WARNING: These specifications shall not be changed or modified in any manner. This is the latest version as of August 24, 2012.

TECHNICAL SPECIFICATIONS

PREPARED BY

ENGINEERING DIVISION, PUBLIC WORKS DEPARTMENT

CITY OF LAWTON

INDEX

FOR

TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS

SECTION 0100

STREET AND DRAINAGE CONSTRUCTION

SECTION 0101

Earthwork

Description

The work covered by this section is as described in Section 202.01 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof. All grading and related operations shall be included in this section. All excavation is designated as unclassified excavation. All embankment shall be select borrow.

Materials

The materials used in the execution of the work covered by this section shall be as noted in Section 202.02(B) or Section 705.01 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof. All embankment shall be Select Borrow.

Construction Methods

The construction methods used to execute the work covered by this section shall be in accordance with Section 202.04 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Measurement and Payment

Method of Measurement: Work included in this section will be measured on a lump sum basis for the project.

Basis of Payment: Completed and accepted work will be paid for at the contract unit price for:

Earthwork	Lump Sum

And such payment shall be full compensation for drifting or hauling of excavated material, hauling and placing of borrow material, plowing scarifying, blading, removal of stone and boulders from the roadway, compacting, shaping, clearing all normal inlet and outlet channels to right-of-way lines, and for all labor, tools, equipment, and incidentals necessary to complete the work as specified.

SECTION 0102

Subgrade

Description

The work of this section is presented in Section 310.01 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Construction Methods

The work covered in this section shall be executed in compliance with the methods described in Section 310.04 Method B, of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof with the following exception: Excavation required for the removal of unstable material and the replacement of the unstable material with acceptable material will be included in the contract price for earthwork. Compaction shall be to 95% Standard Proctor Density and moisture content shall be -2% to +3% above optimum moisture content as determined by AASHTO T-99.

Measurement and Payment

Method of Measurement: Subgrade will be measured by the square yard for work completed in accordance with the plans and specifications and in reasonable close proximity with the lines, grades, and elevations on the plans or as established by the Engineer.

Basis of Payment: Accepted subgrade will be paid for at the contract unit price for:

Subgrade, Method B	Square Yard

SECTION 0103

Separator Fabric for Bases

Description

This work shall consist of the installation of a separator fabric between subgrade and base. The base may be a bituminous mixture, stabilized aggregate or graded crushed stone. The installation shall be performed in accordance with these Specifications and as directed by the Engineer.

Materials

The separator fabric shall be of a nonwoven, needle-punched construction and consist of long-chain polymeric filaments composed of at least 85 percent by weight polyolefins, polyester or polyamide. The filaments and fibers shall be oriented whereby they retain their relative positions with each other and allow the passage of water as specified.

The fabric shall be mildew, insect and rodent resistant and shall be inert to chemicals commonly found in soil. The separator fabric shall show no distress when heated to 325 degrees F. The separator fabric shall conform to the physical property minimum* requirements below:

Physical Property	Test Method	Limit
Tensile Strength, wet, lbs.	ASTM D-4632	200 lbs
Elongation, %	ASTM D-4632	50 %
Coefficient of Permeability, cm/sec	ASTM D-4491	0.2 cm/sec
Puncture Strength, lbs.	ASTM D-4833	100 lbs
Mullen Burst Strength, psi	ASTM D-3786	300 psi
Abrasion Resistance, lbs.	ASTM D-4866 Sliding Block Test (250 cycles, 30 cycles per minute, 1 Kg. load)	90 lbs
Trapezoidal Tear Strength, lbs.	ASTM D-4533	75 lbs
AOS (U.S. Std. Sieve Size)	ASTM D-4751	60-100

*Minimum test value: All these values represent certifiable minimum values in the weakest principal direction, i.e., each roll in a lot should meet or exceed these minimum test values when sampled according to ASTM D-4354.

The Contractor shall furnish a Type A Materials Certification for the fabric in accordance with ODOT Subsection 106.11. A one square yard sample of the fabric shall be furnished the Materials Engineer from each lot or shipment for inspection and testing.

Construction Methods

The separator fabric shall be furnished in a protective wrapping which shall protect the fabric from ultraviolet radiation and from abrasion due to shipping and handling. In the field, the fabric rolls shall be stored in a manner that protects them from the elements.

The fabric shall be placed in the manner and at the locations shown on the Plans. The geotextile at the overlap shall be either lapped a minimum of 18 inches or sewn. If lapped, the fabric shall be placed so that the preceding roll overlaps the following roll in the direction the base material is being spread. If sewn, the seam strength shall not be less than 70 percent of the required tensile strength of the unaged fabric. The surface to receive the fabric shall be prepared to a smooth condition, free of obstructions and debris that may damage the fabric during installation.

The fabric shall be covered with the base material within two weeks of its placement. Should the fabric be damaged during construction, the torn or punctured section shall be repaired by the Contractor placing a piece of fabric that is large enough to cover the damaged areas and to meet the overlap requirement as described above.

If windy conditions disturb the fabric, it may be stabilized by pinning with large nails with washers, or weighing with cover material.

Each roll shall be labeled to provide product identification for inventory and quality control.

Cover material shall be applied by back dumping. The cover shall be a minimum of three inches. Bituminous mix material may be laid by a tracked lay down machine. Any rutting that occurs in the base material shall be filled with appropriate material and compacted.

Measurement and Payment

Method of Measurement: Separator fabric shall be measured by the square yard in place with no allowance for laps.

Basis of Payment: The accepted quantities, measured as provided above, will be paid for at the contract unit price for:

Separator Fabric	Square Yard

which shall be full compensation for furnishing all material, equipment, labor and incidentals to complete the work as specified.

SECTION 0104

Aggregate Base

Description

The scope of work for this section is furnishing and placing of one or more courses of aggregates as described in Section 303.01 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Materials

The materials used shall meet the requirements of Section 703.01 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof. Aggregate base shall be Type "A".

Construction Methods

The construction methods used in executing the work shall comply with the requirements of Section 303.04 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof. Upon satisfactory compaction testing, the aggregate base shall be primed within 24 hours if it is not covered with asphalt or concrete.

Measurement and Payment

Method of Measurement: Aggregate base will be measured by the square yard of surface area for furnishing and placing one or more courses of aggregates and additives, if specified, on a prepared subgrade or subbase in accordance with these specifications and in reasonably close conformity with the lines, grades, thickness and typical cross sections shown on the plans or established by the Engineer.

Basis of Payment: Accepted quantities including prime coat, if required, will be paid for at the contract unit price for:

Aggregate Base	Square Yard

SECTION 0105

Portland Cement Concrete Pavement

Description

The scope of work for this section is the furnishing and placing of concrete pavement as described in Section 414.01 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Materials

The materials used shall meet the requirements of Section 414.02 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof, except P.C. concrete shall meet the following: 1.) minimum cement content 588 lbs/cy 2.) air content 6 +/- 1.5% 3.) maximum water/cement ratio 0.48 4.) slump 2 +/- 1 inch 5.) minimum 3,500 psi 28 day compressive strength 6.) coarse aggregate shall meet size No. 57 specifications.

Construction Methods

The construction methods used in executing the work shall comply with the requirements of Section 414.04 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Strength Requirements

The Portland Cement Concrete shall comply with the requirements of Section 414 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof, the mix design specified herein and with the following requirements.

A.) Strength – On delivery to the site of the work, the concrete shall be of a workable, plastic consistency and shall have a compressive strength of not less than thirty-five hundred (3500) pounds per square inch when tested at the age of twenty-eight (28) days, unless otherwise specified. Specimens and compression tests shall conform to the latest revision of ASTM Methods C-31. The test specimens shall be taken from the mixture in actual use. The average strength of not less than two (2) test specimens shall be used in determining the strength of the concrete.

B.) Tolerance in Strength – It is the intent of these specifications that the strength of the concrete shall not be less than that specified. In the event the compressive strength does not meet the specifications, but the average of the two test cylinders is at least 85% of the specification, then the pavement shall be considered satisfactory upon submittal of an extended maintenance bond for the low-test area. In the event the test cylinders do not average 85% of the specification, a test consisting of three (3) cores taken from the area represented by the low test cylinders shall be taken at locations as

directed by the Engineer. Core tests including curing, capping and/or corrections shall conform to the latest revision of ASTM C-42.

1. Concrete for the area represented by the low test cylinders (averaging less than 85% of the specification) shall be considered satisfactory if the average of (3) cores equals or exceeds 100% of the specification, or if the following conditions are met: (1.) the average core strength of three cores as provided above is equal to at least eighty-five (85%) percent of the specified strength (2.) no single core is less than seventy-five (75%) percent of the specified strength and (3.) the submission of an extended maintenance bond for said area. Additional testing of cores extracted from locations represented by erratic core strength results shall be permitted.
2. Concrete which does not meet the criteria as indicated above will not be accepted, and the Contractor shall be required to remove same. The Contractor shall then replace the deficient concrete with satisfactory concrete.

Weather Limitations

Under all weather conditions, the temperature of concrete at time of placement shall be between 50°F and 90°F (10°C and 32°C).

A.) Cold Weather Limitations & Requirements:
   1. Concrete shall not be placed on, against or around any surface whose temperature is below 35°F (2°C).
   2. The Contractor shall prevent the concrete from freezing for a period of 72 hours after placement with the use of polystyrene foam sheeting, foamed vinyl blankets, mineral wool or cellulose fiber blankets, moisture-proof batt insulation, or by means requested by the Contractor and approved by the Engineer. The materials and equipment needed to protect the concrete will be stored at the site prior to placement of the concrete.
   3. Any concrete that freezes or is damaged by frost during the period 72 hours after placement will be removed and replaced at the Contractors expense.

B.) Hot Weather Limitations & Requirements:
   1. Concrete shall not be placed when the atmospheric temperature is 90°F and rising.
   2. Concrete shall not be placed on, against or around any surface whose temperature is above 115°F (46°C).

C.) Precipitation Limitations & Requirements:
   1. Concrete placement shall cease when precipitation is sufficient that it may cause damage to the work. Damage includes, but is not limited to, increasing the water/cement ratio in the surface course during finishing operations, marring freshly finished concrete, washing surface grout off and exposing aggregates, etc. Any work so damaged shall be removed and replaced by the Contractor at no expense to the Owner.

2. On days when a chance of rainfall has been forecasted, and the Contractor elects to place concrete, the Contractor will have at the site materials and equipment to provide protection of freshly placed concrete prior to the rainfall event. Any concrete work that is not covered/protected prior to the rainfall and is damaged as described above under C.1 will be removed and replaced at the Contractor's expense.
3. Concrete that is subject to overland flows, such as an RCB, ditch liner, streets with no storm drain systems, etc. should not be placed when precipitation is predicted. If the Contractor elects to pour such items and runoff causes damage as described in C.1. above, the Contractor shall remove and replace the damaged areas at no expense to the Owner.

Measurement and Payment

Method of Measurement: Concrete pavement will be measured by the square yard of surface area for furnishing and placing P.C. concrete pavement on a prepared aggregate base in accordance with these specifications and in reasonable close conformity with the lines, grades, thickness and typical cross sections shown on the plans or established by the Engineer.

Basis of Payment: Accepted quantities will be paid for at the contract unit price for:

P.C. Concrete Pavement	Square Yard

SECTION 0106

Asphaltic Concrete Pavement

Description

The scope of work for this section is the furnishing and placing of Asphaltic Concrete Pavement as described in Section 407.01, 408.01 and 411.01 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Materials

The materials used shall meet the requirements of Section 407.02, 408.02 and 411.02 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Construction Methods

The construction methods used in executing the work shall comply with the requirements of Section 407.04, 408.04 and 411.04 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

If specified, the construction of a "leveling course" of fine aggregate bituminous base ("hot sand mix") shall be placed as directed by the Engineer. The costs of furnishing and placing prime or tack coats shall be included in the price bid for other items.

Measurement and Payment

Method of Measurement: Asphaltic Concrete Pavement will be measured by the square yard of surface area for furnishing and placing Asphaltic Concrete Pavement on a prepared aggregate base or by the ton for furnishing and placing fine aggregate bituminous base in accordance with these specifications and in reasonably close conformity with the lines, grades, thickness and typical cross sections shown on the plans or established by the Engineer.

Basis of Payment: Accepted quantities will be paid for at the contract unit price for:

Asphaltic Concrete Pavement (Type "C")	Square Yard
Fine Aggregate Bituminous Base (Hot Sand Mix)	Ton
Course Aggregate Bituminous Base	Square Yard
Superpave, Type S4 (PG 76-28 OK)	Ton
Superpave, Type S6 (PG 64-22 OK)	Ton

SECTION 0107

Chip Seal

Description

The work for this section is the furnishing and placing of acceptable single- or double-surface treatment of aggregates and bituminous materials; this means that the surface is free from bleeding, loose chips, loss of imbedded aggregates, or other defects as described in Section 403 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Materials

The materials used shall meet the requirements of Sections 703.02 and 708.03 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Construction Methods

The construction methods and rates used in executing the work shall comply with the requirements of Section 403 and 408 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Measurement and Payment

Method of Measurement: Chip Seal will be measured by the square yard of surface area for furnishing and placing Chip Seal (Double Treatment) including prime coat, bituminous binder coats and cover aggregate courses on a prepared aggregate base in accordance with these specifications and in reasonably close conformity with the lines, grades, thickness and typical cross sections shown on the plans or established by the Engineer.

Basis of Payment: Accepted quantities will be paid for at the contract unit price for:

Chip Seal (Double Treatment)	Square Yard

SECTION 0108

Integral Curb, Combined Concrete Curb and Gutter, Asphalt Curbing and Header Curbing

Description

The scope of work for this section is the furnishing and placing of concrete curbing (3,500 PSI minimum) as described in Section 609.01 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Materials

The materials used shall meet the requirements of Section 609.02 of Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof, except P.C. concrete shall meet the following: 1.) minimum cement content 588 lbs/cy 2.) air content 6 +/- 1.5% 3.) maximum water/cement ratio 0.48 4.) slump 2 +/- 1 inch 5.) minimum 3,500 psi 28 day compressive strength 6.) coarse aggregate shall be meet size No. 57 specifications.

Construction Methods

The construction methods used in executing the work shall comply with the requirements of Section 609.04 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Measurement and Payment

Method of Measurement: Concrete barrier curb and gutter will be measured by the lineal foot along the front of the curb.

Basis of Payment: Accepted quantities will be paid for at the contract unit price for:

6" Combined Concrete Barrier Curb and Gutter	Lineal Foot

for furnishing and placing 6" combined concrete barrier curb and gutter in accordance with the lines, grades and dimensions shown on the plans or established by the Engineer.

SECTION 0109

Excavation and Backfill for Structures

Description

The scope of work for this section is the excavation and backfill or disposal of materials as described in Section 501.01 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Materials

The classification of excavation shall met the requirements of Section 501.02 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Construction Methods

The construction methods used in executing the work shall comply with the requirements of Section 501.04 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Measurement and Payment

All costs involved for this item of work shall be considered incidental and shall be included in the unit bid price for other items.

SECTION 0110

Drainage Conduits

Description

The scope of work of this section is the furnishing and placing of drainage conduits as described in Section 613.01 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Materials

The materials used shall meet the requirements of Section 613.02 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition or the latest edition thereof.

Construction Methods

The construction methods used in executing the work shall comply with the requirements of Section 613.04 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Measurement and Payment

Method of Measurement: Measurement will be for the lineal foot of drainage conduit placed in accordance with the plans and specifications, and in reasonably close conformity with the lines, grades and elevations on the plans or established by the Engineer including trenching and required bedding. The removal of existing structures and connection to any new or existing pipe structures shall be included in the lineal foot price for installation of reinforced concrete pipe.

Basis of Payment: Completed and accepted work will be paid for at the unit contract price for:

Reinforced Concrete Pipe (18" – 54”)	Lineal Foot
Corrugated Aluminum Pipe	Lineal Foot
Triple Wall Corrugated Polyethylene Pipe	Lineal Foot
Cast Iron Pipe	Lineal Foot
Polyvinyl Chloride (PVC) Pipe	Lineal Foot
Perforated Pipe Underdrain	Lineal Foot
Non-Perforated Pipe Underdrain	Lineal Foot
Edge Drain Conduit – Perforated	Lineal Foot
Edge Drain Outlet Lateral – Non-perforated	Lineal Foot
Prefab. Culv. End Sect., Round/Ellip./Arch	Each
Culvert End Treatment	Each
Sloped Concrete End Section	Each

Special End Sections of Reinforced Concrete	Each
Outlet Lateral Headwall	Each
Jacked Conduit	Linear Foot
Re-Laying Culvert Pipe	Linear Foot

SECTION 0111

Manholes, Drop or Curb Inlets and Junction Boxes

Description

The work covered by this section is as described in Section 611.01 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof. The scope of this section also includes special curb drain openings and inlet structures such as Gary Grated Inlets, and reinforced concrete box structures or special designs.

Materials

The material used in the execution of the work covered by this section shall comply with the requirements set forth in the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof and the requirements of the project documents. Curb drain openings shall be Neenah R-3262-4 Curb Openings or approved equivalent.

Construction Methods

The construction methods used to execute the work covered by this section shall be in accordance with the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof. Curb drain openings shall be installed in accordance with the manufacturer's recommendations.

Measurement and Payment

Method of Measurement: Measurement of the Gary Grate Inlet shall include the Gary Grated Inlet, and extended outlet structure. No separate quantity will be measured for payment for the extended outlet part of the Gary Grate Inlet. The cost for this shall be included in the Gary Grate Inlet item.

Measurement will be for the completed structures as constructed in accordance with the plans and specifications and in reasonably close conformity with the lines, grades, and elevations on the plans or as established by the Owner. Contractor to furnish all materials, equipment, labor and incidentals to complete the work as specified. Excavation and backfill will not be measured for payment, but the cost of same will be included in the unit price or prices bid for various pay items. Reinforcing steel will be included as part of the cost of the structure complete and will not be measured as a pay item.

Cost of manhole frame and covers, inlet frame and grates, cast iron curb inlets and special frames and grates shall be included with the unit price bid for the associated item, or included in the price bid for other items.

Basis for Payment: Completed and accepted work will be paid for at the contract unit price for:

Manhole	Each
Gary Grate Inlet	Each
Junction Box	Each
Curb Inlet and Grates (complete)	Each
Grate Inlet	Each
Curb Drain Openings	Lineal Foot
Reinforced Concrete Drop Inlet (extra depth) w/Handrails	Each
Reinforced Concrete Box	Lineal Foot
Drainage structure No. ___	Lump Sum

SECTION 0112

Structural Concrete

Description

The scope of work for this section is furnishing and placing of Class "AA" structural concrete as described in Section 509.01 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Materials

The materials used shall meet the requirements of Section 509.02 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Construction Methods

The construction methods used in executing the work shall comply with the requirements of Section 509.04 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Measurement and Payment

All costs involved for this item of work shall be considered incidental and shall be included in the unit bid price for other items.

SECTION 0113

Guard Rail and End Treatments

Description

The work covered by this section is as described in Section 623.01 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest revision thereof.

Materials

The materials used in the execution of the work covered in this section shall be as noted in Section 623.02 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition or the latest edition thereof.

Construction Methods

The construction methods used to execute the work covered in this section shall be in accordance with Section 623.04 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Measurement and Payment

Measurement will be for the completed barricade as constructed in accordance with the plans and specifications and in reasonably close conformity with the lines, grades and elevations on the plans or as established by the Engineer.

Basis of Payment: Completed and accepted work will be paid for at the contract unit price for:

Guard Rail (complete)	Each

SECTION 0114

Fabric Reinforcement for Hot Mix Asphalt Pavement

Description

The scope of the work for this section is the furnishing and placing of reinforcement fabric for plant mix asphalt concrete pavement in accordance with these specifications and in reasonably close conformity with the locations and dimensions shown on the plans or established by the Engineer. The work shall comply with this section and as presented in Section 409 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest version thereof.

Materials

The materials used shall meet the requirements of Section 712.01 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest version thereof.

Type or Grade of Bituminous Binder to be used prior to fabric placement shall be as set forth in the printed manufacturer's recommendations of the fabric. The application of tack coat prior to asphalt overlay of the fabric shall be in accordance with the printed fabric manufacturer's recommendations, and be as set forth in Section 407 of the above referenced ODOT Specifications.

Construction Methods

The construction methods used in executing the work shall comply with the requirements of Section 409.04 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest version thereof.

Placement of the asphalt concrete pavement overlay should closely follow fabric lay down unless approved by the fabric manufacturer and permitted by the Project Engineer. IF it can be shown that limited traffic causes no adverse effect to the fabric reinforcement membrane, limited traffic will be allowed on uncovered fabric within the main intersections to expedite free traffic movement.

Measurement and Payment

Method of Measurement: Fabric Reinforcement successfully placed in accordance with the plans and specifications will be measured by the square yard of street surface area covered. Tack coat or bituminous binder required for this installation shall be considered incidental to the fabric placement and will be included in the cost of the fabric reinforcement. Excess fabric

reinforcement required in the lapping of joints will not be measured for payment, but shall be included in the cost of fabric reinforcement.

Basis of Payment: Accepted fabric reinforcement will be paid for at the contract unit price for:

Non-Woven Geotextile Fabric	Square Yard

SECTION 0115

Traffic Stripe

Description

The scope of this section shall consist of furnishing materials and placing thermoplastic compound or preformed plastic tape markings on the roadway in accordance with these Specifications and in reasonably close conformity with the locations, lines, dimensions, and color shown on the Plans or established by the Engineer, and as set forth in the Manual of Uniform Traffic Control Devices, 1988. The work shall be as set forth in Section 855 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition.

Materials

White or yellow thermoplastic compound shall be used for all markings and shall be in compliance with that as set forth in Section 711 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition.

Equipment

Equipment used in the performance of the work of this section shall comply with that as set forth in Section 855.03(a) of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition.

Construction Methods

Construction methods employed shall be as set forth in Section 855.04 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition. Film thickness to be a single coat of a minimum 120 mils, not to be exceeded by more than 25 percent. Sufficient monitoring shall be provided to prevent pickup from traffic or disturbances from other outside forces while the thermoplastic compound is curing.

Measurement and Payment

Method of Measurement: Traffic stripe (plastic) will be measured by the linear foot of 4 inch wide traffic stripe material actually placed or the equivalent 4 inches wide stripe when a narrower or wider stripe is specified in the Plans. Where arrows, words and symbols are placed they will be measured by each unit.

Basis of Payment: Accepted traffic stripe (plastic), measured as provided above, will be paid for at the contract unit price for:

(a)	Traffic Stripe (plastic) (4 inch wide)	Linear Foot
(b)	Traffic Stripe (plastic) (Arrows)	Each
(c)	Traffic Stripe (plastic) (Words)	Each
(d)	Traffic Stripe (plastic) (Symbols)	Each

which shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

SECTION 0116

Concrete or Asphalt Sidewalks, Driveways, Dividing Strips and Tactile Warning Devices.

Description

The scope of the construction covered by this section of the specifications is described in Sections 610.01 and 402.01 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof and as shown in the plans.

Materials

The materials used to construct the work covered by this section shall meet the requirements of Sections 610.02 and 402.02 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof, except concrete shall be per Section 0105 of these specification and other requirements as shown in the plans.

Construction Methods

The construction methods used to execute the work will comply with the requirements of Sections 610.04 and 402.04 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof with the following modifications:

1. Concrete or asphalt driveways are to be constructed at the locations and to the lines, grades, and thickness as shown on the construction plans. Materials and construction procedures used shall be in accordance with other sections of these specifications. Concrete used, however, shall be high early strength with a minimum compressive strength at 28 days of 3500 psi. A Type "A" transverse joint shall be installed at the right-of-way line for each driveway constructed and a Type "C" transverse joint shall be constructed on a maximum spacing of fifteen feet. Driveways eighteen feet wide and wider shall be constructed with a Type "C" or Type "D" longitudinal joint through the centerline of the driveway.

2. All driveways and approaches shall be 6" thick non-reinforced concrete or 6" thick Type "B" or "C" Asphalt and constructed on a 4" thick compacted aggregate base Type "B" which has been compacted to 95% Standard Proctor Density. Approaches to be constructed in accordance with ODOT Standard ASCD-3-2 (modified).

3. Traffic Bound Surface Course shall be Type “C” unless otherwise specified by the Engineer.

4. Sidewalks shall be 4” thick PC Concrete with a compressive strength of 3500 psi with reinforcing wire mesh (6x6-10x10) and constructed on a 2” sand cushion. Sidewalks shall include ADA compliant tactile warning device. Sidewalk removals shall be included in this section and they shall be executed in compliance with Section 619.04 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Measurement and Payment

Method of Measurement: Completed and accepted work will be measured by the square yard of replacement. Actual field measurements will be used for basis of payment. A separate measurement and payment for 4" thick compacted crusher run base material will not be made. Compensation for this material shall be included in the price bid for 6" concrete drives.

Basis of Payment: Accepted quantities will be paid for at the contract unit price for:

6" Concrete driveway	Square Yard
6" Asphalt Driveway	Square Yard
4" T.B.S.C. Rock Drives	Square Yard
4" Concrete Sidewalks	Square Yard

which shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

SECTION 0117
EDGE DRAIN
(Section 117 combined with another Section)

SECTION 0118

Subgrade Treatment

Description

The work covered by this section is as described in Section 307.01 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof. All grading and related operations shall be included in this section. The percentage of lime required and the layer thickness shall be as shown on the plans.

Materials

The materials used in the execution of the work covered by this section shall be as noted in Section 307.02 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof. All lime shall be quick lime unless authorized by the Engineer.

Construction Methods

The construction methods used to execute the work covered by this section shall be in accordance with Section 307.04 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Measurement and Payment

Method of Measurement: Work included in this section shall be measured on a square yard basis for the project and shall include the lime, water, etc. to complete the work.

Basis of Payment: Completed and accepted work shall be paid for at the contract unit price for:

Lime Stabilized Subgrade Square Yard

And such payment shall be full compensation for furnishing all material, labor, tools, equipment and incidentals necessary to complete the work as specified.

SECTION 0119

Joint Fillers and Sealers

Description

The work covered by this section is as described in Section 701.08 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the lasted edition thereof.

Materials

The material used in the execution of the work covered shall meet all requirements noted in Section 701.08 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the lasted edition thereof.

Acceptable hot poured joint sealer products include W.R. Meadows 164, W.R. Meadows HI-SPEC or approved equal. Acceptable cold poured joint sealer products include W.R. Meadows Gardox, Dow Corning 890 SL, Dow Corning 888 or approved equal.

Construction Methods

The construction methods used in executing the work shall comply with the requirements of Section 701.08 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition, or the lasted edition thereof.

Measurement and Payment

Joint Fillers and Sealers will not be measured for payment. No direct payment for the work described under this section will be made. Contractor shall include consideration for this item in the bid price for other scheduled items of the contract.

SECTION 0120

Traffic Signs

Description

The work covered by this section is as described in Section 850.01 and 851.01 of the Standard Specifications of the Oklahoma Department of Transportation, 1999 Edition, or the latest edition thereof. All sign hardware and concrete for sign footings shall be included in this section.

Materials

The materials used in the execution of the work covered by this section shall be as noted in Section 850.02 or Section 851.02 of the Standard Specifications of the Oklahoma Department of Transportation, 1999 Edition, or the latest edition thereof. All posts shall be 2" Square 12 Gage Perforated tubing and of such a length to provide 7' clearance between the bottom of the sign and the ground line.

Construction Methods

The construction methods used to execute the work covered by this section shall be in accordance with Section 850.04 and 851.04 of the Standard Specifications of the Oklahoma Department of Transportation, 1999 Edition, or the latest edition thereof.

Measurement and Payment

Method of Measurement: Work included in this section will be measured on an each basis for the project.

Basis of Payment: Completed and accepted work will be paid for at the contract unit price for:

Traffic Signs	Each

And such payment shall be full compensation for complete installation of sign including sign footing, post, sign, hardware, and for all labor, tools, equipment, and incidentals necessary to complete the work as specified.

SECTION 0121

Cold-Milling Pavement

Description

The work covered by this section is as described in Section 412 of the Standard Specifications of the Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof. The work includes hauling of removed material to a site specified in the plans.

Materials --Vacant

Construction Methods

The construction methods including equipment used to execute the work covered by this section shall be in accordance with Section 412.03 and 412.04 of the Standard Specifications of the Oklahoma Department of Transportation, 2009 Edition, or the latest edition thereof.

Measurement and Payment

Method of Measurement: Work included in this section will be measured on a per square yard (SY) basis for the project.

Basis of Payment: Completed and accepted work will be paid for at the contract unit price for:

Cold-Milling Pavement	SY

And such payment shall be full compensation for all labor, tools, equipment, and incidentals necessary to complete the work as specified.

TECHNICAL SPECIFICATIONS

SECTION 0200

WATERLINE CONSTRUCTION

INDEX

SECTION 0201

WATERLINE CONSTRUCTION

I. GENERAL:

All potable water mains shall be constructed of ductile-iron materials, or polyvinyl-chloride (PVC) materials. All construction materials and procedures shall conform to Oklahoma State Department of Environmental Quality (ODEQ) requirements, City of Lawton standard details, the construction drawings, and the following specifications. All standard specifications referred to shall be the latest edition in effect at the time construction begins.

II. MATERIALS:

1. DUCTILE IRON PIPE: Ductile-iron pipe shall be manufactured in the United States of America in accordance with AWWA C151 (ANSI A21.51). The pressure rating, thickness class, net weight of pipe without lining, length of pipe and name of manufacturer shall be clearly marked on each joint of pipe.

    1.1 JOINTS:

        1.1.1 BURIED JOINTS: Shall be push-on, mechanical, or restrained in accordance with AWWA C111.

        1.1.2 ABOVE GROUND JOINTS: Shall be flanged in accordance with AWWA C110.

        1.1.3 JOINT GASKETS: Shall comply with AWWA C111 (ANSIA21.11).

    1.2 COATINGS:

        1.2.1 INSIDE: All ductile-iron pipe shall be internally lined with Cement-mortar in accordance with AWWA C104 (ANSIA21.4).

        1.2.2 OUTSIDE: All ductile-iron pipe shall be coated externally with a bituminous coating or coal tar primer approximately 1 mil thick. The finished coating shall be continuous and smooth.

    1.3 THICKNESS CLASS:

        1.3.1 Ductile-Iron Pipe: The thickness class for ductile iron pipe shall be Class 50 for underground pipe and Class 52 for aboveground pipe unless specified differently elsewhere in these specifications or on the construction drawings.

2. POLYVINYL-CHLORIDE (PVC) PIPE: PVC pipe shall be manufactured in accordance with AWWA C900 for pipe sizes 12" and under, and in accordance with AWWA C905 for pipe sizes larger than 12". Each joint of pipe shall be clearly marked with the nominal size and O.D. base, material code designation, dimension ratio number, AWWA pressure class and designation number, manufacturer's name or trademark and production code, and seal of the testing agency verifying the suitability of the pipe material for potable water service.

2.1 JOINTS:

2.1.1 BURIED JOINTS: All pipe joints shall be push-on.

2.1.2 JOINT GASKETS: Shall be elastomeric and comply with ASTM F477.

2.2 THICKNESS CLASS:

2.2.1 PVC PIPE: The thickness class for PVC pipe shall be DR-18 unless specified differently elsewhere in these specifications or on the construction drawings. PVC pipe shall not be used for above ground installations.

3. FITTINGS:

3.1 DUCTILE-IRON COMPACT FITTINGS: All fittings shall be ductile-iron compact fittings and shall comply with AWWA C153. All mechanical joint fittings through 24" Dia. pipe shall be Class 350. Mechanical joint fittings for larger than 24" Dia. pipe and all flanged fittings shall be Class 250. All fittings shall have the same inside and outside coatings as ductile-iron pipe. Join pipe and fittings in accordance with manufacturer's instructions, unless otherwise shown or specified.

4. MECHANICAL JOINT RESTRAINTS:

4.1 DESIGN/MATERIAL

The mechanical joint restraints shall be designed so that the wedges and wedge actuating components are incorporated into the design of the follower gland. It shall consist of individually activated wedges that increase their resistance to pullout as pressure or external forces increase. These wedges must be mechanically retained. "Set Screw" designs are not acceptable.

The mechanical joint restraints shall be made from grade 65-45-12 ductile iron material in accordance with ASTM A536. The wedges shall be heat treated to a minimum hardness of 370 BHN.

The mechanical joint restraints shall be designed with torque-limiting twist-off nuts to assure proper actuation of the restraining wedges. Once the twist-off nut is

removed it will expose a bolt head of proper size to loosen and remove the joint restraint if conditions require its removal or repositioning. This bolt head must be capable of accommodating a six point socket for loosening and tightening.

Chemical and nodularity test shall be performed as recommended by the Ductile Iron Society, on a per ladle basis.

The mechanical joint restraints for ductile iron pipe must have dimensions and thicknesses equal too or greater than the EBAA Iron Megalug 1100 series. The mechanical joint restraints for PVC must have dimensions and thicknesses equal too or greater than the EBAA Iron Megalug 2000 PVC series.

4.2 TRACEABILITY

An identification number consisting of year, day, plant and shift (YYDDD) (plant designation) (shift number), shall be cast into each gland body. All physical and chemical test results shall be recorded such that they can be accessed via the identification number on the casting. These Material Traceability Records are to be made available, in hard copy, to the purchaser that requests such documentation and submits his/hers gland body identification number.

4.3 COATING

All wedge assemblies and related parts shall be processed through a phosphate wash, rinse and drying operation prior to coating application. The coating shall consist of a minimum of two coats of liquid Xylan fluoropolymer with heat cure to follow each coat.

All casting bodies shall be surface pretreated with a phosphate wash, rinse, and sealer before drying. The coating shall be electrostatically applied and heat cured. The coating shall be a polyester based powder to provide corrosion, impact, and UV protection. Requests for approved equal must submit coating material and process details for review prior to bid.

4.4 APPROVALS

Mechanical joint restraint devices for ductile iron pipe shall be listed by Underwriters Laboratories (3” through 24”) and approved by Factory Mutual (3” through 12”)

Mechanical joint restraint devices for PVC pipe shall be listed by Underwriters Laboratories and approved by Factory Mutual (4” through 12”). The sizes 4” through 24” shall meet or exceed the requirements of ASTM F1674 of the latest revision.

Mechanical joint restraints for ductile iron pipe shall be Megalug Series 1100, and/or for PVC shall be Megalug Series 2000 produced by EBAA Iron Inc. or approved equal.

The City Engineer shall be the sole authority in determining acceptability of all products.

5. POLYETHYLENE ENCASEMENT: Polyethylene used to wrap pipe, fittings, and other appurtenances shall be manufactured in accordance with AWWA C105 (ANSI A21.5).

6. RESILIENT-SEATED GATE VALVES: All gate valves furnished shall be manufactured by Mueller, American-Darling, U.S. Pipe, Clow, M&H or Kennedy. The valves shall conform to AWWA C509 or AWWA C515, except where modified by the following specifications:

6.1 JOINTS: Valves to be hub end, mechanical joint unless specified differently on the plans. The dimensions of sockets for hub-end and mechanical-joint valves shall conform to the dimensions of AWWA Standard Specifications for Special Casting not lighter than Class B, and in any case, shall have an inside diameter not less than 0.80 inches larger than the outside diameter of the pipe connected therewith.

6.2 STEM: The valve stem shall be non-rising. The stem seal shall be comprised of one "O" ring above and one "O" ring below the thrust collar forming a lubricant reservoir between to isolate and lubricate the thrust collar and thrust collar bearing surfaces. The thrust collar shall be secured in a machined recess in the top of the bonnet so replacement of the stem can be made without bonnet removal.

6.3 OPERATING NUT: The operating nut shall be left-hand opening (counter-clockwise) and shall be painted black.

6.4 DISC: The valve disc shall be fully epoxy coated with the rubber seat attached to the disc by self-setting stainless steel set screws or shall be fully rubber encapsulated. The disc shall be constructed in such a manner as to eliminate the collection of corrosive material in the center of the disc cavity.

6.5 FLANGES: All flanges for flanged-end valves shall conform to the American Class 125 standard.

6.6 INTERIOR COATINGS: All internal ferrous metal surfaces (machined or cast) shall be factory epoxy coated with an epoxy material approved by the Food and Drug Administration.

7. BUTTERFLY VALVES: All butterfly valves shall be designed for buried operation. Valves shall conform to AWWA C504 and be Class 150B unless specified differently elsewhere in these specifications or on the construction drawings.

7.1 BODY, DISC & SHAFT: Butterfly valves shall have cast iron or ductile iron bodies, alloy cast iron or ductile iron discs, and one piece stainless steel shafts extending full size through the valve disc and bearings.

7.2 SEATS: Valve seats shall be constructed of Buna-N and bonded or mechanically retained to the valve body or to the body or disc. Ring type rubber seats not mechanically fitted to the body or disc will not be acceptable. Seals mounted on the disc shall be designed with a shoulder providing 360° mechanical retention against the seat pulling out from between the retaining ring and disc. The clamp ring cap screws shall pass through the rubber seat for added retention.

7.3 JOINTS: Valves shall have mechanical or flanged ends. Flange gaskets, if used, will be red rubber.

7.4 SHAFT SEAL & BEARINGS: Shaft seals shall be self-adjusting Chevron type seals. Bearings shall be of one piece and completely retained in hubs cast integral with the body.

7.5 OPERATOR: Operators shall be capable of being earth covered and shall be fully gasketed and grease packed and designed to withstand submersion in water to at least ten (10) psi. The operator shall be standard traveling-nut type, manual operation, turning counter-clockwise to open, requiring a minimum of 30 turns to move from fully open to fully closed. Buried operators shall be equipped with valve boxes containing a valve position indicator showing direction to open.

8. TAPPING SLEEVES AND VALVES: Tapping sleeves and valves shall be manufactured by Powerseal, Mueller, American-Darling, Kennedy, U.S. Pipe or approved equal. All taps shall be at least two (2") inches smaller that the mainline pipe diameter. Taps shall not be allowed on pipe with diameters twelve inches (12") and smaller. The Engineer and Water Superintendent may approve a saddle installation for pipe twelve inches (12") and smaller at a location were health or safety concerns are present.

8.1 Ductile-iron tapping sleeves (all sizes) shall be heavy duty, bolted type using cadmium plated iron bolts, etc. Restrained mechanical joint type shall be used for all sizes.

Stainless steel tapping sleeves (all sizes) shall be 304 stainless steel, full wrap around type with stainless steel bolts, etc. Restrained mechanical joint type (equal to PowerSeal 3480MJ-SS or 3490MJ-SS) shall be used for pipe sizes 36" and below, and flanged type (equal to PowerSeal 3480AS or 3490AS) for pipe sizes over 36".

Epoxy coated steel tapping sleeves (for pipe larger than 24") shall be 150 psi working pressure, stainless steel nuts and bolts, anode protection, sand backfill and

12 mil thickness of fusion bonded epoxy coating (interior/exterior). Restrained mechanical joint type shall be used for pipe sizes thru 36” and flanged type for pipe sizes larger than 36” .

All tapping sleeves shall be wrapped with polyethylene. All tapping sleeves and valves shall have poured concrete blocking.

8.2 VALVE ENDS: Valve ends for restrained mechanical joint type sleeves shall be standard mechanical joint. Valve inlet ends for flanged type sleeves shall be flanged with centering lip on the valve flange to fit recess or counter bore on the outlet tapping sleeve flange. The valve outlet end for flanged type sleeves shall be a standard mechanical joint end.

9. VALVE BOXES: All valve boxes shall be constructed of a piece of DR21 or thicker PVC piping and a two (2) piece cast iron type top. The cast-iron cover shall have the word "WATER" cast in the top. The cast-iron parts of the boxes shall be constructed of materials meeting the requirements of ASTM A 48 and shall be coated by dipping in hot bituminous base material such as used for pipe dip and shall be Sigma #VB-165 or approved equal.

10. FIRE HYDRANTS: Fire hydrants shall be manufactured in accordance with AWWA C502. The only fire hydrants acceptable are the U.S. Pipe Metropolitan 250, Mueller Centurion and Clow Medallion. The hydrants shall be designed for a minimum of 150 psi working pressure or 300 psi hydrostatic test pressure and shall conform to AWWA C502. Hydrant valve shall be a minimum of 5-1/4” diameter.

10.1 CONNECTIONS: The fire hydrant base shall have a 6" mechanical joint connection. Hose connections shall consist of two 2-1/2" streamers and one 4-1/2" pumper. The 2-1/2" outlets shall have a 60` V-threads, 7-1/2 threads per inch, and the outside diameter of the external threads shall be 3-1/16". The 4-1/2" outlet shall have 4 threads per inch, and the outside diameter of the external threads shall be 5-3/4". All hose connections shall have National Standard threads.

10.2 PAINTING: Hydrants shall be painted with primer and finish coats of fire hydrant red paint per AWWA C-502.

10.3 OPERATING UNIT: The operating nut shall be 1-1/2" pentagon shape and shall open counter-clockwise.

11. INDIVIDUAL SERVICE MATERIALS: Water service installations are governed by Lawton City Code, and specifications have been prepared by the City Engineer. The contractor shall follow these specifications in this work.

III. CERTIFICATION:

The Contractor shall furnish the City Engineer an affidavit from the materials manufacturers to the effect that all inspections and tests as required in the standard specifications have been made and that the results thereof meet the requirements of the specifications. Reports of test results shall be furnished when requested.

IV. PIPELAYING:

1. DUCTILE-IRON PIPE: Pipelaying shall be in accordance with AWWA C600. Minimum bedding shall be Type 1, as described in AWWA C150 (ANSI A21.50). All ductile-iron pipe and appurtenances, such as fittings, fire hydrants, valves, tapping saddles, etc., shall be completely wrapped with a polyethylene encasement in accordance with AWWA C105 (ANSI A21.5).

2. PVC PIPE: Pipelaying shall be in accordance with AWWA C605. Since PVC pipe deteriorates rapidly when exposed to ultra-violet radiation, all PVC material must be stored in a manner that does not expose it to direct sunlight. During backfill of PVC pipe, the contractor shall place a locator wire along with the pipe. The wire is to be placed continuously throughout the extent of the pipeline. Wire shall be copper 12 AWG single conductor type THHN or THWN. All field splices shall be in waterproof couplings for underground installations. Wire shall extend up into valve boxes and other access points as directed by the Engineer. Cost of locator wire shall be included with the price bid for pipe. All cast-iron and ductile-iron appurtenances, such at fittings, fire hydrants, valves, tapping saddles, etc., shall be completely wrapped with a polyethylene encasement in accordance with AWWA C105 (ANSI A21.5).

V. FIELD TESTING & DISINFECTION:

All testing procedures required as outlined in these specifications or on the construction drawings shall be performed by the Contractor. The date and time of the testing shall be coordinated with the City Engineer.

1. HYDROSTATIC TESTING: Hydrostatic pressure and leakage tests shall be made at 150 psi based on the elevation of the lowest point in the section under test and corrected to the elevation of the test gauge. Allowable leakage shall not exceed 10 gallons per inch of pipe diameter per mile of pipe per 24 hours. Tests shall be performed in accordance with AWWA C600.

2. BACTERIA TESTING: After the potable water facilities are disinfected (disinfecting procedures are covered in Section VIII of these specifications), the Contractor shall be responsible for the successful completion of all bacteria and chlorine residual tests required by the Oklahoma State Department of Environmental Quality. The local Chief Sanitarian shall be contacted to determine the appropriate procedures in use for these tests at the time of construction.

VI. TRENCH EXCAVATION, BACKFILL, AND COMPACTION:

1. EXCAVATION: All excavation shall be open cut unless otherwise approved by the City Engineer. The sides of the trenches shall be as nearly vertical as soil conditions permit and construction workers shall be protected from cave-ins by appropriate sheeting or shoring. Worker protection shall comply with the Occupational Safety and Health Administration Regulations in effect at the time of construction. The maximum length of trench to be opened at one time is the amount that can be accommodated in one working day by the Contractor. If the Contractor excavates more trench than what he can install pipe in by the end of the working day, the excess length of trench must be backfilled prior to the Contractor leaving the work site for the day. Excavated material shall be placed adjacent to the trench a sufficient distance from the edge of the trench to prevent slides or cave-ins. All material that is not suitable for backfill shall be removed from the construction area and disposed of properly.

   Care shall be taken not to over excavate. If unauthorized over-excavation occurs, the trench shall be brought back to grade with Class I or II material, as described in ASTM D2321, and compacted to a minimum of 90% Standard Proctor Density. Whenever wet or unsuitable soil, incapable of properly supporting the pipe, or rock is encountered in the trench bottom, such material shall be removed to a minimum depth of 6" below the bottom of the pipe and replaced with Class I or II material and compacted as described above.

   Unless otherwise required for installation of sheeting or shoring and approved by the City Engineer, the trench's width at the top of pipe elevation shall be a maximum of the pipe's outside diameter plus two (2) feet and a minimum of the pipe's outside diameter plus eight (8) inches. Minimum pipe cover shall be thirty (30) inches.

   The trench bottom and/or the pipe bedding shall be accurately graded to provide uniform bearing and support for each section of the pipe along the entire barrel length. Bell holes shall be dug so that the pipe is not supported by the bell. Bell holes shall be large enough to properly join the joints of pipe without getting foreign material in the joint.

   Where trenches lie within portland cement concrete, or asphalt sections of existing streets, alleys, driveways, or sidewalks, etc., such surfaces shall be saw cut before the paving is removed. The cut shall be to a minimum depth of 1-1/2". All sawing shall be to neat, vertical, true lines and performed in such a manner that adjoining surfaces will not be damaged. No excavation will be permitted outside limits of the cuts. Excavated asphalt and concrete surfacing materials shall be hauled from the job immediately and shall not be used in the backfill. All excavated material not used as backfill shall be removed from the construction site by the Contractor.

   Existing utilities shall be located prior to starting the trenching operation and reasonable care shall be exercised to prevent damage to utilities. All existing City-owned and private facilities (including all utilities whether privately or publicly owned) which are damaged during construction shall be repaired at the Contractor's expense.

2. BACKFILL: Unless otherwise directed by the City Engineer, backfill may be native trench material except under existing streets, alleys and drives and under proposed streets where backfill to the surfacing level shall be Class I or II materials per ASTM D 2321. Backfill materials shall be free of all organic material or wet or frozen soil. For a minimum distance of 6" above the pipe, backfill shall be free of stones and hard clods that exceed 3" in their largest dimension. If in the opinion of the City Engineer, the native trench material is not adequate for backfill, Class I or II material per ASTM D 2321 shall be used as backfill. Backfill material shall be placed as specified in Section VI-3.3, MINIMUM COMPACTION REQUIREMENTS, to achieve compaction results specified. The ground surface shall be restored to its original contours, and all existing street, alleys, driveways or sidewalks, etc., that were disturbed, shall be restored in accordance with all City of Lawton ordinances in effect at the time of construction.

3. COMPACTION: Depending on characteristics of the backfill material, methods of compaction may be water settlement, hand tamping, or mechanical compaction as described below.

3.1 WATER SETTLEMENT: Water settlement shall be accomplished by leveling the fill material, flooding the trench and jetting the material with sufficient water to thoroughly saturate the material and to cause it to settle and fill all voids. All jetting shall be done along the trench and transversely across the trench at intervals not in excess of six feet, with jetting locations on one side of the trench offset to jetting locations on the other side of the trench. The Contractor shall provide capacity to jet at not less than 30 pounds per square inch pressure. After the material has settled, tamping or hydro-hammering shall be performed, if necessary, to secure the required density as defined in Section VI-3.3, MINIMUM COMPACTION REQUIREMENTS.

3.2 MECHANICAL COMPACTION: Where water settlement is not permitted by the City Engineer or does not result in adequate compaction, backfill material shall be uniformly moistened to optimum moisture content, placed in layers as defined in Section VI-3.3, MINIMUM COMPACTION REQUIREMENTS, and compacted with hand and/or mechanical work methods. Equipment used shall be rollers, pneumatic tamps, hydro-hammers or other approved devices which secure uniform and required density without injury to the pipe or related structures.

3.3 MINIMUM COMPACTION REQUIREMENTS:

AREA	STANDARD PROCTOR DENSITY	MAXIMUM HEIGHT OF LIFT
Under any existing or proposed street, curb or gutter	95%	6"

Above and below any intersecting utilities	95%	6"
Under any existing or proposed asphalt or concrete driveway	95%	6"
Under any existing or proposed sidewalk, turfed or seeded lawn	90%	12"
Under all other areas	90%	24"

The actual densities achieved in the field will be determined by AASHTO Designation T205 or T238.

VII. WATER SERVICE INSTALLATION:

When specified elsewhere in these specifications or included on the construction drawings, the Contractor shall install water service to individual properties. Water service installations are governed by Lawton City Code and specifications have been prepared by the City Engineer. The Contractor shall follow these specifications in this work.

The location of all service lines crossing under the street shall be marked by placing a "W" in the street curb over the location of the service line on the side of the street opposite the water main. The "W" shall be clearly marked by scribing or stamping the top service of the curb while the concrete is still wet or by chiseling or routering the letter in the curb after the concrete has dried. The letter shall be approximately three (3) inches tall be four (4) inches wide by 1/4 inch deep.

VIII. WATERLINE DISINFECTION:

The Contractor shall disinfect all waterlines, fittings, valves, fire hydrants, and other appurtenances prior to placing the facilities into service. It is recommended that the disinfecting activity be accomplished after the line has been hydrostatically tested. Prior to disinfecting, the Contractor shall flush the line of all foreign materials. Disinfecting shall be accomplished in accordance with AWWA C651. Water entering the new line, etc., for disinfecting shall contain free chlorine with a minimum concentration of 50 mg/l and a maximum concentration of 100 mg/l, and shall be allowed to stand for 24 hours. At the end of the 24-hour period, a residual of at least 10 mg/l of free chlorine shall be present. All Oklahoma State Department of Environmental Quality standards and regulations shall be observed. Safe bacteriological samples shall be obtained on two consecutive days before placing the water line into service.

The following table provides the approximate amount of granular calcium hypochlorite (typically 65% free chlorine) needed to produce a concentration of 50 mg/l per 100 feet for common

diameters of water line. The Contractor must comply with the requirements of initial flushing after disinfection of the water line.

Approximate Chlorine (Granular Calcium Hypochlorite)
Required to Produce 50 mg/l Concentration in 100' (30m) pipe

Pipe Diameter (inches)	Pipe Diameter (mm)	100 % Chlorine (pounds)	65% Chlorine (pounds)
4	100	0.027	0.042
6	150	0.061	0.094
8	200	0.108	0.168
12	300	0.240	0.377
16	400	0.436	0.670
24	600	0.875	1.507

(adapted from Table 6-6, Handbook of Chlorination, Clifford White, 1999)

When the Contractor chooses to disinfect by introducing a chlorine solution into the water line, the solution shall be fed after initial flushing at a constant rate until the entire water line is filled with highly chlorinated water. The following table provides the approximate amount of 1 % chlorine solution needed to produce a concentration of 50 mg/l per 100 feet for common diameters of water line. 1% chlorine solution requires 1 lb of 65% granular calcium hypochlorite in 8 gal of water, or 1 lb of 100% granular calcium hypochlorite in 12 gal of water.

Approximate Chlorine (1% Chlorine Solution)
Required to Produce 50 mg/l Concentration in 100' (30m) of Pipe

Pipe Diameter	Pipe Diameter	One Percent Chlorine Solution	
(inches)	(mm)	(Gallons)	(Liters)
4	100	0.33	1.25
6	150	0.73	2.76
8	200	1.30	4.92
12	300	2.93	10.90
16	400	5.22	19.76
24	600	11.75	38.23

(adapted from Table 6-6, Handbook of Chlorination, Clifford White, 1999)

Water line and appurtenances shall be flushed of all highly chlorinated water prior to placing in service. The highly chlorinated water shall be dechlorinated or disposed of by the Contractor in accordance with applicable Federal or State regulations without damage to public or private property.

All water necessary for the construction, sterilization and testing of the water mains shall be furnished by the City of Lawton at no cost to the Contractor. The Contractor shall exercise care in the use of water.

IX. WATERLINE / SEWERLINE CROSSING

PVC (AWWA C900, DR18) or lined D.I. (ASTM A746, AWWA C150/ANSI A21.50, Class 51) sanitary sewer pipe may be required at locations where the minimum spacing requirement with water mains cannot be achieved. Lining material shall be 40 mils of Protecto 401™ Ceramic Epoxy, or approved equal. The contractor shall furnish and install (complete) the required type and length of pipe at locations as directed by the Engineer. Materials and methods for trenching and backfill shall follow specifications as set in Section 0300 “Sewerline Construction”.

SECTION 0202

WATER SERVICE INSTALLATIONS

I. Introduction

These specifications as presented herein are intended to supplement City Code 22-2-1. In no case shall these specifications supersede any provisions of the Lawton City Code or approved ordinances.

These specifications are divided into two major sections: Installation Procedures and Material Specifications. All water service installers shall comply with the requirements of the Material Specifications. Installation procedures are further divided into four subsections; General requirements, New Subdivision Water Service Crossing by Developer, Water Service Installations by builder and Water Service Installations by City of Lawton Water Distribution Division. All installers shall comply with the provisions of the General Requirements subsection while requirements for specific types of installations are presented in the remaining subsections.

All installers are encouraged to thoroughly familiarize themselves with these specifications, City Code 22-2-1 and all other ordinances or sections of the City Code that apply to water service installations. Failure to do so shall not be an acceptable reason for non-compliance.

II. Definitions

Terms used in these specifications and in City Code 22-2-1 shall have the following meanings:

1. Water Distribution Division shall mean the Water Distribution Division of the Public Works Department, and all include all authorized employees and deputies thereof, except as otherwise clearly shown by context.

2. Director shall mean the Director of the Public Works Department.

3. Water service used alone as a single term and without any other qualifying or descriptive word connected therewith as a part of the term containing such words shall] be construed in the sense of the ordinary meaning and general usage ascribed thereto and be inclusive of the general municipal service of providing, maintaining, and distributing water and providing, maintaining and operating all of the facilities and procedures legally under the control of the Water Distribution for the purposes of said service.

4. Meter service connection shall mean the service pipe connected to a City water main and extending from there to the property line of premises serviced or subject to be served by the water service.

5. Extension service line shall mean the extension of the meter services connection from the terminus of said connection at the property line to the point of meter setting whenever said point is inside and beyond the property line.

6. Meter setting shall mean the installation of water meter connected to the meter service connection or at the terminus of extension service line.

7. Water service installation shall mean the tapping, meter service connection, and meter box setting, in accordance with the City Engineer's specifications on file in the City Clerk's Office.

8. Water service crossing is the service line from the water main, including the tap in the street or alley right-of-way, to the property of lots on the opposite side of the street or alley paving from the water main.

9. Slip is defined as any pipe, hose, or other apparatus which is installed at any location between a City water main and any private domestic or commercial system in such a manner that water can be withdrawn from the City water main without passing through a meter installed by the City.

10. Water Distribution Division shall mean the Water Distribution Division of the Public Works Department and shall include all authorized employees.

11. Field Service Branch shall mean the Revenue Services Division of the Finance Department and shall include all authorized employees.

III. Installation Procedures

A. General Requirements

1. This subsection of the specifications shall apply to all water service installers.

2. All installers are to supply and use materials complying with the requirements of Section IV - Material Specifications. When a brand name is specified, any other item of an equal quality may be substituted with the City Engineer's approval. When a question arises as to applicability, the City Engineer shall also determine whether a specific item complies with the specifications.

3. The use of slips or unauthorized meters is prohibited and such use shall constitute a violation of City Code 22-2-1.

4. The installer shall be responsible for coordination of his activities with all appropriate agencies and utility companies. Information pertaining to specific locations of City owned water and sewer lines may be obtained from the Water Distribution Division of the Department of Public Works. Operation of water valves on City owned and maintained mains is to be accomplished by Public Works personnel only. If it is necessary to operate any valve, 24 hours advance notice to the Public Works Department is required unless an emergency situation exists. An emergency situation is defined as a water line break occurring with a resulting leakage of water from the main or any other situation that would endanger someone's life or result in property damage. The installer shall also contact all owners of private utilities (gas, electric, telephone, etc.) prior to excavating and comply with any requirements that they may have pertaining to the safety of their facilities.

5. In the event that a City owned water or sewer main is damaged by an installer making a water service installation, the Community Services Department representative shall contact the Public Works Department and the damaged utility shall be repaired by the public Works Department. Following the repair to the damaged utility by the Public Works Department, the responsible installer will be charged. Said charges shall be based on current labor and material prices to the City and equipment rates charged shall be based on the current edition of "Rental Rates Compilation", as published by the Associated Equipment Distributors. No further installation permits will be issued to the installer until such charges are recovered.

6. All water service installations shall be accomplished by an individual who holds a Water Operator's Certificate issued by the Oklahoma State Department of Environmental Quality or by an individual who holds a plumber’s license issued by the State of Oklahoma or who is working under the responsible charge of such licensed plumber.

7. Each separate lot shall have its own meter service connection with each service having a minimum nominal diameter of 1 inch.

8. Installation of more than one water service to serve an individual lot shall be prohibited unless a separate application has been approved.

9. The installer shall refer to City of Lawton standard details of Water Systems (2) for schematic representations of completed water service installations.

10. All taps to City owned water mains shall be made while the main is under normal working pressure. Direct taps shall be made with a suitable tapping machine in good working order and the machine shall simultaneously tap the main and install a corporation stop. Taps made using tapping saddles and a corporation shall be made thru the corporation with the main under pressure. Corporation stops shall be installed with the longitudinal axis of the stop forming an approximate 45" angle with the vertical. Minimum spacing for tapping the main is 18 inches for 1 inch taps and 24 inches for 2 inch taps with the spacing for larger taps to be determined by the Inspector at the time of the tap.

11. 1" services taps shall be made by direct tap or with a tapping saddle for either ductile iron pipe or PVC pipe with at least a wall thickness of DR 18. Threaded connections shall be made according the manufacturer's recommendations and utilize teflon tape. Service taps larger than 1" and up to 2" on ductile iron pipe can be made either by direct tap or with a tapping saddle. Service taps larger than 1" and up to 2" on PVC pipe shall be made utilizing tapping saddles only. Saddles shall be brass body double strap/double bolt types such as Mueller BR2B or stainless steel double bolt wrap around type such as Ford FS303. All saddles shall be wrapped with polyethylene wrap (AWWA C105/A21.5-05). All services shall be bedded and backfilled with an approved washed sand. Only tapping saddles shall be used on thin walled PVC pipe.

12. Meter service lines installed under existing streets and paved alleys shall be bored. All excavation shall be a minimum of 24 inches from back of curb or edge of pavement. Bores shall be a minimum of 36 inches below the top of street curb or crown of street or alley without curbs. The bore shall be no larger than the outside diameter of the service line plus one (1) inch. At locations where boring is not practicable, a separate paving cut permit must first be acquired from the Community Services Department. The permit will be issued in accordance with City Code 21-2-203 and all subsequent revisions thereto. Water service lines installed under parking lots or non-paved areas shall have a minimum depth below finished grade of 30 inches.

13. The meter service connection shall not be kinked during the installation. Any evidence of weakened areas along the line due to bending the pipe too short shall be cause for rejection of that installation. The meter service connection shall be installed with adequate expansion/contraction goosenecks on a horizontal plane both at the corporation stop and the meter box. Service lines shall extend a minimum of five (5) feet beyond the meter box on the property line side. The service line from the main line to

the meter box shall be continuous with no intermediate couplings or connections.

14. Both far side water services and near side water services shall have water meter boxes installed on the property lines. All boxes are to be installed in locations readily available for reading by the Field Services Branch, Revenue Service Division, and in no case shall a box be located in or under a driveway or sidewalk. Each meter box is to be installed plumb and the top of the box is to be flush with the finished ground level. All service lines on the property owner's side of the meter, when the meter is located in a street right-of-way or public easement, shall extend from the meter to the property line in as short a route as physically possible.

B. New Subdivision Water Service Crossings by Developer

1. A developer, as herein used, is defined as a person, whether individual or corporate, that acquires land and installs water, sewer, drainage and street improvements. The land is then subdivided into smaller parcels and sold to builders.

2. This subsection of the specifications shall apply to water service crossings in new housing developments. All provisions of the Section III.A - General Requirements shall also apply to this type of installation.

3. Work required under this subsection is as generally defined in City Code 22-2-1-211.

4. Construction activity covered by this subsection consists of supplying a water service crossing from the water main that is either existing or previously placed by the developer to all lots in the subdivision that are located on the opposite side of the street (proposed or existing) from the main. Lots located adjacent to cul-de-sacs shall also be served in this manner. Said crossings shall consist of tapping the main, installing saddle and/or corporation, placing the service line and attaching an angle valve at the property line of the lot being served.

5. Prior to installation of the water service crossings, the developer or his contractor shall give advance notice to the Community Services Director or his representative so an Inspector can be assigned to the project. All crossings shall be complete and approved by the Community Services Director prior to City Council acceptance of the subdivision improvements.

6. All taps on un-dedicated water lines in new subdivisions shall be made and water service crossings installed prior to street construction. Water service crossings shall be installed a minimum of 36 inches below the finished top

of curb elevation of all proposed streets. Water service crossings made prior to street construction may be made by the open-trench method.

7. The main lines are to be tapped while the line is under normal working pressure. After the main line has been chlorinated and the water service crossings are complete, the water service crossings shall be flushed with fresh water from the main line for a minimum of 5 minutes. The angle valve is then to be closed and each water service crossing be observed for another 5 minutes for leaks while under main line pressure. The corporation stop shall be left in the opened position.

8. The crossings are to be made in pairs; one line for each of the adjacent lots. The crossings are to be located on the property dividing the two lots being served. Each line shall be connected separately to the main with its own corporation stop and each line shall receive an angle valve at the end facing the lot being served. The crossings are to be of such a length and the angle valve placed in such a manner to assure that the meter, when installed, would be located 30" back of curb.

9. Each pair of crossings may be placed in the same ditch. No special backfill will be required if both of the following conditions are met: 1) Ditch width is not to exceed 6 inches, and; 2) Crossings made and backfilled prior to base preparation (subgrade preparation, lime stabilization, placement of crushed stone base, etc.) for proposed street. If either condition is not met, the ditch shall be backfilled with sand, all of which passes a 3/8 inch sieve and not more than 15% passing the No. 200 sieve, compacted in 6 inch layers within the limits of pavement and 2 feet back of the proposed curb.

10. Due to the physical layout of cul-de-sacs, the developer shall also be required to construct those water service crossings that must cross under the street pavement. Refer to City of Lawton standard details of Water Systems (2) for a schematic presentation of this special case.

C. Water Service Installation by Builder

1. Builder, as herein used, is defined as a person, whether individual or corporate, that constructs or causes the construction of new residential, commercial or industrial structures or modifications to existing structures. The builder may be, but is not required to be, the same person that developed the land on which the construction takes place (i.e., the developer).

2. All provisions of the Section III.A - General Requirements shall apply to work accomplished under this subsection of these specifications.

3. Work required under this subsection is as generally defined in City Code 22-2-1-211. More specifically, the builder shall be responsible for supplying the materials that are necessary for constructing complete water service installations. Water service installations consist of, but may not be limited to, tapping the main line, installing saddles and/or corporation stops, placing service lines, meter boxes, angle valves, and the complete connection to the customer side of the meter. An exception to this is when the developer has previously placed the water service crossing.

4. When the installer constructs a complete water service installation, he shall be responsible for installation of all items except the water meter. The City's Field Services Branch, Revenue Services Division shall be responsible for installation of the meter. The water service installer shall construct the installation in such a manner as to facilitate placement of the meter. The space left between the water meter couplings for the meter shall have the following dimensions for the various meter sizes:

Meter Size (Inches)	Spacing (Inches)
5/8	8
1	11
1-1/2	13
2	17

For meter sizes greater than 2 inches, spacing information shall be obtained from the Water Distribution Division.

5. Water service installations performed by builders under the requirements of these specifications and City Code 22-2-1-211 are subject to inspection by the Water Distribution Division. Said inspections shall be coordinated with the Water Distribution Division as outlined in City Code 22-2-1.

6. For water service installations performed by builders on dedicated fire lines, the meter shall be constructed within the easement at a distance not greater than ten (10) feet from the fire line and at a location between the front or side of the building and the property line adjacent to a street right of way.

D. Water Service Installation by City of Lawton's Water Distribution Division

1. All provisions of the Section III.A - General Requirements shall apply to work accomplished under this subsection of these specifications.

2. Work required under this subsection is as generally defined in City Code 22-2-1.

IV. Material Specifications

A. Introduction

1. All installers are to supply and use materials complying with the requirements of Section IV - Material Specifications. When a brand name is specified, any other item of an equal quality may be substituted with the City Engineer's approval. When a question arises as to applicability, the City Engineer shall also determine whether a specific item complies with the specifications.

2. The following specifications are divided into six subsections with each subsection specifying a particular component of the water service installation. Each subsection is further divided into three sections; "Materials", "Workmanship" and "Testing". The "Workmanship" section covers the quality of the work involved in the manufacturing process. The "Testing" section applies to testing in the manufacturer's shop and does not apply to field testing by the installer.

3. Included in the following specifications are references to specific ASTM (American Society for Testing and Materials) and AWWA (American Water Works Association) standard specifications. These specifications are to become a part of this document by reference as if they were included in total. Each ASTM and AWWA standard specification listed shall be the latest revision issued.

B. Corporation Stops

1. Materials

All brass castings shall conform to ASTM B62, Standard Specifications for Composition Bronze or Ounce Metal Castings. All bodies, plugs, D Washers and bottom nuts shall be of cast bronze. Corporation stops shall meet the following table, or be equivalent as determined by the City Engineer.

Manufacturer	Catalog No.
Ford	F 1000
Hays	5200 CF, DD, EF
Jones	J 3401
Mueller	H/P 15008 or H/P 15013

2. Workmanship

a. The key and body shall be accurately fitted together by turning the key and reaming the body, and the seating surfaces shall be lapped together using abrasive suspensions to insure accurate fit.

b. The port through the corporation stop shall be full size and so shaped as to eliminate turbulence in the flow passageway.

c. Inlet and outlet threads shall conform to the latest revision of AWWA C 800 and shall be protected during shipment and storage by plastic coating or other suitable means.

d. All corporation stops shall be so designed as to rotate about the axis of the flow passageway to properly clear the tapping machine.

3. Testing

a. All corporation stops shall be tested at the factory by the manufacturer. Such tests are to be made at 85 PSIG air pressure while submerged in water, both in the open and closed positions, and shall show no leakage during a minimum period of 10 seconds.

b. At the City's option, stops shall be subjected to a 300 PSIG hydrostatic test and shall not leak and shall not show signs of structural failure.

c. The City will make such confirming laboratory tests as may be considered necessary and such tests will govern the acceptance or rejection, in whole or in part, of the shipment involved.

d. At the City's option, the manufacturer shall be required to provide certification records in triplicate of confirmation of materials, design and testing requirements as contained in these specifications.

C. Service Lines

1. Materials

a. Polyethylene (PE) plastic tubing shall conform to ASTM D2737, PE-3408, SDR 9-200 psi rated and AWWA C-901 shall be utilized. Copper locator wire 12 AWG single conductor type THHN or THWN shall be utilized with polyethylene (PE) plastic tubing. Wire shall extend from the main to the meter box without splices. Connection to waterline locator wire shall be in a water proof type connection. Minimum size shall be one (1) inch diameter.

b. The copper tubing shall not be utilized unless authorized by the Engineer. Copper tubing shall conform to ASTM B 88 and AWWA C 800, Type K, Copper Water Tube, unless otherwise specified. Annealed tubing shall be required. Minimum size shall be one (1) inch diameter.

2. Workmanship

Service lines shall be seamless and suitable for underground water services.

3. Testing

a. Polyethylene plastic tubing shall be tested at the factory according to the specifications for polyethylene plastic tubing noted in C.1.a.

b. Copper tubing shall be tested at the factory and shall have an ultimate tensile strength of 6480 psi for 1 inch diameter. Tubing shall be hydrostatical tested at 693 psi for 1 inch diameter and have a safe working pressure of 513 psi for 1 inch diameter tubing.

c. The City may make such confirming laboratory tests as may be considered necessary and such tests will govern the acceptance or rejection, in whole or in part, of the shipment involved.

d. At the City's option, the manufacturer shall be required to provide certification records in triplicate of conformance of materials, testing and. design requirements as contained in these specifications.

D. Service (Tapping) Saddles

1. Materials

a. Brass saddles shall have brass castings, bolts, nuts and straps which shall conform to ASTM B 62. Stainless steel saddles shall be 304 stainless steel including tap, band, nuts and bolts and shall be full wrap around type. All saddles shall be wrapped with polyethylene wrap.
b. Castings shall be free of porosite and all sharp edges removed.
c. Service saddles shall be double strap type such as Mueller BR2B or full wrap around type such as Ford FS303 or approved equal.

2. Workmanship

a. Service clamps shall be constructed to fit the contour of pipe of the following dimensions:

Nominal Pipe Size, Inches	Minimum Pipe O.D., Inches	Maximum Pipe O.D., Inches
1.50	1.900	2.000
2.00	2.375	2.500
2.25	2.875	3.000
4.00	4.900	5.000
6.00	6.900	7.100
8.00	9.050	9.300
10.00	11.100	11.400

b. The saddles shall be formed to fit against the walls of the maximum diameter of the specified pipe size with approximately 180 degree wrap-around.

c. The outlet boss shall be designed so that outlet threads will not be distorted by bending moments. The outlet boss shall be tapped for corporation stop thread conforming to Table 1 of AWWA Specification C 800.

d. The clamp casting shall be clearly marked by letters and numerals cast thereon showing the manufacturer's name and type and size of pipe for which the clamp is designed.

3. Testing

a. Each service clamp shall be tested by the manufacturer with 85 PSIG air pressure while submerged in water and shall show no signs of leakage during a minimum time of 10 seconds.

b. At the City's option, service clamps shall be subjected to a 300 PSIG hydraulic test and shall not leak or show signs of structural failure.

c. The City will make such confirming laboratory tests as may be considered necessary and such tests shall govern the acceptance or rejection, in whole or in part, of the shipment involved.

d. At the City's option, the manufacturer shall be required to provide certification records in triplicate of conformance of materials, design and testing requirements as contained in these specifications.

E. Miscellaneous Materials

1. Materials

a. Unless otherwise approved in writing, all material between the main line and the meter shall be bronze or copper with polyethylene, neoprene or polybutylene gaskets. Galvanized iron fittings, nipples, valves, etc., shall not be installed in service taps.

b. Any alternate material for water service installation shall be submitted 30 days prior to the installation for consideration. Prior approval of alternate materials shall not be construed as "Blanket Approval" for the materials and shall not waive the responsibility of the contractor to acquire approval of the material for each subsequent installation.

2. Workmanship

a. All copper and brass castings shall be ported full size and so shaped as to eliminate turbulence in the flow-way.

b. Threads shall conform to AWWA C 800 and shall not be damaged prior to installation. Threads on meter connections shall conform to AWWA C 700.

F. Meter Boxes

1. Materials

a. Meter boxes and extensions installed in areas not subjected to vehicular loading shall be of polyethylene structural foam, impregnated with carbon black during the molding process. Meter box covers may be constructed of polyethylene plastic. The cover or lid shall be embossed with the word "WATER" or "WATER METER". For 1" Meters, or smaller, the Meter Box shall be Carson 1419 x 18” with flush cover or approved equal. Cover shall be #14194292 with slot for Sensus AMR units. For 1½" and larger Meters, the Meter Box shall be Carson 012-3 with 6” extension or approved equal.

b. Meter Boxes and Extensions installed in areas subjected to occasional vehicular loading shall be precast concrete; with a cast iron locking hinged reading lid. For 1" Meters, or smaller, the Meter Box shall be Brooks #37MB (12" x 20") or approved equal. For 1½" and larger Meters, the Meter Box shall be Brooks #65MB (17" x 28") or approved equal.

SECTION 0203

Roadway Excavation, Backfill and Compaction

1. GENERAL:

The work covered by this section is as described in Section 202.01 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition or the latest edition thereof. The scope of this section also includes the removal of all existing pavement and curbs as indicated on the project plans. All grading and related operations shall be included in the section also. All excavation is designated as unclassified excavation.

2. MATERIALS:

The materials used in the excavation of the work covered by this section shall be as noted in Section 202.04 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition or the latest edition thereof.

3. CONSTRUCTION METHODS:

The construction methods used to execute the work covered by this section shall be in accordance with Section 202.04 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition or the latest edition thereof.

SECTION 0204

PAVING REPAIR AND RESURFACING AND TEMPORARY SURFACING

1. GENERAL:

This section covers the permanent repair and resurfacing of street, driveway and sidewalk cuts by utility trenches and related excavations/repairs of street pavements; and the installation, maintenance, and removal of a traffic-bound surface course (TBSC) for use as a temporary pavement surface during construction operations.

2. MATERIALS

All materials used shall conform to the requirements set forth in the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition or the latest edition thereof.

3. CONSTRUCTION METHODS

3.1 GENERAL

3.1.1 All paved surfaces shall be removed to neat saw cut lines to a width equal to the trench width plus 12 inches on either side OR as directed by the Engineer.

3.1.2 Trench backfill/compaction under streets, driveways and sidewalks shall be in accordance with the requirements shown on Details 5 & 6 on City Water Systems Standards.

3.1.3 Contractor shall coordinate activities with the OWNER.

3.1.4 Construction methods shall conform to those set forth in ODOT Standard Specifications noted above.

3.2 STREET CUTS/REPAIRS

3.2.1 All asphalt and concrete street cuts for trench excavation shall be repaired in accordance with Details 5 & 6 on City Water Systems Standards.

3.2.2 All asphalt alley cuts shall be repaired in accordance with Details 6, except that the concrete requirement shall be deleted and the repair section shall be surfaced with asphalt to the thickness of the existing section but not less than four (4) inches.

3.2.3 All street cuts (including curb & gutter) for other than trench excavations shall be repaired in accordance with City Street Standards.

3.2.4 Arterial streets shall be repaired utilizing a typical section equal to the existing pavement or as a minimum in accordance with city street standards.

3.3 DRIVEWAY AND SIDEWALK CUTS/REPAIRS

3.3.1 Concrete driveway cuts shall be repaired in accordance with Details 5 on City of Lawton Standard Details for Water Systems with the exception that the concrete requirement shall be non-reinforced 3500 PSI high early strength (H.E.S.) concrete.

3.3.2 Asphalt driveway cuts shall be repaired with Type “B” or “C” asphalt to the thickness of the existing section but not less than six (6) inches.

3.3.3 Gravel driveways shall be resurfaced with 4" of compacted Type "C" Traffic Bound Surface Course.

3.3.4 Concrete sidewalks shall be removed as needed to an existing joint and replaced with 4” thick 3500 PSI concrete.

3.4 TRAFFIC-BOUND SURFACE COURSE (TBSC)

3.4.1 TBSC as described in Section 402 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition or most current edition, will be placed as called for on the Plans or as directed by the Engineer.

3.4.2 When the need for the temporary surface no longer exists, the Contractor will remove the TBSC and dispose of it off site or as directed by the Engineer.

SECTION 0205

MEASUREMENT AND PAYMENT

1.1 WATER MAIN

METHOD OF MEASUREMENT: Ductile Iron Pipe, Class 50 or PVC C900, PVC C905, DR18:

Waterline shall be measured along the centerline of waterline installed, through all valves and fittings. The unit price payment shall be considered full compensation for furnishing and laying of all water main, encasing ductile iron pipe in polyethylene, testing, disinfecting the line, trenching and backfill of waterline and incidentals necessary to make a complete project. All material and equipment costs including temporary caps and corporation stops required for testing will be included in cost of waterline pipe on Bid Schedule.

BASIS OF PAYMENT: Accepted waterline will be paid for at contract unit price for:

6" Waterline	Linear Foot
8" Waterline	Linear Foot
12" Waterline	Linear Foot
16" Waterline	Linear Foot
24" Waterline	Linear Foot
36" Waterline	Linear Foot

1.2 DUCTILE IRON FITTINGS (AWWA C153)

METHOD OF MEASUREMENT: Fittings to be paid for shall be measured by weight for size and type of fitting required for a complete project. Fitting weights shall be bare body AWWA weights. The fitting accessories shall be considered incidental and weight shall not be included in weight of fittings, but should be included in unit bid price for fittings. The unit price payment shall be considered full compensation for furnishing all material, tools, equipment, labor and incidentals necessary for a complete job. Meglugs shall be used at locations as directed by the Engineer and cost shall be paid at the unit bid price for fittings.

BASIS OF PAYMENT: Accepted fittings will be paid for at the contract unit price for:

Ductile Iron Fittings (AWWA C153)	Pounds

1.3 RESILIENT-SEATED GATE VALVES

METHOD OF MEASUREMENT: Resilient seated gate valves shall be measured by each valve of various size and valve box satisfactorily installed according to the plans and specifications. Payment will be made at the unit price bid for each valve. This payment shall be total compensation for all material, tools and incidentals required for a complete job.

BASIS OF PAYMENT: Accepted valves will be paid at the contract unit price for:

8" Resilient-Seated Gate Valves	Each
12" Resilient-Seated Gate Valves	Each

1.4 FIRE HYDRANTS AND 6” GATE VALVE

METHOD OF MEASUREMENT: Fire Hydrants will be measured by the number in place and complete. Payment will be made at the unit price bid for each fire hydrant and 6” gate valve installed in place and such payment shall constitute full compensation for supplying and installing all pipe required for hydrant lead, hydrant extensions, rock for drain, thrust blocking, trenching and backfill, resilient-seated gate valve, valve box, testing, equipment and any other incidentals required for complete installation.

BASIS OF PAYMENT: Accepted fire hydrant and gate valve will be paid for at the contract unit price for:

Fire Hydrant w/6” Gate Valve	Each

1.5 WATER METER RELOCATION

METHOD OF MEASUREMENT: Water meter relocation shall be measured by each water meter requiring relocations as set forth on the plans or identified by Project Engineer. Payment for water meter relocations shall be at the unit price bid for water meter relocations. Payment shall include a new meter box, angle valve, five foot (5') of service line on the house side of the meter, reconnection to the service lines on both sides of the installation, removal and reinstallation of the meter/AMR(complete) and all other material, labor and equipment required to make a complete water meter relocation. Installations paid for as water meter relocation will not also be paid for as water meter reconnection.

BASIS OF PAYMENT: Accepted water meter relocations will be paid for at the contract unit price for:

Water Meter Relocation 1"	Each
Water Meter Relocation 1½"	Each
Water Meter Relocation 2"	Each

1.6 WATER METER RECONNECTION

METHOD OF MEASUREMENT: Water meter reconnection shall be paid at unit bid for water service reconnection. Payment shall include angle valve, meter box, all fittings, labor, equipment and other incidentals required to make a complete connection of new water service line to existing water meter including removal and re-installation of the meter/AMR(complete) as necessary and other incidentals.

BASIS OF PAYMENT: Accepted water meter reconnection shall be paid for at the contract unit price for:

Water Meter Reconnection 1"	Each
Water Meter Reconnection 1½"	Each
Water Meter Reconnection 2"	Each

1.7 2" BLOWOFF

METHOD OF MEASUREMENT: 2" Blowoff shall be measured by each 2" blowoff completed and accepted. Payment shall include all material, 2" copper line, 2" valve, valve box, labor, equipment and other incidentals required to install a complete 2" blowoff. Payment shall be at the contract unit bid price for 2" blowoff.

BASIS OF PAYMENT: Accepted 2" blowoff shall be paid at the contract unit price for:

2" Blowoff	Each

1.8 SERVICE TAPS

METHOD OF MEASUREMENT: Service taps shall be measured for each tap made and accepted. The service tap shall be paid at the contract unit price bid for service taps. Payment shall include tap of new main, corporation stop and all labor and equipment required to perform a complete service tap.

BASIS OF PAYMENT: Accepted service tap shall be paid for at the contract unit price for:

Service Tap 1"	Each
Service Tap 1½"	Each
Service Tap 2"	Each

1.9 TAPPING SADDLE

METHOD OF MEASUREMENT: Tapping saddle shall be measured for each tapping saddle complete and accepted. The tapping saddle shall be paid at the contract unit price bid for tapping saddle of the size require. Payment shall include tapping saddle, and all labor and equipment required to complete a main line tap.

BASIS OF PAYMENT: Accepted tapping saddle shall be paid at the contract unit price for:

24"x 8" Tapping Saddle	Each
36"x 12" Tapping Saddle	Each

1.10 WATER SERVICE LINE

METHOD OF MEASUREMENT: Service line shall be measured by the lineal foot complete and accepted. Measurement for service line will be made on a direct horizontal line from corporation stop to connection point. All fittings required to make connection to existing service line, equipment, trenching and backfill shall be considered incidental. All service line installation work is to be done in accordance with the City Engineer's Specification for Water Service Installation.

BASIS OF PAYMENT: Accepted service line will be paid for at the contract unit price for:

Service Line 1"	Lineal Foot
Service Line 1½"	Lineal Foot
Service Line 2"	Lineal Foot

1.11 SERVICE LINE BORE

METHOD OF MEASUREMENT: Service line bore shall be measured by the lineal foot complete and accepted. Measurement for service line bore will be made on a direct horizontal line from edge of pavement to edge of pavement. Payment for service line bore shall include all equipment, labor and materials required to complete service line bore and install service line through bore.

BASIS OF PAYMENT: Accepted service line bore will be paid for at the contract unit price for:

Service Line Bore 1"	Lineal Foot
Service Line Bore 1½"	Lineal Foot
Service Line Bore 2"	Lineal Foot

1.12 DRIVEWAY REPAIRS

METHOD OF MEASUREMENT: Driveway repair shall be measured by the square yard of repair completed and accepted. The contractor may elect to bore under a driveway in lieu of trenching. All costs for the bore shall be paid at the contract bid price for driveway repairs for the type of driveway bored, i.e. concrete or asphalt. Driveway repair shall be paid at the contract unit price bid for driveway repair. All sidewalk shall be paid under contract unit price bid for driveway repair (concrete). Payment shall include removal of existing pavement, grading, limestone screening, backfill, compaction of backfill to 95% standard proctor density, pavement material, all labor and other material to complete driveway repair as shown on plans or as directed by Project Engineer.

BASIS OF PAYMENT: Accepted driveway repair shall be paid at the contract unit price for:

Driveway Repair (Concrete)	Square Yard
Driveway Repair (Gravel)	Square Yard
Driveway Repair (Asphalt)	Square Yard

1.13 STREET REPAIR

METHOD OF MEASUREMENT: Street repair shall be measured by the square yard of repair completed and accepted. Street repair shall be paid at the contract unit price bid for street repair. Payment shall include removal of existing pavement, grading, paving and backfill material, labor, equipment and other incidentals required to repair street as specified in contract.

BASIS OF PAYMENT: Accepted street repair shall be paid at the contract unit price for:

Street Repair (Concrete)	Square Yard
Street Repair (Asphalt)	Square Yard

1.14 TRAFFIC-BOUND SURFACE COURSE

METHOD OF MEASUREMENT: Traffic-Bound Surface Course (TBSC) shall be measured by the Ton. All weight of moisture in excess of 5 percent oven-dry weight will be deducted from the pay quantity. TBSC shall be paid at the contract unit price bid for TBSC. Payment shall include furnishing all materials, equipment, labor and incidentals to install & remove the work as shown on the Plans or as directed by the Project Engineer.

BASIS OF PAYMENT: Accepted TBSC shall be paid at the contract unit price for:

TBSC, Type '__'	Ton

1.15 SCREENING BACKFILL

METHOD OF MEASUREMENT: Screening backfill shall be measured by lineal foot horizontal along main waterline. Screening backfill will only be paid in location required to be backfilled with screening as directed by Project Engineer. Screening backfill under pavement, drives, and sidewalk will be paid under contract unit price for driveway repair and street repair. Payment shall include all equipment, material, and other incidentals required to backfill trench and compact material to 95% standard proctor density.

BASIS OF PAYMENT: Accepted screening backfill shall be paid at the contract unit price for:

Screening Backfill	Lineal Foot

1.16 FENCE REPLACEMENT

METHOD OF MEASUREMENT: Fence replacement shall be measured by the lineal foot for fence replaced and accepted. Payment shall include all labor, material and other incidentals to reinstall existing fence that is removed by direction of Project Engineer. Fence removed but not reinstalled shall not be paid for under the contract unit price for fence replacement; but shall be considered incidental and cost included in other pay items.

BASIS OF PAYMENT: Accepted fence replacement shall be paid at the contract unit price for:

Fence Replacement	Lineal Foot

1.17 TREE REMOVAL

METHOD OF MEASUREMENT: Tree removal shall be measured by the inch diameter of trunk of tree, three feet above existing ground level. Tree removal shall only be made with approval of Project Engineer. All trees removed with trunk diameter of 3" or less shall not be paid for but considered incidental. Payment shall include all equipment, labor, material and other incidentals required to complete tree removal and disposal. Trees removed shall become property of contractor.

BASIS OF PAYMENT: Accepted tree removal shall be paid at the contract unit price for:

Tree Removal	Inch-Diameter

1.18 BUTTERFLY VALVES

METHOD OF MEASUREMENT: Butterfly valves shall be measured by each valve of various size and valve box satisfactorily installed according to the plans and specifications. Payment will be made at the unit price bid for each valve. This payment shall be total compensation for all material, tools and incidentals required for a complete job.

BASIS OF PAYMENT: Accepted valves will be paid at the contract unit price for:

16" Butterfly Valves	Each
24" Butterfly Valves	Each

1.19 SANITARY SEWER PIPE (PVC C-900 DR18 OR PROTECTO 401™ LINED D.I. PIPE CLASS 51)

METHOD OF MEASUREMENT: PVC (AWWA C900, DR18) or Protecto 401™ Lined D.I. (ASTM A746, AWWA C150/ANSI A21.50, Class 51) sanitary sewer pipe shall be measured by the lineal foot for pipe installed and accepted. Payment shall include all equipment, tools, labor, fittings to connect to existing sewer main, and other incidentals necessary to complete the work as specified.

BASIS OF PAYMENT: Accepted Sanitary Sewer Pipe PVC (AWWA C900, DR18) or Protecto 401™ Lined D.I. Pipe (ASTM A746, AWWA C150/ANSI A21.50, Class 51) installed shall be paid for at the contract price for:

Sanitary Sewer Pipe (PVC C-900 DR18 or Protecto 401™ Lined D.I. Pipe Class 51)	Lineal Foot

APPENDIX A
Definitions

Terms used in these specifications and in Ordinance No. 81-34 shall have the following meanings:

1) Water Distribution Division shall mean the Water Distribution Division of the Public Works Department, and all include all authorized employees and deputies thereof, except as otherwise clearly shown by context.

2) Director shall mean the Director of the Public Works Department.

3) Water service used alone as a single term and without any other qualifying or descriptive word connected therewith as a part of the term containing such words shall] be construed in the sense of the ordinary meaning and general usage ascribed thereto and be inclusive of the general municipal service of providing, maintaining, and distributing water and providing, maintaining and operating all of the facilities and procedures legally under the control of the Water Distribution for the purposes of said service.

4) Meter service connection shall mean the service pipe connected to a City water main and extending from there to the property line of premises serviced or subject to be served by the water service.

5) Extension service line shall mean the extension of the meter services connection from the terminus of said connection at the property line to the point of meter setting whenever said point is inside and beyond the property line.

6) Meter setting shall mean the installation of water meter connected to the meter service connection or at the terminus of extension service line.

7) Water service installation shall mean the tapping, meter service connection, and meter box setting, in accordance with the City Engineer's specifications on file in the City Clerk's Office.

8) Water service crossing is the service line from the water main, including the tap in the street or alley right-of-way, to the property of lots on the opposite side of the street or alley paving from the water main.

9) Slip is defined as any pipe, hose, or other apparatus which is installed at any location between a City water main and any private domestic or commercial system in such a manner that water can be withdrawn from the City water main without passing through a meter installed by the City.

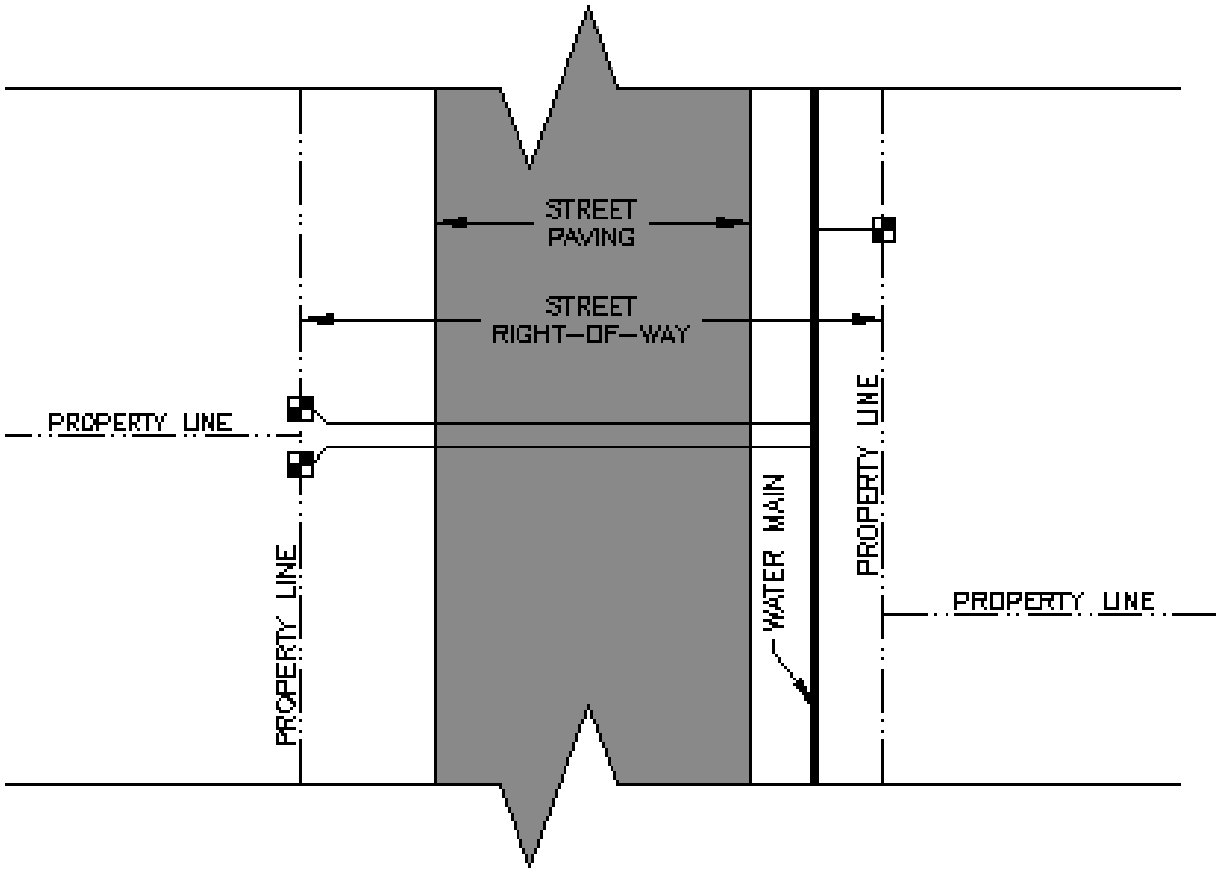
10) Water Distribution Division shall mean the Water Distribution Division of the Public Works Department and shall include all authorized employees.

11) Field Service Branch shall mean the Revenue Services Division of the Finance Department and shall include all authorized employees.

APPENDIX B

SCHEMATIC DRAWINGS

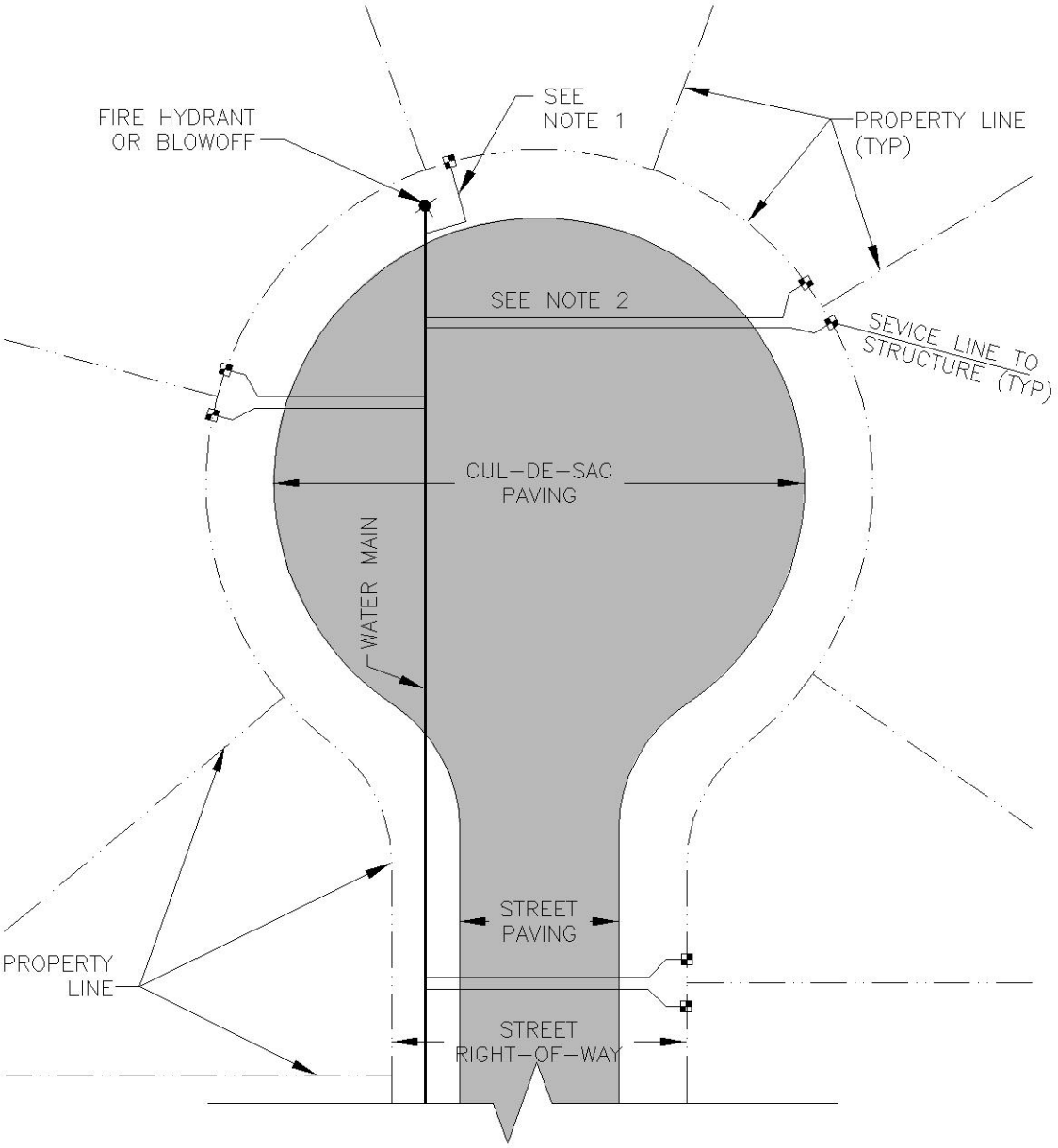
WATER SERVICE INSTALLATION – PLAN VIEW
TYPICAL LAYOUT
DRAWING A



NOTES:

1. Water service crossings to occur in pairs. See specifications for details.
2. Meter box to be installed on property line, if possible.
3. Water service installations on water main side of street to be performed by the Builder.
4. Drawing is not to scale.
5. Refer to Drawing C for installation details.

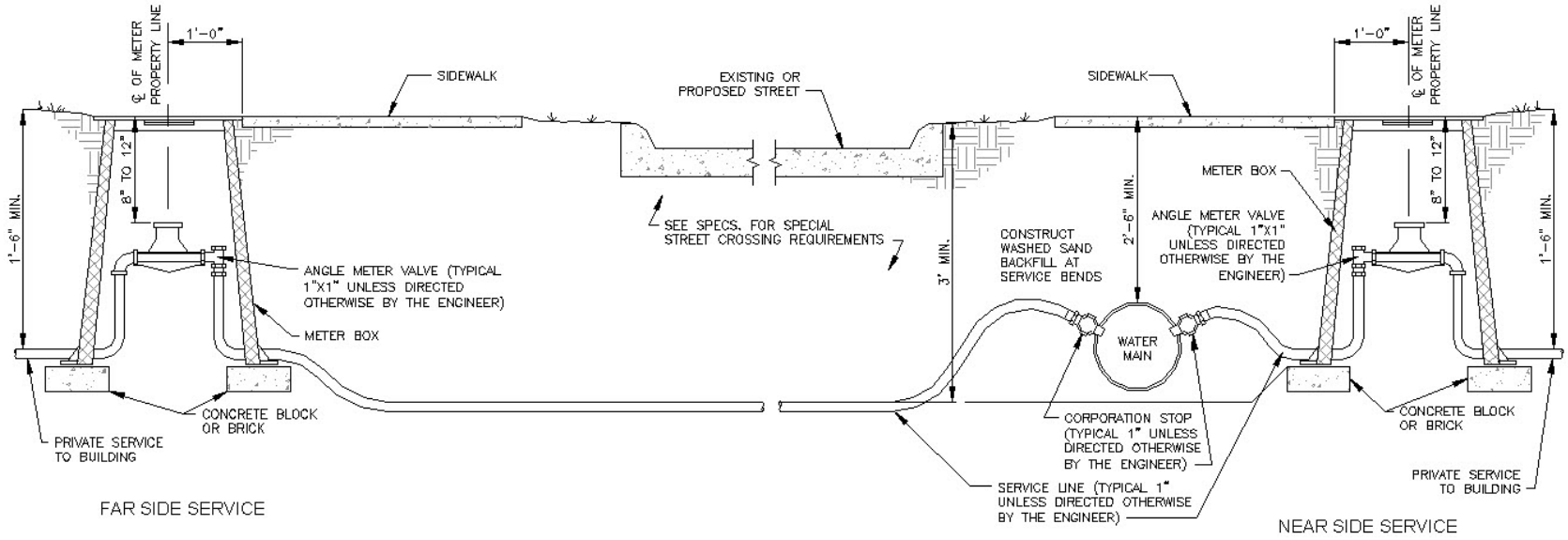
WATER SERVICE INSTALLATION – PLAN VIEW
CUL-DE-SAC LAYOUT
DRAWING B



NOTES:

1. All meter service connections with taps for lots adjacent to cul-de-sacs to be performed by the developer.
2. Taps to water main to be located back of curb where possible.
3. Drawing is not to scale.
4. Refer to Drawing C for installation details.

DETAIL – WATER SERVICE INSTALLATION
DRAWING C



NOTES:

1. Shaded items to be provided and installed by the Developer – all other items by the Builder.
2. To be bored if street or alley paving existing.
3. Service pipe bend to rest on undisturbed ground for support of corporation stop
4. All taps to the water main to be made while the main is under normal operation pressure. Minimum size of tap and meter service connection to be 1". Polyethylene wrap on the water main to be repaired after tap is made.
5. Drawing is not to scale.
6. Refer to Drawing A for typical layout and Drawing B for cul-de-sac layout.
7. Refer to specifications for required installation procedures and material specifications.

TECHNICAL SPECIFICATIONS

SECTION 0300

SEWERLINE CONSTRUCTION

INDEX

INDEX

INDEX

SECTION 0300

SEWERLINE CONSTRUCTION

SECTION 1 - GENERAL

1.1 BID SCHEDULE: The sanitary sewer system to be constructed as designated on the Plans shall be bid using the Unit Bid Price Method for those items listed in the bid schedule.

1.2 SCOPE OF WORK: The work required by the project shall consist of furnishing all labor, equipment, materials, plant and supervision; and performing all work necessary to construct a sanitary sewer system in accordance with the plans and these Technical Specifications. The work shall consist of, but not necessarily be limited to, performing the following work tasks where specified:

PVC Sanitary Sewers
Manholes
Service Reconnections
By-Pass Pumping
Pavement Removal/Replacement
Rip-Rap

1.3 UTILITIES: The Contractor shall be responsible for having utilities located. Any Contractor caused damage to any utilities; Telephone, T.V. Cable, Gas, Water, Sanitary Sewer, etc., shall be repaired at the Contractor's expense.

1.4 SUBMITTALS: The complete list of submittals is listed in Section 700.

SECTION 2 - SANITARY SEWER PIPE

2.1 GENERAL: Sanitary sewers shall be installed in easements or right-of-ways and connected with the existing municipal sewerage system as shown on the Plans. All gravity sanitary sewer mains shall be constructed of polyvinyl chloride (PVC) materials or High Density Polyethylene (HDPE) materials. All construction materials and procedures shall conform to Oklahoma State Department of Environmental Quality requirements, City of Lawton Standard Details and the following Specifications. All standard specifications referred to shall be the latest edition in effect at the time construction begins.

2.2 MATERIALS

2.2.1 POLYVINYL CHLORIDE (PVC): All PVC gravity sewer pipe and fittings shall comply with ASTM D 3034 or ASTM F 1803. All thickness class designs shall be approved by the Owner. The minimum pipe stiffness for pipe manufactured in accordance with ASTM F 1803 shall be 46 psi when tested in accordance with ASTM D 2412. The thermoplastic pipe Standard Dimension Ratio (SDR) of pipe manufactured in accordance with ASTM D 3034 shall be 35 or lower.

2.2.1.1 JOINTS: Joints shall be either bell ends or couplings with elastomeric gaskets per ASTM D 3212

2.2.1.2 GASKETS: Gaskets shall be elastomeric and comply with ASTM F 477.

2.2.2 HIGH DENSITY POLYETHYLENE (HDPE): All HDPE gravity sewer pipe and fittings shall comply with ASTM F 714 and ASTM D3350 respectively. All thickness class designs shall be approved by the Owner. The minimum pipe stiffness for pipe manufactured in accordance with ASTM F 714 shall be 46 psi when tested in accordance with ASTM D 2412. The thermoplastic pipe Standard Dimension Ratio (SDR) of pipe manufactured in accordance with ASTM F 714 shall be 35 or lower with an established hydrostatic design basis (HDB) of not less than sixteen hundred (1,600 psi) pounds per square inch for water at 73.4 F determined in accordance with ASTM Test Method D-2837. High density polyethylene compound properties shall be in accordance with Section 16.3 “Material Properties” of these specifications.

2.2.2.1 JOINTS: Sections of polyethylene pipe shall be assembled and joined on the job site. Jointing shall be accomplished by the heating and butt-fusion method in strict conformance with the manufacturer's printed instructions.

2.2.3 DUCTILE-IRON: Ductile-iron pipe shall comply with ASTM A 746. Thickness class shall be determined in accordance with AWWA C 150 (ANSI A21.50), for laying condition Type 4 and the design depth of cover, minimum Class 51. Above ground pipe shall be Class 52 minimum.

2.2.3.1 JOINTS:

2.2.3.1.1 BURIED JOINTS: Shall be push-on, mechanical or restrained.

2.2.3.1.2 ABOVE GROUND JOINTS: Shall be flanged, unless specified otherwise elsewhere in these specifications or on the plans.

2.2.3.1.3 JOINT GASKETS: Shall comply with AWWA C111 (ANSI A21.11).

2.2.3.2 COATINGS:

2.2.3.2.1 INSIDE: All ductile-iron pipes shall be internally lined with 40 mils nominal thickness of Protecto 401 Ceramic Epoxy per the latest specifications by the manufacturer, or approved equal.

2.2.3.2.2 OUTSIDE: All ductile-iron pipes shall be coated externally with a bituminous coating or coal tar primer approximately 1 mil thick. The finished coating shall be continuous and smooth.

2.2.3.3 FITTINGS:

2.2.3.3.1 DUCTILE-IRON COMPACT FITTINGS: The thickness class for ductile-iron compact fittings (AWWA C153) shall be Class 350 for all sizes.

2.2.3.3.1 CAST-IRON AND DUCTILE IRON FITTINGS: The thickness class of all gray and ductile-iron fittings (AWWA C110).

2.2.3.4 POLYETHYLENE ENCASEMENT: All buried ductile-iron pipe and fittings shall be wrapped with polyethylene in accordance with AWWA C105 (ANSI A21.5).

2.3 CERTIFICATION: The Contractor shall furnish the Owner an affidavit from the materials manufacturers to the effect that all inspections and tests as required in the standard specifications have been made and that results thereof meet the requirements of the specifications. Reports of test results shall be furnished when requested.

2.4 CONSTRUCTION

2.4.1 PVC PIPE: Solid wall and Closed wall profile PVC pipelaying shall be in accordance with the latest addition of ASTM D 2321.

2.4.2 HDPE PIPE: Solid wall profile HDPE pipelaying shall be in accordance with the latest addition of ASTM D 2321.

2.4.3 DUCTILE IRON: Pipelaying shall be in accordance with AWWA C600. Unless specified differently in these specifications or on the plans, the minimum bedding shall be Type 4, as described in AWWA C150 (ANSI A21.50).

SECTION 3 - TRENCHING AND BACKFILL

3.1 GENERAL: Excavation and backfilling shall be done in accordance with all Occupational Safety and Health Administration (OSHA) Regulations. The trench shall be

properly backfilled in order that a minimal amount of settlement occurs once the new PVC sewer pipe is placed and the trench backfilled.

The excavated trench shall be no wider than the pipe's outside diameter plus two (2) feet, one foot on each side. Bedding shall be as hereinafter described.

3.2 EXCAVATION: Existing utilities shall be located prior to starting the trenching operation and reasonable care shall be exercised to prevent damage to utilities. All existing City owned and private facilities such as fences (including all utilities whether privately or publicly owned), which are damaged during construction, shall be repaired at the Contractor's expense.

All excavation shall be open cut. The sides of the trenches shall be as nearly vertical as soil conditions permit and construction workers shall be protected from cave-ins by appropriate methods.

The maximum length of trench to be opened at one time is the amount that can be accommodated in one working day by the Contractor. If the Contractor excavates more trench than what he can install pipe in by the end of the working day, the excess length of trench must be backfilled prior to the Contractor leaving the work site for the day. Excavated material shall be placed adjacent to the trench a sufficient distance from the edge of the trench to prevent slides or cave-ins. It shall be the responsibility of the contractor to remove all material from the construction area that is not suitable for backfill and to dispose of this material properly.

Care shall be taken not to over-excavate. If unauthorized over-excavation occurs, the trench shall be brought back to grade with Class I or II material, as described in ASTM D2321, and compacted to the required density as defined in Section 3.5.3 MINIMUM COMPACTION REQUIREMENTS. Whenever wet or unsuitable soil, incapable of properly supporting the pipe, or rock is encountered in the trench bottom, such material shall be removed to a depth of stable material and replaced with Class I or II material and compacted as described above.

Unless otherwise required for installation of sheeting or shoring, the trench's width at the elevation of top of pipe shall be a maximum of the pipe's outside diameter plus two (2) feet and a minimum of the pipe's outside diameter plus eight (8) inches.

The trench bottom and/or the pipe bedding shall be accurately graded to provide uniform bearing and support for each section of the pipe along the entire barrel length. Bell holes shall be dug so that the pipe is not supported by the bell. Bell holes shall be large enough to properly join the joints of pipe without getting foreign material in the joint.

The Contractor shall continuously check the grade of the pipe by means of a laser or other device to insure that the grade indicated on the Plans is followed.

3.3 BEDDING AND INITIAL BACKFILL : For pipe overburden depths of 0 - 20 feet, the pipe shall be bedded with ASTM D 2321 Class 1 material such as 3/4" #1 cover crushed stone as produced by the Richards Spur Dolese Plant, or approved equal; or ASTM D2321 Class II material. Bedding under the pipe shall have a minimum depth of 1/4th the outside pipe diameter (4" minimum) and shall extend upwards to the top of the pipe. Bedding and initial backfill shall be compacted to a minimum density of 85% Standard Proctor Density. Initial backfill shall consist of 6" minimum of ASTM D2321 Class I material or Class II material compacted to 85% minimum Standard Proctor Density. Backfill material shall be free of all organic materials or wet or frozen soil. For a minimum distance of six (6) inches above the pipe, backfill shall be free of stones and hard clods that exceed three (3) inches in their largest dimension.

3.4 FINAL BACKFILL: Final backfill may be native trench material except under existing streets, alleys, drives and under proposed streets where backfill to the surfacing level shall be washed sand or limestone screenings compacted to minimum of 97% Standard Proctor Density. Final backfill shall be free of all organic materials or wet or frozen soil. All rock greater than six (6) inches in the largest dimension shall be disposed of offsite or buried deeper than three (3) feet from the finished surface but no closer to the top of the pipe than 24". If the native trench material is not adequate for backfill, Class I or II material per ASTM D2321 shall be used as backfill.

Backfill material shall be placed as specified in Section 3.5.3 MINIMUM COMPACTION REQUIREMENTS, to achieve compaction results specified. The ground surface shall be restored to its original contours, and all existing street, alleys, driveways or sidewalks, etc., that were disturbed, shall be restored to its original condition or better.

3.5 COMPACTION: Depending on characteristics of the backfill material, methods of compaction may be water settlement, or mechanical compaction as described below:

3.5.1 WATER SETTLEMENT: Water settlement shall be accomplished by leveling the fill material, flooding the trench and jetting the material with sufficient water to thoroughly saturate the material and to cause it to settle and fill all voids. All jetting shall be done along the trench and transversely across the trench at intervals not in excess of six (6) feet, with jetting locations on one side of the trench offset to jetting locations on the other side of the trench. The Contractor shall provide capacity to jet at not less than 30 pounds per square inch pressure. After the material has settled, tamping or hydro-hammering shall be performed, if necessary, to secure the required density as defined in Section 3.5.3 MINIMUM COMPACTION REQUIREMENTS.

3.5.2 MECHANICAL COMPACTION: Where water settlement does not result in adequate compaction, backfill material shall be uniformly moistened to optimum moisture content, placed in layers as defined in Section 3.5.3 MINIMUM COMPACTION REQUIREMENTS, and compacted with hand and/or mechanical work methods. Equipment used shall be rollers, pneumatic tamps, hydro-hammers

or other approved devices which secure uniform and required density without injury to the pipe or related structures.

3.5.3 MINIMUM COMPACTION REQUIREMENTS:

AREA	STANDARD PROCTOR DENSITY	MAXIMUM HEIGHT OR LIFT
Under any existing or proposed street, curb or gutter	97%	6"
Above and below any intersecting utilities or alley	97%	6"
Under any existing or proposed asphalt or concrete driveway	97%	6"
Under any existing or proposed sidewalk, turfed or seeded lawn	90%	12"
Under all other areas	90%	24"

The actual densities achieved in the field will be determined by AASHTO Designated T205 or T238.

3.6 FIELD TESTING SEWER PIPE AND MANHOLES: All testing procedures required as outlined shall be performed by the contractor and coordinated with the City Engineering or his representative.

3.6.1 VISUAL INSPECTION: As pipe laying progresses, and after partial backfilling, the interior of sewer lines shall be visually inspected for alignment and grade, by means of artificial or reflected light. Necessary corrections shall be made by the Contractor, as directed by the City Engineer.

3.6.2 AIR TESTING: Sewer lines, regardless of the pipe material used, shall be subject to test for leakage after they have been partially backfilled. This test shall be conducted in accordance with the test procedure described in ASTM C 828. If the test fails, the Contractor shall find and correct the defective portion of the line and retest until a passing test is achieved.

3.6.3 DEFLECTION TEST: Deflection tests shall be performed on all flexible pipe. The test shall be conducted after the final backfill has been in place for at least thirty (30) days. No pipe shall exceed a deflection of five percent (5%). The deflection test shall be run using a rigid ball or mandrel with a minimum diameter equal to 95% of inside diameter of the pipe. The testing device shall be pulled through the

line by one or more persons; no mechanical pulling devices shall be allowed. The test section is considered failed if moderate resistance is met anywhere along the line. If the test fails, the Contractor shall find and correct the defective portion of the line, backfill the removed portion, rerun the air test, wait another 30 days and rerun the deflection test on that portion of line that failed. This procedure is to be repeated until all of the line passes all testing.

3.6.4 MANHOLE TESTING:

3.6.4.1 Exfiltration Testing: All incoming and outgoing lines shall be plugged and the manhole filled with water to the bottom of the manhole ring. If the water loss is greater than 1/8" per vertical foot of depth over a 5-minute test period, the manhole has failed the test. The Contractor shall make repairs and retest the manhole until it passes.

3.6.4.2 Vacuum Testing: All incoming and outgoing lines shall be plugged and the vacuum tester head placed on the manhole ring and sealed. A vacuum of 10" of Hg shall be drawn on the manhole and the time measured for the vacuum to drop to 9" of Hg. If the time is less than 60 seconds, the manhole has failed the test. The Contractor shall make repairs and retest the manhole until it passes.

SECTION 4 - MANHOLES

4.1 GENERAL: All sanitary sewer manholes shall be constructed in accordance with the standard details and these specifications. Care shall be taken to maintain true and accurate grades between adjacent manholes. Each manhole shall be constructed with the center of the channel invert set to the flow line elevation specified on the construction drawings, and the frame shall be set so the top of the frame is at the top of the manhole elevation specified on the construction drawings. Care shall be taken that the frame be set firmly and level on the manhole.

The channel invert shall be established by either casting the bottom half of the carrier pipe in the manhole base or by forming the channel invert with cement mortar. All mortar used shall be placed with a hard, impervious, steel-troweled finish. The upper edges of the invert shall be slightly rounded and the flow line shall be true and uniform through the manhole.

After all concrete and mortar used to construct the manhole has cured for at least thirty-six (36) hours, the interior surfaces of all manholes shall receive two (2) coats of a coal tar epoxy such as 46H-413 Hi-Build Tneme-Tar as manufactured by Tnemec, Bitumastic No. 300-M as manufactured by Carboline or equal as approved by the City Engineer, applied with a brush or spray gun in accordance with the manufacturer's specifications. A minimum interval of twenty-four (24) hours shall elapse between coats. The manhole surface to be coated shall be first prepared by removing all loose mortar, dirt

or other foreign matter and cleaned of all grease or oil with a solvent compatible with the paint to be used. After drying, the coating shall be inspected for pinholes or light coating. Additional coats of paint shall be applied if evidence is found of insufficient coverage by the previous coat. Precast manholes shall also be coated in the same manner except the bulk of the coating may be applied at the factory with touch ups in the field as required after installation.

4.2 PRECAST CONCRETE MANHOLES: Manholes constructed of precast concrete sections shall be built in accordance with the standard details and in accordance with current ASTM C478. Pipe penetrations and lifting holes shall be sealed with non-shrink grout in a workmanlike manner, and the top elevation of the manhole adjusted to grade in accordance with the standard details.

4.3 CAST-IN-PLACE CONCRETE MANHOLES: Manholes constructed of cast-in-place concrete shall be built in accordance with the standard details. Walls, floor and invert shall be constructed of 3000 psi concrete having a slump of four (4) inches to six (6) inches. Forms shall be accurately made of steel sheets and shapes of ample strength to form dense watertight walls true to line and dimensions. No metal or wooden spacers or struts shall be permitted to remain embedded in the concrete. The preferred method of attaching the manhole frame to the concrete walls is to cast the frame into the top of the manhole cone section. An alternate method that is acceptable, but not preferred, is to cast the manhole and then grout the frame onto the top of the cone after the manhole forms are removed.

SECTION 5 - ABANDON MANHOLE

Any manhole that will no longer be in service after construction of the new sewer mainlines shall be abandoned by removing the frame and the manhole walls to a minimum depth of four (4) feet below the proposed grade. The manhole invert shall then be filled with concrete to plug all pipe leads entering or leaving the manhole and the portion of the manhole to remain in place filled with compacted sand backfill. Manhole frames and covers removed from these manholes shall become the property of the City of Lawton and shall be delivered to the City of Lawton Public Works Yard by the Contractor in accordance with direction given by the Owner.

All other materials removed shall become the property of the Contractor and shall be appropriately disposed of in a manner acceptable to the Owner.

SECTION 6 - REMOVE MANHOLE

Any manhole that will no longer be in service after construction of the new sewer mains and so designated on the plans to be removed shall be completely removed from the site and disposed of by the Contractor. Pipe leads shall be plugged with concrete and the area backfilled as specified for trench excavation. Manhole frames and covers removed from these manholes shall become

the property of the City of Lawton and shall be delivered to the City of Lawton Public Works Yard by the Contractor by directions given by the Owner. All other materials removed shall become the property of the Contract or and shall be appropriately disposed of in a manner acceptable to the Owner.

SECTION 7 - RIP-RAP

The Contractor shall furnish and place 12" rip-rap (limestone) at the locations as shown on the plans. The rip-rap shall be placed on a uniformly graded surface. The minimum thickness of the rip-rap shall be 24". Final surface of placed rip-rap shall be uniform and shall match adjacent ground elevations.

SECTION 8 - ASPHALT PAVING REMOVAL/REPLACEMENT

8.1 GENERAL: Asphalt paving shall be cut and replaced as indicated on the plans or as directed by the Owner. Asphalt shall be Type "C" asphaltic concrete (hot mix-hot laid) and concrete shall be 3500 psi high early strength concrete. Both shall conform to Oklahoma Department of Transportation Standard Specifications, the latest edition thereof.

8.2 CONSTRUCTION METHODS

8.2.1 All paved surfaces and curbs to be removed shall be sawed to a sufficient depth to provide a neat removal line.

8.2.2 Trench backfill shall be clean sand or screenings only and shall be compacted to 95% Standard Proctor Density to alleviate settlement. (See Section 3.5.3: MINIMUM COMPACTION REQUIREMENTS.)

8.2.3 Contractor shall coordinate these activities with the Owner.

8.2.4 Construction methods shall conform to those set forth in the ODOT Standard Specifications noted above.

Asphalt shall be removed to neat saw cut lines to a width equal to the trench width plus a minimum of 12 inches on both sides of the trench and replaced with 6" of 3500 psi reinforced concrete (high early) and 2" of hot mix-hot layed Type "C" asphaltic concrete. All construction shall be according to the standard detail as shown in the plans for ASPHALT PAVEMENT REPAIRS.

SECTION 9 - CONCRETE PAVING REMOVAL/REPLACEMENT

9.1 GENERAL: Concrete paving shall be cut and replaced as indicated on the plans or as directed by the Owner. This concrete is to be High Early Strength concrete and all materials shall conform to the requirements set forth in the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition or the latest edition thereof.

9.2 CONSTRUCTION METHODS

9.2.1 All paved surfaces and curbs to be removed shall be sawed to a sufficient depth to provide a neat removal line.

9.2.2 Trench backfill shall be clean sand or screenings only and shall be compacted to 95% Standard Proctor Density to alleviate settlement. (See Section 3.5.3: MINIMUM COMPACTION REQUIREMENTS.) Backfill shall extend 12" beyond curbs.

9.2.3 Contractor shall coordinate these activities with the Owner.

9.2.4 Construction methods shall conform to those set forth in the ODOT Standard Specifications noted above.

Concrete shall be removed to neat saw cut lines to a width equal to the trench width plus a minimum of 12 inches on both sides of the trench and replaced with 3500 psi, High Early Strength Concrete. Reinforcing steel shall be as shown on the Standard Detail for CONCRETE PAVEMENT CUTS.

Concrete curb and gutter shall be removed as needed and replaced with a new curb and gutter of the same configurations and constructed of 3500 psi concrete. Curb and gutter shall be monolithic. If poured separately from the roadway slab, curb and gutter shall be doweled into the roadway slab.

SECTION 10 - 4" and 6” SEWER SERVICE LINE

10.1 GENERAL: This work shall consist of the construction of schedule 40 PVC sewer service lines at locations as directed by the Owner. All work shall be in accordance with the Oklahoma State Department of Health Regulations, City of Lawton Standards, applicable manufactures recommendations for installation and construction, and the following specifications.

10.2 MATERIALS: All pipe shall be polyvinyl Chloride (PVC) materials and shall be schedule 40 classification. Joints shall be either solvent weld or o-ring type gaskets. All fittings shall be PVC or Neoprene as approved by the Owner.

10.3 CONSTRUCTION: Refer to Section 2.4.

10.4 TRENCHING AND BACKFILL: Refer to Section 3.

SECTION 11 - SEWER SERVICE CONNECTION

11.1 GENERAL: This work shall consist of furnishing and constructing a new sewer service connection to connect an existing sewer service line to the new sewer main. Care shall be taken to insure that both the new main and the existing sewer service line are not damaged during construction.

11.2 MATERIALS: The tapping saddle shall meet the specifications of the latest edition of the BOCA National Plumbing Code. The saddle shall have a neoprene gasket and stainless steel bands. All PVC materials shall be schedule 40. All other materials shall be as approved by the Engineer.

11.3 CONSTRUCTION: The new sanitary sewer main shall be cut to the same size as the size of the service lateral at 45` to the vertical. This shall be done with a cutting tool designed for this application. Upon inspection of this hole after cutting, no cracks or blemishes should extend from the hole. If visible cracking is noticed, this area of pipe plus a minimum of two (2) feet on both sides of the damaged area shall be replaced with the same size and type of pipe. The method used to replace the damaged section of pipe shall be approved by the Owner prior to any repair of the pipe.

After the main is properly cut, a tapping saddle shall be placed on the main. When this is completed the service lateral can be connected to the tapping saddle. Contractor shall furnish any required fittings to connect to the existing service line. All fittings shall be PVC, neoprene or as approved by the Engineer. The entire service connection to 6" above the top of the service line shall be backfilled with washed sand or ¾" #1 cover crushed stone as produced by Dolese.

SECTION 12 - BY-PASS PUMPING

12.1 GENERAL: The purpose of by-pass pumping is for uninterrupted sanitary sewer service for those residents that are connected to the sewer main that is in the process of being replaced, and/or for uninterrupted flow of a sewer main under construction.

12.2 CONSTRUCTION METHODS: A pump and a hose and/or pipe shall be placed in or next to the upstream manhole. The hose and/or pipe shall be of enough length to reach into at least the next manhole downstream. This will allow the Contractor to work in the area between these manholes. The pump must not create excessive noise so that residents are not disturbed during time periods of the Contractor's absence from the project site.

The Contractor shall have available at all times sufficient equipment in proper working order for continuous by-pass pumping. The Contractor shall be responsible for continuous uninterrupted sanitary sewer service while by-pass pumping.

The Contractor shall be responsible for backups or other interruptions caused as a result of by-pass pumping.

SECTION 13 - FENCE REMOVAL/REPLACEMENT

13.1 GENERAL: This work shall consist of the removal and replacement in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans or as directed by the Owner.

13.2 MATERIALS: When replacement is called for, materials salvaged from the existing installation may be used if in good condition. Any damaged material shall be replaced with approved materials. Chain link fences for areas adjacent to schools, parks or recreational areas shall be knuckle type on both the top and bottom of the fence fabric.

13.3 CONSTRUCTION

13.3.1 REMOVAL AND STORAGE: The removed material, unless otherwise provided, shall be stored at a designated location as may be directed by the Owner.

Care shall be taken in removal of material to prevent damage to posts, cable, fence, plates, or fittings. Cable or fence shall be coiled and tied tightly before storing. Fittings shall be tied together in bundles or boxed. Such items as metal plates and posts shall be neatly stacked on blocks to prevent contact with the ground.

13.3.2 FENCE REPLACEMENT: When replacement of fence is provided in the Contract, fence in place shall be removed and stored as required above until such time as it is to be reset. All construction of fence shall be done in the same manner as provided for new work. Posts shall be set in concrete from ground level to bottom of posts, minimum of 24" or as approved by Owner. The Contractor will be required to replace at his own expense any material damaged or lost.

SECTION 14 - TEMPORARY FENCING

14.1 GENERAL: This work shall consist of installing and maintaining temporary fencing at locations on the project as directed by the Owner.

14.2 MATERIALS/CONSTRUCTION: The temporary fencing shall be a safety fence as manufactured by Con-Web, 5' minimum height secured to 7' tee posts spaced not more

than 8' on centers driven 24" into the ground. Alternate manufacturers of the safety fence will be considered for approval by the Owner.

SECTION 15 - GAS METER RELOCATION

15.1 GENERAL: This work shall consist of performing all work necessary to relocate gas meters that interfere with the construction of the new sanitary sewer main. All work including pressure testing shall be done in accordance with these specifications and the latest edition of the BOCA National Mechanical Code and any applicable City of Lawton regulations.

15.2 CONSTRUCTION METHODS

15.2.1 The gas service line shall be located and the Contractor shall pressure test this existing service line from the gas meter to the house. In the event an existing gas service line does not pass this test, the Contractor shall notify the Owner so that the resident can be notified of this problem. After the resident has resolved this problem, the Contractor shall retest this gas service line.

15.2.2 Once the gas service line passes the initial pressure test, the gas meter shall be relocated within the permanent Utility Easement in a location that will not interfere with the construction of the new sanitary sewer main.

15.2.3 After the gas meter has been relocated, the Contractor shall conduct another pressure test on the gas service line from the gas meter to the house under the supervision of a City Building and Safety Inspector.

SECTION 16 - PIPE BURSTING

16.1 GENERAL: This section covers furnishing and installation of pipe by trenchless method of bursting existing pipes as shown on the plans and in conformity with these specifications. The operation shall be conducted with a hydraulic pulling or pushing apparatus and a pipe expander (i.e. pig and swab). The pipe expander shall be pushed or pulled through the existing pipe on grade, widening the existing pipe material for insertion of the new pipe material.

16.2 SUBMITTALS: The Contractor shall furnish for the Engineer's approval, a plan showing his proposed method of handling, including the design for the equipment, equipment support of backstop, arrangement and position of jacks, pipe guides, etc., complete in assembled position. The approval of this plan by the Engineer will not relieve the Contractor from his responsibility to obtain the specified results.

16.3 PIPE MATERIALS: The pipe shall be HDPE pipe made of high density plastic compound meeting the requirements of Type III, Class C, Category 5, Grade P34 as

defined in ASTM D-1248 and with an established hydrostatic design basis (HDB) of not less than sixteen hundred (1,600 psi) pounds per square inch for water at 73.4 F determined in accordance with ASTM Test Method D-2837. Materials shall also meet the requirements of cell classification PE 345434C or higher cell classification, when classified in accordance with ASTM D-3350, and as shown below:

Property	ASTM Test Method	Minimum Value
Density	D-1505	0.941 (gm/cm^3)
Melt Index	D-1238	<0.15 (gm/10 min.)
Initial Flexural Modulus	D-790	110,000 psi
Long-Term Flexural Modulus	*	28,200 psi
Initial Flexural Strength	D-790	3,000 psi
Long-Term Flexural Strength	*	1,500 psi
Environmental Stress Crack Resistance, Test Condition C, (failure % = hours)	D-1693	F_{20} = 192
Hydrostatic Design Basis	D-2837	1,600 psi
Color & Ultraviolet Stabilizer	D-3350	Black with minimum 2% carbon black

* Note: The long-term values are considered to be for a continuous load duration of fifty (50) years for design loading conditions and shall be certified by the manufacturer.

16.4 SOLID WALL (HDPE)

16.4.1 General - All solid wall HDPE pipes may be used for open-cut and slip lining installations, in sizes ranging from six (6") inches to forty-eight (48") inches in diameter. All solid wall HDPE pipe and fittings shall be manufactured in accordance with ASTM F-714.

16.4.2 Joint System - Sections of polyethylene pipe shall be assembled and joined on the job site. Jointing shall be accomplished by the heating and butt-fusion method in strict conformance with the manufacturer's printed instructions.

The butt-fusion method for pipe jointing shall be carried out in the field by operators with prior experience in fusing polyethylene pipe with similar equipment using proper jigs and tools per standard procedures outlined by the pipe manufacturer. These joints shall have a smooth, uniform, double rolled back bead made while applying the proper melt, pressure, and alignment. It shall be the sole responsibility of the Contractor to provide an acceptable watertight butt-fusion joint. Butt fusion procedures shall be qualified in accordance with Title 49 Code of Federal Register, Part 192.283 and personnel qualified in accordance with 49 CFR 192.285.

16.4.3 Pipe Stiffness - For all installations, except sliplining, HDPE pipe shall have a minimum pipe stiffness of forty-six (46 psi) pounds per square inch as determined in accordance with ASTM D-2412 or an equivalent DR of 21.

16.5 CONSTRUCTION REQUIREMENTS: Where pipe is required to be installed under railroad embankments or under highways, streets, or other facilities by trenchless methods, construction shall be made in such a manner that will not interfere with the operation of the railroad, street, highway, or other facility, and shall not weaken or damage any embankment or structure. During construction operations, barricades and lights to safeguard traffic and pedestrians shall be furnished and maintained, as directed by the Engineer, until such time as the backfill has been completed and then shall be removed from the site.

The Contractor shall take proper precautions to avoid excavating earth or rock or shattering rock beyond the limits of excavation shown on the plans. All damages caused by excavating or blasting, either to surface or subsurface structures, shall be repaired or replaced by the Contractor at his own cost and expense.

Suitable pit shafts, or trenches shall be excavated for the purpose of conducting the trenchless operations and for placing end joints of the pipe. Wherever end trenches are cut in the sides of the embankment or beyond it, such work shall be sheeted securely and braced in a manner satisfactory to the Engineer to prevent earth caving.

The removal of any obstruction that may be found to conflict with the placing of the pipe shall not be measured for payment nor paid for as a separate contract pay item. The removal of any such obstruction shall be included in the cost of other items.

Once the pipe installation has commenced it shall be continued uninterrupted around the clock until the pipe has been installed between the specified limits.

Any pipe damaged during operations shall be removed and replaced by the contractor at his expense.

The pits or trenches excavated to facilitate the operations shall be backfilled immediately after the pipe has been installed.

All pipe shall be constructed to the grades specified on the plans. After completion of the new sanitary sewer line, the contractor shall have the line televised for any irregularities. Variations in grade of more that one quarter (1/4) of the pipe diameter shall be corrected by open trench excavation by the contractor at his expense.

SECTION 17 - TV INSPECTION/CLEANING

17.1 GENERAL: The work required by the project shall consist of furnishing all labor, equipment, materials, plant and supervision; and performing all work necessary to televise the designated sanitary and/or storm sewer lines, manholes, etc., all in accordance with the Technical Specifications. The work shall consist of, but not necessarily be limited to, performing the following work tasks where specified:

Sewer Line Cleaning

Sewer Flow Control

Television Inspection

Sewer line cleaning shall be performed with hydraulically propelled equipment, high velocity jet, mechanically operated cleaning equipment (bucket type) or root cutting equipment. Section of equipment shall be based on field conditions such as access to manholes, type and quantity of debris to be removed, size of sewer, depth of flow, etc.

17.2 CONSTRUCTION METHODS – SANITARY SEWER CLEANING

17.2.1 Intent: The intent of sanitary sewer cleaning is to remove foreign materials from the lines and manholes and restore the sanitary sewer as closely as possible to original conditions. Since the success of the other phases of work depends a great deal on the cleanliness of the lines, the importance of this phase of the operation is emphasized. It is recognized that there are some conditions such as broken or collapsed pipe and major blockages that prevent cleaning from being accomplished or where additional damage would result if cleaning were attempted or continued. Should such conditions be encountered, the Contractor will not be required to clean those specific manhole sections. If in the course of normal cleaning operation, damage to the sewer main does result from preexisting and unforeseen conditions such as broken pipe, the Contractor will not be held responsible.

17.2.2 Cleaning Equipment:

17.2.2.1 Hydraulically Propelled Equipment: The equipment used shall be of a movable dam type and be constructed in such a way that a portion of the dam may be collapsed at any time during the cleaning operation to protect against flooding of the sewer. The movable dam shall be equal in diameter to the pipe being cleaned and shall provide a flexible scraper around the outer periphery to insure removal of grease. If sewer cleaning balls or other equipment which cannot be collapsed are used, special precautions to prevent flooding of the sewers and public or private property shall be taken.

17.2.2.2 High-Velocity Jet (Hydro cleaning) Equipment: All high-velocity, sewer cleaning equipment shall be constructed for ease and safety of operation.

The equipment shall have a selection of two or more high-velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all size lines designated to be cleaned. Equipment shall also include a high-velocity gun for washing and scouring manhole walls and floor. The gun shall be capable of producing flows from a fine spray to a solid stream. The equipment shall carry its own water tank, auxiliary engines, pumps, and hydraulically driven hose reel.

17.2.2.3 Mechanically Powered Equipment: Bucket machines shall be in pairs with sufficient power to perform the work in an efficient manner. Machines shall be belt operated or have an overload device. Machines with direct drive that could cause damage to the pipe will not be allowed. A power rodding machine shall be either a sectional or continuous rod type capable of holding a minimum of 750 feet of rod. To insure safe operation, the machine shall be fully enclosed and have an automatic safety clutch or relief valve.

17.2.2.4 Root Cutting Equipment: Root cutters shall be of a movable type and operate in such a way as to not damage the inside of the sewer line or service taps. A camera shall be propelled through the service line behind the cutter which will allow for monitoring of the cutter. The cutter shall be able to be operated from outside the sewer line.

17.2.3 Cleaning Precautions: During sewer cleaning operations, satisfactory precautions shall be taken in the use of cleaning equipment. When hydraulically propelled cleaning tools, high velocity jets (which depend upon water pressure to provide their cleaning force) or tools which retard the flow in the sewer line are used, precautions shall be taken to insure that the water pressure created does not damage or cause flooding of public or private property being served by the sewer. When possible, the flow of sewage in the sewer shall be utilized to provide the necessary pressure for hydraulic cleaning devices. When additional water from fire hydrants is necessary to avoid delay in normal work procedures, the water shall be conserved and not used unnecessarily. When placing any hoses connected to a fire hydrant in a manhole, an air gap must be maintained between the end of the nozzle on the hose and the fluid level in the manhole. No fire hydrant shall be obstructed in case of a fire in the area served by the hydrant.

17.2.4 Sewer Cleaning: The designated sewer manhole sections shall be cleaned using hydraulically propelled, high-velocity jet, or mechanically powered equipment. Selection of the equipment used shall be based on the conditions of lines at the time the work commences. The equipment and methods selected shall be satisfactory to the Owner. The equipment shall be capable of removing dirt, grease, rocks, sand and other materials and obstructions from the sewer lines and manholes. If cleaning of an entire section cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole and cleaning

again attempted. If, again, successful cleaning cannot be performed or the equipment fails to traverse the entire manhole section, it will be assumed that a major blockage exists and the cleaning effort shall be abandoned.

17.2.5 Root Removal: Roots shall be removed in the designated sections where root intrusion is a problem. Special attention should be used during the cleaning operation to assure almost complete removal of roots from the inside of the sewer line. Any roots which could prevent a television camera from properly televising a sewer main shall be cut by means of a cutting tool designed for this purpose. Procedures may include the use of mechanical equipment such as rodding machines, bucket machines and winches using root cutters and porcupines, and equipment such as high-velocity jet cleaners.

17.2.6 Material Removal: All sludge, dirt, sand, rocks, grease, and other solid or semisolid material resulting from the cleaning operation shall be removed at the downstream manhole of the section being cleaned. Passing material from manhole section to manhole section, which could cause line stoppages, accumulations of sand in wet wells, or damage pumping equipment shall not be permitted.

17.2.7 Disposal of Materials: All solids or semisolids resulting from the cleaning operations shall be removed from the site and disposed of at a site designated by the Contractor. The designated disposal site must be approved by the Owner before disposal of solids or semisolids is allowed. Arrangements will be made by the Owner for the Contractor to dispose of solids or semisolids at the City landfill without a charge to the Contractor. All materials shall be removed from the site no less often than at the end of each workday. Under no circumstances will the Contractor be allowed to accumulate debris, etc., on the site of work beyond the stated line, except in totally enclosed containers and as approved by the Owner.

17.2.8 Final Acceptance: Acceptance of sewer line cleaning shall be made upon the successful completion of the television inspection and shall be to the satisfaction of the Owner. If TV inspection shows the cleaning to be unsatisfactory, the Contractor shall be required to reclean and re-inspect the sewer line until the cleaning is shown to be satisfactory. In areas where television inspection is not performed, the Owner may require the Contractor to pull a double squeegee (with each squeegee the same diameter as the sewer) through each manhole section as evidence of adequate cleaning.

Sanitary Sewer Cleaning shall be considered incidental and no payment will be made for this item.

17.3 CONSTRUCTION METHODS - SEWER FLOW CONTROL

When sewer line depth of flow at the upstream manhole of the manhole section being worked is above the maximum allowable for television inspection, the flow shall be reduced to the level

shown below by operation of pump stations, plugging or blocking of the flow, or by pumping and bypassing of the flow as specified.

Depth of flow shall not exceed that shown below for the respective pipe sizes as measured in the manhole when performing television inspection.

Maximum Depth of Flow	Television Inspection
6" - 10" Pipe	20% of pipe diameter
12" - 24" Pipe	25% of pipe diameter
27" & up Pipe	30% of pipe diameter

Maximum Depth of Flow	Joint Testing/Sealing
6" - 12" Pipe	25% of pipe diameter
15" - 24" Pipe	30% of pipe diameter
27" & up Pipe	35% of pipe diameter

Plugging or Blocking: A sewer line plug shall be inserted into the line upstream of the section being worked. The plug shall be so designed that all or any portion of the sewage can be released. During TV inspection, testing and sealing operations, flow shall be reduced to within the limits specified above. After the work has been completed, flow shall be restored to normal.

Pumping and Bypassing: When pumping and bypassing is required, the Contractor shall supply the pumps, conduits, and other equipment to divert the flow of sewage around the manhole section in which work is to be performed. The bypass system shall be of sufficient capacity to handle existing flow plus additional flow that may occur. During a rainstorm, the contractor shall have all of his equipment removed from the sanitary sewer line. The Contractor will be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system. If pumping is required on a 24-hour basis, engines shall be equipped in a manner to keep noise to a minimum.

Flow Control Precautions: When flow in a sewer is plugged, blocked, or bypassed, sufficient precautions must be taken to protect the sewer lines from damage that might result from sewer surcharging. Further, precautions must be taken to insure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewers involved. The television contractor shall be held liable and responsible for any damage to public or private property that might result from the Contractor's work efforts during the course of the project.

Sewer Flow Control shall be considered incidental and no payment will be made for this item.

17.4 CONSTRUCTION METHODS – TELEVISION INSPECTION

After cleaning, the manhole sections shall be visually inspected by means of closed-circuit television. The inspection will be done one manhole section at a time and the flow in the section being inspected will be suitably controlled as specified under Sewer Flow Control.

The television camera used for the inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of the Owner; and if unsatisfactory, equipment shall be removed and no payment will be made for an unsatisfactory inspection. Any grease, water or other foreign material which causes obscuring of the camera lens will not be considered satisfactory and no payment will be made for any such case.

The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition. In no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation, the television camera will not pass through the entire manhole section, the Contractor shall set up his equipment so that the inspection can be performed from the opposite manhole. If, again, the camera fails to pass through the entire manhole section, the inspection shall be considered complete and no additional inspection work will be required.

When manually operated winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two manholes of the section being inspected to insure good communications between members of the crew.

The importance of accurate distance measurements is emphasized. Measurement for location of defects shall be above ground by means of a meter device. Parking on the cable, or the like, which would require interpolation for depth of manhole, will only be allowed when the manhole section is televised from both manholes surrounding the section. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, or other suitable device, and the accuracy shall be satisfactory to the Owner.

Documentation of the television results shall be as follows:

Television Inspection Logs: Printed location records shall be kept by the Contractor and will clearly show the location in relation to an adjacent manhole of points of significance observed during inspections. Points of significance are locations of service line taps, unusual conditions, roots, storm sewer connections, joint separation, broken pipe, presence of scale and corrosion, sags and or discernible features. These shall be recorded and a copy of such records will be supplied to the Owner.

Videotape Recordings: The Contractor shall provide videotape records for all footages of sewer line televised. The recordings shall be on Maxell XL HIFI cassette video tape or equal as approved by the Owner playable on a VHS video player. The tapes shall become the Owner's and shall be provided to the Owner on not less than a weekly basis. The videotapes shall also be accompanied by a voice over sound track that gives a verbal description of what is being viewed on the videotape. The original videotapes and television inspection logs shall become the property the Owner. In any case when the television camera becomes hung up in the sewer line, it shall be the responsibility of the Contractor to dig up the camera and repair the sewer main at no cost to the Owner. Any areas or utilities disturbed as a result of digging up the television camera shall be restored back to the original conditions or better. Costs for restoring any disturbed areas shall be incurred by the Contractor.

SECTION 18 - MEASUREMENT AND PAYMENT

18.1 GENERAL

For the purpose of payment to the Contractor, the work has been divided into bid items described below. It is the intent of these plans and specifications to define a project complete and in place. Any work necessary to complete the project, and not included in a bid item, will be considered to be incidental and no direct payment will be made, but its cost shall be included in the price bid for the bid item.

Payment will be made at the contract unit price for each item measured as specified below and such payment shall be for compensation for furnishing all plant, labor, equipment, materials and incidentals necessary to complete the project in a workmanlike manner.

18.2 SANITARY SEWER PIPE:

18.2.1 METHOD OF MEASUREMENT: Sanitary sewer pipe shall be measured along the centerline of the sewer actually laid. No deductions will be made for wye branches or fittings. Also no deductions will be made for manholes for sewers 36-inch in diameter and smaller. Deductions will be made for special structures unless otherwise shown on the plans. However, no deduction will be made for sewer pipe inside encasements, bores without encasements and aerial crossings. Placement of bedding and initial backfill will be considered incidental work and included in this item. Trench and backfill will be paid for under another item.

18.2.2 BASIS OF PAYMENT: Sanitary sewer pipe, measured as provided above, will be paid for at the contract unit price for:

Sanitary Sewer Pipe (PVC)	Linear Foot
Sanitary Sewer Pipe (D.I.)	Linear Foot

Which such payment shall constitute full compensation for all equipment, tools, labor and incidentals necessary to complete the work as specified.

18.3 TRENCH AND BACKFILL:

18.3.1 METHOD OF MEASUREMENT: Trench and backfill shall be measured along the centerline of pipe sewer actually laid. Trench and backfill will not be measured through areas that are bored. The depth of trench and backfill will be measured from the existing natural grade to the sewer pipe flow line. Reserving and replacing topsoil will be considered incidental work and be included in this item.

18.3.2 BASIS OF PAYMENT: Trench and backfill, measured as provided above, will be paid for at the contract unit price for:

Trench and Backfill	Linear Foot

Which such payment shall constitute full compensation for all equipment, tools, labor and incidentals necessary to complete the work as specified.

18.4 STANDARD DEPTH MANHOLE:

18.4.1 METHOD OF MEASUREMENT: Standard depth manhole shall be measured per each manhole satisfactorily constructed or installed in accordance with the plans and specifications. Payment for this item will include the frame and cover and manhole depths to eight (8) feet. Manhole depth will be measured from the top of frame elevation to the outlet lead flow line elevation. "Manhole Extra Depth" will be used to pay for the manhole depth in excess of eight (8) feet.

18.4.2 BASIS OF PAYMENT: Measured as provided above, will be paid for at the contract unit price for:

Standard Depth Manhole	Each
Manhole Extra Depth	V.F.

Which such payment shall constitute full compensation for all equipment, tools, labor and incidentals necessary to complete the work as specified.

18.5 ADJUST EXISTING MANHOLE TO GRADE

18.5.1 METHOD OF MEASUREMENT: The adjustment of an existing manhole to grade will be measured either by the vertical ft. of height the completed manhole has been raised or lowered; or by the number of manholes adjusted to grade. Measurement shall include removal and re-setting of the existing frame and cover.

18.5.2 BASIS OF PAYMENT: Adjust existing manhole to grade measured as provided above and as specified in the Contract Documents will be paid for at the contract unit price for:

Adjust Existing Manhole to Grade	V.F.
Adjust Existing Manhole to Grade	Each

Which such payment shall constitute full compensation for all equipment, tools, labor and incidentals necessary to complete the work as specified.

18.6 REMOVE EXISTING MANHOLE

18.6.1 METHOD OF MEASUREMENT: Remove existing manhole shall be measured per each manhole satisfactorily removed in accordance with the plans and specifications. This item will include all excavation backfill, manhole demolition, salvaging manhole frame and cover, deliver of salvaged item to City of Lawton Public Works Yard, concrete, etc. for a complete item.

18.6.2 BASIS OF PAYMENT: Remove Existing manhole, measured as provided above, will be paid for at the contract unit price for:

Remove Existing Manhole	Each

Which such payment shall constitute full compensation for all equipment, tools, labor and incidentals necessary to complete the work as specified.

18.7 ABANDON MANHOLE:

18.7.1 METHOD OF MEASUREMENT: Abandon manhole shall be measured per each manhole satisfactorily abandoned in accordance with the plans and specifications. This item will include all excavation, backfill, manhole, frame and cover, deliver of salvaged item to City of Lawton Public Works Yard, concrete, etc. for a complete item.

18.7.2 BASIS OF PAYMENT: Abandon manhole, measured as provided above, will be paid for at the contract unit price for:

Abandon Manhole	Each

Which such payment shall constitute full compensation for all equipment, tools, labor and incidentals necessary to complete the work as specified.

18.8 ASPHALT PAVING REMOVAL/REPLACEMENT

18.8.1 METHOD OF MEASUREMENT: Asphalt paving removal/replacement will be measured by square yards on the ground surface of asphalt used for satisfactorily constructed street or parking area according to the plans and these specifications. Payment will be made at the unit price bid for square yards of asphalt placed. The unit price payment shall be considered full compensation for all materials, equipment, tools, labor and incidentals necessary to complete the work specified.

18.8.2 BASIS OF PAYMENT: Asphalt paving removal/replacement will be measured as provided above and will be paid for at the contract unit price for:

Asphalt Paving Removal/Replacement Square Yards

Which such payment shall constitute full compensation for all equipment, tools, labor and incidentals necessary to complete the work as specified.

18.9 CONCRETE PAVING REMOVAL/REPLACEMENT

18.9.1 METHOD OF MEASUREMENT: Concrete paving removal/replacement will be measured by square yards on the ground surface of concrete used for satisfactorily constructed street, curb and gutter and/or drainage swale according to the plans and these specifications. Payment will be made at the unit price bid for square yards of concrete placed. The unit price payment shall be considered full compensation for all materials, equipment, tools, labor and incidentals necessary to complete the work specified.

18.9.2 BASIS OF PAYMENT: Concrete paving removal/replacement will be measured as provided above and will be paid for at the contract unit price for:

Concrete Paving Removal/Replacement Square Yards

Which such payment shall constitute full compensation for all equipment, tools, labor and incidentals necessary to complete the work as specified.

18.10 RIP-RAP (12")

18.10.1 METHOD OF MEASUREMENT: Rip-rap (12") shall be measured by the square yard of rip-rap (12") satisfactorily constructed in accordance with the plans and specifications. This item will include all excavation. Material and placement of rip-rap (12") to a minimum thickness of 24" at locations shown on as directed by the Engineer.

18.10.2 BASIS OF PAYMENT: Rip-rap (12") measured as provided above will be paid for at the contract price for:

Rip-rap (12") Square Yard

Which such payment shall constitute full compensation for all equipment, tools, labor and incidentals necessary to complete the work as specified.

18.11 4" SEWER LINE

18.11.1 METHOD OF MEASUREMENT: 4" sewer service line will be measured by the linear foot of line satisfactorily constructed in accordance with the plans and these specifications. Measurement shall include all excavation, backfill, pipe, bedding and fittings as required to connect to an existing service line.

18.11.2 BASIS OF PAYMENT: 4" sewer service line measured as provided above, will be paid at the contract unit price for:

4" Sewer Service Line L.F.

Which such payment shall constitute full compensation for all equipment, tools, labor and incidentals necessary to complete the work as specified.

18.12 4" SEWER SERVICE CONNECTION

18.12.1 METHOD OF MEASUREMENT: Service connections shall be measured per each connection satisfactorily installed in accordance with the plans and specifications. This item will include the sewer pipe tap, tapping saddle, new service line fittings and pipe as required up to 10 L.F., connection to existing service line with neoprene fittings, trench, backfill, etc. for complete installation.

18.12.2 BASIS OF PAYMENT: Service connection, measured as provided above, will be paid for at the contract unit price for:

Sewer Service Connection Each

Which such payment shall constitute full compensation for all equipment, tools, labor and incidentals necessary to complete the work as specified.

18.13 GAS METER RELOCATION

18.13.1 METHOD OF MEASUREMENT: Gas meter relocation will be measured by each gas meter properly relocated in accordance with the plans and these specifications including up to 20 L.F. of gas service line and fittings. Payment will be made at the unit price bid per gas meter relocated. The unit price payment shall

be considered full compensation for all materials, equipment, tools, labor and incidentals necessary to complete the work specified.

18.13.2 BASIS OF PAYMENT: Gas meter relocation will be measured as provided above and will be paid for at the contract unit price for:

Gas Meter Relocation Each

Which such payment shall constitute full compensation for all equipment, tools, labor and incidentals necessary to complete the work as specified.

18.14 FENCE REMOVAL/REPLACEMENT

18.14.1 METHOD OF MEASUREMENT: Fence removal/replacement will be measured by the lineal foot of existing fencing that is removed and replaced in accordance with the plans and these specifications. Payment will be made at the unit price bid per lineal foot of fencing that is removed and replaced. The unit price payment shall be considered full compensation for all materials, equipment, tools, labor and incidentals necessary to complete the work specified.

18.14.2 BASIS OF PAYMENT: Fencing will be measured as provided above and will be paid for at the contract unit price for:

Fence Removal/Replacement Lineal Foot

Which such payment shall constitute full compensation for all equipment, tools, labor and incidentals necessary to complete the work as specified.

18.15 TEMPORARY FENCING

18.15.1 METHOD OF MEASUREMENT: Temporary fencing will be measured by the lineal foot of fencing satisfactorily constructed or installed in accordance with the plans and specifications. Measurement will include all fence, post, connections, tees, labor, etc. required for a complete installation.

18.15.2 BASIS OF PAYMENT: Temporary fencing will be measured as provided above and will be paid for at the contract unit price for:

Temporary Fencing Lineal Foot

Which such payment shall constitute full compensation for all equipment, tools, labor and incidentals necessary to complete the work as specified.

18.16 PIPE BURSTING

18.16.1 METHOD OF MEASUREMENT: "Pipe Bursting" shall be measured along the centerline of the sewer actually completed. Bursting of the existing sewer line, installation of the new sewer line and all other work shall be included. Measurement will include all pipe, labor, etc. required for a complete installation.

18.16.2 BASIS OF PAYMENT: "Pipe Bursting" shall be measured as provided above and will be paid for at the contract unit price for:

8” Pipe Bursting (Clay/Cement)	Lineal Foot
8” Pipe Bursting (PVC)	Lineal Foot
8” Pipe Bursting (Cast Iron)	Lineal Foot
10” Pipe Bursting (Clay/Cement)	Lineal Foot
10” Pipe Bursting (PVC)	Lineal Foot
10” Pipe Bursting (Cast Iron)	Lineal Foot

Which such payment shall constitute full compensation for all materials, including pipe, equipment, tools, labor and incidentals necessary to complete the work as specified for each size.

TECHNICAL SPECIFICATIONS

SECTION 0400

BORING AND ENCASEMENT

SECTION 0400

BORING AND ENCASEMENT

1.0 Description

Where shown on the plans or at locations specified in the field by the City Engineer, the Contractor shall construct the utility lines by means of horizontal boring. Also some creek or channel crossings may require encasement of the utility line without the need for boring. This specification shall also cover those types of crossings.

2.0 Materials

2.1 Steel Encasement: Steel encasement pipe shall be welded steel pipe conforming to ASTM A-139 Grade B, or approved equal. The pipe shall be coated with a minimum of 2 mils of an approved bituminous coating or coal tar primer. The sizes of the encasement shall be as shown on the plans. If no size is given on the plans, the size (inside diameter) to be used shall be the outside bell diameter of the carrier pipe plus two (2”) inches unless specified otherwise herein.

2.2 All steel encasement pipe shall have a minimum wall thickness corresponding to standard weight pipe, i.e. 0.375 in. wall thickness for 12 in. and larger pipe, unless specified otherwise.

3.0 Construction Methods and Equipment

3.1 Boring: Bores shall be made at the locations shown on the construction drawings. All excavation shall be a minimum of 24 inches from back of curb or edge of pavement. During boring, proper alignment and grade shall be maintained by first drilling a pilot hole on the centerline of the proposed bore and checking the pilot hole for correct alignment and grade. If the pilot hole does not match the proposed alignment and grade within tolerances allowed by the City Engineer, the Contractor shall offset the boring machine a nominal distance and bore other pilot holes until satisfactory compliance with the alignment and grade criteria is reached. As an alternative, boring may be made with guided boring equipment that contain provisions for checking and keeping the bore on line and simultaneously placing the encasement pipe. The borehole shall not be more than 2" larger than the outside diameter of the casing or of the carrier pipe if casing is not required.

3.2 Steel Encasement: Steel encasement shall be required only at those locations specified on the construction drawings or as required by the City Engineer, such as arterial street crossings. After boring, the steel encasement pipe shall be carefully inserted into the tunnel left by the boring machine.

3.3 Utility Carrier Pipe: After completion of the bore and placement of the encasement, if required, the utility carrier pipe with joint restraints shall be inserted in the bore or casing. Carrier pipe with interior/integral joint restraints shall be pulled into the bore or casing, or carrier pipe with exterior joint restraints that meet the manufacturers recommendations may be pushed into the casing. If a casing is used, the utility pipe shall be blocked with cradles to center the pipe inside the casing and keep it from coming into contact with the casing. Casing spacers shall be High Density Polyethylene (HDPE) projection type or an approved equal and shall be installed as recommended by the manufacturer. Steel components, such as nuts, bolts, banding straps, etc., shall be constructed of stainless steel. Each end of the casing shall be sealed with a neoprene or rubber end seal attached with stainless steel bands.

4.0 Measurement and Payment

4.1 Method of Measurement: Bores shall be measured by the lineal foot of bore complete and accepted as set forth on the plans and in these specifications.

4.2 Basis of Payment: Payment shall include all equipment, labor and material required to complete the encased bore or unencased bore as specified and as directed by the City Engineer. All bores shall be unencased unless casing is specified. The portion of the casing that is placed in a trenched section will be paid for as Casing (Only). Accepted bore/casing shall be paid at the contract unit price per lineal foot of the size and type of bore and/or casing set forth:

__" WL Bore w/Casing	Lineal Foot
__" WL Bore w/o Casing	Lineal Foot
__" WL Casing (Only)	Lineal Foot

TECHNICAL SPECIFICATIONS

SECTION 0500

GRASSING

SECTION 0500

GRASSING

1.0 Description

This work consists of establishing a viable stand of bermuda grass according to these specifications at locations specified in the contract and by the Engineer.

2.0 Materials

2.1 Materials shall meet the requirements of section 735 of the Standard Specifications for Highway Construction, Oklahoma Department of Transportation, 2009 Edition.

2.2 If hydro-mulching is done, the following materials and rates shall be used:

Per Acre:		
2000	lbs	virgin wood cellulose fiber
600	lbs	10-20-10 fertilizer
60	lbs	hulled bermuda grass seed
4	in	topsoil

3.0 Construction Methods and Equipment

3.1 Construction methods and equipment shall conform to the requirements of Section 230 of the ODOT Standard Specifications.

3.2 The Contractor shall provide a topsoil base at least 4" thick for all grass. Topsoil may be salvaged from the construction site or trucked in. The cost of salvaging topsoil shall be included in the price bid for grassing.

3.3 The Owner shall provide all water necessary for this purpose. However, the Contractor must provide all labor, equipment, etc. for applying the water. In order to keep accurate city water usage records, the Contractor will obtain a water meter from the City and submit a deposit for said meter, returnable upon completion of the project. This meter shall be used exclusively on this project.

3.4 Solid slab may be installed throughout the year. Sprigging or hydro-mulching shall be accomplished only from April 1 through September 30 each year. The Engineer shall issue approval prior to the start of this work.

3.5 Areas that do not produce a satisfactory stand of grass, as determined by the Engineer, shall be regrassed at no additional cost to the Owner. All areas disturbed that are not necessary for construction of this project or areas disturbed

in excess of that required for normal construction (as determined by the Engineer), shall be grassed at the Contractor's cost in accordance with these specifications.

3.6 Seeded areas shall be protected from damage or disturbance after planting operations are complete. Damage resulting from erosion, gullies, washouts, or other causes shall be repaired by filling with topsoil, tamping, re-fertilizing, and reseeding by the Contractor at his expense, if such damage occurs prior to final payment for grassing operation or acceptance of the project, whichever is later.

3.7 Ponding will be eliminated. Debris and stones will be removed.

4.0 Measurement and Payment

4.1 Method of Measurement: Grassing will be measured by the square yard of surface area for all disturbed areas that the Contractor has established a healthy stand of grass satisfactory to the Engineer. This shall be full compensation for salvaged and additional topsoil required, if any, sod, mulch, fertilizer, seed, related items and water. Water will be provided to the Contractor at no cost to the Contractor.

4.2 Basis of Payment: The Owner shall retain an amount equal to 50% of the amount due the Contractor for this item of work in addition to the amount indicated for grassing, until acceptance by the Engineer. Accepted quantities will be paid for at the contract unit price for Grassing which shall be mulch sod, mulch sprigging or sprigging, **or** Grassing (solid slab sod) which shall be solid slab sodding only.

Grassing	Square Yard
Grassing (solid slab sod)	Square Yard

TECHNICAL SPECIFICATIONS

SECTION 0600

CONSTRUCTION SIGNING, BARRICADES, AND LIGHTS

SECTION 0600

CONSTRUCTION SIGNING, BARRICADES, AND LIGHTS

1.0 Description

The Contractor shall provide the construction signing, barricades, and lights needed to protect the public and as required by the Engineer.

2.0 Materials

Construction signing, barricades, and lights shall conform to the latest edition of the "Manual of Uniform Traffic Control Devices" (MUTCD), the Oklahoma Department of Highways Construction and Maintenance Barricading, or as approved by the Traffic Engineer.

3.0 Execution

3.1 Signs, barricades, and lights shall be installed in compliance with the MUTCD. The Contractor shall submit a plan for construction signing at the pre-construction conference for approval by the Engineer.

3.2 The Contractor`s schedule shall afford maximum possible access to local property owners.

3.3 The Contractor will be responsible for the control of traffic within his work area. The Contractor shall furnish and erect all signs, barricades, lights, and other traffic control devices required to control traffic and maintain said devices during the duration of construction unless otherwise directed by the Engineer.

3.4 Maintenance of Traffic:

A. The Contractor shall provide reasonable access to the affected residents during construction.

B. The roadway, while undergoing improvements, shall be kept open to traffic by the Contractor as possible. When so provided on the plans, traffic will be detoured over an approved route. The Contractor shall keep the portion of the project being used by public traffic (through or local) in a condition such that traffic is adequately accommodated. He shall also provide and maintain, in a safe condition, intersections with streets, residential driveways, garages.

3.5 Traffic Control Signs. All existing stop signs, yield signs, or other traffic control signs which impede construction shall be removed and relocated as directed by the

Engineer. When reinstalling, the Contractor shall remove existing concrete from sign and reset the sign with new concrete. It shall be the Contractor's responsibility to arrange for prior inspection by the city of all city-owned signs scheduled for removal. If the Contractor fails to notify the City prior to sign removal, it will be assumed such signs were in good condition at the time of removal.

3.6 Should the Contractor desire to completely close the roadway within the work area, he shall submit a written request for approval to the Engineer. The request shall contain the date and duration of closing. The Contractor shall coordinate roadway closings with the County and City officials and shall properly notify all agencies operating emergency vehicles. As a minimum, the Contractor shall provide written notice 48 hours in advance of approved closings to the following individuals or agencies:

Chief, Lawton Police Department
Chief, Lawton Fire Department
Public Works Director/City Engineer
All privately owned ambulance companies
Others (list to be provided by Engineering Division)

3.7 All signs damaged or lost by the Contractor shall be replaced by him at no cost to the City. Materials shall be approved by the Engineer. All post-mounted signs shall be reset in concrete and at the proper height and location as directed by the Engineer.

4.0 Measurement and Payment

4.1 Method of Measurement: Construction signing, barricades, and lights will not be measured for payment.

4.2 Basis of Payment: No direct payment for the work described under this section will be made. The Contractor shall bear all expense of maintaining traffic over the section of road undergoing improvement and of constructing and maintaining such approaches, crossing, intersections and other features as may be necessary without direct compensation. Contractor shall include consideration for this item in the bid price for other scheduled items of the contract.

TECHNICAL SPECIFICATIONS

SECTION 0700

SUBMITTALS

SECTION 0700

SUBMITTALS

Description

This section covers the requirements for submittal data for equipment and non-equipment items to be furnished on this project.

General Execution

The Contractor shall submit to the City Engineer, with such promptness as to cause no delay in his own work or in that of any other contractor, five (5) copies of all shop drawings, manufacturer's catalog sheets, brochures, performance charts, diagrams, schedules, and other standard descriptive data required for the work. The City Engineer shall review them with reasonable promptness, making any necessary corrections. If the submittals indicate variances from the requirements of the contract, the Contractor shall make specific mention of such variation in his letter of transmittal in order that, if acceptable, suitable action may be taken for proper adjustment. Otherwise, the Contractor shall not be relieved of the responsibility of executing the work in compliance with the contract even though the submittals have been reviewed.

Form of Submittals

The submittals shall be numbered consecutively and shall present the following data as applicable:

a) Name of project
b) Date of submittal
c) Reference to applicable section of specifications
d) Applicable Standards
e) Identification of revisions on re-submittals
f) Kinds of materials and finishes
g) All working and erection dimensions and clearances
h) All arrangement and section views
i) Connections between functional parts

The Project Engineer may decline to consider any submittal that does not contain complete data on the work and full information on related matters.

Submittal Procedure

The procedure for review of submittals shall be as follows:

1) The Contractor shall submit five (5) copies of the submittal to the City Engineer for his approval. The submittal shall be accompanied by a letter of transmittal,

containing the name of the project, the name of the Contractor, the number of the submittals, titles and other requirements.

2) When a submittal is satisfactory to the City Engineer, all five (5) copies will be stamped or marked "Approved" or "Approved as Noted", be dated and three (3) copies will be returned to the Contractor by letter.

3) Should a submittal be unsatisfactory to the City Engineer, he will stamp thereon "Revise and Resubmit" and will return three (3) copies to the Contractor with the necessary corrections and changes indicated. The Contractor must make such corrections and changes and submit at least five (5) copies of the re-submittal for approval. The Contractor shall review and resubmit as required by the Project Engineer, until acceptance is obtained.

4) The Contractor shall allow sufficient time for preliminary review, corrections and resubmission, and final review of all submittals. The Contractor shall allow not less than fourteen (14) days for each review. Submittals critical to job progress, when requested in writing by the Contractor, will be given priority review.

List of Required Submittals

1. List of all subcontractors
2. Product data on service line and fittings, meters and meter boxes.
3. Product data and certifications on Ductile Iron Pipe, or PVC Pipe and fittings and accessories
4. Product data on butterfly or gate valves and valve boxes
5. Product data on tapping valves, sleeves and valve boxes
6. Product data on fire hydrants
7. Data on waterline or sewerline encasement
8. Copies of all test reports
9. Project Construction Schedule
10. Construction Signing and Traffic Control Plan
11. Manufacturer's data on non-woven geotextile fabric
12. Manufacturer's data on separator fabric
13. Manufacturer's data on the type of joint sealer
14. Manufacturer’s data on bituminous primer and binder
15. Test reports on the following materials:
    1. Crushed Stone Pipe Bedding
    2. Cover Aggregate and Base Material
    3. Portland Cement Concrete
    4. Asphalt Concrete
16. Product data on drainage structure fittings (i.e., grates, manholes, inlets, etc.)
17. Manufacturer's data on sanitary sewer manhole frame/cover.

TECHNICAL SPECIFICATIONS

SECTION 0800

PROJECT MANAGEMENT

SECTION 0800

PROJECT MANAGEMENT

1.0 Description

This section covers project management -- individual authorities, construction scheduling, payments, inspections, and project signs.

2.0 Authorities, Duties, Responsibilities

2.1 Project Engineer.

All work shall be done to the satisfaction of the Engineer. He shall decide all questions which arise as to quality and acceptability of materials furnished and work performed, rate of progress of the work, interpretation of the plans and specifications, acceptable fulfillment of the contract, compensation, mutual rights between contractors under these specifications and the suspension of work. He shall determine the amount and quality of the work performed and materials furnished and his decisions and estimates shall be final. His estimates, in such event, shall be condition precedent to the right of the Contractor to receive money due under the contract.

2.2 Inspectors.

A. Inspectors, designated by and acting under the direction of the Owner/Engineer, shall have the authority to inspect all work done and all materials furnished. Such inspection may extend to all or any part of the work and to the preparation, fabrication or manufacture of the materials to be used. He is authorized to call to the attention of the Contractor any failure of the work or materials to conform to the plans, specifications and contract documents. He shall have the authority to reject materials or suspend the work until any situation at issue can be referred to and decided by the Engineer. These inspections are for assurance on behalf of the Owner and do not relieve the Contractor from the responsibility of controlling the quality of work or materials furnished under this contract.

B. The Inspector is not authorized to revoke, alter or waive any requirements of the plans and specifications. He shall not act as foreman, perform other duties for the Contractor, or interfere with the management of the Contractor's work. Any advice that the Inspector may give the Contractor shall not be construed as binding the Engineer in any way nor waiving any of the terms of the Contract.

C. If the Contractor refuses to suspend operations on verbal order of the Inspector, a written order will be presented to the Contractor by the Inspector giving the reason for suspension of work. After placing the order in the hand of the man-in-charge, the Inspector shall immediately leave the job. Work performed during the absence of the Inspector will not be accepted nor paid for, and shall be removed and replaced.

2.3 Contractor.

The Contractor shall become familiar with the project conditions. The Contractor is responsible for controlling all aspects of work and construction and the quality of materials and construction on the jobsite according to the Specifications. Quality Assurance inspections by the Engineer and Inspectors, and visits by other representatives of the Owner shall not relieve the Contractor from complying with the requirements of the Contract.

3.0 Project Construction Schedule

3.1 Prior to the start of construction, the Contractor shall submit to the City six (6) copies of a project construction schedule and shall not begin work until written approval from the City is received. The project completion schedule shall include anticipated time frames for each activity for each project and shall be of a "time grid diagram" format.

3.2 No progress payments will be made without an approved schedule.

4.0 Prosecution of Construction

4.1 The Contractor will, unless otherwise approved by the Engineer, conduct construction on this project during normal working hours as defined below:

A. Normal workday shall mean normal eight-hour working day.

B. Normal workweek shall mean the forty-hour week encompassing the five-eight-hour days, Monday through Friday.

C. Holidays to be observed and not to be included into the normal workweek will be:

New Years Day	January 1st
Memorial Day	Observed the last Monday in May
Independence Day	July 4th
Labor Day	1st Monday in September
Thanksgiving Day	4th Thursday in November
Christmas Day	December 25th

D. Any of the above dates falling on Sunday shall be observed on the following Monday.

4.2 All work contemplated to be done which will not be in accordance with the normal hours will require prior approval of the Engineer. Work, which is of necessity performed at times other than normal working hours, will not require prior approval unless construction scheduling can be arranged to prevent such conflict of time requirements. The Engineering Division shall receive a request from the contractor desiring to work weekends by noon on Thursday. If possible, Engineering will approve such work on a case basis and as set forth in Paragraph 4.4.

4.3 All work performed other than the normal working hours, whether scheduled or required, will in no way increase the cost to the Owner for the performance of such work.

4.4 The Contractor shall reimburse the City for any overtime inspection services performed on this project. Overtime rates shall be time and a half at the hourly wage of the designated City Inspector. For the purpose of this contract, this overtime rate shall be $21.75/hour. Overtime shall be defined as any work that occurs outside the normal workday, or workweek, described above, for this project.

The City will bill the Contractor for said overtime services. Payment shall be paid to the City no later than 30 days from date of billing.

5.0 Project Signs

5.1 This item shall include the construction, painting, erection, maintenance and removal of project signs for the number of signs indicated in the construction documents at the locations specified therein. Upon completion of the project, the signs shall become the property of the Contractor.

5.2 The sign shall be constructed from 3/4 inch exterior grade plywood with one smooth side. Paint for the sign shall be a commercial grade exterior paint that will not show signs of fading during the complete construction period. If the sign fades before completion of the project, the Contractor shall repaint the sign to its original quality. Painting of the sign shall be of professional quality equivalent to commercial sign painting. Mounting posts shall be either redwood or pressure treated pine.

5.3 Mounting posts shall be buried to the depth indicated on the drawing and hand compacted in 6 inch lifts. The sign shall be attached to the mounting posts with 3 bolts per post. Bolts shall be standard grade, minimum 3/8 inch diameter with flat

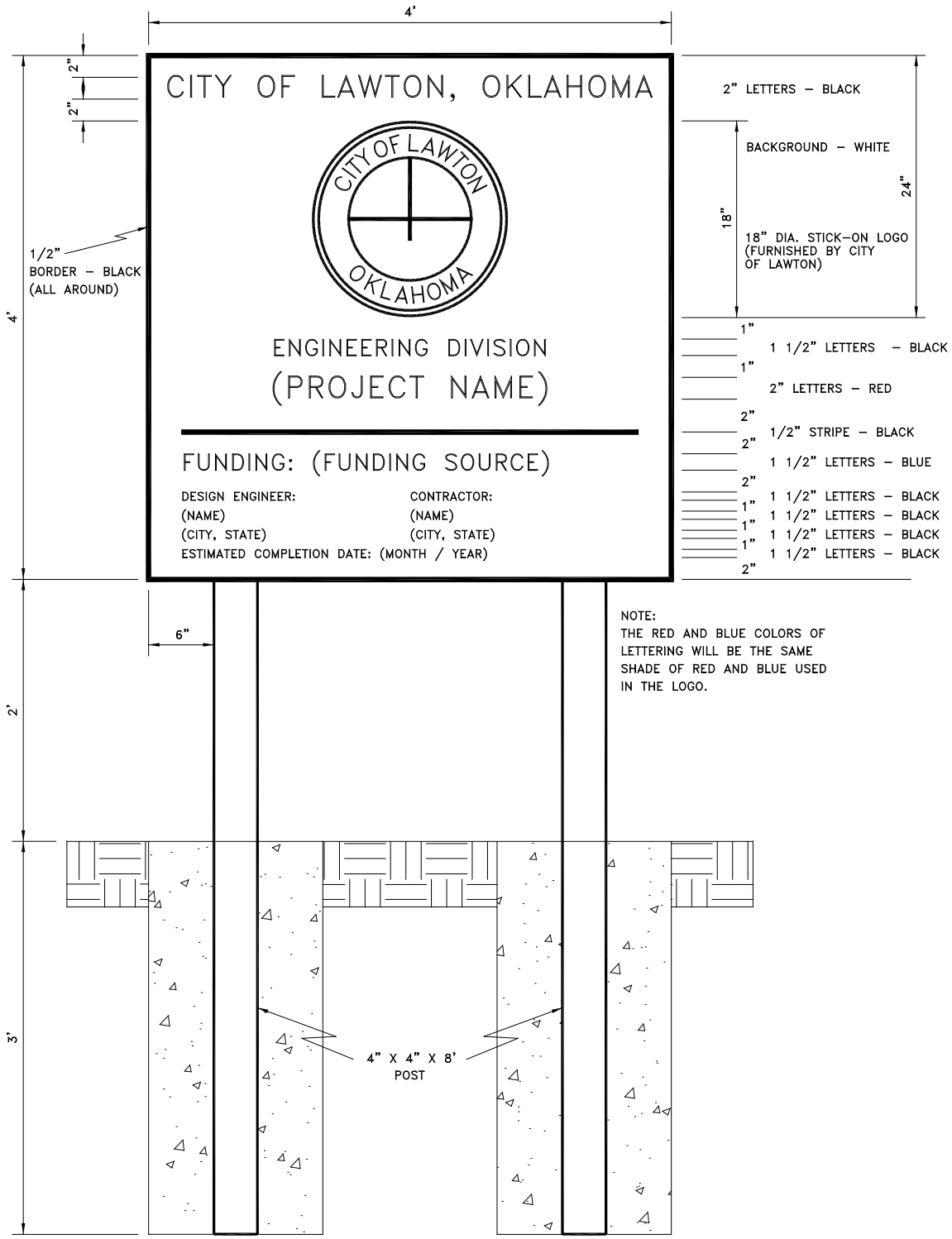
washers on both sides, lock washer and double nuts. Bolts shall be spaced on the sign face between lettering so as not to obscure the wording on the sign and shall be as evenly spaced as possible.

5.4 Sign Data:

Project Name: xxx
Funding: _____
Design Engineer:
Name: City of Lawton - Engineering Division
City, State: Lawton, Oklahoma

NOTE: Two (2) project signs will be required for this project. Location for the installation of these signs will be determined by the Engineer.

5.5 The project sign(s) shall be in place within 14 calendar days from the date the Owner awards the contract and shall remain in place during the entire construction period. The project sign(s) shall be removed within 14 calendar days after the Owner's acceptance of the project improvements.



PROJECT SIGNS

6.0 Payment.

Project Management will not be measured for payment. No direct payment for the work described under this section will be made. Contractor shall include consideration for this item in the bid price for other scheduled items of the contract.