformity with the lines and grades given.

This item shall include, in the bid prices per unit requested, the cost of common excavation and backfill, the cost of furnishing and installing all trench bracing, and the material for and the making of all joints.

1.02 LOCATION OF LINES

The approximate location of lines, valves, fire hydrants, etc., has been indicated on the plans as being within the street, highway or easement rights-of-way. Final locations of the various items of construction shall be established in the field by the Engineer. Any location within said street, etc. may be used.

All costs not specifically listed as a pay item shall be included in the price bid for the item of which the costs are a part.

1.03 LAYOUT OF WORK

Layout of work will be as specified in the General Requirements of these specifications.

1.04 REFERENCE STANDARDS: References shall mean the latest revision of the following standards:

- | | | |
|-----------|-------------------------------|---|
| A. | AASHTO M 36 ----- | Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains |
| B. | AASHTO M 190 ----- | Standard Specification for Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches |
| C. | AASHTO T 99----- | Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop |
| D. | AASHTO T 180 ----- | Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop |
| E. | ANSI/AWS D10.7M/D10.7 ----- | Guide for the Gas Shielded Arc Welding of Aluminum and Aluminum Alloy Pipe |
| F. | ANSI/AWWA C104/A21.4----- | Cement-Mortar Lining for Ductile-Iron Pipe and Fittings |
| G. | ANSI/AWWA C105/A21.5----- | American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems |
| H. | ANSI/AWWA C110/A21.10 ----- | Ductile-Iron and Gray-Iron Fittings for Water |
| I. | ANSI/AWWA C111/A21.11 ----- | Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings |
| J. | ANSI/AWWA C115/A21.15-05----- | Standard for Flanged Ductile-Iron Pipe With Threaded Flanges |
| K. | ANSI/AWWA C150/A21.50 ----- | Thickness Design of Ductile-Iron Pipe |

- L.** ANSI/AWWA C151/A21.51 ----- American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water
- M.** ANSI/AWWA C153/A21.53 ----- Ductile-Iron Compact Fittings for Water Service
- N.** ANSI/AWWA C200 ----- Steel Water Pipe - 6 in. (150 mm) and Larger
- O.** ANSI/AWWA C206 ----- Field Welding of Steel Water Pipe
- P.** ANSI/AWWA C502 ----- Dry-Barrel Fire Hydrants
- Q.** ANSI/AWWA C504 ----- Rubber-Sealed Butterfly Valves
- R.** ANSI/AWWA C509 ----- Resilient-Seated Gate Valves for Water-Supply Service
- S.** ANSI/AWWA C515 ----- Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
- T.** ANSI/AWWA C600 ----- Installation of Ductile-Iron Water Mains and Their Appurtenances
- U.** ANSI/AWWA C651 ----- AWWA Standard for Disinfecting Water Mains
- V.** ANSI/AWWA C700 ----- AWWA Standard for Cold-Water Meters-Displacement Type, Bronze Main Case
- W.** ANSI/AWWA C800 ----- AWWA Standard for Underground Service Line Valves and Fittings
- X.** ANSI/AWWA C900 ----- AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 60 in. for Water Distribution
- Y.** ANSI/AWWA C901 ----- AWWA Standard for Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in. for Water Service
- Z.** ANSI/AWWA C906 ----- AWWA Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4 in. (100 mm) through 63 in. (1,575 mm), for Water Distribution and Transmission
- AA.** ANSI/AWWA C909 ----- Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 in. through 24 in. for Water Distribution
- BB.** ASTM D1599 ----- Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic, Pipe, Tubing, and Fittings
- CC.** ASTM D1784 ----- Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds
- DD.** ASTM D1785 ----- Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
- EE.** ASTM D2241 ----- Standard Specification for Polyvinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)

FF.	ASTM D2464 -----	Standard Specification for Threaded Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
GG.	ASTM D2466-----	Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
HH.	ASTM D2467-----	Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
II.	ASTM D2564-----	Standard Specification for Solvent Cements for Polyvinyl Chloride (PVC) Plastic Piping Systems
JJ.	ASTM D2672 -----	Standard Specification for Joints for IPS PVC Pipe Using Solvent Cement
KK.	ASTM D2855-----	Standard Practice for Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings
LL.	ASTM D3036 -----	Standard Specification for Socket-Type PVC Plastic Line Couplings
MM.	ASTM D3139 -----	Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
NN.	ASTM F477 -----	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
OO.	LADOTD 1007.03 -----	Standard Specification for Bituminous Coated Corrugated Steel Underdrain Pipe
PP.	LADOTD TR 401 -----	The Determination of In-Place Density
QQ.	LADOTD TR 418 -----	Moisture-Density Relationships
RR.	International Building Code, Chapter 29-Plumbing Systems	
SS.	International Residential Code, Part VII-Plumbing	
TT.	International Plumbing Code	

1.05 RELATED WORK

03 30 10 – Concrete for General Construction

PART 2 – MATERIALS

2.01 GENERAL

The pipe and other materials shall be of the type called for on the plans, in the Bid Form and/or in the General Requirements.

All materials in contact with potable water shall meet the reduced lead requirements of Parts XII (Water Supplies) and XIV (Plumbing) of LAC Title 51 (Sanitary Code).

2.02 UNIFORM MATERIAL TYPES

Each type of material, such as pipe, valves, fittings, hydrants, service assemblies, etc., shall be supplied by a single manufacturer throughout the project. Once he begins the project with material of a given type, the Contractor shall complete the project, including all change orders, with material of the original type unless otherwise approved by the Engineer.

2.03 PIPE SHIPPING AND DELIVERY

The pipe manufacturer shall take the necessary steps in handling and shipping the pipe as not to injure the pipe, coating, or lining. Each joint of ductile iron pipe shall be individually stacked on the truck or railroad car bed with adequate support under each joint of pipe and adequate support and protection between each layer of pipe stacked on the vehicle. The entire stack shall be adequately and securely fastened to the truck or rail bed to prevent unnecessary vibrations, movements and stresses in the pipe during transportation.

Polyvinyl chloride plastic pipe (P.V.C.) shall be stacked into bundles (sized that the Contractor can unload one bundle at a time) and the bundle shall be securely banded together with adequate wood boards around the bundle to protect it during shipment. The bundles shall then be stacked on the truck or rail bed for shipment to the job site. The load of bundles shall be securely attached to the shipping bed to prevent unnecessary stresses during transportation. Smaller sizes of P.V.C. pipe may be placed inside larger diameter pipe which is bundled as specified above.

2.04 HANDLING OF ALL PIPE

The Contractor shall handle all pipe with handling and hauling equipment as not to injure the pipe, pipe lining, or pipe coating. Any pipe pushed off the truck bed will be rejected. Adequate equipment shall be used by the Contractor to remove the pipe from the truck bed and string it along the trench location.

If the pipe is to be stockpiled before it is strung along the trench the Contractor shall stack the pipe on a level site in neat stacks. Ductile iron pipe shall be stacked using the timber supports which were used in transporting the pipe. P.V.C. pipe shall be stacked in the bound bundles that the pipe was shipped in and the bundles shall not be broken up until the stringing operation is started.

2.05 DUCTILE IRON PIPE, JOINTS, FITTINGS

A. Ductile Iron Water Pipe: Ductile iron water pipe shall conform in all respects to ANSI/AWWA C 150/A21.50 and ANSI/AWWA C 151/A21.51 standards. The iron shall be fully annealed Grade 60-42-10. The exterior shall have standard coal tar coating. The interior shall be cement mortar lined in accordance with ANSI/AWWA C104/A21.4. Unless otherwise indicated on the plans, Bid Form and/or Specifications, the minimum pressure class for the push-on pipe shall be 350 psi for 3" through 24" diameter, 300 psi for 30" through 42" diameter, and 250 psi for 48" through 64" diameter. 3" through 12" M.J. pipe shall be Class 53.

B. Pipe Joints:

1. Push-on and Mechanical Joints: Push-on joints shall be used unless otherwise indicated on the plans, Bid Form, and/or Specifications. Push-on and mechanical joints shall meet the requirements of the latest revision of ANSI/AWWA C111/A21.11.
2. Restrained Joints: Restrained joints shall be "Fastite" with "Fast-Grip" gaskets as manufactured by American Cast Iron Pipe Company or "Tyton" joint with "Field Lok 350" gaskets by US Pipe & Foundry Company, or an approved equal.

Restrained joints that are subject to movement or vibration in service shall utilize a locking ring feature. Locking ring restrained joints shall be "Flex-Ring" as manufactured by American Cast Iron Pipe Company, "TR-Flex" as manufactured by US Pipe & Foundry Company, "Super-Lock" as manufactured by Clow Water Systems Company, or approved equal.

All means of joint restraint shall be as provided or as recommended by the pipe manufacturer and shall be installed in accordance with the manufacturer's written instructions.

3. **Flexible Joints:** Bolt-on type ball and socket flexible joints shall be as manufactured by American Cast Iron Pipe Company, US Pipe, or an approved equal. Bolts shall be stainless steel conforming to ASTM A296, Grade CA-15.

Boltless type ball and socket flexible joints shall be as manufactured by James B. Clow and Sons, Inc., American Cast Iron Pipe Company, or an approved equal. These joints shall provide a minimum of 15 degrees of deflection per joint.
- C. **Fittings:** Fittings for ductile iron pipe shall be ductile iron fittings conforming to the latest revisions of ANSI/AWWA C110/A21.10 (3" through 48"), or ANSI/AWWA C153/A21.53 (3" through 64"). Fittings shall be pressure rated equal to or greater than the pipe on which they are installed.

Fittings shall be coal tar coated and cement mortar lined in accordance with ANSI/AWWA C104/A21.4.

Fittings shall be of a joint type identical to the joints of the pipe on which they are installed, except that M.J. fittings may be used with push-on joint pipe.
- D. **Bolts, Nuts, Gaskets, Etc.:** Bolts, nuts, gaskets, etc. shall be as specified by the applicable ANSI specification for bolted joints or as recommended by the pipe manufacturer; all subject to the approval of the Engineer. All bolts on flanged or mechanical joint pipe installed underground shall be made from a non-corrosive metal subject to the approval of the Engineer.

2.06 FLANGED DUCTILE IRON PIPE AND FITTINGS

- A. **Flanged Pipe:** Flanged pipe shall conform to the latest revised requirements of ANSI/AWWA C115/A21.15. Pipe thickness shall be as shown on the plans, on the bid form, and/or in the Specifications, and shall have a minimum working pressure of 250 psig unless otherwise specified. Pipe shall be cement mortar lined in accordance with the latest revision of ANSI/AWWA C104/A21.4.
- B. **Flanged Fittings:** Flanged fittings shall be cast or ductile iron conforming to the latest revised requirements of ANSI/AWWA C110/A21.10 for sizes 3" through 48".

Fittings shall be cement mortar lined in accordance with the latest revision of ANSI/AWWA C104/A21.4. Fittings pressure rated at a minimum of 250 psig shall be used unless otherwise specified. Companion flanges shall be Class 125 meeting the latest revised requirements of ANSI/AWWA C115/A21.15

2.07 P.V.C. PIPE, JOINTS, FITTINGS (SDR) (PR)

- A. **Pipe:** All polyvinyl chloride (PVC) pipe which is specified by Standard Dimension Ratio (SDR) or pressure rating class (PR) shall conform to ASTM D 2241. SDR PVC pipe shall be extruded from clean virgin resin which conforms to ASTM D 1784, Class 12454-B (PVC 1120). PVC pipe shall have an integral bell with a locked in gasket.

All pipe shall have the manufacturer's trade name, the NSF seal of approval, the SDR, the internal pressure rating, and ASTM designation D 2241 conspicuously marked on each length of pipe. Pipe shall be SDR 26 unless otherwise specified.
 1. **Class 160:** SDR 26 PVC pipe shall have a minimum internal pressure rating of 160 psig @ 73° F.
 2. **Class 200:** SDR 21 PVC pipe shall have a minimum internal pressure rating of 200 psig @ 73° F.
- B. **Joints:** Unless otherwise specified, integral bell push-on type joints shall be furnished.
 1. **Bell End Push-On Joints:** Integral bell end push-on joints having one elastomeric gasket per joint of pipe shall comply with ASTM D3139 and ASTM F477.

2. Solvent Cement Bell Ends: Solvent weld joints will be allowed only where specifically shown on the plans or called for in the bid form. Where allowed, solvent cement bell pipe joints shall conform to ASTM D 2672.

- C. Fittings: Ductile iron fittings shall be used on pipe sizes 6" and larger. PVC fittings shall be used on pipe 4" and smaller. PVC fittings shall be made from the same resin type meeting ASTM D 1784 as the pipe resin. PVC fittings shall be marked with the NSF seal of approval.

Fittings shall be pressure rated equal to or greater than the pipe on which they are installed.

The wall thickness of PVC fittings shall be such that the SDR of the fitting at any point shall not exceed the SDR of the pipe. Fittings shall be of a joint type identical to the joints of the pipe on which they are installed.

1. Ductile Iron Push-On Fittings: Ductile iron push-on fittings shall comply with applicable portions of ANSI/AWWA C153/A21.53 (3" through 64") or C110/A21.10 (3" through 48") and C111/A21.11 and shall be coal tar coated and cement mortar lined in accordance with ANSI A21.4.
2. Ductile Iron Mechanical Joint Fittings: Ductile iron mechanical joint fittings shall comply with ANSI/AWWA C153/A21.53 (3" through 64") or ANSI/AWWA C110/A21.10 (3" through 48") and ANSI A21.11 and shall be coal tar coated and cement mortar lined in accordance with ANSI A21.4.
3. PVC Push-On Fittings: PVC push-on fittings shall comply with ASTM D3139, ASTM D 1599, and ASTM F-477.
4. PVC Solvent Cement Fittings: PVC solvent cement fittings, where allowed, shall be SCH 40 complying with ASTM D 2466, or SCH 80 complying with ASTM D 2467.

- D. Solvent Cement: PVC solvent cement shall comply with ASTM D 2564 and shall be recommended by and supplied by the manufacturer of the pipe on which it is used.

2.08 SCHEDULE 40 AND 80 PVC PIPE JOINTS AND FITTINGS

- A. Schedule 40 and 80 PVC Pipe: PVC pipe which is specified by schedule number shall comply with ASTM D 1785. PVC pipe shall be extruded from clean virgin resin which conforms to ASTM D 1784, Class 12454-B (PVC 1120). All pipe shall be marked at intervals not less than 5 feet with manufacturer's name or trade mark, the NSF seal of approval, the schedule number and the ASTM designation D 1785. Pipe shall be SCH 40 unless otherwise specified.
- B. Pipe Joints: Below-ground joints shall be gasketed as specified in Paragraph 2.09(B) unless specifically indicated otherwise. Above-ground joints shall be solvent cement unless otherwise specified.
- C. Fittings: Fittings shall be as specified in Paragraph 2.09(C) of this specification with the exception that threaded PVC fittings will be acceptable. Fittings shall be pressure rated equal to or greater than the pipe on which they are installed.

Schedule 40 PVC solvent cement fittings shall comply with ASTM D 2466. Schedule 80 PVC solvent cement fittings shall comply with ASTM D 2467. Threaded fittings shall be Schedule 80 and shall comply with ASTM D 2464.

2.09 AWWA PVC PIPE, JOINTS AND FITTINGS

- A. AWWA PVC Pipe: All PVC pipe which is specified by AWWA pressure class shall conform to AWWA C900 (4" through 60") latest edition. If specifically called for on the Plans, in the Specifications or on the Bid Form, pipe may be AWWA C909 (4" through 16").

Pipe shall be as specified on the plans, Bid Form, or in the Specifications. Unless otherwise indicated, AWWA C-900 and C-909 PVC pipe shall be DR 18 Class 235 cast iron pipe size (CL 235 CIPS). Unless specifically allowed by the Engineer, the Contractor shall not use both C900 and C909 pipe on the same project.

All pipe shall be marked at intervals not less than five feet with the manufacturer's name or trade mark, the NSF seal of approval, the nominal size and OD base, PVC, the dimension ratio, pressure class and the AWWA designation number.

- B. Pipe Joints:** Pipe joints complying with AWWA C 900 and C909 shall be the integral wall-thickened bell type.
- C. Fittings:** Fittings shall be ductile iron push-on type or mechanical joint type complying with ANSI/AWWA C153/A21.53 (3" through 64") or ANSI/AWWA C110/A21.10 (3" through 48") and ANSI A21.11.

Fittings shall be coal tar coated and cement mortar lined in accordance with ANSI A21.4. Fittings shall be pressure rated equal to or greater than the pipe on which they are installed.

2.10 COLOR CODING OF PVC WATER MAINS

Unless otherwise indicated on the Plans or specified in the Bid Form or Specifications, PVC water piping shall be pigmented blue in color for positive identification as water piping. White pipe shall be allowed, provided 3-inch "Water" marking tape is installed directly above the pipe. When marking tape is used, it will not take the place of the required locator wire. Green pipe shall not be used for water applications.

2.11 HIGH-DENSITY POLYETHYLENE PIPE, JOINTS AND FITTINGS

- A. HDPE Pipe:** Polyethylene water pipe shall be PE 4710 manufactured in accordance with AWWA C906, having a minimum cell classification of P.E. 345464C in accordance with ASTM D3350. HDPE pipe shall be manufactured from virgin resin. HDPE water mains shall be Ductile Iron Pipe Size, SDR-11 unless otherwise specified in the project plans, bid form, or Specifications.

All HDPE pipe shall be of a single manufacturer and shall be marked as required by AWWA C906 and shall bear the NSF seal of approval for potable water service. HDPE pipe shall be black in color with a blue stripe or similar markings to indicate potable water service.

- B. Joints:** Pipe shall be joined into continuous lengths on the jobsite, aboveground using butt heat-fusion or electro fusion equipment and instructions provided by or recommended by the pipe manufacturer. Equipment shall be capable of meeting all temperature, pressure and alignment conditions recommended by the manufacturer. All fusion machine operators shall be certified by the pipe manufacturer. Butt fusion joining shall be 100% efficient and shall produce a joint weld strength equal to or greater than the tensile strength of the pipe.
- C. Fittings:** Fittings shall be ductile iron push-on type or mechanical joint type complying with ANSI/AWWA C153/A21.53 (3" through 64") or ANSI/AWWA C110/A21.10 (3" through 48") and ANSI/AWWA C111/A21.11.

Fittings shall be coal tar coated and cement mortar lined in accordance with ANSI A21.4. Fittings shall be pressure rated equal to or greater than the pipe on which they are installed.

Transition fittings required at pipe material changes shall be the Harvey type mechanical joint adapter. Transition fittings shall be of the same DR as the pipe, shall exceed the tensile strength of the pipe, and shall comply with AWWA C-906.

2.12 POLYETHYLENE SERVICE PIPE AND TUBING 3/4" THROUGH 3"

Service pipe and tubing size 3/4" through 3" shall be PE 4710 and shall comply with AWWA C901. Pipe and tubing shall be NSF approved and shall comply with the International Plumbing Code. Service tubing size basis shall match the Owner's existing service tubing, if applicable. Unless, specifically indicated, the Contractor shall verify the Owner's existing service tubing size basis prior to ordering tubing.

- A. **O.D. Base P.E. Tubing:** Unless otherwise indicated, service lines shall be O.D. base P.E. pressure tubing, DR 9.0, pressure Class 200 psi, copper tubing size (CTS), or iron pipe size (IPS), as required.
- B. **I.D. Base P.E. Pipe:** Where specifically shown on the plans or called for on the bid form, service lines shall be I.D. base P.E. pressure pipe, DR 7.0, pressure Class 200 psi.
- C. **Insert Stiffeners:** Service pipe and tubing ends to be installed with compression type fittings and connections shall be fitted with a stainless steel insert stiffener of the correct size for the service pipe or tubing.

2.13 SERVICE ASSEMBLY THRU 1"

The service assembly shall consist of the service saddle, corporation stop, meter stop, meter, meter coupling, and meter box.

- A. **Service Saddles:** Service saddles shall be all brass or bronze and shall be the following or an equal approved by the Engineer:

Main Size & Type	Mueller	Ford
SDR PVC 2"-6"	H 13420 thru H 13431	S70-253 thru S70-603
SDR PVC 8"	H 13433	S70-803
C.I., or CIPS PVC 4"-12"	H 13440 thru H 13444	S90-403 thru S90-1203

- B. **Corporation Stops:** Corporation stops shall be the ball valve type, rated for working pressures of 300 psi, and constructed in accordance with AWWA C800. Corporation stops shall have AWWA corporation stop threads and a tubing connection similar to Ford's "Pack Joint", sized to fit the specified service line tubing. Corporation stops shall be Mueller 300 series, Ford Meter Box Company, or approved equal.
- C. **Meter Stops:** Meter stops shall be the ball valve type constructed of heavy cast bronze with a one-piece head and stem. Valves shall be rated for a working pressure of 300 psi and shall comply with AWWA C800. Connections shall be made using a connection similar to Ford's "Pack-Joint". Meter stops shall be Mueller 300 series, Ford Meter Box Company or an equal approved by the Engineer.
- D. **Water Meter:** All water service meters shall comply with AWWA C 700 and shall be of the same make and manufacture.

The meter shall be of the magnetic drive hermetically sealed register with disc or piston type design. The register shall be of the odometer type reading in U.S. gallons, complete with test index circle with a heat treated glass. The meter shall have an all bronze housing with bronze housing bolts, and a bronze hinged register cover. When the meter furnished requires special keys to remove the register, two keys shall be furnished to the Owner. All meters shall be accurate when operating at the following flow rates:

Meter Size (inches)	Safe Operating Capacity (G.P.M.)
5/8 X 3/4	20
3/4	30
1	50
1 x 1 1/4	50
1 1/2	100

- E. **Meter Couplings**: Meter couplings shall be Mueller #H 10890 or Ford #C38-23-2 (3/4") or C38-44-2 (1")
- F. **Meter Box**: Meter boxes shall be one of the following types at the option of the Contractor unless otherwise specified. Meter box lids shall be furnished without locks.
1. **Cast Iron Meter Box**: Cast iron meter boxes shall be Ford Meter Box Company, East Jordan Iron Works, or an approved equal as follows:

Meter Size	Cast Iron Meter Box
5/8" x 3/4"	Ford "Yokebox" YL161-233
3/4"	Ford "Crescent Box" #CB111-333
1"	Ford "Crescent Box" #CB111-444

2. **Concrete Meter Box**: Concrete meter boxes shall be as manufactured by Southern Meter Box, Inc., East Jordan Iron Works, or an approved equal as follows:

Meter Size	Concrete Meter Box
3/4"	CH 5/8 x 3/4
1"	CH 1
2"	CH 2

Concrete meter boxes shall have a reinforced concrete cover with a cast iron reading lid hinged to cover with a brass or steel pin.

3. **Plastic Meter Box**: Plastic meter boxes shall be as manufactured by NDS Inc., DFW Plastics Inc., or an approved equal, shall be equipped with a plastic iron reading lid and shall be as follows:

Meter Size	NDS Plastic Meter Box
3/4"	Model D 1200
1"	Model D 1500

2.14 SERVICE ASSEMBLY LARGER THAN 1"

Service assemblies larger than 1" shall be as detailed on the Drawings, Specifications or Bid Form.

2.15 SERVICE ASSEMBLIES WITH REGULATOR

The service assemblies with regulator shall consist of the service assembly specified in Paragraph 2.13 with the pressure regulator installed after the meter and inside the meter box. The meter box shall be at least 17" long.

A. **Service Assemblies with Regulator (Thru 1")**:

1. **Service Assembly**: The service assembly shall be as specified in Paragraph 2.13.
2. **Service Regulator with Strainer**: Service regulator shall be Watts N35BU-Z6 with stainless steel strainer, or an equal approved by the Engineer. Regulators shall comply with the International Plumbing Code, latest revision and shall be suitable for meter box installation. Unless otherwise specified pressure regulators shall be set at 50 psi.

B. **Service Assemblies with Regulator (Larger Than 1")**:

Service assemblies with regulator larger than 1" shall be as detailed on the Drawings, Specifications, or Bid Form.

2.16 TAPPING SLEEVES

Tapping sleeves shall be cast iron or stainless steel and shall be rated for a 200 psig working pressure as follows or approved equal:

	Mueller	Clow	Smith Blair
<u>Cast Iron:</u>			
For CI or CIPS PVC	H 615	F 5205	-
For SDR PVC	-	F 6342	-
<u>Stainless Steel:</u>			
For CI or CIPS PVC	H 305	-	663
For SDR PVC	H 305	-	663

Stainless steel tapping sleeves shall have stainless steel outlet flanges and shall be equipped with $\frac{3}{4}$ " NPT stainless steel test plugs. All nuts, bolts and flanges shall be equipped with insulating gaskets.

2.17 GATE VALVES AND TAPPING VALVES

- A. General:** All gate valves and tapping valves shall be manufactured in compliance with Standard C509 or C515 of the American Water Works Association, or the latest revision thereof. Valves shall be the resilient seat type, shall have non-rising stems and shall be Mueller 2360 series, American Flow Control 2500 Series or an equal approved by the engineer.

All gate valves shall operate so that the valve will open when turning the operating nut in a counter-clockwise direction. All gate valves buried underground shall have a non-rising stem with operating nut and cast iron valve box. All gate valves shall be designed for a minimum working pressure of 250 pounds per square inch and shall be capable of withstanding an internal hydrostatic pressure of 500 pounds per square inch. Buried gate valves shall have stems equipped with the standard (2" square) wrench nut. Gate valves installed above ground shall be equipped with hand wheels. One (1) valve wrench suitable to open and close all gate valves in this project shall be supplied to the Owner.

- B. Gate Valve 1-1/2" and Smaller:** Gate valves 1-1/2 inches or smaller shall be iron body, with bronze trim or bronze body. The valves shall be of the screwed end type.
- C. Gate Valves 2 to 20 Inches:** Gate valves 2 to 20 inches inclusive shall be installed in an upright position and shall have mechanical joint or push-on ends unless otherwise specified.
- D. Gate Valves 24 Inches and Larger:** Gate valves 24" and larger shall have spur or bevel gearing as indicated on the plans or in the Specifications or Bid Form. Valves shall be installed to accommodate the gearing.

2.18 CHECK VALVES

- A. General:** All check valves shall be of the type shown on the plans and shall conform to the following specifications. Check valves shall be the standard swing check type unless otherwise noted.
- B. Standard Swing Check Valve:** All standard swing type check valves shall be equipped with an external lever and weight unless otherwise specified. All standard swing type check valves shall be Mueller A-2606 series, Clow F-5382, or approved equal.
- C. Air Cushioned Swing Check Valve:** All air cushioned swing check valves shall be furnished with a lever and weight unless otherwise specified. The swing check valve shall be constructed with heavy cast iron or cast steel body with a bronze or stainless steel seat ring, a non-corrosive shaft for attachment of weight and lever, complete non-corrosive cushion chamber, and shall allow removal of all internal parts without removing the valve body from the line.

The cushion chamber shall be attached to the side of the valve body externally and so constructed with a piston operating in a chamber that will effectively permit the valve to be operated without any hammering action. The cushioning shall be by air, and the cushion chamber will be so arranged that the closing speed will be adjustable to meet the service requirements.

The valve disc shall be of cast iron or cast steel and shall be suspended from a non-corrosive shaft which will pass through a stuffing box and be connected to the cushion chamber on the outside of the valve.

The valve will be the Golden-Anderson Valve Specialty Company, Figure No. 250-D, Mueller A2606, or approved equal.

- D.** Hydraulically Operated Globe Check Valve: All hydraulically operated check valves shall be diaphragm-actuated, and hydraulically operated by line pressure. It shall be a spring-loaded, single seat globe type valve having a renewable seat ring. All necessary repairs other than replacement of the valve body shall be possible without removing the valve from the line. External packing glands or stuffing boxes are not permitted, and the diaphragm cannot be used as a seating surface. The disc shall be made of a resilient material.

The valve shall contain auxiliary controls which permit adjustment of the opening and closing speeds. The valve shall be Clayton 81C as manufactured by the Cla-Val Company, or #273D as manufactured by Golden-Anderson, or approved equal.

2.19 BUTTERFLY VALVES

All valves 16 inch and larger shall be butterfly valves and shall be manufactured in accordance with AWWA Standard C-504.

Valve shafts may be of one piece or two piece construction; however, in either case, the disc shall be of uniform thickness at the shaft axis. The steel shaft shall be of 18-8 stainless steel or 304 stainless steel. The valve shafts shall be designed as to provide permanent centering of the disc and shall have permanent self-lubricating shaft bushings.

The valve disc shall be manufactured of cast Ni-resist or a NSF approved corrosion-resistant material approved by the Engineer. The valve seat shall be of rubber and may be applied to the valve body or disc. In either case, the mating seat surface shall be 18-8 stainless steel, 304 stainless steel, or Ni-resist Type 1.

Unless otherwise stated on the Plans, and/or Bid Form, all butterfly valves shall be manufactured for a working pressure of 150 psi. All valves shall be tested to 300 psi by the manufacturer. The valve body shall be of cast iron with mechanical joint or flanged ends as indicated on the plans. All M.J. and flanged joints shall meet the applicable portions of Paragraphs 2.05 and 2.06 of these specifications.

All butterfly valves shall be designed for underground service. Valves to be used below ground shall be furnished with a 2 inch operating nut while valves to be used in above ground installations shall be furnished with a standard operating wheel.

Below ground valves shall be furnished with a suitable cast iron valve box complete with indicator and an indicator shall be attached to above ground installations.

The Contractor shall furnish the Owner with one (1) valve wrench to fit the operating nut furnished.

2.20 AIR RELEASE; AIR AND VACUUM; AND COMBINATION AIR AND VACUUM AND AIR RELEASE VALVES

- A.** General: All air release valves and combinations air and vacuum and air release valves shall be guaranteed not to blow shut under normal operating conditions with air flowing into the pipeline or being exhausted from the pipeline via the valve. Certifications may be requested of complete test results to substantiate the above requirements.

- B. Air Release Valves:** Air release valves shall be so designed to permit small quantities of air to escape automatically from pipelines under pressure. Air release valves shall be 1" NPT inlet unless otherwise specified and shall be Crispin Model PL10 or Golden-Anderson Figure 930-T, or approved equal.
- C. Air and Vacuum Valves:** Air and vacuum valves shall be so designed as to release a large quantity of air from an empty pipeline or water well during the filling process. The valve shall also permit air to enter the pipeline or water well. The valve size shall be as shown on the Plans, Specifications or Bid Form and shall be Crispin Series D or Golden-Anderson Figure 933, Val-Matic 102ST or approved equal.
- D. Combination Air Release and Air and Vacuum Valves:** Combination air and vacuum and air release valves shall include a small orifice valve for exhausting small quantities of entrained air and a large orifice valve for inducting as well as exhausting large quantities of air. The size of the required orifice shall be as specified on the plans.
- Combination valves shall be Golden Anderson's Figure 930-T, Dezurik Series 140 with mushroom cap, or approved equal.

2.21 VALVE BOXES

Valve boxes shall be cast iron of the two-piece screw type with an inside diameter not less than 5¼". The valve boxes shall be adjustable in length and the lid shall have the word "water" embossed on the top.

The box shall be installed flush with the ground or street surface and shall be supported by a 2' square concrete foundation as shown on the drawings. The box shall be suitable for the depth-of-bury of the valve on which it is installed. Contractor's compensation will not be based on length of the valve box.

The valve box shall be Mueller #H-10360, Clow #F-2454, or an approved equal.

2.22 FIRE HYDRANTS

- A. General:** Fire hydrants shall be UL-FM approved, cast iron bodied, fully bronze mounted, suitable for a working pressure of 250 psi and shall meet all requirements of AWWA C-502. Each hydrant shall be factory tested to 500 psi hydrostatic pressure. Fire hydrants shall have a 10 year standard warranty by the manufacturer, transferable to the Owner upon completion of the Contractor's warranty period. Fire hydrants shall be American Darling B-84-B, M&H Model 129, or approved equal.
- B. Connection and Nozzles:** Each hydrant shall have a 6-inch connection to street main, two 2-1/2 inch brass nozzles with threads for hose connections, and one 4-1/2 inch brass nozzle with threads for pumper coupling, together with caps fastened securely to each hydrant and threaded to fit nozzles. The threads for hose and pumper connections shall be those in use by the local firefighting department unless otherwise specified. Hydrants shall be opened by turning in a counter-clockwise direction and the direction of opening shall be cast on the head of the hydrants. The Contractor shall confirm the thread spacing with the applicable authority having fire-fighting responsibility in the area before ordering the hydrant. Furnish cap chains for each nozzle.
- C. Main Valve:** The bottom valve of the hydrant, unless otherwise specified, shall not be less than 5-1/4 inches in diameter. Friction loss shall not exceed 3.0 psi at 1,000 gpm through the 4 ½" pumper nozzle when tested in accordance with AWWA C502. The hydrant main valve shall be of the compression type, closing with pressure. The valve shall be faced with heavy impregnated waterproof balata or other approved equal material.

Drain valves shall be automatic and positive acting. When the main valve is closed, they shall automatically open insuring rapid and complete drainage of the hydrant riser. They shall close automatically when the main valve is opened. The hydrant shall be so constructed to permit withdrawal of internal working parts without disturbing the barrel or casing.

- D. **Color:** The color for fire hydrants shall be yellow.
- E. **Installation:** All hydrants shall have a safety breakable section located above the ground line. The hydrant shall be so constructed so that the main valve, when shut shall be tight when the upper portion of the barrel is broken off.

A standard depth hydrant shall be defined as a hydrant suitable for connection to water mains with 30 inches of cover from the top of the pipe to natural ground. All hydrants shall be standard depth unless otherwise specified on the plans, Bid Form, and/or Specifications.

Hydrants shall be accurately set in place such that the breakable flange shall be four (4) inches above finished grade or as recommended by the hydrant manufacturer. The recommended bury line shall be clearly marked on the hydrant barrel. Where standard depth hydrants are not suitable the Contractor shall furnish and install hydrant extensions to adjust the hydrant to the proper setting.

2.23 CASING PIPE

- A. **Corrugated Metal Pipe:** Corrugated metal pipe shall be conforming to AASHTO M 36 Type III and the requirements of LADOTD Specification 1007.03. The size and gage shall be as specified on the plans.
- B. **Welded Steel Pipe:** Steel casing pipe shall be in accordance with AWWA Specifications C 200, minimum grade B. The size and wall thickness shall be as specified on the plans. The interior and exterior of all casing pipe shall be cleaned, primed and lined with two coats of asphalt in accordance with AASHTO Designation: M 190, Type A. All steel casing shall be butt-welded and all welds shall be full penetration single butt-welds in accordance with AWWA Specification C206 and ANSI/AWS D10.7M/D10.7.

2.24 CONCRETE

Concrete shall be in accordance with 03 30 10 Concrete for General Construction.

2.25 COPPER CONDUCTOR

The Contractor shall furnish and install #10 AWG Type THHN insulated stranded copper wire where required to facilitate the use of electronic pipe locating equipment for locating non-electrically-conductive pipes, mains and service lines. Copper wire shall be installed with all non-conductive mains. Copper wire shall be installed with all non-conductive service lines located within highway rights-of-way. Wire splices shall be made using splice kits rated for direct burial under UL-486D and shall be 3M model DBR, King Innovation model King-6 DryConn, Spears Manufacturing model DS500 Dri-Splice, or approved equal.

Copper wire is not required to be installed with non-conductive service lines located on private property or private rights-of-way. No separate payment will be made for installation of copper conductor. The cost of copper conductor shall be included in the unit price per foot of pipe installed.

2.26 JOINT RESTRAINT

- A. **General:** The Contractor shall furnish and install joint restraint harnesses on all buried water piping 2" in diameter and larger as necessary to withstand the specified test pressure. All fittings, bends, tees, plugs, caps, etc. shall be restrained using an approved restraint device as shown on the plans. Pipe bell joints shall be restrained for the minimum lengths shown or as recommended by the restraint manufacturer, whichever length is greater. Unless otherwise specified in the plans or General Requirements, the Contractor shall use joint restraint harnesses in lieu of thrust blocks.
- B. **Joint Restraint for Fittings:** Joint restraint harnesses shall be specifically designed for the type of pipe used and shall be as recommended by the pipe manufacturer. Joint restraint harnesses shall utilize wedges or gripping rings to distribute the load uniformly around the circumference of the pipe. Harnesses employing wedges with radial actuating screws shall have breakaway bolt heads to limit the torque applied. Joint restraint

harnesses shall be capable of withstanding the full pressure rating of the pipe. Joint restraint harnesses shall be coated with fusion bonded epoxy and constructed of ductile iron and corrosion resistant materials. Bolts and nuts shall be stainless steel, or high strength, low-alloy steel manufactured in accordance with AWWA C111.

1. Mechanical Joints on Ductile Iron Pipe: Joint restraint harnesses for mechanical joint fittings on ductile iron pipe shall be Megalug Series 1100 as manufactured by EBAA Iron Works, Uniflange Series 1400 as manufactured by Ford Meter Box Company, or approved equal.
2. Push-On Joints on Ductile Iron Pipe: Joint restraint for push-on fittings on ductile iron pipe shall be "Fastite" with "Fast-Grip" gaskets as manufactured by American Cast Iron Pipe Company or "Tyton" joint with "Field Lok 350" gaskets by US Pipe & Foundry Company, or an approved equal.
3. Mechanical Joints on PVC Pipe: Joint restraint harnesses for mechanical joint fittings on PVC pipe shall be Megalug Series 2000PV or Megalug Series 15MJ00 as manufactured by EBAA Iron Works; Uniflange Series 1300 or Uniflange Series 1500 as manufactured by Ford Meter Box Company; or approved equal.
4. Push-On Joints on PVC Pipe: Joint restraint harnesses for push-on fittings on PVC pipe shall be Megalug Series 2500 as manufactured by EBAA Iron Works, Uniflange Series 1360, as manufactured by Ford Meter Box Company, or approved equal.
5. Mechanical Joints on HDPE Pipe: Mechanical joint connections to HDPE pipe shall use Harvey-type transition fittings as described in Paragraph 2.11.C.

C. Bell Joint Restraints:

1. Ductile Iron Pipe: Bell joint restraint shall be by use of gaskets and locking rings as described in Paragraph 2.05.B.2.
2. PVC Pipe: Bell joint restraint harnesses on PVC pipe shall be Megalug Series 1600 as manufactured by EBAA Iron Works, Uniflange Series 1390 as manufactured by Ford Meter Box Company, or approved equal.

D. Restrained Length: The Contractor shall provide joint restraints on all fittings and bell joints within a minimum distance of each restrained tee, bend, reducer, or cap. Unless otherwise approved by the Engineer, the minimum restrained lengths shall be as shown in the project details.

Minimum restrained lengths are dependent upon the test pressure, type of connection, type of pipe, type of backfill, and depth of bury. The Contractor may propose alternate restrained lengths for the specific installation conditions encountered in the project. Such proposals for alternate restrained lengths must be supported by data and calculations from the manufacturer and must be approved by the Engineer.

E. Installation: Joint restraint harness installation shall be in accordance with the manufacturer's instructions.

F. Thrust Blocks: Unless otherwise indicated on the plans or in the General Requirements, thrust blocks may only be used where specifically approved by the Engineer. Thrust blocks, where allowed, shall be constructed in accordance with Paragraph 3.18.

PART 3 – CONSTRUCTION METHODS

3.01 GENERAL

This part of the work includes installation of water mains, fittings, valves, valve boxes and appurtenances; excavation and backfill of trenches; cutting and replacing walks and roadway surfacing; and other miscellaneous items necessary to complete and make ready for operation a complete water distribution system.

3.02 COOPERATION WITH UTILITY OFFICIALS

The Contractor's attention is directed to the fact that his work will be performed in the close proximity of existing utilities, streets, drainage structures, etc. The Contractor shall at all times cooperate with the various utility and street officials and shall notify the appropriate personnel prior to excavation in areas where known utilities are located.

3.03 CLEARING OF RIGHT-OF-WAY

The Contractor shall clear the right-of-way provided for the main of all objectionable debris and obstructions that will interfere with the installation of the mains. Wooded areas shall be cleared and grubbed, and surface obstructions to remain shall be protected in accordance with Paragraph 3.06 of these specifications.

3.04 EXCAVATION OF TRENCH AND BACKFILL

Excavations, preparation of trenches, and backfill shall be in accordance with AWWA C600, except where amended by these Specifications. Excavation shall be such that the pipe will have no less than 30 inches of minimum cover (measured from top of trench to top of the barrel of the pipe). Trench bedding and standard backfill shall be as specified for each individual pipe material and detailed on the plan sheets.

A minimum horizontal separation of six feet shall be maintained between all water mains and services and any sewer mains. All water mains and services crossing sewer mains shall have a minimum vertical separation of 18 inches. All distances shall be measured from outside of pipe to outside of pipe.

3.05 OBSTRUCTION OF STREETS, PREMISES, ETC.

All material shall be placed so as to interfere as little as possible with public travel. At street crossings and other points as directed by the Engineer, trenches shall be bridged in a manner so as to prevent any serious interruption of public travel; the closure of both sides of a double roadway to vehicular traffic will not be permitted except by special permission. Special care must be taken to give free access at all times to all fire hydrants, water valves, fire alarm boxes and Police Department and Fire Department driveways.

In case the Contractor shall fail to keep open streets, sidewalks, approaches to premises, etc., and shall refuse or neglect to open them within twelve (12) hours after written notification by the Owner; or shall the Contractor fail to afford proper and necessary access to fire hydrants, water valves, fire alarm boxes or Police Department or Fire Department driveways, and shall neglect or refuse to afford such access within one (1) hour of receiving oral or written notice to do so, the Owner shall be and is hereby authorized and empowered to put on such force as may be necessary to do this work, deducting the actual cost thereof from any money which may be due or may become due the Contractor.

3.06 CONFLICT WITH SURFACE OBSTRUCTION

All shade trees, shrubbery, utility poles, etc., within the right-of-way provided shall be protected and any building or structure which may be endangered during the work shall be shored up and otherwise protected.

Any properties disturbed or damaged by the Contractor shall be restored to its original condition. No additional compensation will be made for this corrective work.

3.07 CONFLICT WITH SUBSURFACE OBSTRUCTIONS

The Contractor shall anticipate all underground obstructions such as waterlines, gas lines, sewer lines, utility lines, concrete and debris. Any such lines or obstructions indicated on the plans show only the approximate location and must be verified in the field by the Contractor. Neither the Owner nor the Engineer implies or guarantees the exact location of any existing underground utility; however, the Owner and Engineer will endeavor to familiarize the Contractor with all known underground obstructions.

The Contractor shall take the necessary precautions not to injure any gas or water pipe, sewer, drain or service pipes connected therewith or conduits or other underground structures, and the Contractor must repair or have repaired at once, at his own cost, any public or private structure or pipe damaged by or in the course of his work. Should the Contractor fail to repair or have repaired such damage or injury within a reasonable time, the Owner may after 24 hours written notice, have such repairs made and deduct the cost thereof from any amounts due or to become due the Contractor.

The Contractor shall assume all risks and be responsible for all expense and damage attending the presence or proximity of any gas or water pipes, sewers, drains, conduits, or other underground structures where such pipes or other structures cross the trench or appear in the trench in such a manner as not to demand their rearrangement or realignment. The Contractor's risks and responsibilities shall also apply to such structures as are approximately parallel with or adjacent to but outside of said trench.

The Contractor shall uncover known subsurface obstructions in advance of construction so that the method of avoiding same may be determined before pipe laying reaches the obstruction.

Should any pipe or other obstruction (so located as to interfere with the work) be encountered, the Contractor shall at once notify the Engineer of the locality and circumstances and the place shall be passed over until satisfactory arrangements are made.

Should the obstruction parallel the trench, the Engineer may require the Contractor to offset or realign his pipeline to miss the obstruction. This realignment may be made by the use of fittings, pipe deflection and/or manholes as the case may dictate.

When the pipeline is offset to miss an obstruction no claim for damages or extra compensation shall accrue to the Contractor from the presence of such pipe or other obstruction or from any delay due to its presence. However, should there be a change in quantity of any established pay item due to this relocation, the Contractor shall be paid for these changes at the unit price bid.

Where subsurface obstructions cross the trench, the Contractor will be permitted to lay pipe above the obstruction if a minimum amount of cover can be maintained while providing a cushion between the bottom of the pipe and the top of the obstruction at least 6 inches thick. Where this minimum cover cannot be obtained, the Contractor will be required to lay the pipe under the obstruction and maintain a 6-inch cushion between the top of the pipe and the bottom of the obstruction. No additional payment will be made for additional depth or over depth mains required to miss an obstruction. Should the location or position of such obstruction within the limits of the trench be such, in the opinion of the Engineer, as to require removal, realignment or change of the obstruction in order that the work may proceed, such removal, realignment or change shall be without expense to the Contractor. When, however, such obstruction shall come within the limits of the excavation for the work as located by the Engineer, such pipe, conduit, or other obstruction shall be stripped or uncovered by the Contractor, at his own expense, as constituting a part of his work in excavating. No claim for damages or extra compensation shall accrue to the Contractor for any delay due to the presence and adjustment of the obstructions.

The Engineer will in all cases be the judge of the necessity or expediency of any change or rearrangement of any underground structures which may interfere with the construction of the work under this contract.

3.08 SPECIAL CROSSING - CANALS, RAILROADS, HIGHWAYS, ETC.

- A. **General:** Special crossings for which drawings have been made and on which a special price has been asked, whether a lump sum bid or otherwise, will be paid for according to the special specifications governing said crossings. Otherwise, no additional compensation will be paid for the construction of any utility line because of its crossing under or over any natural or man-made obstacle, provided the route of the waterline as bid has not been changed so as to produce a crossing not to be anticipated by the bidder.

- B. Permits:** Unless otherwise noted, the Owner will secure the necessary permit from the controlling agency for laying these lines. The Contractor shall comply with all provisions and requirements of the permit.
- C. Cooperation with Controlling Agency:** The Contractor shall submit to the Owner and the representative of the controlling agency, all details concerning the method of construction and materials to be used at least 10 days before beginning construction.

3.09 HANDLING AND DISPOSAL OF WATER

The Contractor shall pump, bail, or otherwise remove any water which may be found or may accumulate in the excavations, trenches, etc., and shall perform all work necessary to keep them clear of water while the work is in progress. The cost of removing water by pumping or otherwise shall be included in the prices bid for the various items of the work, unless a specific bid item is asked for such. The Contractor shall keep his completed work reasonably free of water and shall completely remove all of it for the purpose of installations, inspections, etc.

The Contractor shall prevent any of his work from obstructing any drainage ditch, canal, etc., unless special permission is obtained.

3.10 SHEETING AND BRACING

Wherever necessary for protection of workmen, for security of adjacent utilities or structures, for stability of trench, or for proper installation and operation of the water main the Contractor shall secure the trench to his satisfaction, to the extent of requiring close sheeting, or sheet piling and suitable bracing, including all nails, spikes and other fastenings.

Where the sheeting for a pipe is driven no lower than the top of the pipe, such sheeting may be withdrawn, provided that no sheeting is withdrawn until the trench has been refilled as hereinafter provided to a point not less than 2 feet above the crown of the pipe. Where it is necessary to drive sheeting below the top of the pipe, such sheeting shall be driven down to a point not less than 2 feet below the bottom of the pipe and properly braced. Bracing above the pipe shall be placed as to allow at least 1 foot clear space between the bottom of the bracing and the top of the pipe. Sheeting and bracing driven below the top of the pipe shall be cut off no lower than 2 feet above the top of the pipe before removing.

The Contractor will be paid by separate pay item for all sheeting and bracing left in place at the written direction of the Engineer. The cost of all sheeting and bracing not required to be left in place shall be included in the price bid for water main, and the Contractor will receive no additional compensation therefore.

3.11 LOCATION OF AND CONNECTION TO EXISTING WATER SYSTEM

- A. General:** The attention of the Contractor is directed to the fact that existing water mains or service lines will have to be temporarily removed from service, tapped, cut, abandoned, relocated, tied together and otherwise adjusted to completely perform all work required for this project.

These lines presently serve the residents of the area, and the Contractor will not be permitted to indiscriminately shut off service in these lines. The Contractor shall cooperate with the Owner in order that interruptions of service will be reduced to a minimum. The Contractor shall arrange with representatives of the Owner and the Engineer for a mutually acceptable time when service can be discontinued in the various sections of the system.

The general location, size and type of existing utilities have been taken from field observations or information provided by the utility owners.

The size of pipe indicated is the nominal diameter and the Contractor shall be responsible for obtaining the correct outside diameter of the pipe before ordering any valves, fittings or appurtenances to assure a proper fit.

- B. Location of Existing Utilities:** The approximate location of known existing utilities has been shown on the drawings. The final location of all tie-ins, taps and connections, shall be approved by the Engineer.

The Contractor shall be responsible for physically locating all existing pipe and appurtenances. No additional compensation shall be paid for such work, but shall be included in the various pay items established for such work.

- C. Tapping or Connecting to Existing Mains:** Where tapping sleeves and valves are called for on the plans the connection shall be effected without interrupting service of the existing mains.

Where plans call for "connect (size) to existing (size)" mains the Contractor may cut-in to the existing main. The Contractor shall prosecute the work in such a manner as to minimize the interruption of service to the Owner's customers.

These two items of work are separate and independent, with no duplication between them (i.e. installation of a tapping sleeve and valve does not qualify in addition as "connecting to existing main").

The Contractor shall notify the Owner and the Engineer at least 24 hours in advance and shall obtain prior approval before proceeding with the work.

- D. Connecting Existing Service Lines to Water Mains or Other Services:** Where indicated on the plans, the Contractor shall tie existing service lines, regardless of type, to the water main or service line as indicated.

This work shall include all necessary labor, field taps, adaptors, unions, dresser couplings, or other incidental devices required to connect the existing service line to the distribution main. Any gate valves or service pipe required to complete the installation shall be paid for separately

3.12 INSTALLING DUCTILE IRON PIPE

Ductile iron water pipe shall be installed in accordance with AWWA C600 (latest revision). Thrust restraint harnesses or thrust blocks shall be required at all bends, tees, and other fittings and at water hydrant installations.

The Standard Pipe Foundation detailed on the plan sheet shall be used for the installation of all ductile iron water mains, unless another type is specified on the plans.

Unless otherwise specified in the plans, General Requirements, or Bid Form and/or Plans, the Contractor shall encase all ductile iron mains in polyethylene encasement. The installation of all polyethylene encasement shall be in accordance with AWWA C105.

3.13 INSTALLING PLASTIC PIPE

All plastic water mains shall be installed in strict accordance with the manufacturer's recommendation and thrust restraint harnesses or thrust blocks shall be installed on all fittings 2 inches in size and larger.

Where plastic pipe lines are larger than two inches, valves and fittings will be anchored by tie rods and clamps to concrete anchors. See details on plans.

Solvent cement joints shall be made in accordance with ASTM D2855.

Solvent weld plastic pipe shall be snaked in the trench. Backfill shall not be placed on any plastic pipe while it is in a heated condition. Cooling of the pipe by some method approved by the Engineer will be required, if necessary.

Set time for newly assembled solvent weld joints shall be as follows:

30 Minutes minimum @ 60°F to 90°F

1 Hour minimum @ 40°F to 60°F

2 Hours minimum @ 25°F to 40°F

3.14 FIELD CUTTING OF PIPE

Field cutting of all pipe shall be accomplished by a method approved by the Engineer. Any section of pipe which is damaged during the cutting operation (including cement mortar lining) will be rejected.

3.15 SETTING OF VALVES AND FITTINGS

Setting of valves and fittings shall be in accordance with Section 10 of AWWA C600, except as modified for plastic pipe in Paragraph 3.14 of these Specifications.

3.16 SETTING OF FIRE HYDRANTS

Setting of fire hydrants shall be in accordance with Section 11 of AWWA C502 and the fire hydrant details shown on the plan sheets.

3.17 INSTALLING SERVICE ASSEMBLIES

The Contractor shall furnish and install service assemblies where shown on the plans or as directed by the Engineer. Service assemblies shall be installed according to the size and type designated on the plan sheets, and the Contractor shall furnish all necessary material, labor, and equipment to completely install the assembly according to this detail. Service pipe shall be a separate item and paid for as such. The Contractor shall not set the water meters until after all the mains have been hydrostatically tested and disinfected and approved by the Engineer and LDH.

3.18 THRUST BLOCKS, ANCHORING DEVICES, AND JOINT RESTRAINT

Unless otherwise specified on the plans or in the General Requirements or Bid Form, the Contractor shall restrain each fitting where thrust is generated (tees, bends, caps, reducers, valves, etc.) with joint restraint harnesses and shall restrain each joint and connection within a minimum specified distance of the restrained fitting as described in Paragraph 2.26. Thrust restraint harnesses and similar devices shall be installed in accordance with the instructions of the joint restraint harness manufacturer and any supplemental instructions by the pipe manufacturer.

Where indicated on the plans or in the General Requirements or Bid form or as directed by the Engineer, joints shall be restrained with concrete thrust blocks. The size of the thrust blocks shall be in accordance with details on the plan sheets. The sizes indicated were based on an undisturbed soil bearing pressure of 2,000 pounds per square foot. The Engineer shall be the sole judge as to the bearing pressure the soil encountered will be able to sustain. If in his judgment the soil allowable bearing pressure is other than the 2,000 pounds per square foot specified, the size of the thrust block shall be adjusted accordingly. No separate payment will be made for joint restraint harnesses or concrete thrust blocks. The cost of these shall be included in the price of other pay items.

The Contractor shall provide and remove any temporary thrust blocks or joint restraint harnesses needed to complete the testing of the system. No additional compensation will be made for such temporary thrust blocks but the cost of such shall be included in the various items for which a price has been established.

3.19 INSTALLING PIPE BY DRILLING OR BORING METHODS

When permitted by the specifications, certain street, highway, and/or railroad crossings by utility mains may be made either by jacking and boring or Horizontal Directional Drilling methods. The installation of utility pipe by either of these methods shall be in accordance with the requirements of the *Louisiana Standard Specifications for Roads and Bridges* regarding jacked or bored pipe.

The excavation of all approach pits and trenches within the right-of-way of the highway or railroad shall be of sufficient length from the street or railroad tracks to permit traffic to pass without interference. All backfill on the approach pits and trenches within the right-of-way shall be tamped in layers a maximum of 6 inches thick for the entire length and depth of the trench or pit. The backfill shall be compacted to 90% of maximum density obtained at optimum moisture as

determined by AASHTO T 180, Method A. Mechanical tampers may be used after a cover of 6 inches has been obtained over the top of the barrel of the pipe.

The boring operation shall be accomplished using a commercial type boring rig and the hole made by the installation shall be of the same diameter (within 2 inches) as the largest outside joint diameter of the pipe installed. The pipe shall be installed in the hole immediately after the bore has been made and in no instance shall the hole be left open while unattended.

In the event subsurface operations result in injury or damage to the pavement, repairs to this pavement shall be made by the Contractor, at no additional cost to the Owner. In the event paving cracks on either side of the pipeline, or is otherwise disturbed or broken due to the Contractor's operations, he shall repair or replace same at his own expense without further compensation.

3.20 INSTALLING CASING PIPE

When specified on the plans, the Contractor shall furnish and install all utility mains parallel to and under railroad tracks and highways in a casing pipe. This casing shall be complete with end seals, vent pipe, and other specials required to install the main in the casing. All installations shall be in accordance with these Specifications and the requirements of the railroad or highway, as applicable.

Unless otherwise specified, the casing pipe shall be installed by boring or drilling methods in conformance with Paragraph 3.19.

3.21 FIELD HYDROSTATIC AND LEAKAGE TESTS

The hydrostatic testing of all lines shall conform to the requirements of AWWA C600, Section 5, except as modified below.

1. The maximum allowable leakage shall be 10 gallons per inch of pipe diameter per mile of pipe for 24 hours. The test pressure shall be 150 psi and shall be maintained for a minimum of 4 hours.
2. The test shall be applied to the whole or individual valved-off sections of the mains either before or after the trench is backfilled, as directed by the Engineer.
3. At the Contractor's option, services may or may not be included in the hydrostatic and leakage test. If the Contractor elects not to test the services, then all services will have a visual inspection after installation with full line pressure and the Contractor shall satisfy himself that there are no leaks. All services shall be flushed for a full 15 minutes.

The Engineer may require that he be present at any or all of these tests.

4. The Contractor shall furnish gauges, meters, water, tools, labor, equipment, and all other materials necessary to conduct the tests. The Engineer will be notified at least 48 hours in advance of the hydrostatic test.
5. The test pressure shall be 150 psi. The test pressure will be based upon the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge. Gauges shall have an operating range of twice the testing pressure and be glycerin-filled and liquid lubricated type.

Should the amount of leakage exceed that specified, the Contractor shall, at his expense, locate and repair the defective joints until the leakage is within the specified limits.

6. When the main being tested is a dedicated fire line serving a sprinkler system, the flushing and testing procedure shall be as identified in NFPA form "Contractor's Material and Test Certificate for Underground Piping". The test pressure shall be not less than 200 psi and shall be maintained for a minimum of 2 hours. The maximum allowable leakage shall be 2 quarts per hour per 100 joints regardless of pipe diameter. Allowable leakage adjustments identified on

the form will apply. The Contractor shall complete the form and submit it to the Office of the State Fire Marshall upon satisfactory completion of the testing.

3.22 WITNESSING OF TESTS

The cost of witnessing a test by the Engineer shall be borne by the Owner one time. The cost of witnessing re-tests of sections which fail the initial test will be deducted from Contractor payments for compensation of the Engineer.

3.23 DISINFECTION

All new water lines including appurtenances shall be disinfected in accordance with the Continuous Feed method of AWWA C651 following the acceptance of the hydrostatic test, except as noted herein.

Prior to disinfection, mains shall be filled to eliminate air pockets and shall be flushed with a minimum flushing velocity of 3 ft/s.

All new mains and repaired portions of, or extensions to, existing mains shall be chlorinated so that a chlorine residual of not less than 10 ppm remains in the water after 24 hours standing in the pipe. A minimum application rate of 25 ppm chlorine solution is required.

While the disinfectant is being applied to any section of the system, the water will be allowed to escape at all extremities of this section until the presence of chlorine is evident by measurement with a DPD test kit furnished by the Contractor.

The Contractor may, subject to the approval of the Engineer, use the Tablet/Granule method or the Slug method as described in AWWA C651.

Once the water mains have been disinfected, flushed and are ready for bacteriological testing, the Contractor shall contact the Owner for collection of a sample. If bacteriological tests indicate insufficient disinfection at the completion of the test and flushing of the system, the procedure shall be repeated on that part of the system at no additional compensation. In no event will water from mains which have not been bacteriologically tested, or which have failed the test, be furnished for use as potable water until such mains have passed the test.

The Contractor shall take whatever steps necessary to prevent the backflow of the strong chlorine solution into any existing water distribution system.

3.24 LABORATORY TESTING

Each required water sample shall be analyzed by an independent State certified laboratory. All water samples shall be collected, preserved, and analyzed in accordance EPA-approved methods and with the latest edition of *Standard Methods for the Examination of Water and Wastewater*, published by the American Public Health Association. The laboratory shall be a State Certified Laboratory and shall be acceptable to the Louisiana Department of Health, Office of Public Health for each parameter tested or method used. Regularly updated lists of LDH/OPH State Certified Laboratories can be found on the Louisiana Department of Health website at:

www.ldh.la.gov

The Contractor shall maintain chain-of-custody for all samples and shall submit chain of custody documentation with all sample results. The sample volumes, types of sample containers, types of sample preservation, and required blank samples shall be as recommended by the laboratory. The Contractor shall obtain appropriate sample containers and chain-of-custody forms from the laboratory conducting the analysis.

All reports shall clearly identify the sample location. The Contractor shall provide complete reports on the Laboratory's standard format with the required QA/QC data. Sample results shall be provided to the Engineer promptly. Upon completion of all required analyses, the laboratory shall provide the testing results to:

1. The Engineer at his address of record.
2. The Contractor at his address of record.
3. The Owner at his address of record

3.25 INSTALLING LOCATOR WIRE OVER NON-CONDUCTIVE WATER PIPE

The Contractor shall install locator wire directly over and on the center of all non-conductive water mains. This wire shall be continuous on all non-conductive mains and shall be connected to all fixtures and appurtenances.

The Contractor shall install locator wire directly over and on the center of all non-conductive service pipe located on or tapped into water mains located on LADOTD or Parish rights-of-way.

For nonmetallic mains installed by trenchless methods, the locator wire shall be taped to the pipe with duct-type tape approximately every 10 feet. Tape length shall be sufficient to wrap a minimum of halfway around the pipe.

Installation of the wire shall be as detailed on the plan sheets. No special payment will be made for installation of locator wire. The cost of such shall be included in the unit price bid for water pipe.

3.26 SPECIAL BACKFILL

Certain areas requiring special backfill shall be as specified on the plans, Bid Form, and/or Specifications. The special backfill shall be of non-plastic granular backfill conforming to Unified Soil Class SW or SP with maximum aggregate size being 3/8 of an inch. The degree of compaction shall be as specified for the various pipe materials.

3.27 SPECIAL FOUNDATION (TYPE 2 STANDARD PIPE FOUNDATION)

Where indicated on the plans, Bid Form and/or Specifications, all pipe shall be supported by a special lumber foundation and gravel bedding detailed as Type 2 on the plans. The lumber shall be Southern yellow pine S.P.I.B. Grade No. 2, dimension rough, creosote coal-tar treated, with a minimum net retention of preservative of 16 pounds full cell per cubic foot of wood. The Contractor shall furnish a notarized manufacturer's certificate that the lumber meets specifications both in grade and treatment.

The gravel shall be clean, free from clay, sticks, or other deleterious substances, meeting the following gradation:

<u>Sieve</u>	<u>Percent Passing by Weight</u>
3/4	100
5/8	95-100
No. 4	0-7

3.28 TRENCH BACKFILL AND COMPACTION

The pipe shall be supported and protected by tamping backfill in layers to the springline of the pipe. Stones encountered in the trench shall be removed for a depth of at least six inches below the bottom of the pipe.

- A. **Outside Street Surface and Shoulders:** The backfill in the trench above the pipe shall be placed in layers and compacted to prevent settlement of the trench. Prior to the final acceptance of the pipeline, the trench shall be level with the surrounding natural ground.
- B. **Inside Street Surfaces, Other Paved Areas and Street Shoulders:** The backfill in the trench above the pipe zone shall be placed in lifts not to exceed six inch compacted layers and compacted to the approximate density of the surrounding ground. The maximum density shall be determined in accordance with LADOTD Designation TR 418 and the in-place density determined by LADOTD Designation TR 401.

The trench shall be compacted for a depth of 2'- 0" above the top of the pipe using hand tamps or hand mechanical tamps before the use of a wheel type device or a hydro-hammer shall be used for compaction purposes.

The top 6 inches shall be compacted to 95% of standard density when measured by AASHTO - T99.

3.29 REPLACING STREET SURFACING AND SIDEWALKS

In all paved or unimproved streets, the surface of the trenches shall be finished without any needless delay and in the best workmanlike manner with the same kind of roadway or sidewalk improvement that was removed in excavating the trench.

Should the Contractor fail or refuse to repair any such damage, the Owner may after twenty-four (24) hours written notice, employ such personnel and furnish such materials as may be necessary and do the work, deducting the actual cost thereof from any amounts due or to become due to the Contractor.

The Contractor shall be obligated to maintain and keep in good condition any replacement of base, street surfacing or sidewalks from the time of installation until final acceptance of the work.

The replacement of all street surfaces shall be in accordance with the plan sheets and Section 03 30 10 Concrete for General Construction.

3.30 CLEANING UP, REMOVING SURPLUS EARTH, ETC.

The Contractor shall backfill each trench and excavation immediately after the work is installed. The Contractor shall then begin the initial cleanup, grading, shaping and removal of all surplus dirt except that actually necessary to provide for settlement of the filling. He shall also remove all pipe and other material placed or left on the street or right-of-way by him except material needed for the replacement of the paving. The street shall be opened and made passable for traffic.

The Contractor shall maintain all areas disturbed by construction until such time that all testing, pavement repairs and final restoration are completed. Testing, pavement repair and final restoration shall begin as promptly as possible or as otherwise required by the specifications.

Any surplus earth which may be left on the street or right-of-way after the excavations have been completely refilled shall be removed as soon as possible at his own expense except that in ungraded streets, it shall be optional with the Engineer whether surplus material shall be removed or deposited on the surface and graded for the convenience of traffic.

Final restoration and cleanup shall include grading and shaping ditches disturbed by construction and removing siltation from all drainage pipes and structures. Begin final restoration within 14 days of backfilling of each line segment.

Final acceptance will not be made until the Contractor has cleaned up the project to the satisfaction of the Engineer and Owner.

3.31 WARRANTY REPAIRS

Any defects repaired by the Contractor during the construction or warranty periods shall be performed in such a manner that the repaired work shall meet the specifications for original construction. The use of non-standard fittings such as full circle repair clamps shall not be allowed in lieu of standard cast or ductile iron fittings.

PART 4 – METHOD OF MEASUREMENT AND PAYMENT

- 4.01 WATER PIPE:** No separate measurement and payment will be made for water pipe. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.02 DUCTILE IRON PIPE FITTINGS:** No separate measurement and payment will be made for ductile iron pipe fittings. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.03 VALVES AND VALVE BOXES:** No separate measurement and payment will be made for valves and valve boxes. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.04 TAPPING SLEEVES AND TAPPING VALVES WITH BOXES:** No separate measurement and payment will be made for tapping sleeves and tapping valves with boxes. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.05 NEW FIRE HYDRANT ASSEMBLIES:** No separate measurement and payment will be made for new fire hydrant assemblies. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.06 FIRE HYDRANT EXTENSIONS:** No separate measurement and payment will be made for fire hydrant extensions. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.07 REMOVING AND SALVAGING FIRE HYDRANTS:** No separate measurement and payment will be made for removing and salvaging fire hydrants. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.08 INSTALLING SALVAGED HYDRANTS:** No separate measurement and payment will be made for installing salvaged hydrants. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.09 SPECIAL WATER STRUCTURES:** No separate measurement and payment will be made for special water structures. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.10 WATER SERVICE ASSEMBLIES:** No separate measurement and payment will be made for water service assemblies. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.11 WATER SERVICE ASSEMBLIES WITH REGULATOR:** No separate measurement and payment will be made for water service assemblies with regulator. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.12 WATER SERVICE PIPE:** No separate measurement and payment will be made for water service pipe. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.13 CASING PIPE- JACKING AND BORING METHOD:** No separate measurement and payment will be made for casing pipe – jacking and boring method. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.14 CASING PIPE- LAID IN OPEN CUT:** No separate measurement and payment will be made for casing pipe – laid in open cut. All materials and labor associated with this work shall be included in the price bid for associated items of work.

- 4.15 INSTALLING PIPE BY DRILLING OR BORING METHODS:** No separate measurement and payment will be made for installing pipe by drilling or boring methods. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.16 GRAVEL, STONE, CONCRETE OR OTHER PIPE FOUNDATION:** No separate measurement and payment will be made for gravel, stone, concrete, or other pipe foundation. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.17 SPECIAL FOUNDATIONS:** No separate measurement and payment will be made for special foundations. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.18 SPECIAL BACKFILL:** No separate measurement and payment will be made for special backfill. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.19 SHEETING AND BRACING LEFT IN PLACE:** No separate measurement and payment will be made for sheeting and bracing left in place. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.20 REMOVAL AND REPLACEMENT OF HIGHWAY, STREET, DRIVEWAY AND SIDEWALK PAVEMENT AND CURBS:** No separate measurement and payment will be made for removal and replacement of highway, street, driveway, and sidewalk pavement and curbs. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.21 CONCRETE SURFACES TO BE SAWED:** No separate measurement and payment will be made for concrete surfaces to be sawed. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.22 CLEARING AND GRUBBING:** No separate measurement and payment will be made for clearing and grubbing. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.23 REMOVAL AND REPLACEMENT OF CULVERT PIPES:** No separate measurement and payment will be made for removal and replacement of culvert pipes. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.24 CONNECTIONS TO EXISTING MAINS:** No separate measurement and payment will be made for connections to existing mains. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.25 CONNECTIONS OF EXISTING SERVICE LINES TO MAINS:** No separate measurement and payment will be made for connections of existing service lines to mains. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.26 INTERCONNECTING SERVICE LINES:** No separate measurement and payment will be made for interconnecting service lines. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.27 SPECIAL LUMP SUM- RAILROAD CROSSINGS, ROADWAY CROSSINGS, CANAL CROSSINGS AND LEVEE CROSSINGS, ETC.:** No separate measurement and payment will be made for special lump sum – railroad crossings, roadway crossings, canal crossings, and levee crossings, etc. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.28 VALVE ASSEMBLIES - AIR AND VACUUM AND AIR RELEASE VALVES, BLOW-OFF ASSEMBLIES, ETC.:** No separate measurement and payment will be made for valve assemblies – air and vacuum and air release valves, blow-off assemblies, etc. All materials and labor associated with this work shall be included in the price bid for associated items of work.

- 4.29 ITEMS TO BE FURNISHED TO THE OWNER:** No separate measurement and payment will be made for items to be furnished to the owner. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.30 TESTING AND DISINFECTION OF WATER MAINS:** No separate measurement and payment will be made for testing and disinfection of water mains. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.31 CLEANUP, MAINTENANCE AND FINAL RESTORATION:** No separate measurement and payment will be made for cleanup, maintenance and final restoration. All materials and labor associated with this work shall be included in the price bid for associated items of work.

END OF SECTION 02510

**SECTION 02535
SANITARY SEWER SYSTEM**

PART 1 - GENERAL

1.01 DESCRIPTION

This item shall consist of sewer trunk mains, lateral mains, service lines and force mains along with fittings, manholes, cleanouts, and other specified appurtenances, furnished and installed at such places as are designated on the contract drawings and profiles, or by the Engineer, in accordance with these specifications and in conformity with the lines and grades given.

The item shall include, in the bid prices per unit requested, the cost of common excavation and backfill, the cost of furnishing and installing all trench bracing and dewatering and the material for and the making of all joints.

1.02 LOCATION OF LINES

The approximate location of lines and manholes is indicated on the drawings as being within the bounds of street, highway or easement rights-of-way. The Engineer shall establish final location of the various items of construction in the field. Any location within said street, etc. may be used.

All costs not specifically listed as a pay item shall be included in the price bid for the item of which the costs are a part.

1.03 LAYOUT OF WORK

Layout of work will be as specified in the General Requirements of these specifications.

1.04 REFERENCE STANDARDS: References shall mean the latest revision of the following standards:

- A. AASHTO M 6-----Standard Specification for Fine Aggregate for Hydraulic Cement Concrete
- B. AASHTO M 190 -----Standard Specification for Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches
- C. AASHTO M 198 -----Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
- D. AASHTO T 99-01 -----Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop
- E. ANSI/ASME B16.1-----Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250
- F. ANSI/AWS D10.7M/D10.7 -----Guide for the Gas Shielded Arc Welding of Aluminum and Aluminum Alloy Pipe
- G. ANSI/AWWA C104/A21.4-----Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
- H. ANSI/AWWA C105/A21.5-----American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
- I. ANSI/AWWA C110/A21.10 -----Ductile-Iron and Gray-Iron Fittings for Water
- J. ANSI/AWWA C111/A21.11 -----Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- K. ANSI/AWWA C115/A21.15-05-----Standard for Flanged Ductile-Iron Pipe with Threaded Flanges
- L. ANSI/AWWA C150/A21.50 -----Thickness Design of Ductile-Iron Pipe

M.	ANSI/AWWA C151/A21.51 -----	American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water
N.	ANSI/AWWA C153/A21.53 -----	Ductile-Iron Compact Fittings for Water Service
O.	ANSI/AWWA C200 -----	Steel Water Pipe - 6 in. (150 mm) and Larger
P.	ANSI/AWWA C206 -----	Field Welding of Steel Water Pipe
Q.	ANSI/AWWA C504 -----	Rubber-Sealed Butterfly Valves
R.	ANSI/AWWA C509 -----	Resilient-Seated Gate Valves for Water-Supply Service
S.	ANSI/AWWA C515 -----	Reduced-Wall, Resilient-Seated Gate Valves for Water-Supply Service
T.	ANSI/AWWA C600 -----	Installation of Ductile-Iron Water Mains and Their Appurtenances
U.	ANSI/AWWA C906 -----	AWWA Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,575 mm), for Water Distribution and Transmission
V.	ASTM A36 -----	Standard Specification for Carbon Structural Steel
W.	ASTM A473 -----	Standard Specification for Stainless Steel Forgings
X.	ASTM C150 -----	Standard Specification for Portland Cement
Y.	ASTM C32 -----	Standard Specification for Sewer and Manhole Brick (Made From Clay or Shale)
Z.	ASTM C33 -----	Standard Specification for Concrete Aggregates
AA.	ASTM C478 -----	Standard Specification for Precast Reinforced Concrete Manhole Sections
BB.	ASTM D1784 -----	Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
CC.	ASTM D2241 -----	Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
DD.	ASTM D2321 -----	Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
EE.	ASTM D2412 - 02-----	Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
FF.	ASTM D2412 - 02-----	Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
GG.	ASTM D2487-----	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

HH.	ASTM D3034 -----	Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
II.	ASTM D3139 - 98-----	Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
JJ.	ASTM D3212 -----	Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
KK.	ASTM D3261 -----	Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
LL.	ASTM D3350 -----	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
MM.	ASTM D698 -----	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft ³ (600 kN-m/m ³))
NN.	ASTM F1417 -----	Standard Practice for Installation Acceptance of Plastic Non-Pressure Sewer Lines Using Low-Pressure Air
OO.	ASTM F477 -----	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
PP.	ASTM F679 -----	Standard Specification for Poly Vinyl Chloride (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
QQ.	ASTM F714 -----	Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
RR.	CISPI 301 -----	Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications
SS.	LADOTD TR 401 -----	The Determination of In-Place Density
TT.	LADOTD TR 418 -----	Moisture-Density Relationships
UU.	LADOTD Standard Specifications-----	Section 728 Jacked or Bored Pipe
VV.	UNI-B-6 -----	Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe.

1.05 RELATED WORK

- A.** Section 03301----- Concrete for General Construction

PART 2 - MATERIALS

2.01 GENERAL

The pipe and other materials shall be of the type called for on the plans, in the Bid Form and/or in the General Requirements and shall be in accordance with the following appropriate requirements.

2.02 DIMENSION RATIO (DR)

Wherever in these specifications the term Dimension Ratio (DR) is used, it shall be understood to mean the ratio of diameter to wall thickness that is common for all pipe sizes of a particular dimension ratio series.

2.03 DUCTILE IRON PIPE, JOINTS, FITTINGS

- A. Ductile Iron Sewer Pipe:** Ductile iron sewer pipe for gravity sewers and sewage force mains shall conform in all respects to ANSI/AWWA C151/A21.51. The iron shall be fully annealed ductile iron, grade 60-42-10. The words ductile iron and the thickness class shall be conspicuously marked on each joint of pipe.

The pipe shall be of the thickness class fifty (50) or as otherwise specified in the General Requirements, Bid Form and/or plans for all joints except flanged. Flanged joint pipe shall be of the thickness Class 53.

The exterior of the pipe shall be standard coal tar coated as specified by ANSI/AWWA C151/A21.51.

The interior of ductile iron pipe shall be full thickness cement mortar lined at the factory in accordance with ANSI/AWWA C104/A21.4, unless a special lining is required by the General Requirements.

If required by the General Requirements, the pipe interior shall be lined with a resistant material, such as American Cast Iron Pipe Company, "Polybond" or U.S. Pipe Company "Protecto 401" liner, or approved equal.

- B. Joints:** The joints for ductile iron pipe and fittings shall be push-on or mechanical joint except where other joints are indicated on the plans and joints shall meet the following specifications:

1. Push-on and mechanical joints shall meet the requirements of ANSI/AWWA C111/A21.11 except as amended by ANSI/AWWA C115/A21.15.
2. Flanged joints shall meet the requirements of ANSI/AWWA C115/A21.15. Flanges shall be rated for a working pressure of 250 psi.
3. Restrained Joints: Restrained joints shall be "Fastite" with "Fast-Grip" gaskets as manufactured by American Cast Iron Pipe Company or "Tyton" joint with "Field Lok 350" gaskets by US Pipe & Foundry Company, or an approved equal.

Restrained joints that are subject to movement or vibration in service shall utilize a locking ring feature. Locking ring restrained joints shall be "Flex-Ring" as manufactured by American Cast Iron Pipe Company, "TR-Flex" as manufactured by US Pipe & Foundry Company, "Super-Lock" as manufactured by Clow Water Systems Company, or approved equal.

All means of joint restraint shall be as provided or as recommended by the pipe manufacturer and shall be installed in accordance with the manufacturer's written instructions.

4. Flexible Joints: Bolt-on type ball and socket flexible joints shall be as manufactured by American Cast Iron Pipe Company, US Pipe, or an approved equal. Bolts shall be stainless steel conforming to ASTM A296, Grade CA-15.

Boltless type ball and socket flexible joints shall be as manufactured by James B. Clow and Sons, Inc., American Cast Iron Pipe Company, or an approved equal. These joints shall provide a minimum of 15 degrees of deflection per joint.

- C. Fittings:** Fittings for ductile iron pipe shall be ductile iron fittings.

Ductile iron fittings for pipe shall be the compact type conforming to the requirements of ANSI/AWWA C153/A21.53 and shall be coal tar coated. All fittings shall be cement mortar lined in accordance with ANSI/AWWA C104/A21.4, except those for gravity sewer service, which shall be lined the same as the ductile iron pipe used for similar service. Flanged fittings shall conform to ANSI/AWWA C115/A21.15. Mechanical joint fittings shall conform to ANSI/AWWA C111/A21.11.

All ductile iron fittings shall be furnished in accordance with ANSI/AWWA C110/A21.10 with a rated working pressure of 350 psi for 3 inch to 24-inch diameter and 250 psi for 30 inch to 48-inch diameter.

- D. Bolts, Nuts, Etc.:** Bolts shall be as specified by the applicable ANSI specification for bolted joints or as recommended by the pipe manufacturer and subject to the approval of the Engineer. All bolts on flanged or mechanical joint pipe installed underground shall be made from a non-corrosive metal subject to the approval of the Engineer.

2.04 DUCTILE IRON RIVER CROSSING PIPE, JOINTS

When detailed on the plans, the Contractor shall furnish ductile iron pipe crossing rivers, drainage canals, creeks, etc. for sewage force mains.

- A. Pipe:** The pipe shall be of ductile iron and shall conform to Section 2.03A of these specifications.

The pipe shall be of the ball and socket type and shall have negative buoyancy when empty. The manufacturer shall submit data verifying that the pipe to be supplied has negative buoyancy; however, no pipe shall have a thickness less than Class 54.

- B. Joints:** The joints shall be of the ball and socket type and shall be either the bolt-on type or boltless type as specified below.

1. Bolt-on Type: The bolt-on type shall be furnished with stainless steel bolts conforming to ASTM A473, Grade CA-15. The pipe shall be as manufactured by American Cast Iron Pipe Company, James B. Clow & Sons, or an approved equal.
2. Boltless Type: The boltless type shall provide a 15° minimum deflection per joint and shall be as manufactured by U.S. Pipe Company, James B. Clow & Sons, Inc., or an approved equal.

2.05 DUCTILE IRON RESTRAINED JOINT PIPE

When detailed on the plans, the Contractor shall furnish ductile iron restrained joint pipe. Ductile iron restrained joint pipe shall meet the specifications for ductile iron in Section 2.03A of these specifications and the joint shall be the Flex-Ring as manufactured by American Cast Iron Pipe Company, or "Super-Lock" as manufactured by James B. Clow & Sons, or an approved equal. The minimum wall thickness shall be Class 52.

2.06 CAST IRON SOIL PIPE AND FITTINGS

Cast iron soil pipe and fittings may be used only on cleanouts, service connections and house stacks. Soil pipe shall meet CISPI 301.

2.07 P.V.C. PIPE, JOINTS, FITTINGS

- A. P.V.C. Non-Pressure Sewer Pipe:** All P.V.C. non-pressure sewer pipe shall be suitable for use as a gravity sewer conduit, and shall have a minimum pipe stiffness at 5 per cent deflection of 46 p.s.i. when tested in accordance with ASTM D2412. Pipe shall have an integral bell with a mechanical locked in gasket.

1. P.V.C. sewer pipe 4-inch diameter through 15-inch diameter shall meet the requirements of ASTM D3034, DR35.
2. P.V.C. sewer pipe 18-inch diameter through 27-inch diameter shall meet the requirements of ASTM F679. The pipe dimensions shall be as specified by ASTM F679 for the materials used.

- B. P.V.C. Pressure Sewer Pipe:** All P.V.C. pipe for sewage force mains shall conform in all respects to Product Standard PS 22-70, ASTM D2241, and shall meet the quality standard of the National Sanitation Foundation and bear its seal of approval. P.V.C. pipe shall be manufactured from a virgin polyvinyl chloride resin conforming to Type 1, Grade 1 resin of

ASTM D1784 (P.V.C. 1120). P.V.C. pipe shall have an integral bell with a mechanical locked in gasket.

Unless otherwise required by the plans, Bid Form, or General Requirements, P.V.C. pressure pipe shall have a maximum DR of 26. Where "special force mains" are detailed on the plans, 2-inch diameter and smaller pipe shall be furnished in 40-foot joint lengths.

All pipe shall have the manufacturer's trade name, the initials P.V.C., the pressure rating, and the N.S.F. seal of approval conspicuously marked on each length of pipe.

PVC Pressure Sewer pipe shall be pigmented green in color for positive identification as sewer piping. White pipe will be allowed, provided 3-inch width "Sewer" marking tape is installed directly above and within 6 inches of the pipe. When marking tape is used, it shall not take the place of the required locator wire. Blue pipe shall not be used for sewer applications.

C. Joints for P.V.C. Pipe: Unless otherwise permitted by these specifications or the plans, joints shall conform to the following.

1. P.V.C. Non-Pressure Sewer Pipe: Joints shall be integral wall bell and spigot. Each bell shall be supplied with a continuous rubber ring or gasket, which will be compressed radially to affect a positive watertight seal under all combinations of joint tolerance when assembled. Provision shall be made for expansion and contraction at each joint.

Any lubricant used in the installation shall be as recommended by the pipe manufacturer.

2. P.V.C. Pressure Sewer Pipe: Joints shall be "push-on"; plain end to bell type of joint shall conform to ASTM D3139. The bell shall be on an integral part of the pipe.

Each bell shall be supplied with a continuous, rubber ring which will properly seat in a groove or shoulder of the bell provided for it. The bell wall thickness at any point shall conform to the dimension ratio of the pipe except in the annular gasket space where the wall shall be at least the minimum wall thickness of the pipe. Designs not meeting this requirement shall be tested as specified by ASTM D3139.

Any lubricant used in the installation shall be as recommended by the pipe manufacturer.

D. Fittings and Accessories for P.V.C. Pipe: Unless otherwise permitted by these specifications or the plans, fittings shall conform to the following.

1. P.V.C. Non-Pressure Sewer Pipe: Fittings and accessories shall be as manufactured and furnished by the pipe supplier, or approved equal, and shall have bell and/or spigot configurations identical to that of the pipe. Fittings shall have a minimum pipe stiffness of 46 p.s.i. when tested in accordance with ASTM D2412.

(a) Fittings for diameters 4-inch through 15-inch shall conform to the requirements of ASTM D3034.

(b) Fittings for diameters 18-inch through 27-inch shall be made of P.V.C. plastic meeting the requirements of ASTM F679. Fittings shall be extruded and shall conform to ASTM D3212.

2. Fittings for P.V.C. Pressure Pipe: Fittings for 6-inch and larger P.V.C. pipe shall be ductile iron fittings conforming to Section 2.03C of these specifications. Fittings for 4-inch and smaller P.V.C. pipe shall be plastic fittings.

All plastic fittings furnished for polyvinyl chloride pipe shall be made from polyvinyl chloride conforming to the specifications listed in Section 2.07B. All fittings shall be compatible with the pipe upon which they are installed and only standard manufactured fittings will be accepted. The joints shall be in accordance with Section 2.07C.

2.08 POLYETHYLENE PRESSURE SEWER PIPE, JOINTS, FITTINGS

- A. P.E. Pressure Sewer Pipe:** All P.E. pressure sewer pipe furnished shall conform in all respects to ASTM F714 and ANSI/AWWA C906.

Polyethylene plastic pipe shall be manufactured from a virgin resin which has the primary physical properties which are identified by cell classification P.E. 345564C in accordance with ASTM D3350 and has been listed by the Plastic Pipe Institute (P.P.I.) as a P.E. 3408 designated compound.

All P.E. pipe shall be of a single manufacturer. All P.E. pipe shall be DR 11, Class 160, unless otherwise specified. The pipe shall be furnished in Ductile Iron Pipe Size.

All P.E. pipe shall have the manufacturer's name or trademark, the nominal pipe size, the PPI plastic pipe designation code and the Dimensional Ratio (DR) or wall thickness conspicuously marked at intervals of not more than 2 feet.

P.E. Pressure Sewer pipe shall be black with a green stripe or shall have a green exterior for positive identification as sewer piping. Solid black pipe will be allowed, provided 3-inch width "Sewer" marking tape is installed directly above and within 6 inches of the pipe. When marking tape is used, it shall not take the place of the required locator wire. Blue or blue-striped pipe shall not be used for sewer applications.

- B. Joints:** Pipe shall be joined into continuous lengths on the jobsite, aboveground using butt heat-fusion or electrofusion equipment and instructions provided by or recommended by the pipe manufacturer. Equipment shall be capable of meeting all temperature, pressure and alignment conditions recommended by the manufacturer. All fusion machine operators shall be certified by the pipe manufacturer.

Butt fusion joining shall be 100% efficient and shall produce a joint weld strength equal to or greater than the tensile strength of the pipe.

- C. Fittings:** Ductile iron fittings conforming to Section 2.03C shall be used for pipe sizes 6" and larger. Polyethylene thermal-fused fittings shall be used for pipe 4" and smaller. All polyethylene pipe fittings shall conform to ASTM D3261 and Section 2.08A of these specifications.

Transition fittings required at pipe material changes shall be the Harvey type mechanical joint adapter. Transition fittings shall be of the same DR as the pipe, shall exceed the tensile strength of the pipe and shall meet ANSI/AWWA C906.

2.09 PRECAST CONCRETE MANHOLES

Precast reinforced concrete manhole sections shall be manufactured in accordance with ASTM C478 to the dimensions required by the contract drawings.

Joints for precast sections shall be primed on the sealing faces with a product recommended by the manufacturer of the gasket. Primer shall be applied in accordance with the manufacturer's recommendations prior to delivery of the manhole sections to the job site. Joints shall be sealed with a flexible gasket material conforming to AASHTO M 198, Type B.

Manhole exterior sections including base sections, risers, cones, grade rings, tops, etc. shall receive a waterproofing admixture treatment. The concrete waterproofing admixture shall be of the cementitious crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete. Admixtures shall contain red dye to ensure detection in the concrete and must be added to the concrete at the time of batching and thoroughly blended into the concrete. The dosage rate for the waterproofing admixture shall be 20

lbs. per cubic yard of concrete or as recommended by the manufacturer. The Contractor shall include in his submittals, test reports in accordance with U.S. Army Corps of Engineers CRD C48 "Permeability of Concrete" in which all samples treated with the admixture showed no measurable leakage and water penetration of no more than 1.5 mm after 120 hours of being subjected to 150 psi water pressure. The Contractor shall also supply test reports in accordance with DIN 1048 for water impermeability of concrete in which no water permeates treated samples. The Contractor shall provide data showing that the admixture is capable of sealing cracks up to 0.40 mm in width and is suitable for a pH range of 3-11 with constant contact or 2-12 with periodic contact.

All joints, wall penetrations, lifting holes, etc. shall be grouted inside and outside with shrinkage compensating cement as specified herein.

Precast manhole units, coatings, gaskets, prime, grout, etc. shall be as approved by the Engineer prior to construction.

2.10 METAL CASTINGS

Metal castings for manhole frames, covers, and all other iron castings shall be of tough gray iron, free from injurious defects and of such quality that a blow from a hammer on a square edge will produce an indentation of the casting without flaking the metal. When broken, the faces shall show a fine grained, gray fracture. Manhole castings shall be Catalog No. V-1317 by East Jordan Iron Works, Neenah Foundry 1158-TO5, or approved equal. Adjustor rings shall be Catalog No. V-1941-2 by East Jordan Iron Works or approved equal. Bolted-down frames and covers shall be Catalog No. V-2480-1 by East Jordan Iron Works, or approved equal.

Castings shall be of the designs and dimensions indicated on the plans. All frames and covers shall be made accurately to the dimensions required and shall be machined to secure perfectly flat and true surfaces; allowance shall be made in the patterns to permit machining without sacrificing thickness. Covers shall fit the frames to any position.

Manhole rings and covers shall be of traffic grade and weigh not less than 250 pounds.

2.11 CEMENT

Cement for manhole construction, and other concrete meeting the requirements of Section 03 30 10 of these specifications shall conform to ASTM C150.

Cement used in the grout mixture used to seal pipe connections at manholes shall be shrinkage compensating cement similar to Texas Industries TXI4C, Chemically Prestressed Concrete Corporation of California, or equal.

2.12 SAND

Sand shall be sharp, clear, free from deleterious substances, and shall be uniformly graded. Fine aggregate for concrete shall meet the requirements of AASHTO M 6.

2.13 GRAVEL

Coarse aggregate used in concrete work shall meet the requirements of ASTM C33, one inch to No. 4 size.

2.14 WATER

Water used in concrete or mortar work shall be clear, free from oil, alkali, sugar, or other deleterious substances, and shall be potable.

2.15 CONCRETE

Concrete, reinforcing bars and wire mesh shall conform to Section 03 30 10 of these specifications, as applicable.

2.16 MISCELLANEOUS VALVES FOR SEWERS

When detailed on the plans, the Contractor shall furnish and install the various valves required. These valves shall meet the following specifications.

- A. Air Release and Air and Vacuum Valves:** All air release and air and vacuum valves shall be specially adapted for sewer service. The valve shall be designed to keep the valve operating mechanism free from contact with the sewage. Unless otherwise specified, the valve shall be furnished with a 2" inlet.

Air release valves shall contain provisions for back flushing. Shut-off and blow-off valves shall be permanent features of the design to permit routine back flushing by manipulation of these valves. A back flushing hose with quick disconnect couplings shall be furnished.

Air release valves shall be as manufactured by Dezurik Corporation and shall be the 450 SARV APCO Sewage Valve, or the Crispin Pressure Sewer Valve, as manufactured by Multiplex Corporation, or an approved equal.

Air and vacuum valves shall be as manufactured by Dezurik Corporation and shall be the 402 SAVV series APCO Sewage Valve, or a Crispin Air and Vacuum Sewer Valve, or an approved equal.

Sewer combination air valves shall be as manufactured by Dezurik Corporation and shall be the 445 SCAV series APCO Sewage Valve, or a Crispin combination Air Sewer Valve, or an approved equal.

Air valve installations may be of three types:

Type I	Air Release
Type II	Air and Vacuum
Type III	Combination Air Valve

The type(s) required shall be as listed in the bid schedule.

- B. Gate Valves:** All gate valves and tapping valves shall be manufactured in compliance with ANSI/AWWA C509 or ANSI/AWWA C515. Valves shall be the resilient seat type, shall have non-rising stems and shall be Mueller 2360 series, American Flow Control 2500 series, or an equal approved by the engineer.

All gate valves shall operate so that the valve will open when turning the operating nut in a counter-clockwise direction. All gate valves buried underground shall have a non-rising stem with operating nut and cast-iron valve box. All gate valves shall be designed for a minimum working pressure of 250 pounds per square inch and shall be capable of withstanding an internal hydrostatic pressure of 500 pounds per square inch. Buried gate valves shall have stems equipped with the standard (2" square) wrench nut. Gate valves installed aboveground shall be equipped with hand wheels. One valve wrench suitable to open and close all gate valves in this project shall be supplied to the Owner.

When the depth of bury is greater than 30 inches, the operating nut shall be brought to within thirty 30 inches of the ground surface by an appropriate extension of the stem.

- C. Butterfly Valves:** Butterfly valves shall be manufactured in accordance with ANSI/AWWA C504.

Valve shafts may be of one-piece or two-piece construction; however, in either case, the disc shall be of uniform thickness at the shaft axis. The steel shaft shall be of 18-8 stainless steel or 304 stainless steel. The valve shafts shall be designated as to provide permanent centering of the disc and shall have permanent self-lubricated shaft bushings.

The valve disc shall be manufactured of cast Ni-resist or other corrosion resistant material approved by the Engineer. The valve seat shall be of rubber and may be applied to the

valve body or disc. In either case, the mating seat surface shall be 18-8 stainless steel, 304 stainless steel, or Ni-resist Type I.

All butterfly valves shall be manufactured for a working pressure of 150 psi. Valve bodies shall be of cast iron with mechanical joint or flanged ends as indicated on the plans. All mechanical joints and flanged joints shall meet the requirements of ANSI/AWWA C111/A21.11 or ANSI/ASME B16.1.

All butterfly valves shall be designed for underground service. Valves to be used below ground shall be furnished with a 2-inch operating nut while valves to be used in above ground installations shall be furnished with a standard operating wheel. When the depth of bury is greater than 30 inches, the operating nut will be brought to within 30 inches of the ground surface by an appropriate extension of the stem. Below ground valves shall be furnished with a suitable cast iron valve box. The Contractor shall furnish the Owner with one valve wrench to fit the operating nut furnished.

- D. **Valve Boxes:** All valve boxes shall be made of cast iron and shall be of the heavy roadway type with an inside diameter of not less than 5 inches. The top section shall be adjustable for elevation and shall be of the two-piece screw type unless additional sections are needed due to deep cover of pipe. The base shall be sufficiently large so that it will not come in contact with the valve or pipe at any point.

The top of the valve box shall be installed flush with the ground surface or street surface and shall be supported by a 2' x 2' concrete foundation as shown on the drawings. The valve box cover or manhole cover shall be cast iron.

2.17 PIPE STOPPER, CLEANOUT CAPS, ETC.

- A. **Above Ground Cleanout Box:** All cleanouts shall be furnished with a cast iron cleanout box with "sewer" lettered on cover. The box shall be a Neenah Foundry R-1791-A, East Jordan Iron Works Catalog No. 1150, or approved equal.
- B. **Subsurface Line Plugs, Etc.:** All caps, plugs, etc. for D.I. sewer pipe or force main shall be D.I., mechanical joint or equal. All caps, plugs, etc. for PVC sewer pipe shall be plastic stoppers of standard manufacture.

2.18 CASING PIPE

Casing pipe shall be seamless steel in accordance with ANSI/AWWA C200. Materials shall conform to ASTM A36. The size and wall thickness shall be as specified on the plans. The interior and exterior of all casing pipe shall be cleaned, primed and lined with two coats of asphalt in accordance with AASHTO M 190, Type A. All steel casing shall be butt-welded and all welds shall be full penetration single butt-welds in accordance with ANSI/AWWA C206 and ANSI/AWS D10.7M/D10.7.

2.19 FOUNDATION, BEDDING, HAUNCHING AND BACKFILL MATERIALS

Requirements for various bedding and backfill classes shall be as detailed on the plans and the materials used shall be in accordance with the following specifications.

- A. **Coarse Aggregate:** Unless otherwise required by the pipe manufacturer, washed gravel shall be a No. 57 stone, shall be clean, free from clay, sticks, or other deleterious substances and shall meet the following gradation:

<u>Sieve</u>	<u>Percent Passing by Weight</u>
1"	95-100
1/2"	25-60
No. 4	0-10
No. 8	0-5

- B. **Select Backfill:** Select backfill shall be Unified Soil Classification System Designation A-2-6 for normal excavations or A-2-4 for excavations beneath streets and driveways. Select backfill shall be clean, free from sticks or other deleterious substances.
- C. **Select Native Soil:** Select native soil shall be fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures (Unified Soil Classification soil types GM, GC, SM, and SC) or inorganic silts, very fine sands, silty or clayey fine sands, or inorganic clays of low to medium plasticity, silty clays, lean clays, having a liquid limit of 50% or less (Unified Soil Classification soil types ML, CL or CL-ML), as described in ASTM D2487.
- D. **Lumber:** Lumber shall be southern yellow pine S.P.I.B. Grade No. 2, dimension rough, creosote coal-tar treated, with a minimum net retention of preservation of 12 pounds full cell per cubic foot of wood. The Contractor shall furnish a notarized manufacturer's certificate that the lumber meets specifications in both grade and treatment.

2.20 PIPE FOR JACKING AND BORING

- A. **General:** Pipe for jacking and boring will be referred to as special force main pipe or special gravity sewer pipe. The material options will be as identified hereinafter or as modified in the General Requirements.
- B. **Installations under Louisiana State Highways:** Pipe shall meet the latest requirements of the Louisiana Department of Transportation and Development (LADOTD).
 - 1. **Pressure Sewers:** P.V.C. special force main pipe shall meet the manufacturing requirements described in Section 2.07; the outside diameter (O.D.) of the pipe bell or sleeve shall not exceed the O.D. of the pipe barrel by more than 1 inch. The maximum pipe DR shall be 21, in minimum lengths of 40 feet.
 - 2. **Non-Pressure Sewers:** P.V.C. special gravity sewer pipe shall meet the manufacturing requirements described in Section 2.07 for pressure or non-pressure sewers; the O.D. of the pipe bell or sleeve shall not exceed the O.D. of the pipe barrel by more than 1 inch.
- C. **Installations in Other Locations:** Pipe shall meet the requirements noted below:
 - 1. Pressure Sewers:
 - (a) P.V.C. pipe shall meet the requirements of Section 2.07, having a maximum pipe DR of 21 and minimum lengths of 40 feet.
 - (b) Ductile iron pipe shall meet the requirements of Section 2.03.
 - 2. Non-Pressure Sewers:
 - (a) P.V.C. pipe shall meet the manufacturing requirements described in Section 2.07 for pressure or non-pressure sewers.
 - (b) Ductile iron pipe shall meet the requirements of Section 2.03.

2.21 METALLIC WIRE

Metallic wire used as locator for any non-metallic or non-conductive (electric current) underground facility shall be #10 AWG Type THHN insulated stranded copper wire. Wire splices shall be made using splice kits similar or equal to model DBR by 3M. No separate payment will be made for furnishing and installing metallic wire. The cost of this work shall be included in the unit price per foot of pipe installed.

2.22 ELECTRONIC MARKER LOCATOR

Electronic marker locator furnished for signaling to a buried service connection marker shall be a single purpose instrument designed for such application; its signal frequency shall be compatible with the service connection marker furnished in accordance with Section 2.23.

The unit shall be the digital, microprocessor controlled type and shall be powered by replaceable alkaline C or D cell batteries. The unit shall be Fisher Model TW 7700 or an equal approved by the Engineer. It shall be furnished in a sturdy carrying case, which can be securely closed when not in use.

2.23 SERVICE CONNECTION MARKER

Service connection markers shall be sealed, waterproof, long life units designed for direct bury over underground utilities. The units shall be impervious to minerals, chemicals and temperature extremes, shall be simple to use, and unaffected by metal objects, conduit, fences or AC power. The units shall be compatible with the electronic marker locator furnished in accordance with Section 2.22. Connection markers shall contain no working parts, batteries, or other feature that would require maintenance.

2.24 FLEXIBLE MANHOLE COUPLINGS

Flexible couplings for connecting non-pressure sewer pipes through 27-inch diameter to manholes shall be made of tough elastomeric plastic, shall be resilient, and unaffected by soil conditions. Couplings shall be resistant to chemicals and normal sewer gases.

Stainless steel clamp bands shall be furnished for completing the assembly. Flexible couplings shall be similar to Fernco flexible couplings, or an equal, approved by the Engineer.

2.25 FLEXIBLE MANHOLE BOOTS

Flexible manhole boots for connection of non-pressure sewer pipes through 27" diameter to manholes or other structures shall be made of resilient neoprene elastomers. The boots shall be unaffected by soils conditions, resistant to chemicals and normal sewer gases. Stainless steel clamp bands and stainless-steel self-locking expansion bands shall be furnished for the complete assembly. The flexible manhole boots shall be similar to Kor N Seal Boots, as manufactured by National Pollution Control Systems, Inc.

2.26 ELASTOMERIC WATERSTOPS

Elastomeric plastic seals (gaskets) required on non-pressure sewer pipe connections to manholes shall meet the manufacturing requirements of ASTM F477, and shall be of the type designed for such application.

2.27 INSULATORS FOR PIPE IN CASING

Insulators for supporting pipe installed in casing shall be units designed for such use, constructed of steel, with steel capped plastic, or molded plastic insulating skids in sufficient number to support the carrier pipe when full of water. Insulators shall be DSI Series, as manufactured by PSI Products, Inc., or Model CI as manufactured by Advance Products and Systems, Inc., or approved equal. Appropriate risers and insulating runners shall be sufficient to prevent the carrier pipe bell from resting on the casing and sufficient to prevent flotation for gravity sewers. The spacing of the insulators shall be as indicated on the drawings.

2.28 TIMBER SHEETING

Materials for timber sheeting shall be rough-cut oak timbers with a minimum thickness of 2 inches, minimum width of 12 inches, and length as required. Timber walers and bracing shall be rough-cut oak of sufficient size and strength to adequately brace the sheeting.

2.29 BRICK

Manhole brick shall meet the requirements of ASTM C32. Cored brick is not permitted.

2.30 MANHOLE INSERTS

Where indicated on the plans, Bid Form, or General Requirements, new manholes shall be equipped with a manhole insert. Manhole inserts shall be equipped with a gas relief valve and shall have a water down leak rate of no greater than 5 gallons per 24-hour period. Inserts shall be

constructed of 18 Gauge 304 stainless steel and shall be equipped with a handle of 1" wide nylon webbing attached with stainless steel hardware. The seal between the insert and manhole casting shall be constructed of neoprene. Where specified, manhole inserts shall not be installed in the same manholes as manhole cover vent systems as described in Section 2.31.

2.31 MANHOLE COVER VENT SYSTEM

Where indicated on the plans, Bid Form, or General Requirements, new manholes shall be equipped with a cover vent system. Manhole cover vent systems shall be as manufactured by Sewer Sentry or approved equal. The vent system shall consist of two parts, including a device to penetrate the manhole lid to allow airflow in and out of the manhole as well as a rubber gasket for water tightness between the manhole frame and cover.

The venting device penetrating the manhole lid shall be dome-shaped and protruding approximately 5/8" above the manhole lid. The device shall be composed of a nylon resin material with an HS-20 vehicle loading rating that is resistant to chemicals, UV light and heat/cold. The device shall be equipped with a neoprene washer to effect a watertight seal with the manhole lid. The venting device shall be provided with an optional vent pipe extension of pultruded fiberglass tube 4' in length. The manhole ring gasket shall be EPDM rubber with a minimum 1,000 psi tensile strength resistant to ozone, oxidizing chemicals and acids as well as UV light. The gasket shall be secured in place with high-strength adhesive. Installation of all components shall be in strict accordance with the manufacturer's written instructions.

Where specified for new manholes, manhole cover vent systems shall not be measured and paid separately, but shall be included in the price of the manhole assembly.

2.32 JOINT RESTRAINT

- A. **General:** The Contractor shall furnish and install joint restraint harnesses on all buried pressure piping 2" in diameter and larger as necessary to withstand the specified test pressure. All fittings, bends, tees, plugs, caps, etc. shall be restrained using an approved restraint device as shown on the plans. Pipe bell joints shall be restrained for the minimum lengths shown or as recommended by the restraint manufacturer; whichever length is greater. Unless otherwise specified in the plans or General Requirements, the Contractor shall use joint restraint harnesses in lieu of thrust blocks.
- B. **Joint Restraint for Fittings:** Joint restraint harnesses shall be specifically designed for the type of pipe used and shall be as recommended by the pipe manufacturer. Joint restraint harnesses shall utilize wedges or gripping rings to distribute the load uniformly around the circumference of the pipe. Harnesses employing wedges with radial actuating screws shall have breakaway bolt heads to limit the torque applied. Joint restraint harnesses shall be capable of withstanding the full pressure rating of the pipe and shall be coated with fusion bonded epoxy and constructed of ductile iron and corrosion resistant materials. Bolts and nuts shall be stainless steel, or high strength, low-alloy steel manufactured in accordance with AWWA C111.
1. **Mechanical Joints on Ductile Iron Pipe:** Joint restraint harnesses for mechanical joint fittings on ductile iron pipe shall be Megalug Series 1100 as manufactured by Ebaa Iron Works, Uniflange Series 1400 as manufactured by Ford Meter Box Company, or approved equal.
 2. **Push-On Joints on Ductile Iron Pipe:** Joint restraint for push-on fittings on ductile iron pipe shall be "Fastite" with "Fast-Grip" gaskets as manufactured by American Cast Iron Pipe Company or "Tyton" joint with "Field Lok 350" gaskets by US Pipe & Foundry Company, or an approved equal.
 3. **Mechanical Joints on PVC Pipe:** Joint restraint harnesses for mechanical joint fittings on PVC pipe shall be Megalug Series 2000PV or Megalug Series 15MJ00 as

manufactured by Ebac Iron Works, Uniflange Series 1300 or Uniflange Series 1500 as manufactured by Ford Meter Box Company, or approved equal.

4. Push-On Joints on PVC Pipe: Joint restraint harnesses for push-on fittings on PVC pipe shall be Megalug Series 2500 as manufactured by Ebac Iron Works, Uniflange Series 1360, as manufactured by Ford Meter Box Company, or approved equal.
5. Mechanical Joints on HDPE Pipe: Mechanical joint connections to HDPE pipe shall use Harvey-type transition fittings as described in Paragraph 2.08.C.

C. Bell Joint Restraints:

1. Ductile Iron Pipe: Bell joint restraint shall be by use of gaskets and locking rings as described in Paragraph 2.31.B.2.
2. PVC Pipe: Bell joint restraint harnesses on PVC pipe shall be Megalug Series 1600 as manufactured by Ebac Iron Works, Uniflange Series 1390 as manufactured by Ford Meter Box Company, or approved equal.

D. Restrained Length: The Contractor shall provide joint restraints on all fittings and bell joints within a minimum distance of each restrained tee, bend, reducer, or cap. Unless otherwise approved by the Engineer, the minimum restrained lengths shall be as shown in the project details. Minimum restrained lengths are dependent upon the test pressure, type of connection, type of pipe, type of backfill, and depth of bury.

E. Installation: Joint restraint harness installation shall be in accordance with the manufacturer's instructions.

PART 3 – CONSTRUCTION METHODS

3.01 GENERAL

This part of the work includes installation of sewer mains, manholes and other appurtenances; excavation and backfill of trenches; cutting and replacing walks and roadway surfacing; and other miscellaneous items necessary to complete and make ready for operation a complete sewerage system.

3.02 COOPERATION WITH UTILITY OFFICIALS

The Contractor's attention is directed to the fact that his work will be performed in the close proximity of existing utilities, streets, drainage structures, etc. The Contractor shall, at all times, cooperate with the various utility and street officials and shall notify the appropriate personnel prior to excavation in areas where known utilities are located.

3.03 CLEARING OF RIGHT-OF-WAY

The Contractor shall clear the right-of-way provided for the main of all objectionable debris and obstructions that will interfere with the installation of the mains. Wooded areas shall be cleared and grubbed and surface obstructions to remain shall be protected in accordance with Section 3.06 of these specifications.

3.04 EXCAVATION OF TRENCH AND BACKFILL

Excavations, preparation of trenches and backfill shall be in accordance with the applicable standards for the various types of pipe noted below, unless otherwise amended by these specifications or the contract drawings.

TRENCH AND BACKFILL PREPARATION STANDARDS

Type of Pipe	Standard
Ductile Iron	ANSI/AWWA C150/A21.50
Polyvinyl Chloride	ASTM D2321

It is the intent of these specifications that all pipe be properly supported, and then backfilled with select material meeting the requirements of Section 2.19 B or C. If the native soil in the trench is satisfactory for backfill (in any horizon), the Contractor shall preserve that material for use as backfill in the pipe zone. If the entire trench is in a soil which does not conform to the backfill requirements, Contractor shall furnish a borrow material which conforms to Section 2.19 B (Select Backfill) or Section 2.19A (Coarse Aggregate) for use in the pipe zone. The backfill type shall be approved by the Engineer. Compensation shall be as noted in the payment section.

A minimum horizontal separation of six feet shall be maintained between all water mains and services and any sewer mains. All water mains and services crossing sewer mains shall have a minimum vertical separation of 18 inches. All distances shall be measured from outside of pipe to outside of pipe.

3.05 OBSTRUCTION OF STREETS, PREMISES, ETC.

All material shall be placed so as to interfere as little as possible with public travel. At street crossings and other points as directed by the Engineer, trenches shall be bridged in a manner so as to prevent any serious interruption of public travel; the closure of both sides of a double roadway to vehicular traffic will not be permitted except by special permission.

Special care must be taken to give free access at all times to all fire hydrants, water valves, and Police Department and Fire Department driveways.

In case the Contractor shall fail to keep open streets, sidewalks, approaches to premises, etc., and shall refuse or neglect to open them within 12 hours after written notification by the Owner; or shall the Contractor fail to afford proper and necessary access to fire hydrants, water valves, Police Department or Fire Department driveways, and shall neglect or refuse to afford such access within 1 hour of receiving oral or written notice to do so, the Owner shall be and is hereby authorized and empowered to mobilize such force as may be necessary and to do this work, deducting the actual cost thereof from any money which may be due or may become due the Contractor.

3.06 CONFLICT WITH SURFACE OBSTRUCTION

All shade trees, shrubbery, utility poles, etc., within the right-of-way provided shall be protected and any building or structure which may be endangered during the work shall be shored up and otherwise protected.

Any properties disturbed or damaged by the Contractor shall be restored to its original condition. No additional compensation will be made for this corrective work.

3.07 CONFLICT WITH SUBSURFACE OBSTRUCTIONS

The Contractor shall anticipate all underground obstructions such as water lines, gas lines, sewer lines, utility lines, concrete and debris. Any such lines or obstructions indicated on the plans show only the approximate location and must be verified in the field by the Contractor. Neither the Owner nor the Engineer implies or guarantees the exact location of any existing underground utility; however, the Owner and Engineer will endeavor to familiarize the Contractor with all known underground obstructions.

The Contractor shall take the necessary precautions not to injure any gas or water pipe, sewer, drain or service pipes connected therewith or conduits or other underground structures, and the Contractor must repair or have repaired at once, at his own cost, any public or private structure or pipe damaged by or in the course of his work. Should the Contractor fail to repair or have repaired such damage or injury within a reasonable time, the Owner may after 24 hours written notice, have such repairs made and deduct the cost thereof from any amounts due or to become due the Contractor.

The Contractor shall assume all risks and be responsible for all expense and damage attending the presence or proximity of any gas or water pipes, sewers, drains, conduits, or other underground structures where such pipes or other structures cross the trench or appear in the trench in such a manner as not to demand their rearrangement or realignment. The Contractor's risks and

responsibilities shall also apply to such structures as are approximately parallel with or adjacent to but outside of said trench.

The Contractor shall uncover known subsurface obstructions in advance of construction when directed by the Engineer, so that the method of avoiding the obstruction may be determined before pipe laying reaches the obstruction. Should any pipe or other obstruction (so located as to interfere with the work) be encountered, the Contractor shall at once notify the Engineer of the locality and circumstances and the place shall be passed over until satisfactory arrangements are made.

Should the obstruction parallel the trench the Engineer may require the Contractor to offset or realign his pipeline to miss the obstruction. This realignment may be made by the use of fittings, pipe deflection and/or manholes as the case may dictate.

When the pipeline is offset, realigned, or changed in grade to miss an obstruction, no claim for damages or extra compensation shall accrue to the Contractor from the presence of such pipe or other obstruction or from any delay due to its presence.

However, should there be a change in quantity of any established pay item due to this relocation, the Contractor shall be paid for these changes at the unit price bid.

A. Conflicts Crossing Sewage Force Mains: Where subsurface obstructions cross the trench of a sewage force main, the Contractor will be permitted to lay the force main above the obstruction if a minimum amount of cover can be maintained while providing a cushion between the bottom of the pipe and the top of the obstruction at least 6 inches thick. Where this minimum cover cannot be obtained, the Contractor will be required to lay the pipe under the obstruction and maintain a 6-inch cushion between the top of the pipe and the bottom of the obstruction. Under special circumstances, the minimum cover, with the specific approval of the Engineer, may be reduced from 30 inches to twenty 24 inches.

Should the location or position of such obstruction within the limits of the trench be such, in the opinion of the Engineer, as to require removal, realignment or change of the obstruction in order that the work may proceed, such removal, realignment or change will be without expense to the Contractor.

When, however, such obstruction shall come within the limits of the excavation for the work as located by the Engineer, such pipe, conduit, or other obstruction shall be stripped or uncovered by the Contractor, at his own expense, as constituting a part of his work in excavating. No claim for damages or extra compensation shall accrue to the Contractor for any delay due to the presence and adjustment of the obstructions.

B. Conflicts Crossing Gravity Sewers: Where subsurface utilities or drains cross the trench of a gravity sewer and the sewer grade cannot be changed to miss the obstruction or the sewer cannot be realigned to miss the obstruction one of the following methods will be used at the direction of the Engineer.

1. Junction Boxes: The Contractor shall build a junction box over a drain and construct the sewer main through the junction box.
2. Utility Relocation: The Contractor shall relocate the utility in question to miss the sewer by lowering the utility or raising the utility.
3. Construct an Inverted Siphon: In cases where no other solution is available, the Contractor, at the specific direction of the Engineer, shall construct an inverted siphon under the utility or drain in question.

The Contractor shall be paid for these relocations and appurtenances as provided by the contract documents for such work or a change in contract price will be established for such work if not provided for.

The Engineer will in all cases by the judge of the necessity or expediency of any change or re-arrangement of any underground structures which may interfere with the construction of the work under this contract.

3.08 SPECIAL CROSSING - CANALS, RAILROADS, HIGHWAYS, ETC.

- A. **General:** Special crossings for which drawings have been made and on which a special price has been asked, whether a lump sum bid or otherwise, will be paid for according to the special specifications governing said crossings. Otherwise no additional compensation will be paid for the construction of any utility line because of its crossing under or over any natural or manmade obstacle provided the route of the sewer line as bid has not been changed so as to produce a crossing not to be anticipated by the bidder.
- B. **Permits:** Unless otherwise noted, the Owner will secure the necessary permits from the controlling agencies for laying these lines. The permits will be obtained in the name of the Owner; however, the Contractor shall be responsible for complying with all permit provisions.
- C. **Cooperation with Controlling Agency:** The Contractor shall submit to the Engineer and the representative of the controlling agency, all details concerning the method of construction and materials to be used at least 10 days before beginning construction.

3.09 HANDLING AND DISPOSAL OF WATER

The Contractor shall pump, bail, or otherwise remove any water, which may be found or may accumulate in the excavations, trenches, etc., and shall perform all work necessary to keep them clear of water while the work is in progress. The cost of removing water by pumping, bailing, etc. shall be included in the prices bid for the various items of the work. If a separate pay item is requested in the bid form, the cost of well pointing of sewage main trenches will be paid for separately. Otherwise, the cost shall be included in the amount bid for pipe installation. Separate payment will be made for well pointing only when such well pointing is authorized by the Engineer. The Contractor shall keep his completed work reasonably free of water and shall completely remove all of it for the purposes of installations, inspections, etc.

The Contractor shall prevent any of his work from obstructing any drainage ditch, canal, etc., unless special permission is obtained.

3.10 SHEETING AND BRACING

Wherever necessary for protection of workmen, for security of adjacent utilities or structures, for stability of trench, or for proper installation and operation of the sewer the Contractor shall secure the trench to his satisfaction, to the extent of requiring close sheeting, or sheet piling and suitable bracing, including all nails, spikes and other fastenings.

Where the sheeting for a pipe is driven no lower than the top of the pipe, such sheeting may be withdrawn, provided that no sheeting is withdrawn until the trench has been refilled as hereinafter provided to a point not less than 2 feet above the crown of the pipe. Where it is necessary to drive sheeting below the top of the pipe, such sheeting shall be driven down to a point not less than 2 feet below the bottom of the pipe and properly braced. Bracing above the pipe shall be placed as to allow at least 1 foot clear space between the bottom of the bracing and the top of the pipe. Sheeting and bracing driven below the top of the pipe shall be cut off no lower than 2 feet above the top of the pipe before removing.

The Contractor will be paid by separate pay item for all sheeting and bracing left in place at the written direction of the Engineer. The cost of all sheeting and bracing not required to be left in place shall be included in the price bid for sewer pipe of each size and depth, and the Contractor will receive no additional compensation therefore.

3.11 CUTTING INTO AND CONNECTING TO EXISTING SEWERS AND MANHOLES

When in the course of construction operations, it is necessary to cut into and/or connect to existing sewers and manholes at points indicated on the plans and in these specifications, the following provisions shall apply.

The flow in existing sewers shall not be interrupted without permission of the Engineer. If, in the opinion of the Engineer, any necessary interruption will be such as to prevent proper service to the public, the Engineer may require the Contractor to maintain pumps or other reasonable means of continuing or bypassing flow.

3.12 LOCATION OF EXISTING SEWERS AND MANHOLES

The approximate location of known existing sewers and manholes has been shown on the drawings and the final location of all tie-ins, taps, etc. shall be approved by the Engineer.

The Contractor shall be responsible for physically locating all existing sewer pipe and appurtenances to be connected to the new facilities. Compensation for such work shall be included in the pay items established for connections to existing manholes or sewers.

3.13 TEST PITS FOR LOCATION OF OTHER EXISTING UTILITIES

The approximate location of known existing utilities has been shown on the drawings. When ordered and at the location directed by the Engineer and before field layout of the construction, test pits shall be dug by the Contractor throughout the various streets or rights-of-way in which the work is to be constructed or in the immediate adjacent areas. The purpose of this investigative work is to verify the locations of existing underground utilities, which may conflict with the proposed work prior to construction. Upon discovery of a conflict, the Engineer may realign the proposed work, authorize the Contractor to relocate the existing utility or have the existing utility relocated by other means.

3.14 RELOCATION OF EXISTING UTILITIES

The proposed location and alignment of the work may cross or parallel existing utilities at various locations throughout the project site. It is intended to avoid relocation of existing utilities that conflict with the proposed work where possible by realignment or adjustment of the proposed work prior to installation. In the event of an unavoidable conflict with an existing utility, the Engineer may authorize the Contractor to relocate the utility.

The method of payment for any relocation work by the Contractor shall be as provided for in the bid schedule and described by the General Requirements to the contract documents.

3.15 INSTALLING ALL SEWERS

The installation of all sewer pipe shall be in stages; trench excavation, pipe bedding, and backfilling trenches. Generally, the installation shall be in accordance with the requirements of Section 3.04, unless modified herein.

A. "Pipe Zone" Requirements: The "Pipe Zone" for buried non-pressure sewers is shown on the plan sheets. The pipe zone widths shall comply with those detailed on the plan sheets unless the Engineer authorizes different widths for special situations. Unauthorized overwidths will not be considered when measuring theoretical volumes of pipe zone pay items. The terminology, as appropriate, shall also apply to pressure sewers. The requirements for non-pressure service pipe shall be as shown on the plan sheets, and described in Section 3.15B.

1. **Non-Pressure Sewers:** Unless otherwise required by the General Requirements, the "Standard Foundation" for all non-pressure sewers shall be as follows:

(a) **Invert Depths of 10 Feet or Less:**

1. **Bedding and Haunching:** Select native soil as defined in Section 2.19C, and obtained as described in Section 3.04, shall be utilized

for bedding and haunching. The trench bottom shall be prepared as required by the applicable ANSI or ASTM specification. Contractor shall ensure that adequate and continuous uniform support exists beneath the pipe at all points. Haunching material shall be densified or compacted as noted below (percent based on standard proctor, ASTM D698 or AASHTO T 99-01. Densify means thoroughly hand tamp in maximum 6-inch layers).

TABLE 3.15-1

Pipe Material	Required Compaction
P.V.C.	85-90%
Ductile Iron	75%

2. **Initial Backfill:** Select native soil as defined above shall be utilized from the pipe spring line to a height of 12 inches above the top of the pipe. Compaction or densification requirements shall be the same as required for haunching.

(b) Invert Depths of 10 Feet to 16 Feet:

1. **Bedding and Haunching:** Coarse aggregate as defined by Section 2.19A shall be required for PVC sewers for a bedding depth of the pipe outside diameter (O.D.) divided by 8 (O.D./8, 4" minimum) and for all of the haunching area. Except as provided below, bedding and haunching for ductile iron sewers shall be as described in Section 3.15A(1)(a).
2. **Initial Backfill:** Select native soil as defined by Section 2.19C, and obtained as described in Section 3.04, shall be utilized, compacted or densified as noted in Table 3.15-1.

(c) Invert Depths of 16 Feet to 24 Feet:

1. **Bedding and Haunching:** Bedding and haunching for P.V.C. sewers shall be coarse aggregate to the spring line of the pipe, installed as required by Section 3.15A(1)(b). Ductile iron sewers shall be bedded with coarse aggregate for a depth of OD/8 (4" minimum) and a haunching depth of OD/6; the remainder of the haunching area shall be select native soil placed as required by Table 3.15-1.
2. **Initial Backfill:** The initial backfill requirements shall be the same as described in Section 3.15A(1)(b)2.

(d) Invert Depths of 24 Feet to 30 Feet:

1. **Bedding and Haunching:** P.V.C. pipe shall be encased throughout the pipe zone in coarse aggregate. Ductile iron sewers shall be installed as required by Section 3.15A(1)(c).
2. **Initial Backfill:** Where applicable, initial backfill shall be installed as described in Section 3.15A(1)(b)2.

- (e) **Special Foundations:** If the trench soils and condition are such that the bottom is unstable, or migration of the pipe zone material can be anticipated, the Contractor shall, when specifically directed by the Engineer, install one of the "Special Foundations" detailed on the plan sheets in addition to the standard foundation. Compensation shall be as specified in the payment section.

1. Lumber Foundation: When authorized and directed by the Engineer, the Contractor shall install a lumber foundation as detailed on the plan sheets. The lumber foundation pay item shall include furnishing and installing the lumber foundation material only. The bedding, haunching and initial backfill areas of the pipe zone shall consist of coarse aggregate material in accordance with Section 2.19A.

Separate payment will be made for the coarse aggregate bedding and haunching material and the required initial backfill material only if it is not required as part of the standard foundation for the type and depth of the pipe.

2. Coarse Aggregate Foundation: When authorized and directed by the Engineer, the Contractor shall install a coarse aggregate foundation as detailed on the plan sheets. The coarse aggregate foundation shall consist of furnishing and installing coarse aggregate in accordance with Section 2.19A beneath the pipe zone. The depth of foundation below the pipe zone bedding shall be sufficient to properly support the pipe and prevent migration of fines into the pipe zone. The use of and depth of the coarse aggregate foundation shall be authorized by the Engineer. The bedding, haunching and initial backfill areas of the pipe zone shall consist of coarse aggregate material in accordance with Section 2.19A.

Separate payment will be made for coarse aggregate bedding and haunching material and the required initial backfill material only if it is not required as part of the standard foundation for the type and depth of pipe. The coarse aggregate foundation shall also apply to manholes.

- (f) Special Backfill: Special backfill in the pipe zone shall consist of coarse aggregate in accordance with Section 2.19A or select backfill in accordance with Section 2.19B and shall be used only when authorized by the Engineer. The special backfill may be authorized for the initial backfill or bedding and haunching in the pipe zone when the trench excavation material is unsuitable (in any horizon) to conform to the backfill requirements as specified in Section 3.04 or Section 3.15A(1). It is intended that the select backfill material be utilized as initial backfill in dry conditions when suitable native soils are not available in any horizon of the trench. Suitable native soils for initial backfill are defined in Section 2.19C and shall also have an acceptable moisture content to obtain the compaction requirements defined by Section 3.15A(1) for the depth and type of pipe.

2. Pressure Sewers: Unless otherwise required by the General Requirements, pressure sewers shall be installed as detailed on the plan sheets.

B. Sanitary Sewer Services:

1. Installation: Sanitary sewer services (generally diameters of 6 inch or less) shall be pipe meeting the requirements of Part 2. When the sewer main is 8 feet deep, or less, the service pipe shall be installed in accordance with Section 3.04 and Section 3.15A, for the applicable pipe material. When the sewer main pipe is at a depth greater than 8 feet, the installation shall be in accordance with the detail for "Type B" services shown on the plan sheets.
2. Location: Service line locations shown on the drawings are approximate.

The Contractor, through the Engineer's representative, shall coordinate the service location with the prospective sewer users so that the installed location will best accommodate the property to be served.

If a service is to be installed for a future connection (e.g. vacant lot), the installed location will be as directed by the Engineer. The ends of each service shall be plugged watertight, and marked using a service connection marker as described in Section 2.23, unless a service cleanout is required by the contract. The marker shall be installed strictly in accordance with the manufacturer's recommendations.

3. Grade and Elevation: Sanitary sewer services under this contract shall be installed by the Contractor at a minimum slope of 0.01 ft. per foot for 4-inch diameter services and 0.006 ft. per foot for 6-inch diameter services.

The Contractor shall install services to the elevation indicated on the contract drawings, if shown. If an elevation is not shown, the Contractor shall determine and install the service to the elevation required to enable the future service line to the sewer customer to have sufficient available grade. The available grade shall be sufficient to connect the existing or proposed facilities to the service tap, taking into account the location of the existing sewerage facilities, the elevation of the existing facilities, the length of the proposed route, minimum cover requirements of two (2) feet at any point along the proposed route, and minimum slope requirements for service lines of 0.01 ft. per foot for 4-inch diameter services and 0.006 ft. per foot for 6-inch diameter services. Should the Contractor discover that sufficient grade is not available, the Engineer shall be notified immediately.

C. Trench Requirements Above the Pipe Zone:

1. Outside Street Surfaces and Shoulders: The backfill in the trench above the pipe zone shall consist of the native material in the trench unless deemed unsuitable by the Engineer and shall be placed in layers and compacted to prevent settlement of the trench. Prior to the final acceptance of the pipeline, the trench shall be level with the surrounding natural ground.
2. Inside Street Surfaces, Other Paved Areas and Street Shoulders: The backfill in the trench above the pipe zone shall consist of the native material in the trench unless deemed unsuitable by the Engineer and shall be placed in lifts not to exceed twelve inch compacted layers and compacted to the approximate density of the surrounding ground.

The maximum density shall be determined in accordance with LADOTD TR 418 and the in-place density determined by LADOTD TR 401.

The trench shall be compacted for a depth of 2'-0" above the top of the pipe zone using hand tamps or hand operated mechanical tamps for compaction purposes.

The top six (6) inches shall be compacted to 95% of standard density when measured by AASHTO T 99-01.

Should the Engineer determine that the native material in the trench is not suitable for backfill above the pipe zone, the Engineer may authorize the use of a special backfill material. The special backfill material shall be a select backfill material conforming to Section 2.19B or a select material conforming to Section 2.19C but including only the semi-cohesive clayey gravels, sand-clay mixtures, and gravel clay mixtures, with a plasticity index of less than 15. The select material shall be placed in lifts not exceeding 12 inches and compacted by conventional methods to 95% of the standard density when measured by AASHTO T 99-01. The select backfill material shall be compacted by conventional methods as described above.

- D. **Metallic Wire:** A non-corrosive metallic wire shall be installed over the center and taped to non-metallic or non-conductive underground pressure sewers everywhere, and on non-pressure sewers within Louisiana DOTD highway rights-of-way. Metallic wire on pressure sewers shall be installed continuously and connected to all fixtures. Metallic wire installed on non-pressure sewer mains shall be continuous between manholes and connected to manhole rings at each manhole. Metallic wire over non-pressure sewer service pipes shall be spliced into the wire over the main. No separate payment will be made for this item. The cost shall be included in other items.

3.16 INSTALLING DUCTILE IRON NON-PRESSURE SEWER PIPE

Ductile iron non-pressure sewer pipe shall be installed in accordance with the requirements of Section 3.04 and Section 3.15.

Unless otherwise specified in the General Requirements, Bid Schedule and/or Plans, the Contractor shall encase the pipe in polyethylene material designed for such use. The installation of polyethylene encasement shall be in accordance with ANSI/AWWA C105.

3.17 INSTALLING DUCTILE IRON PRESSURE PIPE

Ductile iron pipe shall be installed in accordance with ANSI/AWWA C600. Joint restraints shall be required at all bends, tees, and other fittings. If directed by the Engineer, the Contractor may utilize concrete thrust blocks in lieu of restrained joints.

Unless otherwise specified in the General Requirements, Bid Form and/or Plans, the Contractor shall encase all ductile iron force mains in polyethylene encasement. The installation of all polyethylene encasement shall be in accordance with ANSI/AWWA C105.

3.18 INSTALLING PLASTIC PRESSURE PIPE

All P.V.C. and polyethylene sewage force mains shall be installed in strict accordance with the manufacturer's recommendations. Thrust restraint shall be required on all valves and fittings 2 inches in size and larger.

Polyethylene pipe shall be snaked in the trench. Backfill shall not be placed on any plastic pipe while it is in a heated condition.

The pipe foundation for pressure sewers shall be as detailed on the plan sheets and shall be used for the installation of all force mains, unless another type is specified on the plans.

3.19 MANHOLES, CLEANOUTS, ETC.

All essential details of construction of manholes, cleanouts, etc. are indicated on the plans; these drawings shall be followed carefully.

Manholes shall be constructed of precast reinforced concrete sections. Manholes shall be brought to grade with precast grade rings, half rings or manhole brick. If manhole brick is used, the inside and outside surfaces shall be plastered with 1/2-inch mortar. Joints shall be gasketed to form a watertight seal. The inside and outside of each joint shall be grouted as shown on the plans.

All manhole frames shall be properly set in mortar and shall finish flush with paving, at the proposed grades at these locations. Manholes outside of paved surfaces shall be set to within $\pm 1/2$ inch of proposed grade. When required by the drawings, bolted-down manhole frame and covers, as detailed on the plan sheets shall be installed. Where required by the drawings, Bid Form, or General Requirements, manhole cover vent systems shall be installed in accordance with Section 2.31 of this specification.

Unless otherwise called for on the drawings, or directed by the Engineer, the top elevation for manholes shall be 0.2 feet above the natural or proposed ground elevation at the manhole location. The top elevations of manholes in paved areas shall be flush with the pavement. Adjustments shall be made by the use of pre-cast concrete grade rings.

Inverts and bottom curves shall be built accurately and so formed as to facilitate the smooth entrance and flow of sewage through the manhole. Benches may be constructed of brick and of concrete, at the option of the Contractor. When brick is used, it shall be surfaced with a 1/2-inch thick layer of cement mortar composed of one part cement and two parts sand. Flow channels equivalent to the top of pipe shall be formed with concrete, then troweled to a smooth, even finish.

The manhole bottom from wall line to flow channels will be sloped approximately one inch per foot, and troweled smooth with a liberal radius applied at flow channel interceptors.

The technique of connecting sewers to manholes shall be as shown on the plans, or as approved by the Engineer. For those sewers which will not be extended immediately, the bell shall be securely closed with a watertight stopper of a type that can be readily removed without risk of damage to the bell.

Drop inlets shall be provided as detailed and where indicated on the plans.

3.20 HOUSE CONNECTIONS

The Contractor shall provide all labor, materials and equipment necessary for the construction of all service connections.

Service connections shall consist of wyes, tees, bends and service pipe either in 6-inch or 4-inch size at the locations shown on the plans or as designated by the Engineer. The type of fittings to be used and the size of fittings and service pipe shall be as designated by the Engineer. The opening of each branch shall be securely closed with a watertight stopper of a type that can be readily removed without risk of damage to the bell.

The standard service connection for sewers less than 8' feet deep shall be Type "A", and for sewers over 8' feet deep shall be Type "B", as shown on the plan sheets.

3.21 TRENCHLESS PIPE INSTALLATION

When permitted by the plans and specifications, certain right-of-way, street, highway, and/or railroad crossings by utility lines may be made by trenchless methods. The installation of gravity sewer, pressure sewer and casing pipe shall be by trenchless methods shall be in accordance with Louisiana Standard Specifications for Roads and Bridges - Section 728.

The excavation of all approach pits and trenches within the right-of-way of the highway or railroad shall be of sufficient length from the street or railroad tracks to permit traffic to pass without interference. All backfill on the approach pits and trenches within the right-of-way shall be tamped in layers a maximum of 6 inches thick for the entire length and depth of the trench or pit. The backfill shall be compacted to 90% of maximum density obtained at optimum moisture as determined by AASHTO T 99-01. Mechanical tampers may be used after a cover of 6 inches has been obtained over the top of the barrel of the pipe.

The boring operation shall be accomplished using a commercial type boring rig and the hole made by the installation shall be of the same diameter (within 2 inches) as the largest outside joint diameter of the pipe installed. The pipe shall be installed in the hole immediately after the bore has been made and in no instance shall the hole be left open while unattended.

In the event subsurface operations result in injury or damage to the pavement, repairs to this pavement shall be made by the Contractor, at no additional cost to the Owner. In the event paving cracks on either side of the pipeline, or is otherwise disturbed or broken due to the Contractor's operations, he shall repair or replace it at his own expense without further compensation.

3.22 JOINT RESTRAINT ON PRESSURE SEWER PIPE

Unless otherwise specified on the plans or in the General Requirements or Bid Form, the Contractor shall restrain each fitting where thrust is generated (tees, bends, caps, reducers, valves, etc.) with joint restraint harnesses and shall restrain each joint and connection within a minimum specified distance of the restrained fitting as described in Paragraph 2.31. Thrust restraint harnesses and

similar devices shall be installed in accordance with the instructions of the joint restraint harness manufacturer and any supplemental instructions by the pipe manufacturer.

Where indicated on the plans or in the General Requirements or Bid form or as directed by the Engineer, joints shall be restrained with concrete thrust blocks. The size of the thrust blocks shall be in accordance with details on the plan sheets. The sizes indicated were based on an undisturbed soil bearing pressure of 2,000 pounds per square foot. The Engineer shall be the sole judge as to the bearing pressure the soil encountered will be able to sustain. If in his judgment the soil allowable bearing pressure is other than the 2,000 pounds per square foot specified, the size of the thrust block shall be adjusted accordingly.

No separate payment will be made for joint restraint harnesses or concrete thrust blocks. The cost of these shall be included in the price of other pay items.

The Contractor shall provide and remove any temporary thrust blocks or joint restraint harnesses needed to complete the testing of the system. No additional compensation will be made for such temporary thrust blocks but the cost of such shall be included in the various items for which a price has been established.

3.23 INSTALLING PIPE IN CASING

When specified on the plans, the Contractor shall furnish and install all utility mains under railroad tracks and highways in a casing. The casing shall be complete with end seals, vent pipe, and other specials required to install the main in the casing. All installations shall be in accordance with these specifications and the requirements of the railroad or highway, as applicable.

Casing pipe shall conform to the requirements of Section 2.18. Unless otherwise specified, the casing pipe shall be installed by the trenchless methods in conformance with Section 3.21.

All carrier pipe installed in casing shall be supported by 360° pipe insulators meeting the requirements of Section 2.27, spaced as called for on the plans.

3.24 ALIGNMENT TEST

Final alignment of the completed gravity sewer mains will be checked by the Engineer. The method of test shall include the use of mirrors and sunlight or artificial light. The alignment shall be confirmed by viewing the main between manholes or manhole locations. Failure to view a "full moon" shall mean rejection of the line under test. The cost of the alignment test shall be included in the separate pay item for testing gravity sewers. The cost of correcting defects and retesting shall be the responsibility of the Contractor at his expense.

3.25 FIELD HYDROSTATIC AND LEAKAGE TESTS FOR FORCE MAINS

The hydrostatic testing of all force mains shall conform to the requirements of ANSI/AWWA C600, Section 4, except as modified below.

- A.** The test shall be applied to the whole or individual valved off sections of the mains either before or after the trench is backfilled.
- B.** The Contractor shall furnish gauges, meters, water and all other material, tools, labor, and equipment necessary for conducting the tests. The Engineer will be notified at least 24 hours in advance of the hydrostatic test.
- C.** The test pressure shall be twice the normal working pressure of the sewage force main or 150 psi (whichever is greater) and shall be maintained for a minimum of 2 hours. The test pressure will be based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge.

Should the amount of leakage exceed that specified, the Contractor shall, at his expense, locate and repair the defects until the leakage is within the specified limits. The cost for testing shall be included in the separate pay item for leakage testing of force mains. The cost of correcting defects and retesting shall be the responsibility of the Contractor at his expense.

3.26 FIELD LEAKAGE TESTS FOR GRAVITY SEWERS

A. General:

1. At no point in the new portion of the gravity sewer shall the leakage of groundwater into the system exceed 200 gallons per day per inch diameter per mile of sewer main, unless another leakage allowance is specified in the General Requirements.

All sections of the sewer mains shall be tested and the cost of testing shall be included in the separate pay item for testing gravity sewers. Repairs on faulty work and additional tests shall be made by the Contractor at no additional cost to the Owner.
2. All tests shall be performed under the direction and to the satisfaction of the Engineer. The Contractor shall provide all labor, work, materials, equipment and facilities necessary to perform all tests. Only equipment approved by the Engineer shall be utilized in the said testing or preliminary line investigation, leak locating, etc.
3. All gravity-sanitary sewer lines, including but not limited to pipe, bends, fittings, specials, stubs, house connections, and appurtenances shall be tested for leakage throughout their entire length by lower pressure air testing as herein specified. This testing method is derived from ASTM F1417 and Uni-Bell UNI-B-6.
4. All sewer pipes being tested shall be entirely free from all debris, stones, sand and any other materials.
5. An accurate determination of the groundwater table shall be made at the time of testing. Groundwater elevation shall be determined by one of the following methods.
 - (a) A pipe probe shall be inserted by boring or jetting into the backfill material adjacent to the center of the pipe, at distances not exceeding 500 feet. Prior to testing, the water level shall be determined after blowing air through the pipe.
 - (b) Manholes at distances of approximately 500 feet apart shall be provided with one-half inch diameter nipple. The nipple shall be threaded inside and extend on each side of the manhole wall by 2 inches. The nipple shall be of non-corrosive material and provided with watertight cap. It shall be installed at a height as directed by the Engineer.

Prior to testing, the water level shall be determined by removing the cap, blowing air through the pipe and connecting clear plastic tube to the pipe nipple. The plastic tube shall be held vertically to allow groundwater to rise in it.

B. Air Testing: Gravity sewer pipe shall be tested by the air test technique between every two consecutive manholes.

1. The test section shall be plugged at each end with one of the plugs tapped and equipped for an air inlet connection for filling the line from an air compressor. The air control equipment shall include the pressure gauge having a pressure range from 0 to 5 psi. The gauge shall have minimum divisions of 0.10 psi and an accuracy of ± 0.04 psi.
2. The air shall be supplied to the test section slowly, until the internal pressure is raised to approximately 4.0 psi, after which the pressure will be allowed to stabilize for not less than 5 minutes. When the pressure has stabilized, and is at or above a starting pressure of 3.5 psi, the test shall begin.
 - (a) The water table elevation shall be determined as stipulated in Section 3.26(A).

- (b) If the pipe to be tested is submerged in groundwater, the backpressure due to groundwater submergence over the end of the probe shall be added to all gauge pressures in the test.
3. The test time shall be determined from the following table. Calculated test times shall take into account the length of all pipe of various diameters within the test section.

MINIMUM TEST TIME FOR VARIOUS PIPE SIZES

Nominal Pipe Size (Inches)	Minimum Test Time (min:sec)	Length for Minimum Time (ft)	Time for Longer Length (sec)
4	3:46	597	0.380 * L
6	5:40	398	0.854 * L
8	7:34	298	1.520 * L
10	9:26	239	2.374 * L
12	11:20	199	3.418 * L
15	14:10	159	5.342 * L
18	17:00	133	7.692 * L
21	19:50	114	10.470 * L
24	22:40	99	13.674 * L
27	25:30	88	17.306 * L
30	28:20	80	21.366 * L
33	31:10	72	25.852 * L
36	34:00	66	30.768 * L
42	39:48	57	41.883 * L

Note: If the tested segment is longer than the length for minimum time, determine the test time by multiplying the length of the segment by the factor in the fourth column. (Ex. – For a 300-foot segment of 12" diameter pipe, the required test time is 300 ft. * 3.418 = 1025.4 sec = 17:05, min:sec)

4. The total pressure drop during the testing period shall be recorded.
- (a) If the pressure drops more than 1.0 psi during the test time, the line segment shall have failed the test.
- (b) If the pressure drops 1.0 psi or less during the test time, the line segment shall have passed the test.
- (c) If the testing time for a line segment is longer than one hour and the segment shows zero pressure drop (0.0 psi) during the first hour of testing, the testing may be stopped and the line segment shall have passed the test. If the line segment has any pressure drop during the first hour, the test shall be continued for the duration of the testing period.

3.27 DEFLECTION TEST FOR FLEXIBLE PIPE

Deflection tests shall be performed on all flexible pipes unless otherwise specified in the General Requirements. The test shall be conducted after the final backfill has been in place at least 30 days. No pipe shall exceed a deflection of 5% unless otherwise specified in the General Requirements. The deflection test is to be run using a rigid ball or mandrel and shall have a

diameter equal to 95% of the inside diameter of the pipe unless otherwise specified. The test shall be performed without the use of mechanical pulling devices.

The cost of the deflection test shall be included in the separate pay item for testing gravity sewers. The cost of correcting defects and retesting shall be the responsibility of the Contractor.

3.28 LEAKAGE TEST FOR MANHOLES

All manholes shall be tested for leakage by visual inspection. Any noted defects shall be corrected by the Contractor at his expense. Retests by the Contractor shall be at the expense of the Contractor.

A visual inspection by the Engineer will be required for all precast concrete manholes. The manholes shall have no visible leaks at the time of inspection, during the contract period, or during the warranty period. All visible leaks which appear shall be repaired. No separate payment will be made for this test inspection.

3.29 WITNESSING OF TESTS

The cost of witnessing a test by the Engineer shall be borne by the Owner one time. The cost of witnessing re-tests of sections which fail the initial test will be deducted from Contractor payments for compensation of the Engineer.

The Engineer will witness all tests, and shall be given at least 24 hours prior notice of a test.

3.30 INTERNAL INSPECTION

The Owner may have the completed gravity sewer line inspected using television or still camera equipment. In the event such inspection is utilized, the actual cost therefore shall be paid by Owner. Beyond normal, routine coordination and cooperation, the Contractor shall not have any responsibility for furnishing assistance.

Problem areas or construction deficiencies identified by internal inspection shall be repaired or corrected by Contractor at no additional cost to Owner.

The time required for performing the internal inspection shall not be considered a part of the contract time unless performed simultaneously with other Contractor activities. If internal inspection is performed, a contract time extension may be authorized by Owner without penalty to Contractor; Contractor shall not be entitled to extra compensation.

3.31 REPLACING STREET SURFACING AND SIDEWALKS

In all paved or unimproved streets, the surface of the trenches shall be finished without any needless delay and in the best workmanlike manner with the same kind of roadway or sidewalk improvement that was removed in excavating the trench.

Should the Contractor fail or refuse to repair any such damage, the Owner may, after 24 hours written notice, employ such personnel and furnish such materials as may be necessary and do the work, deducting the actual cost thereof from any amounts due or to become due to the Contractor.

The Contractor shall be obligated to maintain and keep in good condition any replacement of base, street surfacing or sidewalks from the time of installation until final acceptance of the work.

The replacement of all street surfaces shall be in accordance with the details shown on the plan sheets.

3.32 CLEANUP, MAINTENANCE AND FINAL RESTORATION

As soon as the backfilling of any excavation is completed, the Contractor must at once begin the initial cleanup, grading, shaping, and removal of all surplus dirt, except that actually necessary to provide for settlement, and removal of debris left as a result of construction. All streets and driveways shall be made passable for traffic.

The Contractor shall maintain all areas disturbed by construction until such time that all testing, pavement repairs and final restoration are completed. Testing, pavement repair and final restoration shall begin as promptly as possible or as otherwise required by the General Requirements.

Unless otherwise required by the General Requirements, any surplus earth which may be left on the street or right-of-way at the time final clean up and restoration are started shall be regarded as the property of the Contractor and must be removed at his expense. On ungraded streets, it shall be optional with the Engineer whether surplus material shall be removed or deposited on the surface and graded for the convenience of traffic.

Final restoration and cleanup shall include grading and shaping ditches disturbed by construction and removing siltation from all drainage pipes and structures.

Final acceptance will not be made until the Contractor has cleaned up the project to the satisfaction of the Engineer and the Owner.

3.33 REMOVAL AND REPLACEMENT OF DRIVEWAY CULVERT PIPE

This item of work is intended for driveway culverts of all sizes and types which require removal to facilitate construction of the contract work. When approved by the Engineer, the Contractor shall remove and replace driveway culverts as required to facilitate construction.

Surface material at gravel or shell drives shall be removed and stockpiled separately from the trench excavation material for reuse in restoring the driveway. Hard surfaced driveways shall be removed and replaced in accordance with these specifications and the details shown on the drawings. The culverts shall be carefully removed and stockpiled by the Contractor. Care shall be taken to minimize damage to the culvert during the removal, stockpiling, and reinstallation. Any damage to the culvert caused by the Contractor's negligence will be the Contractor's responsibility. After the installation of the sewer main and/or appurtenance, the driveway culvert shall be replaced on grade. All trench backfill and culvert backfill shall be compacted as required by Section 3.15C(2). At gravel or shell drives, the stockpiled surface material shall be replaced by the Contractor to restore the driveway surface. Additional surface material may be authorized to complete the reinstallation.

It is intended that existing driveway culvert materials be reused when culverts are removed and replaced. Should the existing culvert materials be unsuitable for reuse as determined by the Engineer, the Contractor may be authorized to purchase suitable replacement materials for installation.

The existing salvageable materials not reused shall remain the property of the Owner and shall be delivered to a site to be designated and stockpiled in a neat and orderly arrangement. Unsalvageable materials shall be disposed of by the Contractor. The size, type, and length of the replacement materials will be designated by the Engineer.

3.34 REMOVAL AND REPLACEMENT OF FENCES

This item of work is intended for all types and sizes of fences such as wood, wire, stone, etc. which require removal to facilitate the construction of the contract work.

The number of panels or length of fence to be removed and replaced shall be as shown on the contract drawings or designated by the Engineer. The section of fence to be removed shall be carefully dismantled, and stored.

The Contractor shall construct a temporary fence when required to contain animals, livestock, etc. until the permanent fence is replaced. The cost of temporary fences, including materials, shall be the Contractor's responsibility.

Upon completion of the installation of the sewer main and/or appurtenances, the fence shall be replaced in good condition. Should the existing fence material be unsuitable for reuse, the Engineer

may authorize the purchase of replacement material. The Contractor shall supply a material list to the Engineer of the required fencing materials for approval prior to the purchase.

3.35 STRUCTURAL CONCRETE FOR THE REPLACEMENT OF CONCRETE STRUCTURES

The Contractor shall remove and replace existing concrete structures which conflict with the proposed sewerage facilities as indicated by the contract drawings or as authorized by the Engineer. This item shall include miscellaneous structures such as headwalls, catch basins, retaining walls, concrete boxes, footings, concrete ditches, light standards, etc. This item does not include items covered elsewhere in the contract documents such as pavement repair, fences, standard pipe foundations, thrust blocks, etc.

The concrete materials and construction methods shall be in accordance with Section 03 30 10 of these specifications unless otherwise specified in the General Requirements to the contract documents. The replacement structure shall conform to the dimensions of the existing structure unless otherwise approved by the Engineer. Steel reinforcement shall be required as necessary to replace the structure in kind, or as otherwise required by the Engineer or contract drawings.

The Contractor shall be responsible for disposal of the debris resulting from the replacement including the existing structure.

PART 4 – METHOD OF MEASUREMENT AND PAYMENT

4.01 NON-PRESSURE SEWER PIPE

Non-pressure sewer pipe will be paid for by the lineal foot according to size and depth, as follows: 0-6 feet deep, then in two-foot increments to deepest known depth, such as 6-8 feet, 8-10 feet, etc., except as specified otherwise in the bid schedule. This includes payment for non-pressure sewer pipe installed by trenchless methods.

A. Measurement: Measurement for lengths of the various types of non-pressure sewers installed shall be as follows:

1. **Normal Excavation:** Measurement for the lengths of sewers will be horizontally from center to center of manholes and from the center of manhole to end of pipe without deduction for fittings or manholes. The average depth will ordinarily be calculated from elevations taken approximately 50 feet apart on the ground surface or pavement before it is disturbed and from the elevations of invert of the sewer directly below.

If either the ground surface or the elevation of the sewer is very irregular (as in the case of crossing under embankment), the elevations will be taken at extreme points and closer together as may be necessary to determine the depth with sufficient accuracy.

The average depth of sewer crossing under a waterway or an open canal will be calculated below a straight line joining the natural (not super-elevated) surface on both banks; the average depth under a closed canal or a track will be calculated below the actual ground surface. A normally dry excavation or depression not in use as a canal or waterway will not be regarded as a canal; the actual ground surface will be used in calculating the depth of the sewer.

2. **Jacking and Boring:** Measurement for the length of non-pressure sewers installed by jacking and boring shall be: (1) from toe of fore slope to toe of fore slope for street and highway crossings which have open ditch drainage; (2) from the toe of fore slope to toe of fore slope of the embankment for railroad crossings; (3) from the back of curb to back of curb for street and highway crossings with curb and gutter construction; (4) for the length shown on the plans for any other jack and bore installations.

The Contractor may elect to exceed the limits described above for his convenience in order to avoid inconveniences associated with existing utilities or other reasons, however, measurement will be as described above and additional lengths of special gravity sewer pipe and jack and bore installation for the Contractor's convenience will be at his expense.

The jack and bored pipe will be measured for depth by averaging the depths of the two ends of the crossing.

3. Installed in Casing: Non-pressure sewer pipe installed in casing will be measured on the same centerline length of casing, in accordance with Section 4.01 and Section 4.12. All non-pressure sewer pipe installed in casing will be measured for depth by averaging the depths of the two ends of the casing, for the various diameters installed and accepted.
4. Special Crossings: Special crossings for which drawings have been made and/or on which a special price has been asked, whether a lump sum bid or otherwise, will be measured accordingly.

B. Payment: The actual total lineal feet of sewer pipe, installed and accepted, will be paid for at the contract unit price bid for sewer pipe of the various sizes and classifications at the various depths, which price and payment shall constitute full compensation for furnishing, hauling and installing the pipe complete, with metallic wire if required; for all excavation, sheeting and bracing (except sheeting and bracing left in place and paid for under other items), backfill and compaction, dewatering, removing surplus earth; and for the furnishing of all equipment, tools, labor and incidentals necessary to complete the item in accordance with plans and specifications.

1. Sewer pipe installed under normal excavation, and installed in casing, will be referred to as "gravity sewer pipe".
2. Sewer pipe installed by jacking and boring will be referred to as "special gravity sewer pipe".

C. Item: Payment will be made under:

- | | |
|--------------------|---|
| Item 02535-4.01(1) | (Size)" (Type) Gravity Sewer Pipe, (Depth Range) Depth, per lineal foot |
| Item 02535-4.01(2) | (Size)" (Type) Special Gravity Sewer Pipe, (Depth Range) depth, per lineal foot |

4.02 SEWER SERVICES

Standard sewer service connections will be paid for by the foot for the various sizes installed.

A. Measurement:

1. Service pipe installed at depths 8 feet and less will be measured as described in Section 4.01.
2. Service pipe installed at depths more than 8 feet will be measured by the actual vertical feet of pipe installed, irrespective of the depth.

B. Payment:

1. Standard sewer service connections, identified as Type "A" on the plans, will be paid for as described in Section 4.01.
2. Standard sewer service connections, identified as Type "B" on the plans, placed, tested and accepted, measured as provided, will be paid for at the contract unit price per vertical foot, which price and payment shall constitute full compensation for furnishing, hauling and installing the pipe complete, with metallic wire if

required, and for all excavation, sheeting and bracing (except sheeting and bracing left in place and paid for under other items), backfill and compaction (except coarse aggregate paid for under other items), removing surplus earth; and for furnishing all labor, tools, equipment and incidentals necessary to complete the item in accordance with the plans and specifications.

C. Item: Payment will be made under:

Item 02535-4.02(1) (Size)" Type "A" Gravity Sewer Service Pipe, per lineal foot;

Item 02535-4.02(2) (Size)" Type "B" Gravity Sewer Service Pipe, per vertical foot;

4.03 NON-PRESSURE PIPE FITTINGS

Non-pressure pipe fittings will be paid for per each according to size and type of fittings, except no separate pay will be established for pipe plugs, adaptors, connectors, etc.

A. Measurement:

1. Single wyes or tees of each size shall be one item.
2. Double wyes or tees of each size shall be one item.
3. Pipe bends of each size shall be one item.

Pipe fittings will be measured irrespective of depth, by an actual count of fittings of the various types and sizes installed and accepted.

B. Payment: Non-pressure pipe fittings placed and accepted, measured as provided, will be paid for at the contract unit price bid for the various types and sizes, which price and payment shall constitute full compensation for furnishing, hauling, and installing complete, for all excavation, backfill and compaction, and for the furnishing of all equipment, tools, labor and incidentals necessary to complete the item in accordance with the plans and specifications.

C. Item: Payment will be made under:

Item 02535-4.03 (Size)" x (Size)" (Type of Fittings), per each

4.04 SANITARY SEWER MANHOLES

A. Measurement: Sanitary sewer manholes will be paid for by the actual count per each according to diameter and depth range (0-6 feet, 6-8 feet, 8-10 feet, 10-12 feet, etc.)

Manholes will be measured by the vertical foot and the depth for measurement will be from the top of the manhole casting to the invert of the deepest sewer connecting therewith. Bolted-down frames and covers will be measured separately, per each.

B. Payment: The actual number of manholes installed and accepted, measured as provided, will be paid for at the contract unit price bid per each for manholes to the various depth defined, which price and payment shall constitute full compensation for furnishing, hauling and installing all materials complete, including flexible couplings and waterstops; for all excavation, sheeting and bracing (except sheeting and bracing left in place and paid for under other items), backfill and compaction, removing surplus earth; and for the furnishing of all equipment, tools, labor and incidentals necessary to complete the item in accordance with plans and specifications. Where manhole cover vent systems are specified, the vent system shall be included in the price of the manhole. When bolted-down manhole frames and covers are installed, the actual number of each, measured as provided, will be paid for at the contract unit price per each, in addition to the compensation for the manhole. A value as determined by the Engineer may be withheld from payment of manholes due to incomplete work such as inverts, tops, grouting, penetrations, etc.

C. Item: Payment will be made under:

Item 02535-4.04(1) (Size)' Diameter Standard Manholes, (Depth Range) depth, per each

Item 02535-4.04(2) Bolted-down Manhole Frames and Covers, per each

4.05 MANHOLE DROP INLETS

Manhole drop inlets will be paid for by the vertical foot, according to size installed. This item is to cover the additional cost of drop inlet piping and concrete or masonry encasement that connects various sewer lines to manholes. Fittings used in drop inlets shall be measured in accordance with Section 4.03.

- A. **Measurement:** Manhole drop inlets will be measured by the vertical foot according to size installed. The footage will be measured between the invert of the incoming sewer and the invert of the manhole.
- B. **Payment:** Manhole drop inlets placed and accepted, measured as provided, will be paid for at the contract unit price bid per vertical foot, for the various sizes, which price and payment shall constitute full compensation for furnishing, hauling and installing this pipe complete; for all excavation, sheeting and bracing (except sheeting and bracing left in place and paid for under other items), concrete encasements, waterstops, backfill and compaction, and for the furnishing of all equipment, tools, labor and incidentals necessary to complete the item in accordance with plans and specifications.
- C. **Item:** Payment will be made under:
Item 02535-4.05 (Size)" Drop Inlets, per vertical foot

4.06 SANITARY SEWER CLEANOUTS

- A. **Measurement:** Sanitary sewer cleanouts will be measured per each according to size by an actual count of cleanouts installed and accepted. Fittings and caps in the sewer main for cleanouts will be included in the bid price for cleanouts.
- B. **Payment:** Sanitary sewer cleanouts, placed and accepted, measured as provided, will be paid for at the contract unit price bid per each, which price and payment shall constitute full compensation for furnishing, hauling, and installing all materials complete; for all excavation, backfill and compaction, removing surplus earth; and for the furnishing of all equipment, tools, labor and incidentals necessary to complete the item in accordance with plans and specifications.
- C. **Item:** Payment will be made under:
Item 02535-4.06 (Size)" Cleanouts, per each

4.07 CONNECTIONS TO EXISTING MANHOLES AND SEWER LINES

- A. **Measurement:** Connections to existing manholes and sewer lines will be paid for per each.

Connections to existing sewers by constructing a manhole over the existing sewer will not be measured separately but will be measured as a manhole as specified in Section 4.04.

Connections to existing sewers utilizing fittings will be measured separately and paid for as a connection to an existing sewer. Fittings will be measured separately as specified in Section 4.03.

Connections to existing manholes and sewer lines will be measured by an actual count of connections installed and accepted.
- B. **Payment:** Connections to existing manholes and sewer lines, installed and accepted, measured as provided, will be paid for at the contract unit price bid per each, which price and payment shall constitute full compensation for locating the existing sewer utility; for furnishing, hauling and installing all materials complete; for all excavation, sheeting and

bracing (except sheeting and bracing left in place and paid for under other items), backfill and compaction, removing surplus earth; and for the furnishing of all equipment, tools, labor and incidentals necessary to complete the item in accordance with plans and specifications.

C. Item: Payment will be made under:

Item 02535-4.07

Connections to Existing Manholes or Sewers, per each

4.08 PRESSURE SEWER PIPE

A. Measurement: Sewer force mains will be paid for by the lineal foot according to size and type. This includes pressure sewer pipe installed by trenchless methods. Measurement for the length of the various types of pressure sewers installed shall be as follows.

1. Normal Excavation: Measurement for the length of pressure sewers will be the actual lineal footage laid within the limits shown on plans for all depths, measured along the top centerline of the pipe. No deduction will be made for fittings and valves.
2. Trenchless: Measurement for the length of pressure sewers installed by trenchless methods shall be:
 - a. from the toe of fore slope to toe of fore slope for street and highway crossings which have open ditch drainage;
 - b. from the back of curb to the back of curb for street and highway crossings with curb and gutter construction;
 - c. for the length shown on the plans for any other trenchless installations.

The Contractor may elect to exceed the limits described above for his convenience in order to avoid inconveniences associated with existing utilities or other reasons, however, measurement will be as described above and additional lengths of special gravity sewer pipe and jack and bore installation for the Contractor's convenience will be at his expense.

3. Installed in Casing: Pressure sewer pipe installed in casing will be measured on the same centerline length of casing, in accordance with Sections 4.11 and 4.12. All pressure sewer pipe installed in casing will be measured for payment at the respective unit price bid for force main for the various diameters installed and accepted.
4. Special Crossings: Special crossings for which drawings have been made and/or on which a special price has been asked, whether a lump sum bid or otherwise, will be measured accordingly.

B. Payment: The actual total lineal feet of force main installed and accepted, measured as provided, will be paid for at the contract unit price bid for force main of the various sizes and classifications, which price and payment shall constitute full compensation for furnishing, hauling, installing complete; including fittings, joint restraint, testing, excavation, sheeting and bracing, (except sheeting and bracing left in place and paid for under other items), backfill and compaction, and for the furnishing of all equipment, tools, labor and incidentals necessary to complete the item in accordance with plans and specifications.

C. Item: Payment will be made under:

Item 02535-4.08

(Size)", (Type) Sewage Force Mains, per lineal foot

4.09 DUCTILE IRON FITTINGS

A. Measurement: Ductile iron fittings for force mains will be paid for by the ton. Fittings other than ductile iron will not be paid for separately, but will be included in the unit price per

lineal foot of pipe, unless a specific bid price is requested on the Bid Form. Ductile iron fittings will be measured in units of tons of fittings installed, tested, and accepted, and payment for both mechanical joint and push-on joint fittings shall be made on the basis of ANSI/AWWA C153/A21.53 published body weights for mechanical joint fittings exclusive of weight of gaskets and linings, glands and bolts.

- B. Payment:** Ductile iron fittings, placed and accepted, measured as provided above, will be paid for at the contract unit price per ton for ductile iron fittings, which price and payment shall constitute full compensation for furnishing, hauling, installing complete, and testing; for excavation, preparation of bed and backfilling; concrete thrust blocks or anchors; and for the furnishing of all equipment, tools, labor and incidentals necessary to complete the item in accordance with plans and specifications.
- C. Item:** Payment will be made under:
- Item 02535-4.09 Ductile Iron Fittings, per ton

4.10 SPECIAL SEWER STRUCTURES AND APPURTENANCES

- A. Measurement:** Special sewer structures will be paid for per each. Special sewer structures such as conflict boxes, air release valves with vault, etc., as detailed on the plans and listed in the Bid Form will be measured per each, installed and accepted. Valves with valve boxes shall be measured per each, as a unit, installed and accepted.
- B. Payment:** Special sewer structures and appurtenances, such as conflict boxes, air release valves with vault, valves with valve boxes, etc., in place and accepted, measured as provided above, will be paid for at the contract unit price bid per each, which price and payment shall constitute full compensation for furnishing, hauling, and installing all material complete; for all excavation, of all equipment, tools, labor and incidentals necessary to complete the item in accordance with plans and specifications.
- C. Item:** Payment will be made under:
- Item 02535-4.10 (Description of special sewer installation) Special Sewer Structures, per each

4.11 CASING PIPE - JACKING AND BORING METHOD

- A. Measurement:** According to specifications and as indicated on the plans, the Contractor shall install pipe casings by jacking and boring to receive the sewage carrier line. Casing pipe, installed and accepted, will be measured by the lineal foot for each of the diameters and thicknesses of casing pipe furnished and installed.
- Measurement will be in the same manner as described for non-pressure sewer pipe, Section 4.01A(2) except that there shall be no provisions for depth. Carrier pipe shall be measured separately, as described in Sections 4.01A(3) and 4.08A(3). However, no separate measurement will be made for carrier pipe insulators, which will be installed on all pressure and non-pressure sewers in casing. The cost of these insulators will be included in the bid price for the casing pipe.
- B. Payment:** The actual total lineal feet of casing, installed and accepted, will be paid for at the contract unit prices for casing pipe of various diameters and thicknesses, which price and payment shall constitute full compensation for furnishing, hauling and installing complete, for all excavation, boring, tunneling, jacking, and backfilling; and for furnishing all materials, equipment, tools, labor and incidentals (including insulators) and the performance of all work necessary to complete the item in accordance with plans and specifications. Carrier pipe shall be compensated separately and shall be measured for depth by averaging the depths of the two ends of the casing, or the respective unit price for force main, as the case may be, for the diameters installed and accepted, which price and payment shall constitute full compensation for furnishing, hauling and installing complete.

- C. **Item:** Payment will be made under:

Item 02535-4.11 (Size)" x (Wall Thickness)" Welded Steel Casing Pipe, Jacked and Bored, per lineal foot

4.12 CASING PIPE - BY OPEN CUT

- A. **Measurement:** According to these specifications and as indicated on the plans, the Contractor will install pipe casings, by open cut method, to receive the sewer line. Casing pipe installed and accepted, will be measured by the lineal foot for each of the diameters and thicknesses furnished and installed. The quantity obtained will be the centerline length of the casing installed and accepted. In addition, the carrier pipe installed and accepted shall be measured for separate payment and will be measured for depth by averaging the depths of the two ends of the casing. However, no separate measurement will be made for carrier pipe insulators, which will be installed on all pressure and non-pressure sewers in casing. The cost of these insulators will be included in the bid price for the casing pipe.

- B. **Payment:** The actual total lineal feet of casing, installed and accepted, will be paid for at the contract unit price for casing pipe of various diameters and thicknesses, which price and payment shall constitute full compensation for furnishing, hauling and installing complete; for all excavation and backfilling; and for furnishing all materials, equipment, tools, labor and incidentals (including insulators), and the performance of all work necessary to complete the item in accordance with plans and specifications. Carrier pipe shall be compensated separately and shall be measured for depth by averaging the depths of the two ends of the casing, or the respective unit price for force main, as the case may be, for the diameter(s) installed and accepted, which price and payment shall constitute full compensation for furnishing, hauling and installing complete.

- C. **Item:** Payment will be made under:

Item 02535-4.12 (Size)" x (Wall Thickness)" Welded Steel Casing Pipe, By Open Cut, per lineal foot

4.13 INSTALLING PIPE - TRENCHLESS METHODS

- A. **Measurement:** Installing pipe by trenchless methods either by jacking and boring (gravity sewer) or by horizontal directional drilling (pressure sewers) will be measured by the lineal foot according to the size of pipe installed. Measurement will be as described in Section 4.01A(2) for non-pressure sewer pipe, or Section 4.08A(2) for pressure sewers.

- B. **Payment:** The cost of installing by trenchless methods will be paid for at the contract unit price for installing pipe of various diameters, which price and payment shall constitute full compensation for installing complete; for all excavation, boring, jacking, and backfilling; and for furnishing all equipment, tools, labor and incidentals, and the performance of all work necessary to complete the item in accordance with plans and specifications.

The pipe shall be compensated separately and will be measured as described in Section 4.01A(2) for non-pressure sewer pipe, or Section 4.08A(2) for pressure sewers, as the case may be, for the various diameters installed and accepted, which price and payment shall constitute full compensation for furnishing, hauling and installing complete.

- C. **Item:** Payment will be made under:

Item 02535-4.13 (1) (Size)" (Type) Installing gravity sewer pipe, jacked and bored, per lineal foot;

Item 02535-4.13 (2) (Size)" (Type) Installing pressure sewer pipe, Horizontal Directional Drilling, per lineal foot

4.14 STANDARD PIPE FOUNDATIONS

- A. **Measurement:** Except as provided for in Section 4.16, no separate measurement will be made for standard pipe foundations installed within the pipe zone, as specified in Part 3, or shown on the plans, unless modified by the General Requirements.
- B. **Payment:** Except as provided for in Section 4.16A, no special payment shall be made for standard pipe foundations as specified in Part 3 or shown on the plans, unless modified by the General Requirements.

4.15 SPECIAL PIPE FOUNDATIONS

- A. **Measurement:** Special foundations or pipe supports will be measured per cubic yard or per lineal foot by the type of foundation specified. Special foundations or pipe supports will be measured in place as called for in the bid schedule.

Coarse aggregate special foundations, outside the pipe zone, will be measured by the cubic yard, placed and accepted, and shall be the theoretical volume of compacted special foundation material below the pipe zone. The trench width for determining the volume shall be the actual width of the trench or the maximum width shown in 4.16A(2) below whichever is smaller. Widths in excess of those shown unless otherwise authorized, will be considered excessive, and the calculation shall be limited to the widths shown.

- B. **Payment:** Special foundations or pipe supports, in place and accepted, will be paid for at the contract unit price per cubic yard or per lineal foot, which price and payment shall constitute full compensation for furnishing, hauling and installing all material, and for furnishing all equipment, tools, labor and incidentals necessary to complete the item in accordance with plans and specifications.
- C. **Item:** Payment will be made under:

Item 02535-4.15 (1) (Type) Special Pipe Foundation, per lineal foot

Item 02535-4.15 (2) (Type) Special Pipe Foundation, per cubic yard

4.16 SPECIAL BACKFILL

- A. **Measurement:** Measurement shall be as follows:

1. Coarse aggregate or select backfill, required in the pipe zone as either bedding, haunching or initial backfill material (except as provided in (3), below or required as part of the standard foundation for non-pressure sewer), will only be measured for separate payment when the trench excavation material is unsuitable, in any horizon, to conform to the backfill requirements, as specified in Section 3.04 or when otherwise authorized by the Engineer.

Measurement for payment shall be the theoretical solid volume of pipe zone receiving the special backfill after deducting the volume occupied by the pipe. The width for determining the theoretical volume shall be the actual width of the pipe zone but limited to the maximum pipe zone width indicated by the standard non-pressure sewer foundation detail of the contract drawings. No measurement will be made for overwidths unless specifically authorized by the Engineer.

2. Select backfill, outside the pipe zone, will be measured by the cubic yard, placed and accepted, and shall be the theoretical volume of compacted special backfill material above the top of the pipe zone. The trench width for determining the volume shall be the actual width of the trench or the maximum widths shown below whichever is smaller. Widths in excess of those shown in the following table including sloping the upper portion of the trench, unless otherwise authorized on the plans or in these specifications, will be considered excessive, and the calculation shall be limited to the widths shown.

Maximum Trench Width Above Pipe Zone Based on Pipe Size & Depth			
Size of Pipe	0' – 5'	+5' – 12'	+12' – 30'
4"	3'-0"	6'-0"	8'-0"
6"	3'-0"	6'-0"	8'-0"
8"	3'-6"	6'-0"	8'-0"
10"	3'-6"	6'-0"	8'-0"
12"	3'-6"	8'-0"	10'-0"
15"	4'-0"	8'-0"	10'-0"
18"	4'-0"	8'-0"	10'-0"
24"	4'-6"	8'-0"	12'-0"
27"	5'-0"	8'-0"	12'-0"
30"	5'-0"	8'-0"	12'-0"

- Coarse aggregate required for Type "B" service connections will be measured for separate payment by the vertical foot of 4" and 6" diameter service pipe installed and accepted.

B. Payment: Special backfill payment will be as follows:

- Coarse aggregate or select backfill, in the pipe zone, in place and accepted, will be paid for at the contract unit price per cubic yard of coarse aggregate or select backfill, which payment shall constitute full compensation for furnishing, hauling, and installing all material, and for furnishing all equipment, tools, labor and incidentals necessary to complete the item in accordance with plans and specifications.
- Select backfill, outside the pipe zone, in place and accepted, will be paid for at the contract unit price per cubic yard, which price and payment shall constitute full compensation for furnishing, hauling, and installing all material, and for furnishing all equipment, tools, labor and incidentals necessary to complete the item in accordance with plans and specifications.
- Coarse aggregate required for Type "B" service connections, in place and accepted, will be paid for at the contract unit price for gravel encasement for house service connections, Type "B", per vertical foot of 4" and 6" diameter service pipe installed and accepted.

C. Item: Payment will be made under:

- Item 02535-4.16 (1) Coarse Aggregate Backfill, per cubic yard
- Item 02535-4.16 (2) Select Backfill, per cubic yard
- Item 02535-4.16 (3) Type "B" Service Coarse Aggregate Backfill per vertical foot

4.17 SHEETING AND BRACING LEFT IN PLACE

- Measurement:** Sheeting and bracing left in place at the written direction of the Engineer will be measured by units of one thousand (1,000) board feet and fractions thereof.
- Payment:** Sheeting and bracing left in place, as directed by the Engineer in writing, installed and accepted, will be paid for at the contract unit price per thousand board feet,

which price and payment shall constitute full compensation for furnishing, hauling and installing all sheeting and bracing required to be left in place and for furnishing all equipment, tools, labor and incidentals necessary to complete the item in accordance with plans and specifications.

C. Item: Payment will be made under:

Item 02535-4.17 Sheeting and Bracing Left in Place, per thousand board feet

4.18 REMOVAL AND REPLACEMENT OF HIGHWAY, STREET, DRIVEWAY AND SIDEWALK PAVEMENT AND CURBS

A. Measurement: In cases where no other practical method for installing pipe under improved surfaces is available, the Contractor will be permitted to make such installation by the open trench method. The Contractor will be paid for this work on the basis of the contract unit price for furnishing and laying pipe plus the extra price bid under this item for removing and replacing the various types of improved surfaces.

Removal and replacement of street, highway, driveway, and sidewalk pavement will be measured by the square yard, and the area for measurement shall be as shown on the plans or as specified in the specifications. Unless otherwise provided in the General Requirements or on the Bid Schedule, separate measurements will be made for:

1. concrete over trenches
2. removal and replacement of concrete street surfaces
3. removal and replacement of asphalt street surfaces

If the street surfacing extends beyond the trench limits, the measurement will be based on the total surface replaced.

Removal and replacement of surfacing of gravel or shell streets and driveways cut by trenches for installation of pipe will be measured by the square yard or cubic yard of gravel or shell placed, bladed and accepted. Gravel or shell will be placed only at the direction of the Engineer, and actual invoice records on quantities of material placed will be used for measurement.

Removal and replacement of concrete curbs will be measured by the lineal foot, and the length of measurement shall be as indicated on the plans or in the specifications.

B. Payment: Removal and replacement of highway, street, driveway and sidewalk pavement in place and accepted will be paid for at the contract unit price per square yard for the various types of improved wearing surfaces. Removal and replacement of surfacing of gravel or shell roads in place, bladed and accepted will be paid for at the contract unit price per square yard or cubic yard of gravel or shell. Removal and replacement of concrete curbs, in place and accepted, will be paid for at the contract unit price per lineal foot.

These prices and payment shall constitute full compensation for furnishing, hauling and installing all materials; for excavation and backfill compaction; subgrade preparation; finishing and curing; and for furnishing all equipment, tools, labor and incidentals necessary to complete the item in accordance with plans and specifications.

Unless otherwise provided in the General Requirements or on the Bid Schedule, separate payment will be made for:

1. concrete over trenches
2. removal and replacement of concrete street surfaces
3. removal and replacement of asphalt street surfaces

C. Item: Payment will be made under:

- Item 02535-4.18 (1) Removal and Replacement of (Type) Surfaces, per square yard
- Item 02535-4.18 (2) Removal and Replacement of (Type) Surface, per cubic yard
- Item 02535-4.18 (3) Removal and Replacement of Concrete Curbs, per lineal foot
- Item 02535-4.18 (4) Removal and Replacement of Concrete Over Trench, per square yard

4.19 IMPROVED SURFACES TO BE SAWED

- A. **Measurement:** Concrete or asphalt surfaces to be sawed will be paid for by the lineal foot. Concrete or asphalt surfaces to be sawed will be measured by the actual lineal foot sawed. (Note: When sawing both sides of a trench, both sides will be measured).
- B. **Payment:** Concrete or asphalt surfaces sawed, approved and accepted, will be paid for at the contract unit price per lineal foot for this item, which price and payment shall constitute full compensation for furnishing all equipment, tools, labor and incidentals necessary to complete the item in accordance with plans and specifications.
- C. **Item:** Payment will be made under:
 - Item 02535-4.19 Sawing Concrete Surfaces, per lineal foot

4.20 CLEARING AND GRUBBING

- A. **Measurement:** Clearing and grubbing will be paid for by either lump sum basis or by the acre or as part of another bid item. Measurement will be by one or more of the following alternate methods when a separate bid item is used:
 - 1. Area Basis: The work to be paid for will be the number of acres and fractions thereof acceptably cleared, grubbed, selectively cleared, or cleared and grubbed within the limits shown on the plans or staked for clearing and grubbing by the Engineer. Areas not shown on the plans, or not staked for clearing and grubbing will not be measured for payment.
 - 2. Lump Sum Basis: When the bid schedule contains a clearing and grubbing lump sum item, no measurement of area will be made.
 - 3. If no bid item is listed in the bid form, payment shall be included in other items.
- B. **Payment:** The accepted quantities of clearing and grubbing will be paid for per acre or per lump sum for this item, which price and payment shall constitute full compensation for furnishing of all equipment, tools, labor and incidentals necessary to complete the item in accordance with plans and specifications.
- C. **Item:** Payment will be made under:
 - Item 02535-4.20 (1) Clearing and Grubbing, per acre
 - Item 02535-4.20 (2) Clearing and Grubbing, lump sum

4.21 SPECIAL LUMP SUM - RAILROAD CROSSINGS, ROADWAY CROSSINGS, CANAL CROSSINGS AND LEVEE CROSSINGS, ETC.

- A. **Measurement:** Crossings for which separate lump sum prices are requested will be paid for per each. The price shall be for a complete installation as specified and detailed on the plans. All lump sum crossings will be measured by an actual count of each crossing installed and accepted.
- B. **Payment:** Special lump sum crossings in place and accepted will be paid for at the contract lump sum price which price and payment shall constitute full compensation for furnishing, hauling, and installing all material, and for furnishing all equipment, tools, labor

and incidentals necessary to complete the item in accordance with plans and specifications.

- C. **Item:** Payment will be made under:

Item 02535-4.21 (Description of Crossing) Crossing, per lump sum

4.22 METALLIC WIRE

- A. **Measurement:** No separate measurement for will be made for metallic wire installed and accepted on non-metallic or non-conductive underground facilities. The cost of metallic wire will be included in other items, or the item of which it is a part.

- B. **Payment:** No separate payment will be made for metallic wire installed and accepted on non-metallic or non-conductive underground facilities. The cost of metallic wire shall be included in other items, or the item of which it is a part.

4.23 ELECTRONIC MARKER LOCATOR

- A. **Measurement:** Electronic marker locators will be paid for per each, furnished and accepted, and will be measured accordingly.

- B. **Payment:** Electronic marker locators, furnished and accepted, will be paid for at the contract unit price per each, which price and payment will be full compensation for furnishing and demonstrating its workability.

- C. **Item:** Payment will be made under:

Item 02535-4.23 Electronic Marker Locator, per each

4.24 SERVICE CONNECTION MARKER

- A. **Measurement:** Service connection markers will be paid for per each, installed and accepted, and will be measured accordingly.

- B. **Payment:** Service connection markers, installed and accepted, will be paid for at the contract unit price per each, which price and payment will be full compensation for furnishing, installing and demonstrating workability, and for all excavation, backfill and compaction, removing surplus earth, and for furnishing all equipment, tools, labor and incidentals necessary to complete the item in accordance with the plans and specifications.

- C. **Item:** Payment will be made under:

Item 02535-4.24 Service Connection Marker, per each

4.25 REMOVAL AND REPLACEMENT OF DRIVEWAY CULVERT PIPE

- A. **Measurement:** No measurement will be made for labor and equipment necessary for removal and replacement of existing or new culvert pipes. Measurement will be made for new materials only, furnished and installed. No measurement will be made for materials lost, stolen, damaged or otherwise deemed unusable.

- B. **Payment:** No separate payment will be made for the labor and equipment necessary for the removal, replacement, disposal or stockpiling existing or new culvert pipe. All labor and equipment required will be included in the price bid for installing sewer facilities. Separate payment will be made for new culvert pipe and accessories furnished at the actual invoiced cost including sales tax for the replacement materials installed and accepted. No add-ons for overhead, handling, profit, etc. will be allowed. Payment will be made under the cash allowance item established in the bid form.

- C. **Item:** Payment will be made under:

Item 02535-4.25 Cash Allowance for Reimbursement of Material and Costs for Culverts, \$ _____

Should a section of line fail any element of the required tests and if the repairs and retests are not satisfactorily completed within 20 calendar days of the failed test, a deduction for the failed section of line shall be applied to the next partial payment estimate. The Engineer will determine the value of the deduction. All costs to repair the defective work and retest the failed sections shall be the responsibility of the Contractor. The value of the deduction withheld shall be included in the next partial payment estimate after all defects are satisfactorily corrected and retested.

C. Item: Payment will be made under:

Item 02535-4.28 Testing Gravity Sewers, per lineal foot, (minimum acceptable bid price, _____ per LF)

4.29 TESTING FORCE MAINS

A. Measurement: Testing of force main pipe, completed and accepted, shall be measured per lineal foot regardless of size from the point of origin to the point of discharge without deduction for fittings, valves, bores, or special crossings.

B. Payment: Testing of force main pipe, completed and accepted and measured as provided herein shall be paid at the contract unit price bid per lineal foot, which price and payment shall constitute full compensation for furnishing all materials, tools, equipment, supplies, labor and incidentals necessary to complete the testing in accordance with the contract requirements.

The unit price bid shall not be less than the minimum bid price established on the bid form. Should the Contractor fail to bid a unit price of at least the minimum established bid price, the Notice of Award will be conditioned that a change order be issued reducing the unit price of the force main pipe bid items by the amount of the deficit and increasing the unit price for testing whereby the total contract amount is unchanged.

No payment will be made for testing until all elements of the required testing are satisfactorily completed.

Should a section of line fail the required test and if the repairs and retests are not satisfactorily completed within twenty (20) calendar days of the failed test, a deduction for the failed section of line shall be applied to the next partial payment estimate. The Engineer shall determine the value of the deduction. All costs to repair the defective work and retest the failed sections shall be the responsibility of the Contractor. The value of the deduction withheld shall be included in the next partial payment estimate after all defects are satisfactorily corrected and retested.

C. Item: Payment will be made under:

Item 02535-4.29 Testing Force Mains, per lineal foot, (minimum acceptable bid price, _____ per LF)

4.30 CLEANUP, MAINTENANCE AND FINAL RESTORATION

A. Measurement: Cleanup, maintenance and final restoration, completed and accepted, will be measured per lineal foot of gravity sewer mains or force mains regardless of size without deductions for fittings, manholes, valves, bores, or special crossings. No measurement will be made for house services. No measurement will be made for gravity mains or force mains which are identified as part of lump sum items such as lift stations or other structures identified as including cleanup, maintenance, and final restoration. Where gravity mains and/or force mains are installed parallel, within 20 feet of each other, and not separated by a street, road or alley, measurement will include only one utility length. Measurement for cleanup will be limited to the length of the utility from point of origin to the end of the utility main.

- B. Payment:** Cleanup, maintenance and final restoration completed, accepted and measured as provided herein shall be paid at the contract unit price bid per lineal foot which price shall constitute full compensation for furnishing all labor and equipment to complete the work in accordance with the contract requirements and to the satisfaction of the Engineer and Owner. Separate payment will be made for furnishing and installing materials required by the contract to maintain streets and driveways exclusive of backfill, signs, barricades and markers. Separate payment will also be made for repair of paved surfaces and unimproved surfaces in accordance with the contract requirements. Partial payment for cleanup, maintenance and final restoration as provided herein, will only be made when Substantial Completion is obtained.

At the time of Substantial Completion, a value for the punch list items will be determined by the Engineer and applied as a deduction against the cleanup, maintenance and final restoration item. If the cleanup item is of sufficient value to cover the punch list value, then the balance will be paid on the next payment estimate. If the cleanup item is not sufficient, additional deduction will be applied to other items.

The unit price bid for cleanup, maintenance and final restoration will not be less than the minimum bid price established on the bid form. Should the Contractor fail to bid a unit price of at least the minimum established bid price, the Notice of Award will be conditioned that a change order be issued reducing the unit price of the gravity sewer pipe and force main bid items by the amount of the deficit and increasing the unit price for cleanup whereby the total contract amount is unchanged.

- C. Item:** Payment will be made under:

- Item 02535-4.30 (1) Cleanup, Maintenance and Final Restoration of Gravity Sewers, per lineal foot, (minimum acceptable bid price, _____ per LF);
- Item 02535-4.30 (2) Cleanup, Maintenance and Final Restoration of Force Mains, per lineal foot, (minimum acceptable bid price, _____ per LF)

4.31 TEST PITS

- A. Measurement:** Measurement for payment of test pits for location of existing utilities shall be the actual volume obtained by field measurement of the length, width and depth of excavation necessary to determine the information required by the Engineer.
- B. Payment:** Payment for test pits for location of existing utilities shall be at the contract unit price per cubic yard, which price and payment shall constitute full compensation for furnishing all equipment, tools, labor and incidentals necessary to complete the work in accordance with the plans and specifications.
- C. Item:** Payment will be made under:
- Item 02535-4.31 Test Pits, per cubic yard

4.32 MANHOLE INSERTS

- A. Measurement:** Manhole inserts will be paid for per each, installed and accepted, and will be measured accordingly.
- B. Payment:** Manhole inserts, installed and accepted, will be paid for at the contract unit price per each, which price and payment shall be full compensation for furnishing, hauling and installing, and for furnishing all equipment, tools, labor and incidentals necessary to complete the item in accordance with the plans and specifications.
- C. Item:** Payment will be made under:
- Item 02535-4.32 Manhole Inserts, per each

END OF SECTION 02535

SECTION 02555
GAS DISTRIBUTION

PART 1 – GENERAL

1.01 DESCRIPTION

This item shall consist of gas pipe, including service lines to a point shown on the drawings, and fittings, together with valves, valve boxes, regulators, and other appurtenances necessary to construct the gas distribution system for the project. Included shall be the furnishing and installation of all materials, testing, purging, and odorizing at such places as are designated on the drawings or by the Engineer, in accordance with these specifications and in conformity with the lines and grades given.

This item shall include, in the bid prices per unit requested, the cost of common excavation and backfill, the cost of furnishing and installing all trench bracing and dewatering, and the material for and making of all joints.

1.02 LOCATION OF LINES

The approximate location of lines, valves, regulators and other appurtenances has been indicated on the drawings as being within the bounds of street, highway, or easement rights-of-way. Final locations of the various items of construction shall be established in the field by the Engineer.

All costs not specifically listed as a pay item shall be included in the price bid for the item of which the costs are a part.

1.03 LAYOUT OF WORK

Layout of the work shall be as specified in the General Requirements of these specifications.

1.04 LOUISIANA DEPARTMENT OF HIGHWAYS PERMIT

Unless otherwise noted, the Owner will secure the necessary permit from LADOTD for laying these lines. The Contractor shall comply with all provisions and requirements of the permit.

1.05 PARISH PERMIT

Unless otherwise noted, the Owner will secure the necessary parish permit for laying these lines. The Contractor shall comply with all provisions and requirements of the permit.

1.06 RAILROAD PERMIT

Unless otherwise noted, the Owner will secure the necessary railroad permit for laying these lines. The Contractor shall comply with all provisions and requirements of the permit.

1.07 REFERENCE STANDARDS

The transport of natural gas by pipeline shall conform to the Natural Gas Pipeline Safety Act of 1968. The Act required the U.S. Department of Transportation, (D.O.T.) Office of Pipeline Safety (OPS) to develop and enforce minimum safety regulations for the transportation of natural gas by pipeline. The regulations became effective in 1970 and are published in Title 49, Code of Federal Regulations, Parts 190, 191, and 192. Other publications (latest revisions), listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references.

- A. AASHTO M 190 - Bituminous Coated Steel Pipe
- B. American Gas Association.... Plastic Pipe Manual for Gas Service
- C. ANSI..... B1.20.1 - Pipe Threads, General Purpose (Inch)
- D. ANSI B16.3 Malleable Iron Threaded Fittings, Class 150 and 300
- E. ANSI B16.5 Steel Pipe Flanges and Flanged Fittings
- F. ANSI B16.9 Factory Made Wrought Steel Butt Weld Fittings
- G. ANSI B16.33 Manually Operated Metallic Gas Valves for Use in Gas Systems up to 125 psig
- H. ANSI B31.8 Gas Transmission and Distribution Piping Systems
- I. ANSI B31.8a Addenda to ANSI B31.8
- J. API Specifications 5 L - Specification for Line Pipe
- K. API 5LE Specification for Polyethylene Line Pipe
- L. API 6D Pipeline Valves, End Closures, Connectors and Swivels
- M. API Standard 1104..... Standard for Welding Pipelines and Related Facilities
- O. A.R.E.A Manual for Railway Engineering
- P. ASME Boiler and Pressure Vessel Code and Interpretation: Section IX, Welding Brazing Qualifications
- R. ASME Guide for Gas Transmission and Distribution Piping Systems
- S. ASTM Standard A 53 Black and Hot-Dipped Zinc-Coated, Welded and Seamless Steel Pipe
- T. ASTM A 120..... Black and Galvanized Welded and Seamless Pipe for Ordinary Uses
- U. ASTM A 181 Carbon Steel Forgings for General Purpose Piping
- V. ASTM A 216..... Carbon Steel Castings Suitable for High Temperature Service
- W. ASTM A 234..... Factory Made Wrought Carbon Steel and Ferritic Alloy Steel Welded Fittings
- X. ASTM D 1598..... Time-To-Failure of Plastic Pipe Under Constant Internal Pressure
- Y. ASTM D 2274..... Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping
- Z. ASTM D 2513..... Thermoplastic Gas Pressure Piping Systems
- AA. ASTM D 3350..... Polyethylene Plastics Pipe and Fittings Materials

- BB. Louisiana Standard Specifications for Roads and Bridges, 2006 Edition
- CC. MSS SP-25 Standard Marking System for Valves, Fittings, Flanged and Unions
- DD. MSS SP-44 Steel Pipe Line Flanges
- EE. MSS SP-84 Steel Valves - Socket Welded and Threaded Ends
- FF. NACE Standards RP-01-69 - Recommended Practice - Control of External Corrosion on Underground or Submerged Metallic Piping Systems
- GG. NACE RP-02-74 Recommended Practice - High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation
- HH. NACE RP-02-75 Application of Organic Coatings to the External Surface of Steel Pipe for Underground Service
- II. NAPCA Specifications Bulletins 1-65-91 thru 15-83-90 Pocket Edition of NAPCA Specifications and Plant Coating Guide
- JJ. USAS B 16.3 Malleable-Iron Screwed Fittings, 150 and 300-Pound Class
- KK. USAS B 16.5 Steel Pipe Flanges and Flanged Fittings
- LL. USAS B 31.8 Gas Transmission and Distribution Piping Systems
- MM. US DOT, OPS 49 CFR, Parts 40 and 199 Drug Testing

1.08 RELATED WORK

- A. 03301 - Concrete for General Construction
- B. 02900 - Sodding

PART 2 - MATERIALS

2.01 PIPE MATERIALS AND INSTALLATION

Pipe and other materials shall be of the type called for on the drawings, and shall be in accordance with the following appropriate requirements. Wherever it is necessary to join two pipes of dissimilar metals together, a method of insulating against the passage of electric current shall be provided and shall be approved by the Engineer.

The Contractor shall comply with drug testing requirements of 49 CFR, Parts 40 and 199, latest revision.

2.02 PIPE SHIPPING AND DELIVERY

The pipe manufacturer shall take the necessary steps in handling and shipping the pipe as not to injure the pipe, coating, or lining. Each joint of new steel and/or polyethylene gas pipe shall be individually stacked and secured on the truck or railroad car bed with adequate support under each joint of pipe and adequate support and protection between each layer of pipe stacked on the vehicle.

2.03 HANDLING OF ALL PIPE

The Contractor shall handle all pipe with handling and hauling equipment as not to injure the pipe, pipe lining, or pipe coating. Any pipe pushed off the truck bed will be rejected. Adequate equipment shall be used by the Contractor to remove the pipe from the truck bed and string it along the trench location.

If the pipe is to be stock piled before it is strung along the trench, the Contractor shall stack the pipe on a level site in neat stacks. Steel gas pipe shall be stacked using the supports which were used in transporting the pipe. Polyethylene gas pipe shall be stacked in the bound bundles that the pipe was shipped in and the bundles shall not be broken until the stringing operation is started.

2.04 STEEL PIPE, JOINTS, FITTINGS

- A. Steel Gas Pipe: Steel gas pipe shall be new and conform to the requirements of ASTM A 53, Grade B, Type E or S; or API Specification 5L, Grade B, line pipe, seamless or electric-resistance-welded, black; wall thickness as required to meet ANSI B31.8. New steel pipe shall be in lengths, not less than 20 feet long, with plain ends beveled for welding.

The exterior of the pipe shall have 11 mil minimum thickness "Scotchkote," type 3M 206N, Fostercoat, or approved equal, plant applied fusion bonded epoxy coating meeting the specifications contained in NAPCA Bulletin 12-78-90, and subsequent revisions thereto.

Each length of steel pipe shall be marked in accordance with API Specification 5L, namely to show name or mark of the manufacturer; pipe size (outside diameter) in inches; weight per foot; grade; API Monogram; pipe length; process of manufacturer; type of steel; heat treatment and hydrostatic test pressure.

All steel gas pipe shall be of domestic manufacture and shall be standard Schedule 40, with a weight and wall thickness as follows:

<u>Size (Inch)</u>	<u>Weight (lbs./L.F.)</u>	<u>Wall Thickness (Inches)</u>
10	40.48	0.365
8	28.55	0.322
6	18.97	0.28
4	10.79	0.237
3	7.58	0.216
2	3.652	0.154
1½	2.717	0.145
1	1.678	0.133
¾	1.13	0.113

- B. Joints: Joints for steel gas pipe shall be butt-welded to develop a joint that will result in complete fusion throughout the entire wall thickness of the pipe. All butt-welds shall be full penetration single butt-welds in accordance with D.O.T. Part 192 and API Standard 1104. Welded joints shall satisfactorily hold any pressure that the line will be subjected to in testing or during operation at maximum design pressure. Miter joints shall be limited to pipe connections where commercially fabricated welding fittings cannot be used.

All threaded pipe, nipples, fittings, union, and couplings shall be made up tight to valves, regulators, meters using Rector Seal No. 5 pipe dope, graphite joint sealing compounds for gas service listed in Underwriters Laboratories, Inc. Gas and Oil Equipment Directory, Class 20 or less, polytetrafluoroethylene tape, which conforms to Mil-T-27730, or approved equal.

- C. Fittings: Steel gas pipe threaded fittings shall conform to ANSI B16.3 or B16.11, black. Steel gas pipe butt-welded fittings shall conform to ANSI B16.9 and shall be commercially fabricated ASTM A234 steel fittings of pressure rating equal to or greater than ANSI Class 150 standards. All pipe bends shall be long radius type. The exterior of all bends and fittings shall have the same coating as the pipe. Where reduction of size in pipes occur concentric swage fittings shall be used. Steel gas pipe flanged fittings shall conform to ANSI B16.5.

Steel gas pipe forged branch connections shall conform to ASTM A 181 Class 60, steel. Steel gas pipe threads shall conform to ANSI B1.20.1.

- (1) P.E. to Steel Transition Fitting: The P.E. to steel transition fitting shall be manufactured by the same manufacturer of the P.E. piping supplied for the system. The P.E. ends of the fitting shall conform to paragraph 2.04.A of these specifications. The fitting shall be manufactured by Wayne Manufacturing, Central Plastics, or approved equal.

Upon completion of welding operations for the transition fitting, the steel ends of the fitting shall be thoroughly coated as specified in paragraph 3.12.E of these specifications. The cost for installation of each such transition fitting shall be included in the unit price bid for associated items of work.

- (2) Stopple Fitting: Stopple fittings (short stop) shall be manufactured by T.D. Williamson, Inc., Mueller Co., or approved equal, and consist of a pipe cap, completion plug, and a shaped steel nipple. The stopple fitting shall be designed to conform to ANSI Class 150 standards. The stopple fitting shall be used to effectively stop-off piping under pressure. The Contractor shall be required to provide all the necessary tapping and plugging equipment required to install the stopple. Unless shown otherwise on the Drawings, all stopple fittings shall be welded connections. Where indicated, the stopple shall be mechanically fitted.

The cost for installation of each stopple fitting and the cost of any required tapping and plugging equipment shall be included in the unit price bid for hot tap connections.

- (3) Three-way Tee Fitting: Three-way tee fittings shall be manufactured by T.D. Williamson, Inc., Mueller Co., or approved equal, and consist of a forged steel blind flange with gaskets, nuts and bolts, a cast iron completion plug, and a cast steel fitting meeting ASTM A216 Grade WCB for 4" and larger sizes and consist of a pipe cap, completion plug, and three-way tee with external pipe threads, shaped to fit the pipe for 3" and smaller sizes. The fitting shall be designed to conform to ANSI Class 150 standards. The tee shall be used to connect new lines to existing steel lines that are to remain in service.

The Contractor shall provide all necessary tapping and plugging equipment required to install the three-way tee fitting. Unless shown otherwise on the Drawings, all three-way tees shall be for welded connections. Where indicated, the tees shall be mechanically fitted. The cost for installation of each three-way tee and the cost of any required tapping and plugging equipment shall be included in the unit price bid for hot tap connections.

- D. Bolts, Nuts, Etc.: Bolts shall be as specified by the USAS B31.8 specification for bolted joints or as recommended by the pipe manufacturer; bolts on flanged pipe installed underground shall be made from a non-corrosive metal.

2.05 THERMOPLASTIC GAS PRESSURE PIPE, JOINTS, FITTINGS

- A. Thermoplastic Gas Pressure Pipe: All thermoplastic gas pressure pipe furnished shall be polyethylene (P.E.) plastic pipe and shall conform in all respects to ASTM D-2513. Pipe shall be Driscopipe 8100 Series or approved equal.

Polyethylene plastic pipe shall be manufactured from a virgin polyethylene plastic compound material which meets ASTM Specification D 2513 for use with natural gas, and has the primary physical properties which are identified by cell classification P.E. 345564C in accordance with ASTM D3350 and has been listed by the Plastic Pipe Institute (PPI) as a P.E. 3408 designated compound. All P.E. pipe shall be of a single manufacturer. All P.E. plastic pipe shall be SDR 11 unless otherwise specified. The pipe shall be furnished in Iron Pipe Size (IPS). The outside shell color of all P.E. gas pipe material shall be yellow.

All P.E. pipe shall have the manufacturer's name or trademark, the nominal pipe size, the PPI plastic pipe designation code, and the Standard Dimensional Ratio (SDR) or wall thickness conspicuously marked at intervals of not more than 2 feet.

- B. Joints: Joints shall be made using butt heat-fusion or electrofusion equipment and instructions provided by or recommended by the pipe manufacturer. Butt heat-fusion joints will require the use of a jointing device that holds the heater element square to the ends of the piping, can compress the heated ends together, and holds the piping in proper alignment while the plastic hardens. Electrofusion joints shall be used for gas service line connections to the gas main, as provided for in Paragraph 2.10.A of these specifications.
- C. Fittings: All polyethylene gas pipe fittings shall conform to ASTM Specification D 2513 and paragraph 2.05.A of these specifications. P.E. to steel transition fittings shall be as specified in paragraph 2.04.C(1) of these specifications.

2.06 SERVICE LINE

Gas service lines shall be a minimum of 3/4" diameter and shall conform to Paragraph 2.05.A of these specifications. All service lines shall extend from the gas main to, and including, the point of delivery. The point of delivery is the service meter stop. The service line shall be coated and wrapped from the bottom of the service meter stop or a point at least 1 foot above ground level to a point at least 1 foot below the ground level.

2.07 WELDED STEEL CASING PIPE

Steel casing pipe shall be new and conform to the requirements of ASTM A 53, Grade 13, Type E or API Specification 5L, Grade B., line pipe, seamless or electric-resistance-welded, black. Steel casing pipe shall be in lengths, not less than 20 feet long, with plain ends beveled for welding. The size and wall thickness shall be as specified on the drawings.

The interior and exterior of all casing pipe shall be cleaned, primed and lined with two coats of asphalt to achieve 0.05-inch minimum coating thickness, in accordance with AASHTO Designation: M190, Type A. All steel casing shall be butt-welded and all welds shall be full penetration single butt-welds in accordance with API Standard 1104.

2.08 INSULATORS FOR PIPE IN CASING

Insulators for supporting pipe installed in casing shall be units designed for such use, constructed of steel, with steel capped plastic, or molded plastic insulating skids in sufficient number to support the carrier pipe when full of water. Insulators shall be CG Series, as manufactured by PSI Products, Inc. or Model SS1 as manufactured by Advance Products and Systems, Inc., or approved equal.

Appropriate risers and insulating runners shall be sufficient to prevent the carrier pipe from resting on the casing and sufficient to prevent flotation for gas mains. The spacing of the insulators shall be as indicated on the drawings.

2.09 STEEL VALVES

- A. General: Steel valves shall be new and manufactured to conform to ASTM A-216, Grade WCB. All steel valves furnished shall be from the same manufacturer. Steel valves shall operate so that the valve will open when turning the operating nut in a counter-clockwise direction. Steel valves buried underground shall have butt weld ends and be factory coated with 11 mils minimum thickness Scotchkote 306 by the 3M Company, Fostercoat, or approved equal. Each steel valve buried underground shall be installed with a high head extension, a non-rising stem with a two-inch square shank adapter wrench nut and cast-iron valve box.

The extension shall bring the operating nut and sealant fittings to within 6" of the ground surface. Furnish the Owner with 1 valve wrench to fit the operating nut furnished. Steel valves, for above ground installations, shall have raised face type flange ends and shall be installed with factory made locking devices. Suitable flanges for attaching above ground valves to pipe shall be furnished. Raised face flanged fittings shall be installed with a full face, neoprene-phenolic faced, type E gasket. The gasket shall fully seal the annular space between fitting faces to eliminate flange corrosion. Unless otherwise specified in the drawings or the Proposal Form, all steel valves shall conform to ANSI Class 150 standards.

After installation, all valves will be furnished with the type and amount for the initial lubrication recommended by the manufacturer for natural gas service.

- B. Valve Requirements:
1. 4" and Smaller Distribution System Steel Valves: Four-inch and smaller aboveground steel valves shall be Flowserve-Nordstrom carbon steel plug valves, figure 1925, wrench operated, or Kerotest gate valves, Model EV-11, wrench operated, or approved equal. Buried valves shall be Flowserve-Nordstrom carbon steel plug valves, figure 1925 ½, wrench operated, or Kerotest gate valves, Model M-1, wrench operated, or approved equal.
 2. 6" Distribution System Steel Valves: Six-inch aboveground steel valves shall be Flowserve-Nordstrom Dynamic Balance plug valves, figure 1945, wrench operated, or Kerotest gate valves, Model EV-11, wrench operated, or approved equal. Buried valves shall be Flowserve-Nordstrom plug valves, figure 4185 ½, wrench operated, or Kerotest gate valves, Model M-1, wrench operated, or approved equal.
 3. Pressure Reducing Assemblies, Regulator Stations, Etc.: Valves for special assemblies shall be as specified on the drawings and shall have a sufficient rating to withstand the maximum line and test pressures.
- C. Valve Flanges: All companion flanges shall be raised face type. Companion flanges for ANSI Class 150 standard valves shall be forged steel slip-on or welding neck conforming to USAS 16.5.

2.10 POLYETHYLENE VALVES

- A. General: Polyethylene (P.E.) valves shall be manufactured to conform to ASTM D-2513 and D-1598. All P.E. valves furnished shall be from the same manufacturer and shall operate so that the valve opens when turning the operating nut in a counter-clockwise

direction. P.E. valves shall be made of cell classification P.E. 345564C, SDR 11 material, and shall be designed for an allowable service pressure of 100 pounds per square inch in a Class 4 location.

Buried P.E. valves shall have a non-rising stem with built-in position indicator - standard 2" square adaptor with deflector cone on top and a valve box made of cast iron collar and plastic bottom. The valves shall have 18" length pipe stub ends which can be butt heat-fused to the pipe or other fittings, and shall be wrench operated.

B. Valve Requirements:

1. 2" Through 8" Distribution System P.E. Valves: Distribution system P.E. valves 2" through 8" shall be Kerotest Polyball, Flowserve-Nordstrom Poly-Gas, Figure No. 85111, or approved equal.
2. Pressure Reducing Assemblies, Regulator Stations, Etc.: Valves for special assemblies shall be as specified on the drawings or on the Bid Form.

2.11 SERVICE ASSEMBLIES

Materials, to complete the various types of service assemblies as detailed on the drawings, shall meet the following specifications:

- A. Service Taps:** Service taps on steel pipe distribution system mains shall be made using a Mueller Welding Inlet No-Blo valve tee #H-17650, Rockford Eclipse, or approved equal.

Service taps on polyethylene pipe distribution system mains shall be made using appropriate sized INNOGAZ tapping tees distributed by Kerotest Manufacturing Corporation or approved equal. The gas service tapping tee shall be joined to the system main by the electrofusion installation method using the appropriate INNOGAZ electrofusion procedures and equipment recommended.

- B. Protective Sleeves:** All P.E. service tap outlets will be fitted with the appropriate protective P.E. sleeve to fit snugly over the pipe-fitting juncture and extend at least 12 inches over the pipe to limit pipe bending and exposure to mechanical damage at the joint.

- C. Curb Stops:** Curb stops shall be 1" size P.E. Kerotest Kerotite Service Valve, Nordstrom Poly-Gas, Figure No. 85111, ball valve, or approved equal, for 1" size service line. For 2", 3", and 4" size P.E. service lines, the curb stop shall be made using the appropriate sized P.E. valve as specified in paragraph 2.09.B of these specifications.

- D. Excess Flow Valve:** Excess flow valves (EFV) shall be Lyco 1" IPS SDR 11, 10" long P.E. pipe stick, Part No. EFVEB-BA7YY00. The EFV shall be required downstream of the curb stop valve on 1" size Type I and/or II service assemblies intended for residential 275 CFH meter settings as shown on the drawings.

- E. Curb Stop Box:** The curb stop box for 2", 3", and 4" size P.E. service lines shall be manufactured the same as for a P.E. valve box, as specified in paragraph 2.10.B of these specifications. For 1" size P.E. service lines only, the curb stop box shall have a minimum inside diameter of 2 inches, and the remaining specifications contained in paragraph 2.10.B shall apply, except the type shall be a Handley Industries Inc. Model G21HA, or approved equal. The bottom of each 1" P.E. valve shall be supported by a 60-pound bag of "Sakrete" concrete mix.

- F. Meter Stops:** Meter stops furnished shall be from the same manufacturer and shall be of the permanently lubricated iron body type. Meter stops on all types of service pipe shall be

Mueller No. H11175, galvanized finish, with lock wing, Rockford Eclipse, or approved equal.

- G. Gas Service Regulators: Gas service regulators shall be aluminum case, aluminum paint by Equimeter, Inc., as specified below, or Fisher S402, and shall meet the following requirements:

<u>MODEL</u>	<u>ORIFICE</u>	<u>INLET PRESSURE</u>	<u>OUTLET PRESSURE</u>	<u>CAPACITY (CF/HR)</u>
#043-182	1/4"	0-3 lbs.	5" - 8 1/2" WC	350
#043-182	1/4"	0-10 lbs.	5" - 8 1/2" WC	700
#143-80-2	1/4"	0-20 lbs.	5" - 8 1/2" WC	1,500
#243-12-2	1/4"	0-25 lbs.	6" - 14" WC	2,400

Low pressure regulators shall be equipped with bug proof inverted vents and internal relief valves. Service regulators #043-182 and #143-80-2 shall be checked to 4-ounce outlet pressure in the field. Large capacity regulators will be as detailed in the drawings.

- H. Gas Service Meters: Meters for gas service shall be aluminum case, aluminum paint by Equimeter, Inc., as specified below, shall have a standard direct reading meter index and shall be capable of accurately measuring 0.6 specific gravity natural gas with pressure losses and capacities as specified below. Capacities indicated are at four (4) ounce base. Large capacity meters will be as detailed in the drawings and/or as called for by the General Requirements. Prior to ordering any new meters, the Contractor shall ascertain from the Owner's Gas Superintendent the new meter numbers to be assigned to each new meter for stamping by the manufacturer.

<u>Type</u>	<u>Meter Size</u>	<u>Water Column Pressure Loss</u>	<u>Size Connection</u>	<u>Max. Capacity (CF/HR)</u>
Equimeter	R-275	1/2"	20 Lt	275
Equimeter	#415	1/2"	20 Lt	415
Equimeter	#750	1/2"	45 Lt	750
Equimeter	#1,600	2"	45 Lt	1,600
Dresser Roots	1M 300		1-1/2"	1,000
Dresser Roots	3M 175		2"	3,000
Dresser Roots	5M 175		3"	5,000

Dresser Roots meters specified shall be the rotary type with side connection.

- I. Insulated Meter Swivels and Flanges: Insulated meter swivels and/or insulating flanges shall be installed as shown on the drawings.
- J. Anodeless Meter: Anodeless meter risers for P.E. service pipe shall be joined to the type service pipe using the method described in paragraph 2.05.B of these specifications for P.E. pipe. Each anodeless meter riser shall be 24" long horizontally and 36" long vertically and shall have a 10" radius bend, as manufactured by GF Central Plastics Company, or Elster Protection Corporation. Anodeless meter riser outlets shall be threaded with male I.P.S. threads to fit existing or new meter stop, regulator or meter fitting.

Pipe size of anodeless meter risers shall be determined by I.P.S. (Iron Pipe Size) of pipe required to fit to the existing or new meter stop, regulator or meter fitting, 3/4" minimum.

- K. Customer Connections: Customer connections shall be installed as shown on the drawings. The pipe size of adaptor, coupling, fittings, etc. shall be determined by the I.P.S. of the pipe required to fit to the existing or new customer piping.
- L. Pipe and Fittings: A minimum of 5 L.F. of the IPS Schedule 40 galvanized steel pipe and

the necessary pipe fittings for service assemblies shall be installed, as shown on the drawings. The pipe size of the steel pipe, meter bars, meter stops, nipples, street ells, couplings, fittings, etc., shall be determined by the IPS required to fit to the existing or new regulator and/or meter fittings, 3/4" minimum.

- M. Floor Valves: The Contractor shall inspect each building or residence with gas utility service to verify the presence of suitable cut-off valves at each gas appliance. New cut-off valves shall be provided where no valves exist or where replacement valves are required for existing defective or inoperable valves. New cut-off valves shall be Rockford-Eclipse bronze gas stops, sized as required, or approved equal. Gas service shall not be restored until suitable floor valves are installed, tested and accepted.
- N. Pressure Gauge: A pressure gauge shall be installed on service assembly set-ups when shown on the drawings. Gauge shall have a 4" dial, shall be glycerin filled and shall have a maximum pressure reading of 2 times the working pressure at the location.
- O. Protective Railings: Protective railings shall be installed for service assembly set-ups when shown on the drawings.

2.12 VALVE BOXES

- A. For Steel Pipe: Valve boxes for welded steel pipe mains shall be made of cast iron and shall be of the heavy roadway type with an inside diameter of not less than 5 inches. The valve boxes shall be adjustable for elevation range of 24" to 36" and shall be of the three-piece screw type. The top of the valve box shall be installed flush with the ground surface or street surface and shall be protected by a 24-inch diameter round or square concrete foundation as shown on the drawings. The valve box cover shall be cast iron with the word "GAS" embossed on the top side and shall be of the bolt-down type.

Valve boxes shall be #H-10360, manufactured by Mueller Co., Decatur, IL 62525, Handley Industries, Inc., or approved equal.

- B. For Polyethylene Pipe: Valve boxes for polyethylene pipe mains shall be made of cast iron collar and plastic bottom and shall be of the heavy roadway type with an inside diameter of not less than 5 inches. The valve boxes shall be adjustable for elevation range of 24" to 36" and shall be of the three-piece slide type. The top of the valve box shall be installed flush with the ground surface or street surface and shall be protected by a 24-inch diameter round or square concrete foundation as shown on the drawings.

The valve box cover shall be cast iron with the word "GAS" embossed on the top side and shall be of the bolt-down type. The valve box shall be manufactured by Handley Industries, Inc., P.O. Box 863, Jackson, Michigan 49204, Mueller Co., or approved equal.

2.13 VENT PIPES AND CROSSING MARKER SIGN

Vent pipes topped with marker signs shall be fabricated as shown on the drawings and be installed by the Contractor as detailed on the drawings for cased crossings. The pipe line crossing marker signs shall be fabricated as shown on the drawings and be installed by the Contractor for other type crossing locations or as directed by the Engineer. Each cased or other type crossing which is required to be marked shall be provided with two vent pipes topped with crossing marker signs or pipe line crossing marker signs, as appropriate.

The crossing marker signs shall be mounted on 2" size Schedule 40 steel pipe welded to the top of the vent pipe, or on rigid flanged, vinyl coated channel type steel posts with drilled or punched 3/8" diameter holes centered at 1" intervals along its entire length. The vinyl coated post shall be impregnated with high intensity green color and ultraviolet inhibitors to resist fading. The post shall

be as distributed by Phillips Engineering Company, Inc., Clearwater, Florida (1-800-446-7326), Handley Industries, Inc. or approved equal.

Under this contract no special payment will be made for furnishing and installation of vent pipes topped with crossing marker signs and/or pipe line crossing marker signs. Cost shall be included in the pipe line crossing bid item, if applicable, or in the unit price bid per foot of gas pipe.

2.14 VALVE WRENCHES

Contractor shall provide the Owner with one (1) each heavy tee handle 2" square socket wrench, Flowserve-Nordstrom Part No. 37213, Mueller Co., or approved equal. Valve wrenches for pressure reducing assemblies, regulator stations, etc. shall be provided as detailed in the drawings or as called for by the General Requirements.

2.15 NON-CORROSIVE METALLIC WIRE OVER P.E. GAS PIPE

Non-corrosive metallic wire shall be installed directly over and on the center of all P.E. gas mains and service lines for detection purposes. This wire shall be continuous on all P.E. mains and service lines and shall be connected to all fixtures, appurtenances and pipe as detailed on the drawings.

The non-corrosive metallic wire shall be Type THHN, A.W.G. #10 gauge, insulated, stranded copper wire. Wire splices shall be made using splice kits similar or equal to Model DBR by 3M.

No special payment shall be made for installation of the wire. The cost of such shall be included in the unit price bid for gas pipe.

2.16 LOCATOR WIRE ANODE

The Contractor shall furnish and install 17-pound anodes connected to the P.E. gas pipe locator wire, as detailed in the drawings. The number of anodes required shall be as detailed in the drawings or as called for by the General Requirements.

All materials shall be new and shall comply with all standards of the cathodic protection industry whether or not these standards are set forth in these drawings and specifications. The Contractor shall furnish a certificate to the Engineer from the supplier that the anode materials conform to these specifications.

- A. Magnesium Anodes: The magnesium anodes shall be Harco Grade III, or approved equal, consisting of the following:

<u>Metal</u>	<u>Percent by Weight</u>
Aluminum	5.3 - 6.7
Manganese	0.15 Min.
Zinc	2.5 - 3.5
Silicon	0.10 Max.
Copper	0.02 Max.
Nickel	0.002 Max.
Iron	0.003 Max.
Others	0.30 Max.
Magnesium	Balance

The anodes shall be vibratory packed in a cotton bag in an artificial backfill consisting of the following:

Hydrated gypsum	75%
Bentonite clay	20%
Sodium Sulfate	5%

- B. Anode Lead Wire: The anode lead wire shall be unspliced Type THHN insulated #10 AWG solid copper wire, same color, not less than 10 feet long. The anode lead wire shall be factory installed with the place of emergence from the anode in a cavity sealed flush with a dielectric sealing compound.

2.17 CORROSION PROTECTION

When indicated on the drawings, the Contractor shall furnish all items necessary to provide the facilities with adequate cathodic protection against corrosion. No direct payment will be made for this work, include all costs in other items of work. The cathodic protection shall have a design life of 20 years and shall be installed in accordance with NACE Publication RP-01-69. The following minimum specifications shall apply:

- A. Anodes and Leads: Each location where cathodic protection is to be installed shall be provided with a 17-pound packaged magnesium anode with a high efficiency backfill material for cathodic protection. The anode and backfill material is to be manufactured by Allied Corrosion Industries, Inc., 6180 Atlantic Blvd., Suite 0, Norcross, Georgia 30071, (800) 241-0809; Harco Corporation, or approved equal.

Each anode shall be provided with a minimum 2-foot-long, unspliced, Type THHN insulated, AWG No. 10 gauge solid copper connecting wire. Each connecting wire shall be factory installed. The location at which the wire emerges from the anode shall be a cavity sealed flush with a dielectric sealing compound.

- B. Lead Bonding: Connection of the anode lead to the facilities shall be by the use of thermal welding equal to Cadweld process. After the connection has been made, inspected and approved, the damaged area of the facilities and the metal portion of the connection shall be thoroughly coated as specified by NACE Specifications RP-02-75.

2.18 SERVICE LINE INSERTIONS

Where indicated on the drawings, the Contractor shall insert new P.E. service line into existing steel service pipe. All new service pipe insertions shall be 0.090" minimum wall thickness CTS P.E. gas service line.

All service line insertions shall maintain an annular space clearance of 10% between the O.D. of the new service line inserted and the existing service line I.D. The size of new service line inserted shall be as follows:

<u>Existing Steel Service Line</u>	<u>New Service Line Insertion (O.D.)</u>
2"	1-1/4"
1-1/2"	1"
1"	3/4"
3/4"	1/2"

Each service line insertion shall be provided with appropriate fittings to allow for meter reconnections to main with and/or without meter relocation.

2.19 CONCRETE

Concrete shall have an average compressive strength of 3500 psi at 28 days. Prior to commencing concrete operations, the Contractor shall furnish for review and approval a mix design indicating the proportions of all ingredients that will be used in the manufacture of the concrete proposed for use. The mix shall contain a minimum of 520 pounds of cement per cubic yard and a maximum of 6.5 gallons of water per bag of cement. Portland cement shall be ASTM C 150, Type I. Portland-Pozzolan cement shall conform to ASTM C 340. The proportion of Portland-Pozzolan cement in the blend shall produce a percentage of Pozzolan not exceeding 20 percent by absolute volume of the total combined volumes of Portland cement and Pozzolan. All water used in the mix shall be potable.

2.20 PAINTING

All steel pipe, valves, and equipment, including service assemblies, protective railings, pressure reducing assemblies, meter/regulator stations, etc., installed above ground shall be painted with an aluminum finish paint.

All steel surfaces shall be solvent and handtool cleaned to SSPC-SP 1 and 2 standards for painting preparation. A primer coat of Pratt-Lambert Tech Guard Rust Inhibitive Primer, or approved equal, at 2.0 mils dry film thickness, shall be applied. A 2 mil DFT finish coat of Pratt-Lambert Tech Guard General Purpose Aluminum Top Coat, or approved equal shall be applied.

Curb stop box covers, valve box covers, terminal box lid and associated pads shall be painted "safety yellow" with a good grade of exterior concrete paint.

No special payment shall be made for painting. Cost will be included in the contract unit price of the item being painted.

PART 3 - EXECUTION

3.01 GENERAL

This part of the work includes installation of gas mains, fittings, valves, valve boxes and appurtenances; excavation and backfill of trenches; cutting and replacing walks and roadway surfacing; and other miscellaneous items necessary to complete and make ready for operation a complete gas distribution system. Contractors' employees performing tasks in connection with the construction of these facilities shall be properly qualified in accordance with DOT requirements and the requirements of the Owner's Operator Qualification Plan.

3.02 COOPERATION WITH UTILITY OFFICIALS

This work will be performed in the close proximity of existing utilities, streets, drainage structures, etc. The Contractor shall at all times cooperate with the various utility and street officials and shall notify the appropriate personnel prior to excavation in areas where known utilities are located.

3.03 CLEARING OF THE RIGHT OF WAY

The Contractor shall clear the right-of-way provided for the main of all objectionable debris and obstructions that will interfere with the installation of the mains. Wooded areas shall be cleared and grubbed and surface obstructions to remain shall be protected in accordance with paragraph 3.06 of these specifications.

3.04 EXCAVATION OF TRENCH AND BACKFILL

Excavations, preparation of trenches, and backfill shall be in accordance with USAS B31.8, except where amended by these specifications. Excavation shall be such that the pipe will have no less than 30 inches of minimum cover (measured from top of trench to top of the barrel of the pipe). Trench bedding and standard backfill shall be as specified for each individual pipe material and detailed on the plan sheets.

3.05 OBSTRUCTION OF TRAVEL

All material shall be placed so as to interfere as little as possible with public travel. At street crossings and other points as directed by the Engineer, trenches shall be bridged in a manner so as to prevent any continuing interruption of public travel; the closure of both sides of a double roadway to vehicular traffic will not be permitted except by special permission. Special care must be taken to give free access at all times to all fire hydrants, water valves, fire alarm boxes and Police Department and Fire Department driveways.

In case the Contractor shall fail to keep open streets, sidewalks, approaches to premises, etc., and shall refuse or neglect to open them within 12 hours after written notification by the Owner; or shall the Contractor fail to afford proper and necessary access to fire hydrants, water valves, fire alarm boxes or Police Department or Fire Department driveways, and shall neglect or refuse to afford such access within one hour of receiving oral or written notice to do so, the Owner shall be and is hereby authorized and empowered to put on such force as may be necessary and to do this work, deducting the actual cost thereof from any money which may be due or may become due the Contractor.

3.06 CONFLICT WITH SURFACE OBSTRUCTIONS

All shade trees, shrubbery, utility poles, etc., within the right-of-way provided shall be protected and any building or structure which may be endangered during the work shall be shored up and otherwise protected. Any properties disturbed or damaged by the Contractor shall be restored to original condition. No additional compensation will be made for corrective work.

3.07 CONFLICT WITH SUBSURFACE OBSTRUCTIONS

The Contractor shall anticipate all underground obstructions such as water lines, gas lines, sewer lines, utility lines, concrete and debris. Any such lines or obstructions indicated on the drawings show only the approximate location and must be verified in the field by the Contractor. Neither the Owner nor the Engineer implies or guarantees the exact location of any existing underground utility; however, the Owner and Engineer will endeavor to familiarize the Contractor with all known underground obstructions.

The Contractor shall take the necessary precautions not to injure any utility mains or service pipes connected therewith or conduits or other underground structures, and the Contractor must repair or have repaired immediately, at his own cost, any public or private structure or pipe damaged by or in the course of his work. Should the Contractor fail to repair or have repaired such damage or injury within a reasonable time, the Owner may after 24 hours written notice, have such repairs made and deduct the cost thereof from any amounts due or to become due the Contractor.

The Contractor shall assume all risks and be responsible for all expenses resulting from attending the presence or proximity of any utility mains, conduits, or other underground structures where such pipes or other structures cross the trench or appear in the trench in such a manner as not to require their rearrangement or realignment. The Contractor's risks and responsibilities shall also apply to such structures as are approximately parallel with or adjacent to but outside of said trench.

The Contractor shall uncover known subsurface obstructions in advance of construction so that the method of avoiding same may be determined before pipe laying reaches the obstruction. Should any pipe or other obstruction be determined to interfere with the work the Contractor shall notify the Engineer of the locality and circumstances and the place shall be passed over until satisfactory arrangements are made. Should the obstruction parallel the trench the Engineer may require the Contractor to offset or re-align his pipeline to miss the obstruction. This re-alignment may be made by the use of fittings, pipe deflection and/or valves as the case may dictate.

Where subsurface obstructions cross the trench the Contractor will be permitted to lay pipe above the obstruction if a minimum amount of cover can be maintained while providing a cushion at least 6 inches thick between the bottom of the pipe and the top of the obstruction. Where this minimum cover cannot be obtained the Contractor will be required to lay the pipe under the obstruction and maintain a 6-inch cushion between the top of the pipe and the bottom of the obstruction. Should the location or position of such obstruction within the limits of the trench be such, in the opinion of the Engineer, as to require removal, realignment or change of the obstruction in order that the work may proceed, such removal realignment or change shall be without expense to the Contractor. When, however, such obstruction shall come within the limits of the excavation for the work as located by the Engineer, such pipe, conduit, or other obstruction shall be stripped or uncovered by the Contractor, at his own expense, as constituting a part of his work in excavating.

The Engineer will in all cases render decisions on the necessity or expediency of any change or rearrangement of any underground structures which may interfere with the construction of the work under this contract.

3.08 SPECIAL CROSSINGS

- A. General: Special crossings for which drawings have been made and on which a special price has been asked, will be paid for according to the specifications governing said crossings. Otherwise, no additional compensation will be paid for the construction of any utility line because of its crossing under or over any natural or man-made obstacle provided the route of the gas line as bid has not been changed so as to produce a crossing not anticipated by the bidder.
- B. Permits: The Contractor shall secure the necessary permit from the controlling agency for laying these lines. The permit shall be obtained in the name of the Owner; however, the refundable deposit for the permit shall be made by the Contractor.
- C. Cooperation with Controlling Agency: The Contractor shall submit to the Engineer and the representative of the controlling agency, all details concerning the method of construction and materials and shall have them approved prior to beginning construction.

3.09 HANDLING AND DISPOSAL OF WATER

The Contractor shall pump, bail, or otherwise remove any water which may be found or may accumulate in the excavations, trenches, and shall perform all work necessary to keep them clear of water while the work is in progress. The cost of removing water by pumping or otherwise shall be included in the prices bid for the various items of work; unless a specified bid item is asked for such. The Contractor shall keep his completed work reasonably free of water and shall completely remove all of it for the purpose of installations, inspections and tests.

The Contractor shall prevent any of his work from obstructing any drainage ditch, canal, etc., unless special permission is obtained.

3.10 LOCATION OF EXISTING GAS SYSTEMS

- A. General: The attention of the Contractor is directed to the fact that existing gas mains or

service lines may have to be tapped, cut, temporarily removed from service, relocated, connected and otherwise adjusted to completely perform all required work.

The Contractor will not be permitted to indiscriminately shut off service. The Contractor shall cooperate with the Owner in order that service disruptions will be minimized. The Contractor shall arrange with representatives of the Owner and the Engineer for a mutually acceptable time when service can be discontinued in the various sections of the system. The Contractor shall place a "Gas Cut-Off Notice", furnished by the Owner, on the door of any customer whose gas service is interrupted.

The general location, size and type of existing utilities have been taken from existing maps and/or surveys. The size of pipe indicated is the nominal diameter and the Contractor shall be responsible for obtaining the correct outside diameter of the pipe before ordering any valves, fittings, tapping sleeves, etc., to assure a proper fit.

- B. Locations of Existing Utilities: The approximate locations of known existing utilities has been shown on the drawings and the final location of all tie-ins, taps, etc. shall be approved by the Engineer. The Contractor shall be responsible for physically locating all existing pipe and appurtenances. No additional compensation shall be paid for such work, but shall be included in the unit price bid per foot of pipe.

3.11 INSTALLING STEEL PIPE

All steel gas pipe installations shall be made in accordance with USAS B31.8-841.2, except as amended by these specifications.

The Contractor shall protect all coated pipe from exposure to the weather prior to backfilling. Coated pipe shall be handled at all times with equipment designed to prevent damage to the coating. The Contractor shall not string pipe in excess of the amount which, in the opinion of the Engineer, may not be installed within 7 days.

The use of pinch bars, chain slings, or other pipe handling equipment found to be injurious to the pipe or coating will not be allowed. Sections of coated pipe being tied into the line shall not be dragged or pulled into position, and the length of such sections shall be regulated to allow their handling without damage to the coating. At stream crossings, or at any other locations where it may be necessary to pull, drag, or jack and bore sections of pipe into place, the coated pipe shall be protected as directed by the Engineer.

Type 1 Standard Pipe Foundation as detailed on the plan sheets shall be used for the installation of all steel gas mains, unless otherwise specified on the drawings.

3.12 WELDING AND FIELD COATING PROCEDURE FOR STEEL PIPE

Welding shall be in accordance with USAS B31.8, API Standard 1104, and ASME Section IX, except as modified herein.

- A. Welding Process: Prior to performing any welding, the Contractor's welding shall demonstrate that suitable sound welds can be made by each procedure required. The quality of each weld at every joint shall be determined by mechanical or radiographic testing, as appropriate. Certification of each acceptable written procedure and performance qualification test shall be made by a qualified testing laboratory and the results recorded. Evidence of recent experience making acceptable taps on a pipeline under pressure is also required. A copy of the certification, recorded acceptable test results and hot taps experience shall be given to the Owner and to the Engineer. Retests and renewal of welder performance qualification shall be in accordance with ASME Section IX.

The Contractor shall bear all of the costs associated with qualifying each welding procedure specification, performing each procedure qualification test, recording of the welding data and test results, certifications and retests and renewal of qualification.

The Contractor shall furnish the necessary equipment and personnel to cut out and test welds. For such tests, the entire weld shall be cut from the line, cutting the pipe 4 inches back on each side of the weld. Coupons cut from this weld shall be tested for tensile strength, ductility and penetration. Where welds are cut out for testing, the line shall be tied back together with either a single weld, or by use of a piece of new pipe not less than 2 feet in length.

Pipe shall be butt-welded to develop a joint that will result in complete fusion throughout the entire wall thickness of the pipe. The welded joint shall satisfactorily hold any pressure that the line will be subjected to in testing or during operation at maximum design pressure. At no time shall the pipe be rolled or turned during welding. Any defective joints resulting from poor welding technique, overlaps, under-cuts, convexity, or any other reason shall be cut out and replaced with a satisfactory joint.

Miter joints shall be limited to pipe connections where commercially fabricated welding fittings cannot be used, and then shall be made in segments limiting the deflection in each section to angles agreed upon by the Engineer.

Where welding fittings are required, the welding fittings shall be commercially fabricated ASTM A234 steel fittings of pressure rating equal to or greater than ANSI Class 150 standards. All bends shall be long radius type. Where reduction of size in pipes occur swage fittings shall be used. Ninety-degree saddle welding one pipe into another will not be permitted, except in special cases when prior approval of the Engineer has been obtained.

Each welder shall be furnished a stencil, a record being kept thereof, and each welder shall stencil all welds made by him. The Contractor shall furnish and use only such types and sizes of welding rods as are approved by the Engineer.

- B. Equipment: All pipe shall be electric welded by the "Shielded Metal-Arc" process. Welding machines and appurtenances thereto shall be of size and type suitable for the work, and shall be maintained in such conditions as to insure acceptable welds, continuity of operation, and safety of personnel. Welding machines shall be direct current and shall have reversed polarity, work negative and electrode positive, and shall be operated within the amperage and voltage ranges recommended for each size and type of electrode.
- C. Materials: The filler metal for the shielded metal arc process shall be according to API Standard 1104 and shall be 5/32-inch or 3/16-inch in size.
- D. Procedure Details: Surfaces to be welded shall be free from loose scale, slag, heavy rust, grease, paint, cement and other foreign material except tightly adherent mill scale. A light film of linseed oil primer or spatter film compound may be disregarded. Joint surfaces shall be smooth, uniform and free from fins, tears and other defects which adversely affect proper welding.

The number of filler beads should be such that the completed weld will have a reinforcement of not less than 1/32-inch and not more than 1/16-inch. After the root bead has been completed, the second and third beads shall be added immediately. There shall be not less than three beads. Two beads shall not be started at the same location. The surface pass shall be substantially central to the seam and all surface passes shall be reasonably smooth and free from depressions. The face of the completed weld should be

approximately 1/8-inch greater than the width of the original groove.

The completed weld shall be thoroughly brushed and cleaned. Peening of weld layers or passes may be used to prevent undue distortion. Surface layers and the first pass in groove welds shall not be peened. Peening, when required, shall be performed with light blows of a hammer, using a blunt-nosed tool. Any chipping at the root of welds and chipping of welds to remove defects shall be performed with a round-nosed tool or by gas gouging.

All field welds and test coupons must be clearly marked by stencils to identify the welder and the tests for which the coupons are intended. The Contractor shall keep a record of all symbols and numbers. All welds must present a neat and clean appearance free of cracks, inadequate penetration, burn through or other obvious defects. Undercutting adjacent to the final bead shall not exceed 1/32-inch.

Coupons for all tests may be flame cut from the weld, but all necessary notching and machining of coupons shall be done in the testing laboratory. The use of water for quenching any weld is prohibited.

The Contractor shall, at his expense, cut welds from the line, as directed by the Engineer, for the purpose of testing. After welds are removed from the line, coupons will be cut around the circumference of the pipe and tested as outlined in paragraph 3.12.A above. The Contractor shall bear the cost of replacing defective welds discovered by test or radiographic inspection.

- E. Field Coating of Welded Joints and Repair of Damaged Coating Areas: The field coating procedure for welded steel pipe, fittings, associated appurtenances, and joints installed underground shall be the procedure contained in NAPCA Bulletin 6-69-90-5, and any subsequent revisions thereto, using heat shrinkable materials, such as 3M "Scotchkote" Brand 206P hot melt patch compounds, or Raychem WPCT Thermofit, or approved equal; or a cold-applied coating in 3" wide tapeworm, such as Tapecoat CT, manufactured by the Tapecoat Company, Evanston, Illinois 60204, Grace Servi-Wrap, or approved equal; or the following:

- (1) The pipe and weld shall be cleaned of any scale, dirt or foreign matter. All charred and damaged coating areas shall be abraded by hand filing or use of carborundum cloth.
- (2) A two part, 100% solids, liquid epoxy compound specified by the manufacturer of the coating material shall be applied to the abraded areas. Application shall be made to a minimum thickness of 25 mils and shall overlap undamaged area a minimum of 0.5 inches.
- (3) The liquid patch compounds shall not be applied when the pipe temperature is below 50°F unless provisions are made for heat curing the patch material using methods and temperatures in accordance with the procedures recommended by the coating manufacturer.
- (4) The Contractor shall furnish low-pulse electronic Holiday Detectors of a type approved by the Engineer, and shall check all coating applications with the detector prior to lowering pipe into the trench. All holidays found shall be repaired and such repairs shall again be tested with the detector to make sure the repairs are effective. The Engineer, at his discretion, will inspect both visually and with a Holiday Detector, the coating and repair areas. Any coating showing defects or "Holidays" shall be repaired according to the foregoing specifications for repairing damaged coating areas.

3.13 INSTALLING P.E. PIPE

All P.E. gas mains shall be installed in strict accordance with the manufacturer's recommendation. Each valve on services and mains will be supported by an 80-pound bag of "Sakrete" concrete mix. Heat fused P.E. pipe shall be snaked in the trench. Backfill shall not be placed on any plastic pipe while it is in a heated condition. Cooling of the pipe by an approved method will be required by the Engineer, if necessary. Set time for newly assembled heat fused joints shall be as follows:

10 Minutes minimum @ 60°F to 90°F

11 Minutes minimum @ 40°F to 60°F

12 Minutes minimum @ 25°F to 40°F

3.14 FIELD CUTTING OF PIPE

Field cutting of all pipe shall be accomplished by a method approved by the Engineer. Any section of pipe which is damaged during the cutting operation will be rejected.

3.15 SETTING OF VALVES AND FITTINGS

Setting of valves and fittings shall be in accordance with USAS B31.8, except as modified for P.E. pipe in paragraph 3.13 of these specifications.

3.16 INSTALLING SERVICE ASSEMBLIES

All essential details of construction of the service assemblies to be installed are indicated on the drawings; these drawings shall be followed carefully. The labor, materials and equipment required to be furnished by the Contractor for each service assembly shall depend on the installation size, type and meter setting. The Contractor shall set each service assembly where shown on the drawings or as directed by the Engineer. The drawings will indicate whether the existing meter and/or regulator in the proposed service assembly are to be refitted and used at the relocation point.

Existing meters and regulators, not to be refitted, used again or relocated, shall be delivered to the Owner's Gas Department, accompanied by a "Gas Service Ticket", furnished by the Contractor, detailing the location from which it was removed, old meter number, new meter number, etc. All existing gas service lines which are not to be re-used shall be cut and capped below natural ground surface.

The Contractor shall not set the service assemblies until all the mains have been cleaned, tested, purged and approved by the Engineer.

- A. Service Assembly Type I: Service Assembly Type I as detailed on the drawings shall be for those instances where an existing service assembly with a 275, 415, 750 and/or 1600 cfm meter setting is to be refitted, relocated, and/or replaced.

The Contractor shall disconnect and dismantle the existing service assembly. The Contractor shall furnish the materials as shown on the drawings and install the Owner's existing or new meter and regulator in the service assembly detailed.

Prior to ordering new meters, the Contractor shall ascertain from the Owner's Gas Superintendent the new meter numbers to be assigned to each new meter for stamping by the manufacturer.

The scope of work for "Service Assembly Type I" shall include all the necessary labor,

materials and equipment, field taps, tapping tees, saddles, curb stops, excess flow valves (where required), curb stop boxes, riser, regulator, meter or other incidental devices required to connect the service line to the distribution main; disconnect, refit and/or relocate, reassemble and connect the service assembly to the service line; and connect the customer's piping to the service line.

- B. Service Assembly Type II: Service Assembly Type II as detailed on the drawings shall be for those instances where no service assembly exists. The Contractor shall furnish and install the components, fittings, etc. for the size and type of service assembly set-up as detailed.

The scope of work for "Service Assembly Type II" shall include all the necessary labor, materials and equipment, field taps, tapping tees, saddles, curb stops, excess flow valves (where required), curb stop boxes, or other incidental devices required to connect the service line to the distribution main; and to connect the service assembly set-up to the service line. The meter shall be for a 275 CFH meter setting, except as noted in the drawings, and shall be tagged and delivered to the Owner's Gas Department. The riser alignment device, as manufactured by Gas Products, Inc., P.O. Box 33182, Tulsa, Oklahoma 74153-1183, telephone (800)259-5679, or approved equal, shall be installed in place of the meter.

- C. Service Assembly Type III: Service Assembly Type III as detailed on the drawings shall be for those instances where a designated existing large capacity service assembly with a 2500, 5000 and/or 10,000 CFH meter setting is required to be reconnected, refitted and/or relocated.

The Contractor shall disconnect designated existing large capacity service assemblies. The Contractor shall furnish and assemble the components, fittings, etc. for each proposed large capacity service assembly, as proposed and detailed on the drawings.

The scope of work for "Service Assembly Type III" shall include all the necessary labor, materials and equipment, field taps, tapping tees, saddles, curb stops, curb stop boxes, risers, meters, regulators, pressure gauges, needle valves, concrete blocks with reinforcing for meter supports, adjustable pipe supports, or other incidental devices required to connect the service line to the distribution main; reassemble and relocate (if required) and connect the designated large capacity service assembly to the service line.

3.17 HOT TAP CONNECTIONS OF MAINS

All gas main hot tap connections shall be for those instances where said gas mains to be tapped and/or connected are active and under existing gas system pressure. The Contractor shall furnish the labor, materials (such as all P.E. and steel fittings, transition fittings, weld caps, stopple fittings, three-way tees, etc.) and equipment required for each hot tap connection.

3.18 CAPPING OF EXISTING GAS LINES

Where shown on the drawings, existing cast iron (C.I.), P.E. and steel gas lines shall be cut and capped or cut and double capped. As part of this procedure, the Contractor shall physically remove a length of pipe as indicated in the drawings and as directed by the Engineer. The free ends of the gas line shall be cut in a straight and beveled face after shut off of the gas flow by use of stopple fittings or other means. Caps shall be welded to the P.E. or steel line ends and mechanically jointed to the C.I. line ends with a mechanical joint cap. The steel pipe cap on the existing line that remains in service shall be thoroughly coated as specified in Paragraph 3.12.E of these specifications. The capped ends on the gas lines to be abandoned will not be coated.

3.19 INSTALLING PIPE BY HORIZONTAL DIRECTIONAL DRILLING OR JACKING AND BORING

When shown on the drawings, lines installed under this contract which require crossing under public highways, paved roads, streets, or driveways shall be installed by the horizontal directional drilling (H.D.D.) or the jacking and boring method. The installation of utility pipe by these methods shall be in accordance with A.R.E.A. Specifications.

The excavation of all approach pits and trenches within the right-of-way of the highway or railroad shall be of sufficient length from the street or railroad tracks to permit traffic to pass without interference. All backfill on the approach pits and trenches within the right-of-way shall be tamped in layers a maximum of 6 inches thick for the entire length and depth of the trench or pit. The backfill shall be compacted to 90% of maximum density obtained at optimum moisture as determined by AASHTO T 180-57, Method A. Mechanical tampers may be used after a cover of 6 inches has been obtained over the top of the barrel of the pipe.

The boring operation shall be accomplished using a commercial type drilling or boring rig and the hole made by the installation shall be of the same diameter (within 2 inches) as the largest outside joint diameter of the pipe installed. The pipe shall be installed in the hole immediately after the drill or bore has been made and in no instance shall the hole be left open while unattended.

In the event sub-surface operations result in injury or damage to the pavement, repairs to this pavement shall be made by the Contractor, at no additional cost to the Owner. In the event paving cracks occur on either side of the pipeline, or pavement is otherwise disturbed or broken due to the Contractor's operations, he shall repair or replace the same pavement at his own expense without further compensation.

3.20 INSTALLING CASING PIPE

When shown on the drawings, the Contractor shall furnish and install all utility mains perpendicular to and under railroad tracks and roadways in a casing pipe. This casing shall be complete with end seals, vent pipe, and other specials required to install the main in the casing. All installations shall be in accordance with these Specifications and the requirements of the railroad or roadway, as applicable.

Unless otherwise specified, the casing pipe shall be installed by the H.D.D. or jacking and boring method in conformance with Paragraph 3.19 of these specifications.

3.21 FIELD CLEANING, TESTING AND PURGING

The field cleaning, testing and purging operations shall be applied to the whole or individual valved-off sections of the high pressure distribution mains, distribution mains and service lines either before or after the trench is backfilled, as directed by the Owner. The Contractor shall furnish the equipment, gauges, meter, gas and other material, tools, labor and other necessary assistance for conducting the field cleaning, testing and purging operations.

The Owner shall be notified at least 48 hours in advance of the field cleaning, testing and purging operations. The cleaning, testing and purging of all lines shall conform to the requirements of USAS B31.8, except as modified below:

- A. Cleaning: Prior to conducting the pressure tests, all gas mains, service assembly fittings and/or service lines to be connected thereto shall be blown clear by the use of compressed air and this cleaning operation shall continue until these lines and/or fittings are cleared to the satisfaction of the Owner.

At no time will compressed air be used without a dehumidifier. The lines shall then be pigged with approved foam pigs to demonstrate unrestricted clearance of all 2" size and larger mains.

- B. Testing: All gas mains, services and service assemblies shall be tested as follows:
- (1) Distribution System Mains and Service Lines:
 - (a) Gas mains larger than 3/4" IPS diameter - 100 psi for 24 hours with no pressure loss.
 - (b) Piping from the gas main including the service line to the valve on the upstream side of the service assembly, 100 psi for 24 hours with no pressure loss.
 - (2) Piping from the valve on the upstream side of the service assembly through the service assembly and through the service line to the customer's piping connection - 10" mercury (5 psi) for 15 minutes with no pressure loss.
 - (3) Any leak developing during any test shall be repaired, the lines and/or fittings made tight and the test repeated until successful.
 - (4) All tests on the gas mains larger than 3/4" IPS diameter and the service line from the gas main to the valve on the upstream side of the service assembly shall be recorded by a pressure gauge with 10-inch dial and 24-hour charts which will clearly indicate a differential of 1 psi.
- C. Radiographical Examinations: All welds made on the steel main feeding each regulator station and the welds on the steel pipe in each regulator station shall be subjected to non-destructive testing. The non-destructive testing shall be by radiographical examination and the radiographical examination procedure shall be in accordance with the latest edition of API Standard 1104. Certified radiographical examination results and the film negatives shall be given to the Owner. The radiographical examination laboratory shall be subject to approval by the Owner.
- D. Purging: Prior to delivery of natural gas to the system, all gas mains, service lines, service assemblies and/or the associated fittings shall be purged with natural gas. This is to be performed through the use of the Owner's gas paid for by the Contractor in a manner or procedure as approved by the Owner's Gas Department. At no time shall any valve in the system be subjected to gas pressure on one side and air pressure on the other. Blind flanges shall be used to prevent this condition from occurring.

When gas is delivered to the system, all fittings shall be checked for tightness with a soap-water solution. No gas leaks will be allowed. Results of the tightness tests shall be recorded and a copy given to the Owner. Should the amount of leakage exceed that specified, the Contractor shall, at his expense, locate and repair the defective joints until the leakage is within the specified limits.

3.22 WITNESSING OF TESTS

The cost of witnessing a test shall be borne by the Owner one time. The cost of witnessing re-tests which fail the initial test will be deducted from Contractor payments.

3.23 GAS SERVICE INTERRUPTIONS

Work shall be performed such that gas service will not be interrupted, if possible, throughout this

contract. Whenever it becomes necessary to remove a section of line from service, the Contractor shall cooperate fully with the Owner's Gas Department personnel.

The Contractor and the Owner's Gas Department personnel shall be responsible for checking each house, store, building, etc. in advance to insure that its owner or occupant is or will be available during anticipated gas service interruptions. Prior to refitting and/or relocating the existing service assembly and connecting the service lines to said service assembly and the customer's piping, the Owner's Gas Department personnel will turn off all pilot lights served by said service assembly. After the customer's piping has been reconnected, the Owner's Gas Department personnel will determine that it is safe to turn on the gas, and proceed to re-light all pilot lights served by each service assembly.

The Contractor shall be responsible for coordinating his work with the Owner's Gas Department personnel. Under no circumstances will the Contractor turn on the gas to a customer's piping until it has been determined that it is safe to do so and without the full knowledge of the Owner's Gas Department personnel. The Contractor shall align his work schedule to accommodate the Owner's Gas Department.

3.24 GAS SYSTEM SWITCHOVER

Contractor shall schedule his work such that the switchover from the existing system to the new system shall be at minimum inconvenience to the Owner and its customers. At no time will a new gas main be connected to existing customer until it has been tested and accepted by the Owner. Should the Contractor elect to connect customers to portions of the new system prior to completion of entire system, such connections shall not relieve him of the responsibility of completing his contract as required by the drawings and specifications. Portions so connected or turned over to the Owner will not relieve the Contractor of his responsibilities under the contract until the entire project is completed, tested and accepted.

3.25 PURGING, FLOODING AND ABANDONMENT OF EXISTING GAS LINES

Where noted on the drawings, existing gas lines are to be abandoned. At that time when all services have been transferred to the new mains and all interconnections have been completed, the existing 3" size and smaller gas lines to be abandoned shall be disconnected from their main feed points and purged of gas in the line by cutting and capping, as necessary. The existing 4" size and larger gas lines to be abandoned shall be disconnected from their main feed points, have gas purged from the lines by flooding and filling the lines with water. When all flooding is completed, the 4" size and larger gas lines shall be tightly capped.

No separate payment will be made for abandonment of existing gas lines by the purging and flooding operation. Cost shall be included in the unit price bid per foot of pipe.

3.26 INSTALLING NON-CORROSIVE METALLIC WIRE OVER P.E. GAS PIPE

The Contractor shall install a non-corrosive metallic wire directly over and on the center of all P.E. gas mains and service lines. This wire shall be continuous on all P.E. pipe and shall be connected to all fixtures, appurtenances, and pipe as detailed on the drawings. The wire type shall be as specified in paragraph 2.15.

3.27 INSTALLING LOCATOR WIRE ANODE

The Contractor shall furnish and install 17-pound anodes connected to the P.E. pipe locator wire, as detailed in the drawings. The quantity of anodes required shall be provided as detailed in the drawings or as called for in the General Requirements. The locator wire anode installation shall be as specified in paragraph 2.16. The location of each anode and installation details shall be as shown on the drawings. The anode lead wire connection to the locator wire shall be made using a

3M DBR splice kit. The wire shall be cleaned to bare metal, and the connection made. The packaged magnesium anode shall be placed in an augered hole, as detailed in the drawings. The anode lead wire shall not be used for lowering the anode into the hole. After placing the anode in the hole, the hole shall be filled with earth which is tamped and watered to achieve full compaction.

No special payment will be made for installation of the locator wire anodes. The cost of each shall be included in the unit price bid for P.E. gas pipe.

3.28 SPECIAL BACKFILL

Where shown on the drawings, the Contractor shall furnish and install special backfill. The special backfill shall be red dirt, with a 5 to 15 plastic index which is available in the local area. The degree of compaction shall be as specified in paragraph 3.30.

3.29 SPECIAL FOUNDATION (TYPE 2 STANDARD PIPE FOUNDATION)

Where shown on the drawings, all pipe shall be supported by a special foundation and bedding detailed as Type 2 on the drawings. The special foundation and bedding shall be 4" of washed gravel installed under the pipe. The gravel shall be clean, free from clay, sticks, or other deleterious substances, meeting the following gradation:

<u>Sieve</u>	<u>Percent Passing by Weight</u>
3/4	100
5/8	95-100
No. 4	0-7

3.30 TRENCH BACKFILL AND COMPACTION

- A. Outside Street Surfaces and Shoulders: The backfill in the trench above the pipe shall be placed in layers and compacted to prevent settlement of the trench. Prior to the final acceptance of the pipeline, the trench shall be level with the surrounding natural ground.
- B. Inside Street Surfaces, Other Paved Areas and Street Shoulders: The backfill in the trench above the pipe zone and bedding shall be placed in lifts not to exceed six-inch compacted layers and compacted to 95% of standard density when measured by AASHTO-T99.

The trench shall be compacted for a depth of 2'-0" above the top of the pipe using hand tamps or hand mechanical tamps before the use of a wheel type device or a hydro-hammer is used for compaction purposes.

3.31 REPLACING STREET SURFACING AND SIDEWALKS

In all paved or unimproved streets, the surface of the trenches shall be finished without any needless delay and in the best workmanlike manner with the same kind of roadway or sidewalk improvement that was removed in excavating the trench. The replacement of all street surfaces shall be in accordance with the details shown in the drawings.

Should the Contractor fail or refuse to make such repairs timely, the Owner may after 24 hours written notice, employ such personnel and furnish such materials as may be necessary and do the work, deducting the actual cost thereof from any amounts due or to become due to the Contractor.

The Contractor shall be obligated to maintain and keep in good condition any replacement of base, street surfacing or sidewalks from the time of installation until final acceptance of the work.

3.32 CLEANING UP, REMOVING SURPLUS EARTH, ETC.

As soon as the backfilling of any excavation is completed, the Contractor must at once begin the removal of all surplus dirt except that actually necessary to provide for the settlement of the filling.

He shall also remove all pipe and other material placed or left on the street or right of way by him except material needed for the replacement of the paving. The street shall be opened and made passable for traffic. Following the above work, the repairing and complete restoration of the street surfaces, bridges, crossings and all places affected by the work shall be done as promptly as possible.

Any surplus earth which may be left on the street or right of way after the excavations have been completely refilled shall be regarded as the property of the Contractor and must be removed as soon as possible at his own expense except that in ungraded streets, it shall be optional with the Engineer whether surplus material shall be removed or deposited on the surface and graded for the convenience of traffic.

PART 4 - METHOD OF MEASUREMENT AND PAYMENT

- 4.01 GAS PIPE:** No separate measurement and payment will be made for gas pipe. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.02 STEEL PIPE FITTINGS:** No separate measurement and payment will be made for steel pipe fittings. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.03 VALVES AND VALVE BOXES:** No separate measurement and payment will be made for valves and valve boxes. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.04 GAS SERVICE ASSEMBLIES:** No separate measurement and payment will be made for gas service assemblies. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.05 FLOOR VALVES:** No separate measurement and payment will be made for floor valves. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.06 GAS SERVICE PIPE:** No separate measurement and payment will be made for gas service pipe. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.07 SPECIAL PIPE FOUNDATIONS:** No separate measurement and payment will be made for special pipe foundations. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.08 SPECIAL BACKFILL:** No separate measurement and payment will be made for special backfill. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.09 REMOVAL AND REPLACEMENT OF HIGHWAY, STREET, DRIVEWAY AND SIDEWALK PAVEMENT AND CURBS:** No separate measurement and payment will be made for removal and replacement of highway, street, driveway, and sidewalk pavement and curbs. All materials and labor associated with this work shall be included in the price bid for associated items of work.

- 4.10 CONCRETE SURFACES TO BE SAWED:** No separate measurement and payment will be made for concrete surfaces to be sawed. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.11 CLEARING AND GRUBBING:** No separate measurement and payment will be made for clearing and grubbing. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.12 REMOVAL AND REPLACEMENT OF CULVERT PIPES:** No separate measurement and payment will be made for removal and replacement of culvert pipes. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.13 HOT TAP CONNECTIONS OF MAINS:** No separate measurement and payment will be made for hot tap connections of mains. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.14 CAPPING OF EXISTING GAS MAINS:** No separate measurement and payment will be made for capping of existing gas mains. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.15 METER/REGULATOR STATION, REGULATOR STATION, OR REGULATOR STATION SCADA AND TELEMETRY REMOTE SYSTEM:** No separate measurement and payment will be made for meter/regulator station, regulator station, or regulator station scada and telemetry remote system. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.16 SPECIAL LUMP SUM – RAILROAD CROSSINGS, ROADWAY CROSSINGS, CANAL CROSSINGS AND LEVEE CROSSINGS, ETC.:** No separate measurement and payment will be made for special lump sum – railroad crossings, roadway crossings, canal crossings, and levee crossings, etc. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.17 SPECIAL LUMP SUM – GAS SEPARATOR WITH CONCRETE VAULT:** No separate measurement and payment will be made for special lump sum – gas separator with concrete vault. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.18 ITEMS TO BE FURNISHED TO THE OWNER:** No separate measurement and payment will be made for items to be furnished to the owner. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.19 FIELD CLEANING, TESTING AND PURGING OF GAS MAINS:** No separate measurement and payment will be made for field cleaning, testing, and purging of gas mains. All materials and labor associated with this work shall be included in the price bid for associated items of work.
- 4.20 CLEANUP, MAINTENANCE AND FINAL RESTORATION:** No separate measurement and payment will be made for cleanup, maintenance and final restoration. All materials and labor associated with this work shall be included in the price bid for associated items of work.

END OF SECTION 02555

**SECTION 02900
SODDING**

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions, apply to this Section.
- B. Refer to earthwork specifications for additional requirements that relate to this work.

1.2 DESCRIPTION OF WORK

- A. This work consists of furnishing, hauling, planting, rolling, watering, fertilizing and maintaining live grass sod at locations shown on the plans or as directed by the Engineer.

PART 2 -PRODUCTS

2.1 MATERIALS

- A. Approved slab sod shall be either field grown grass or nursery grown grass.
- B. Grass sod shall be Centipede, St. Augustine, Bermuda Grass, Carpet Grass, or other approved grass native to the sodded area.
- C. Sod shall be free from noxious weeds or other vegetation.
- D. Water may be obtained from any source. Brackish water, sewage water, chemically contaminated or oily water shall not be used.

2.2 FERTILIZER

- A. Fertilizer shall be a commercial grade, uniform in composition, free-flowing, and suitable for application with approved equipment, delivered to the site in bags or other convenient containers, each fully labeled. Where fertilizer is furnished from bulk storage, the contractor shall furnish a supplier's certification of analysis and weight. Fertilizer application shall be at the following rates:

<u>Type</u>	<u>Pounds/Acre</u>
8-8-8	1000
12-12-12	667
13-13-13	615
16-16-16	500

2.3 AGRICULTURAL LIME

- A. If required by the plans or General Requirements, agricultural lime shall consist of ground limestone containing at least 90% calcium carbonate equivalent (CaCO₃). The material shall be ground so that a minimum of 90% passes a No. 10 sieve and 25% passes a No. 100 sieve. Agricultural lime shall be applied at the rate of 2000 lbs/acre.

PART 3 -EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

- A. Slab soil shall be cut with approved sod cutters. The designated area shall be mowed when necessary. Sod shall be cut to a minimum soil depth of one and one-half inches (1-½") for field-grown grass and one inch (1") for nursery grown grass, and to a uniform width and in convenient lengths for handling. Soil shall be retained on roots of sod during excavating, hauling and planting. Slab sod shall match, as close as possible, the type of adjacent grass cover of the area receiving slab sod. If the type of adjacent grass cover cannot be determined, St. Augustine sod will be the type of slab sod used.

3.2 HANDLING SOD

- A. Sod shall be placed flat, grass side up in pallets containing no more than 50 square yards of sod and hauled covered, to the planting site with soil intact. Pallets shall be off-loaded and placed as close as practical to the planting site.

3.3 PLANTING

- A. Areas to receive slab sod shall be pulverized to a depth of at least three inches (3"), graded and cleared of weeds, grass, stones and other debris. If an item for agricultural lime is included in the contract, liming shall be done when the area is being pulverized. Fertilizer shall be applied in accordance with the type and rates as indicated in Section 39 92 10 Broadcast Seeding. Approximately ninety percent (90%) of the fertilizer shall be broadcast over the area to receive slab sodding, and the remaining ten percent (10%) shall be broadcast over sod after placing and rolling. Upon delivery to the planting site, slab sod shall be transferred onto the surface soil. Areas to be added shall be watered as directed. Sod shall be placed with minimum space between slabs. Slabs shall be staggered such as to avoid a continuous seam along the line of flow. Along the edges of such staggered areas, the offset of individual strips shall not exceed 6 inches. Slabs, which do not fit closely shall be pulled together by hand or with suitable tools and pegged when necessary. Topsoil shall be used to fill any unavoidable gaps in the sod.

3.4 ROLLING

- A. Slab sod shall be rolled after planting with smooth drum steel wheel rollers or cultipackers. Where rolling is impractical, sod shall be tamped by approved hand methods.

3.5 WATERING

- A. Slab sodding shall be watered by the Contractor until the root system is established or as required to ensure a healthy stand of grass. Slab sod areas shall be kept moist for a minimum of 30 days after sodding.

END OF SECTION 02900