

**SECTION 02310
GRADING**

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Rough and finished site grading of areas disturbed during construction.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.01 ROUGH GRADING

- A. Grade site to prevent surface water from flowing into excavations and trenches.
- B. Maintain existing drainage.
- C. Remove any water accumulated in the excavation by pumping or other approved method.
- D. If sub-grade is altered, restore to its proper bearing capacity at Contractor's expense.

3.02 FINISH GRADING

- A. Grade after all structures and piping are installed.
- B. Grade site to true grades as shown on the plans.
- C. Ensure that drainage is away from structures.
- D. Dress and trim all slopes for a uniform and smooth appearance.

END OF SECTION

SECTION 02315
EXCAVATION, TRENCHING AND BACKFILL

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Excavation, trenching, and backfill necessary for the construction of the facilities as indicated on the plans including, but not limited to water mains and service lines, sewer mains and service lines, concrete manholes, septic tanks, and other structures.

1.02 REFERENCES

- A. Reference latest manual revision or ASTM standard.
- B. Manual on Uniform Traffic Control Devices.
- C. ASTM D698 – Test Method for Laboratory Compaction Characteristic of Soil Using Standard Effort.
- D. ASTM D1556 – Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
- E. ASTM D1557 – Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
- F. ASTM D2922 – Test Method for Density of Soil and Soil Aggregate in Place by Nuclear Methods.
- G. ASTM D2487 – Classification of Soils for Engineering.
- H. ASTM D3017 – Test Method for Water Content of Soil and Rock in Place by Nuclear Methods.

1.03 SUBMITTALS (if required)

- A. Barricades and lights
- B. Shoring
- C. Imported bedding material

1.04 DEFINITIONS

A. Soil Materials as summarized in the following table and defined in ASTM D2321 and ASTM D2487.

Description and Comparison of Soil Material Classifications			
ASTM D2321		ASTM D2487	
Class	Type	USCS Group Symbol	Description
IA	Manufactured aggregates: ¼ to 1 ½ inch open graded, clean.	* None	Closest to “Poorly graded gravel (GP)”
IB	Manufactured aggregates: ¼ to 1 ½ inch dense graded, clean.	* None	Closest to “Poorly graded gravel with sand (GP)”
II	Coarse sands and gravels with maximum particle size of 1 ½ inch clean.	GW	Well-graded gravels and gravel-sand mixtures; little or no fines.
		GP	Poorly graded gravels and gravel sand mixtures little or no fines.
		SW	Well-graded sands and gravelly sands; little or no fines.
		SP	Poorly graded sands and gravelly sands; little or no fines
	Coarse sands and gravels with maximum particle size of 1 ½ inch, borderline clean.	GW-GC SP-SM Etc.	Sands and gravels which are borderline between clean and with fines
III	Fine sand and clayey gravels.	GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
IV	Fine grained soils (inorganic)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays.
V	Organic soils	OL	Organic silts and organic silty clays of low plasticity
		OH	Organic clays of medium to high plasticity, organic silts
		PT	Peat and other high organic soils

* USCS system is limited to naturally occurring soils. Manufactured aggregates not covered.

PART 2 - PRODUCTS

2.01 BEDDING, HAUNCHING AND INITIAL BACKFILL MATERIAL

- A. Class I, Class II or Class III, utilized in accordance with restrictions described in Part 3 - Execution.

PART 3 - EXECUTION

3.01 GENERAL

- A. Conform to recommended safety standards, identified, but not limited to, OSHA 1910 and 1926.
- B. No workers may enter any trench or excavation without the prior approval of the Competent Person on site.
- C. Obtain all permits from appropriate road agency for construction within road right of way.
- D. Repair damage resulting from settlement, slides, cave-ins, water pressure, and other causes.
- E. Provide adequate signs, barricades, fences, and amber lights and take all necessary precautions to protect the work and the safety of the public in all construction areas.
 - 1. Placement of construction signs and barricades shall conform to the "Manual on Uniform Traffic Control Devices."
 - 2. Protect barricades and obstructions at night by amber signal lights that burn from sunset to sunrise.
 - 3. Barricades
 - a. White or with reflective paint to increase their visibility at night.
 - b. Commercial grade.
 - 4. Minimize obstruction to traffic and inconvenience to the public and residents near the work.
- F. Road, Driveway, and Sidewalk Crossing:
 - 1. Comply with all construction and material requirements of roadway authorities having jurisdiction.

2. Maintain one open lane of traffic at all times.

3.02 PREPARATION

A. Layout and Staking:

1. Lines and building location sites established and staked by the Project Officer.
2. Notify the Project Officer at least three business days in advance of the times and places that stakes and benchmarks will be required.
3. Preserve stakes and benchmarks when set. Re-staking for disturbed or displaced stakes shall be at the Contractor's expense.

B. Close no road or street without permission of the proper authority.

C. Keep fire hydrants accessible.

D. Insure that gutters, sewer inlets, drainage, and irrigation ditches are kept functional.

3.03 PROTECTION OF EXCAVATION

A. Provide suitable sheathing, shoring, and/or bracing to:

1. Prevent excavation from caving.
2. Provide safe working conditions to protect workers and property.

B. Repair damage resulting from settlement, slides, cave-ins, and water infiltration at Contractor's expense.

3.04 GENERAL EXCAVATION

A. Excavate by open cut method unless otherwise approved by the Project Officer or as required by applicable encroachment permits.

B. Remove trees and stumps from excavation and site according to Section 02230 – Clearing and Grubbing.

C. Remove and stockpile existing topsoil and suitable backfill.

D. Dispose of unsuitable backfill at the location shown in the Drawings or as approved by the Project Officer.

E. Dispose of excess material, including rock, broken concrete and bituminous materials, debris, at the location shown in the Drawings or as approved by the Project Officer.

3.05 PIPE LINE EXCAVATION

- A. Install facilities as staked unless otherwise approved by Project Officer.
- B. Maintain surface drainage away from trenching or excavation.

3.06 STRUCTURE EXCAVATION

- A. Install facilities as staked unless otherwise approved by Project Officer.
- B. Maintain surface drainage away from excavation.
- C. Maintain a minimum 1-foot clearance between outer surface of structure being installed and wall of excavation unless concrete for walls, floors, and footings are authorized to be placed directly against excavated surfaces.
- D. Restore unauthorized over excavation at Contractor's expense.
 - 1. Restore to proper elevation by filling with approved granular bedding material.
- E. Conform to paragraph 3.08 for backfill around structures unless requirements that are more stringent are indicated in other sections of the specifications.
- F. Compact in 12-inch, loose measure lifts, to a density not less than the density of the surrounding undisturbed soil unless more stringent requirements are indicated in other sections of the specifications.

3.07 TRENCHING

- A. Bottom width: No less than 12 inches or more than 24 inches wider than the outside diameter of the pipe.
- B. Remove large stones, ledge rock, and boulders to provide a 4-inch minimum clearance for all pipe.
- C. Keep walls as nearly vertical as soil conditions permit below the top of pipe.
- D. Trench width above pipe may be as wide as required for shoring and sheeting, and proper installation of work.
- E. Ensure trench is on proper alignment and center pipe within the trench.
- F. Depth: Provide minimum cover identified in the specifications, or to depths shown on plans.
- G. Accurately shape bottom of trench to provide uniform bearing and support for pipe.

H. Excavate bell holes and depressions for joints after bottom of trench is graded.

1. Excavate bell holes and depressions to the minimum length, depth, and width required to make the particular joint.

3.08 BEDDING

A. If existing soil cannot provide uniform, stable bearing support, over-excavate 4 inches below bottom of pipe or structure.

B. Embedment and the backfill up to 6 inches above the pipe crown shall be done in the presence of the Project Officer or his/her representative.

1. Violation of this provision will require the removal and replacement of the backfill at Contractor's expense, even if backfill was correctly placed and compacted.

C. Compact in lifts not to exceed 6 inches in loose measure.

D. Utilize Class I, II, or III materials as appropriate for bedding as listed in the following table.

Use of Soils and Aggregate for Bedding				
	Class IA	Class IB	Class II	Class III
General	Excellent pipe support. Excellent drainage.	Excellent pipe support. Good drainage. Minimizes migration of adjacent material.	Good pipe support. Fair drainage.	Reasonable pipe support. Poor drainage
Compaction	Not required	Not required	Required 85% of Standard Proctor.	Required 90% of Standard Proctor.
Wet Conditions (below current or future water table). Rock Cuts	Acceptable. Must use same material for Haunching.	Acceptable. Must use same material for Haunching.	Acceptable. Clean groups only suitable for drainage blanket.	Not- Acceptable
Dry Conditions	Acceptable	Acceptable	Acceptable	Acceptable

3.09 HAUNCHING AND INITIAL BACKFILL

A. General

1. Provide imported backfill if native soil is unsuitable for haunching and initial backfill.
 - a. Unsuitable native soil is defined as solid or loose rock, dry or frozen lumps greater than ¾ inches in diameter (in any dimension), or containing organic material, or any other material that could damage the pipe.
2. Provide complete and uniform bearing and support for the pipe, including allowance for bell holes, or structure.
3. Work material under and around the pipe to ensure full pipe support.
4. Hand tamp to prevent movement of the pipe during placement of material.
5. Compact in lifts not to exceed 6 inches in loose measure.
6. Avoid contact between the pipe and compaction equipment.

B. Utilize Class I, II, or III materials as appropriate for haunching and initial backfill as listed in the following table. No frozen materials or frozen clods will be permitted.

Use of Soils and Aggregate for Haunching and Initial Backfill				
	Class IA	Class IB	Class II	Class III
General	Excellent pipe support. Excellent drainage. Install to a minimum of 6" above the pipe crown.	Excellent pipe support. Good drainage. Minimizes migration of adjacent material. Install to a minimum of 6" above the pipe crown.	Good pipe support. Fair drainage. Install and compact to a minimum of 6" above the pipe crown.	Reasonable pipe support. Poor drainage. Install and compact to a minimum of 6" above the pipe crown.
Compaction	Not required	Not required	Required 85% of Standard Proctor. 6-inch maximum lifts.	Required 90% of Standard Proctor. 6-inch maximum lifts.
Wet Conditions (below current or future water table). Rock Cuts	Acceptable. Must use same material for Bedding. Extend Haunching to the top crown of the pipe.	Acceptable. Must use same material for Bedding. Extend Haunching to the top crown of the pipe.	Acceptable. Clean groups only suitable for drainage.	Not- Acceptable
Dry Conditions	Acceptable	Acceptable	Acceptable	Acceptable

3.10 FINAL BACKFILL

- A. Provide imported backfill if native soil is unsuitable for final backfill.
 - 1. Unsuitable native soil is defined as solid or loose rock, dry or frozen lumps greater than 6 inches in diameter (in any dimension) or containing organic material, or any other material that could damage the pipe.
- B. Backfill remainder of excavation with native material, free from large clods, large stones, organic material or frost chunks.
- C. Compact in 12-inch, loose measure, lifts to a density not less than the density of the surrounding undisturbed soil.
 - 1. Provide 3 feet minimum of backfill over the pipe before wheel loading the trench.
 - 2. Wheel roll and mound except as otherwise required by the applicable roadway authority or permits.
- D. Backfill and compact around manholes, valve boxes, and other appurtenances in 12-inch, loose measure lifts.
 - 1. Compact with a mechanical tamper to a density not less than 90% of the maximum dry density, determined by ASTM D 698.
- E. Backfill around septic tanks in 18-inch lifts.
 - 1. Compact in a manner that will not produce undue strain on the tank.
 - 2. Compaction may be accomplished with the use of water, provided the material is thoroughly wetted from the bottom up, and the tank is filled with water to prevent floating.
- F. Repair any trenches improperly backfilled or where settlement occurs, then refill and compact.
- G. Restore surface to the required grade and compaction. Conform to Section 02310 – Grading.
- H. Remove all surplus backfill materials to the location shown in the Drawings or as approved by the Project Officer.

3.11 REMOVAL OF NUISANCE WATER

- A. Remove nuisance water entering the trenches. Nuisance water that can be removed through the use of sump or trash pumps is not considered dewatering.

- B. Keep trenches free from water until the facilities are in place, sealed against the entrance of water, and backfill has been placed and compacted above the water level.

3.12 LOCATE EXISTING UTILITIES

- A. Field locate all existing underground utilities.
 - 1. Utilize state “dig-safe,” “OKIE” or “one-call” hotlines.
 - 2. Contact all other utility owners not covered by the state “dig safe” hotlines.

3.13 UTILITY CONFLICTS

- A. Protect existing utilities from damage during excavation and backfilling operations.
- B. Provide temporary support for existing water, gas, telephone, power, or other utility services that cross the trench, until backfilling operations have reached the elevation of the utility being crossed.
 - 1. Compact backfill to 95% of Standard Proctor Density under disturbed utilities.
 - 2. Repair or replace any damaged existing utilities at Contractor’s expense.
- C. Pipe separation.
 - 1. Horizontal Separation from existing or proposed mains:
 - a. Maintain a 10-foot horizontal separation (O.D. to O.D.) for the following:
 - (1) Water mains
 - (2) Sewer mains
 - (3) Storm sewers
 - (4) Raw water lines
 - (5) Oil and gas lines
 - (6) Buried electric cables
 - b. Maintain a 15-foot horizontal separation for the following:
 - (1) All parts of septic tanks
 - (2) Absorption fields
 - (3) Any other sewage treatment and disposal systems.
 - c. Maintain a 50-foot horizontal separation from any gas storage tank.
 - d. Any deviation must be approved in advance by the Project Officer and permitting authority.

2. Vertical Separation

- a. Vertical crossing with the water main above the sewer main:
 - (1) Maintain a minimum 24-inch vertical separation (O.D. to O.D.) for crossing mains.
 - (2) Lay pipe with joints equidistant from the point of crossing.
 - b. Vertical crossing with the water main below the sewer main.
 - (1) Maintain a minimum 24-inch vertical separation (O.D. to O.D.) for crossing mains.
 - (2) No sewer line joint closer than 9 feet from the water line.
 - (3) Provide adequate support to prevent damage to the water main.
 - c. If it is impossible to meet any of the above separation distances and deviations, the following method shall be adhered to:
 - (1) Sewer main shall be constructed to water main pressure pipe standards, and successfully pass a 150-psi pressure test prior to backfilling.
- D. Water and sewer service crossing and parallel installation.
- 1. Maintain a 30-inch horizontal separation from water and sewer services.
 - 2. Maintain a 12-inch vertical separation for crossing water and sewer services.
 - 3. Water service line splices or joints will not be permitted within 10 feet of a sewer line crossing.

3.14 MOVING FENCES AND MINOR STRUCTURES

- A. Remove and reset culverts, drainage pipes, or other minor structures that fall within the alignment of the new construction. Restore to their original location and grade.
- B. Visit the project site and determine actual conditions with regard to the existence of old car bodies, abandoned houses, fences, driveways, trees, stumps, brush, sidewalks, approaches, and other miscellaneous obstacles to construction.
 - 1. No separate payment will be made for the removal or replacement of these items.

END OF SECTION

**SECTION 02316
ROCK EXCAVATION**

PART 1 - GENERAL

1.01 SUMMARY

- A. This section pertains to the rock excavation necessary for the construction of the facilities as indicated on the plans including:

1.02 RELATED WORK

- A. Section 01330 – Submittal Procedures
- B. Section 02315 – Excavation, Trenching and Backfill

1.03 SUBMITTALS

- A. Contractors blasting license and/ or blasting permit (if applicable).

1.04 DEFINITION

A. Solid Rock

- 1. Large masses of rock which, in the opinion of the Project Engineer, cannot be excavated without drilling, blasting, ripping equipment or other specialized equipment.

B. Loose Rock

- 1. Boulders and other detached stones each having a volume of 1-cubic yard or more.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 METHODS OF EXCAVATION

- A. Rock excavation may be accomplished by any or all of the following methods depending on the rock type:
 - 1. Excavation with earthmoving equipment including ripping with a dozer.
 - 2. Jack-hammering
 - 3. Blasting

3.02 RESPONSIBILITIES

- A. Comply with laws, ordinances, applicable safety code requirements, and regulations relative to the handling, storage, and use of explosives.
- B. Current Oklahoma blasting license required.
- C. Secure necessary permits and submit to Project Engineer.
- D. Protect adjacent utilities lines, property, and structures from blasting operation.
- E. Repair damage caused by rock excavation operations.
- F. Remove excavated rock from site unless otherwise directed by the Project Engineer.

3.03 ROCK MEASUREMENT

- A. Determine rock profile by one of three methods:
 - 1. Excavating and exposing the rock, prior to blasting.
 - 2. Drilling prior to excavating and blasting.
 - 3. Blasting and excavating, then measuring rock. Note: 20% reduction in rock volume shall be factored in to account for expansion.
 - 4. Measure solid rock to the nearest 0.1 foot from the surface and no less than every ten feet along the rock profile.
- B. Trenches
 - 1. Take measurements from the top of the rock to a point 6 inches below the invert of the pipe and 12 inches from each side of the pipe or appurtenance with a maximum 30-inch trench width allowed.
- C. Structures
 - 1. Take measurements starting at 24 inches from the edge of the structure.
 - 2. Measure quantity of loose rock in cubic yards.

3.04 EXCAVATION AND JACK-HAMMERING

- A. Excavate a minimum 4 inches deeper than the pipe invert.

- B. Refill trench to the required elevation with material in accordance with Section 02315
– Excavation, Trenching, and Backfill.

3.05 BLASTING

- A. Blast in accordance with OSHA guidelines.
- B. Comply with conditions of blasting permit.

END OF SECTION

SECTION 02510
WATER DISTRIBUTION

PART 1 - GENERAL

1.01 SUMMARY

- A. This section includes the installation of water mains, valves, fittings, and other appurtenant structures for community water distribution systems.

1.02 RELATED WORK

- A. Section 01339 – Submittal Procedures
- B. Section 02315 – Excavation, Trenching and Backfill
- C. Section 03300 – Cast-in-place Concrete (Non-Structural)

1.03 REFERENCES

- A. Use latest revisions of all References
- B. ANSI/AWWA C110/A21.10 – Ductile Iron and Gray Iron Fittings, 3 Inch Through 48 Inch, for Water and Other Liquids
- C. ANSI/AWWA C111/A21.11 – Rubber-Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings
- D. ANSI/AWWA C150/A21.50 – Thickness Design of Ductile Iron Pipe
- E. ANSI/AWWA C151/A21.51 – Ductile Iron Pipe, Centrifugally Cast, for Water or Other Liquids
- F. ANSI/AWWA C153/A21.53 – Ductile Iron Compact Fittings, 3 Inch Through 16 Inch, for Water and Other Liquids
- G. ANSI/AWWA C509 – Resilient Seat Gate Valves for Water and Sewerage Systems
- H. ANSI/AWWA C515 – Reduced Wall, Resilient Seated Gate Valve for Water Supply Service
- I. ANSI/AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inch Through 12 Inch, for Water Distribution
- J. AWWA C901 – Polyethylene (PE) Pressure Pipe and Tubing, 1/2 Inch through 3 Inch, For Water Service

- K. ASTM D 2241 – Polyvinyl Chloride (PVC) Pressure Rated Pipe (SDR Series)
- L. ASTM D 2321 – Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- M. ASTM D 3139 – Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
- N. ASTM F 477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe

1.04 INTERNET REFERENCES

- A. The references given are for the Contractors information. They are not an endorsement of the manufacturer or their products.
- B. United States Pipe and Foundry Company, (<http://www.uspipe.com/>)
- C. American Cast Iron Pipe Company, (<http://www.international.acipco.com/>)
- D. JM Manufacturing (<http://www.jmpipe.com>)
- E. IPEX (<http://www.ipexinc.com>)
- F. North American Pipe Corporation (<http://www.northamericanpipe.com>)
- G. EBAA Iron, Inc., (<http://www.ebaa.com>)
- H. ISCO industries, (<http://www.isco-pipe.com>)
- I. Charter Plastics, Inc. (<http://www.charterplastics.com>)
- J. Tyler Pipe (<http://www.tylerpipe.com/>)
- K. Valmatic (<http://www.valmatic.com/index.html>)

1.05 SUBMITTALS

- A. Water Pipe
- B. Fittings
- C. Special Anchoring Retainer Glands
- D. Gate Valves and Boxes
- E. Air release valves and vault

- F. Polyethylene Pipe and fittings
- G. Corporation Stops
- H. Saddles
- I. Air release shut-off valve
- J. Method of Connection to Existing Distribution System

1.06 ACCEPTANCE

- A. Work covered by this section will not be accepted until the backfilling and testing connected with the work has been completed satisfactorily.

PART 2 - PRODUCTS

2.01 WATER DISTRIBUTION PIPE AND FITTINGS

- A. Pipe size, material, and pressure rating as indicated on the drawings.
- B. Ductile Iron Pipe
 - 1. Conform to AWWA C151 with a thickness design in accordance with AWWA C150.
 - 2. Manufacturers:
 - a. United States Pipe and Foundry Company
 - b. American Cast Iron Pipe Company
 - c. or approved equal,
- C. Polyvinyl Chloride Pipe
 - 1. Pipe: Conform to ASTM D 2241 (SDR) or AWWA C900 (pressure class).
 - 2. Joints: Conform to ASTM D 3139 with elastomeric seals (gaskets) conforming to ASTM F477.
 - 3. Manufacturers:
 - a. JM Manufacturing
 - b. IPEX

- c. North American Pipe Corporation
- d. or approved equal.

D. Fittings

- 1. Ductile Iron or PVC pipe.
 - a. Conform to AWWA C110 and AWWA C111 for ductile and gray iron fittings.
 - b. Conform to AWWA C153 for ductile iron compact fittings.
 - c. Manufacturers:
 - (1) United States Pipe and Foundry Company
 - (2) American Cast Iron Pipe Company
 - (3) or approved equal

E. Thrust Restraint

- 1. Concrete Thrust Blocks:
 - a. One part Portland cement, 2.5 parts of fine aggregate, 3.5 parts coarse aggregate and just enough water for a workable consistency.
 - b. #4 rebar

F. Special Anchoring Retainer Glands:

- a. Ductile iron:
 - (1) Megalugs, EBAA Iron, Inc.
 - (2) or approved equal
 - b. PVC:
 - (1) 2000PV, EBAA Iron, Inc.
 - (2) or approved equal
- 2. Joint Restraint Rodding:

- a. 3/4 inch mild steel threaded rods
- b. Tie bolts
- c. Duc lugs

2.02 Polyethylene Pipe

- A. IPS or CTS size pipe with a minimum pressure rating of 160 psi. Pipe shall conform to AWWA C901.
- B. CTS size pipe: DR 9 or DR 7.
- C. PS size pipe: IDR 7.
- D. High density, ultra high molecular weight polyethylene pipe compound PE-3408 or 3406.
- E. Stainless steel stiffeners on compression couplings made for DR 9 pipe.
- F. Manufacturers:
 1. ISCO industries
 2. Charter Plastics, Inc
 3. or approved equal.

2.03 GATE VALVES

- A. Meet or exceed AWWA C509 or C515.
- B. Constructed with a non-rising stem (NRS) and a 2-inch square stem-operating nut, opening counter-clockwise.
- C. Supply valves with mechanical or “push-on” joints.
- D. Manufacturers:
 1. Waterous (American Cast Iron Pipe Company, Series 500 or Series 2500
 2. or approved equal

2.04 VALVE BOXES

- A. Valve boxes for valve depth of 6 feet deep or less.
 1. Provide 2-piece, screw type, adjustable cast iron valve boxes.

2. Provide locking cover with:
 - a. Brass cotter pin or brass rod as a keeper
 - b. "WATER" plainly marked.
3. Manufacturers:
 - a. Tyler series 6850
 - b. or approved equal

B. ACCESSORIES

1. Supply one 8-foot long gate valve key.

2.05 FLUSH HYDRANTS

2.06 Flush Hydrants

- A. Non-freezing
- B. Self-draining
- C. 2-inch FIP inlet
- D. 3-foot bury
- E. Non-turning operating rod
- F. All working parts: bronze and serviceable from above ground.
- G. Outlet: 2.5-inch NST
- H. Lockable.
- I. Manufacturers:
 1. Model Mainguard No. 77, Kupferle Foundry Co.
 2. or approved equal

2.07 FIRE HYDRANTS

- A. Conform to AWWA C502.

- B. Supply fire hydrants equipped with the following:
1. An arrow cast on the hydrant showing the direction of opening as counter clockwise.
 2. Two National Standard 2 ½-inch hose nozzles and one 4 ½-inch pumper nozzle.
 3. Traffic flange
 4. Weep holes to allow the hydrant to drain.
 5. Minimum 4 ¼-inch hydrant valve opening capable of opening against water pressure.
 6. Minimum hydrant length of 3 feet as measured from the ground line to the bottom of the trench carrying the connection pipe.
- C. When a hydrant manufacturer and model is specified in the bid schedule, that exact unit must be supplied in order to maintain compatibility with the existing hydrants on the system.
- D. Manufacturers:
1. Waterous (AFC) WB-67.

2.08 AIR RELEASE VALVE

- A. Cast iron body and cover, ASTM 126, Class B.
- B. Inlet: Specify Size inch NPT.
- C. Outlet: Specify Size inch NPT.
- D. Working pressure: 175 psi.
- E. Stainless steel float and internal components.
- F. Manufacturers:
1. Val-Matic model VM-15A
 2. or approved equal.

2.09 AIR RELEASE VAULT

- A. Body: PVC or PE, 15-inch diameter, or approved equal

- B. Lid: Cast iron, lockable.
- C. Steel Post: 4-inch I.D. by 5 feet long, galvanized, Schedule 40.
- D. Air Release Connecting Piping.
 - 1. Piping:
 - a. 1-inch P.E. from water main to valve inlet piping (if required).
 - b. Brass IPT inlet piping.
 - c. Brass inlet shut-off valve.
 - d. Galvanized iron pipe and fittings from valve to post.
 - e. Steel insect screen.
- E. Service saddle: Brass or bronze body, stainless steel straps, o-ring seals, IP threaded outlet, 160 psi working pressure.
- F. Corporation stop: Brass or bronze body, IP threaded inlet, PE compression outlet, 160 psi working pressure.

2.10 WARNING TAPE

- A. Supply detectable warning tape that is a minimum of 2 inches thick, blue or striped blue, and have printing that warns of a water line below.
- B. Manufacturers
 - 1. Trumbull Industries Inc. (<http://www.trumbull-mfg.com/>)

2.11 WATER TESTING LAB

- A. Use a state certified lab.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Inspect pipe, fittings and appurtenances for defects prior to installation.
- B. Reject defective, damaged, or unsound materials.

3.02 SEPARATION DISTANCE

- A. Vertical: refer to Section 02315 – Excavation, Trenching and Backfill

3.03 WATER LINE INSTALLATION

- A. Project Engineer to provide staking in accordance with Section 02315 – Excavation, Trenching and Backfill.
- B. Install water lines and appurtenances in the locations, elevations, sizes and materials shown on the drawings.
- C. Refer to Section 02315 for excavation, trenching, bedding, and backfill requirements and for minimum separation distances.
- D. Install pipe with at the depth noted on the drawings.
- E. Install thrust restraint on all fittings and appurtenances. Contractors option:
 - 1. Concrete Thrust Blocks:
 - a. Pour thrust blocks against the fitting and undisturbed earth.
 - b. Place concrete thrust blocks so that the pipe and joints will be accessible for repair.
 - 2. Special Anchoring Retainer Glands:
 - a. Install in accordance with manufacturer's recommendations.
 - b. All pipe joints less than 20 feet from fittings with special retainer glands shall be restrained.
 - c. Project Engineer may specify additional restraint be used for pipe sections near critical fittings.
 - 3. Joint Restraint Rodding:
 - a. Rod from fitting to fitting.
 - b. Install tie bolts to connect tie rods, if required.
 - c. Install duc lugs where required to increase the width of the rodding.

3.04 WARNING TAPE INSTALLATION

- A. Install warning tape in water main trench one-foot below grade maintaining the same depth throughout.

3.05 GATE VALVE INSTALLATION

- A. Refer to Section 02315 for excavation and backfill requirements.
- B. Install valves at locations shown on the drawings.
- C. Support gate valves on a solid concrete block as shown on the drawings.
- D. Set valves plumb and provide with a valve box.
- E. Center the valve box over the valve with the box cover:
 - 1. Flush with finished grade elevation.
 - 2. Flush with the concrete pad. Prior to concrete hardening, note valve size and direction of line on concrete pad.

3.06 AIR RELEASE VALVE

- A. Install at the locations and as shown on the drawings.
- B. Install valve vault plumb and flush with final grade.
 - 1. Provide 6-inch thick 1.5 minus washed gravel base.
- C. Install guard post as shown in the drawings.
 - 1. Fill post interior with concrete.

3.07 CONNECTIONS TO EXISTING DISTRIBUTION SYSTEMS

- A. Shutoff of mains will not be permitted overnight, over weekends, or on federal holidays.
- B. Coordinate system tie-in with the owner and/or operator of the existing utility a minimum of three working days before any connection is made.
 - 1. Assure the water storage tank is full before starting work.
 - 2. Complete work before storage tank reaches the low water level.
- C. Notify residents affected by the water shutoff of the time and day of shutoff a minimum of two working days in advance.

- D. Start work when all the materials, equipment and labor are on site.
- E. Clean all connection components with a chlorine solution prior to installation.
- F. Once work on the connection has commenced, it shall proceed continuously without interruption, and as rapidly as possible until completed.
- G. Visually inspect any joints not pressure tested for leakage.
 - 1. Test under system pressure prior to backfilling
 - 2. Test in the presence of the IHS representative.
 - 3. Repair and retest any joint with leakage until no leakage is visible at no cost to the owner.

3.08 TESTING OF WATER MAIN

- A. Whenever practical, before backfill is placed or joints covered, test pipe for leaks.
- B. Furnish necessary material, equipment, and labor for testing including, but not limited to: water, pump, water storage vessel, piping, pressure gauge, valve, hydrant, and corporation stop.
 - 1. Pressure gauge shall be liquid filled with 5 psi or less increments.
- C. Test duration: 2 hours minimum.
- D. Maximum length of test section: 1/2 mile.
- E. Testing Procedure:
 - 1. Slowly fill test section with water and expel air from mains.
 - 2. Verify all hydrant lead valves and main valves within the test section are open.
 - 3. Place test section under constant pressure.
 - a. 1.5 times working pressure or 150 psi, whichever is greater.
 - b. Do not exceed 115% of pipe pressure rating at the lowest point in the test section.
 - 4. Pressurize the line to the original test pressure and continue test.

- a. Record amount of water required to re-pressurize the line.
- 5. At the end of the test, re-pressurize the line to the original test pressure.
 - a. Record amount of water required to re-pressurize the line.
- 6. Add total amount of water required to re-pressurize the line during and at the end of the test and compare with the allowable leakage as calculated below.
 - a. If leakage is greater than allowable leakage, test fails.

F. Allowable Leakage Determination

$$L = (N * D * P^{1/2}) / 7400$$

- L = Allowable Leakage (gph)
- N = Total Length Tested Divided by
The Standard Pipe Length
- D = Nominal Diameter of Pipe (inches)
- P = Test Pressure (psi)

Example Allowable Leakage Chart Using Formula Above
PVC Pipe with 20-foot sections

Pipe Diameter, D	Allowable Leakage/ 1000 feet (gph)			
	P = 100 psi	P = 150 psi	P = 200 psi	P = 250 psi
4 inch	0.27	0.33	0.38	0.43
6 inch	0.41	0.50	0.57	0.64
8 inch	0.54	0.66	0.76	0.85
10 inch	0.68	0.83	0.96	1.07
12 inch	0.81	0.99	1.15	1.28

- G. Repair, at no cost to owner, any section of the line that fails this test.
 - 1. Retest all repaired sections of line, at no cost to owner, until pressure test is successfully completed.

3.09 DISINFECTION OF WATER MAIN AND FITTINGS

- A. Disinfection shall conform to Section 5 of AWWA C651.
- B. Obtain water at the site for disinfection.
- C. Flushing chlorinated water in accordance with Section 6 of AWWA C651.
 - 1. Waste flushed disinfection water in an environmentally safe manner. The method used is subject to the approval of the Project Engineer.

- D. After disinfecting and flushing but before the water main is placed in service, collect and test water samples for bacteriological quality.
 - 1. Sample in accordance with the Standard Methods for Examination of Water and Wastewater.
 - 2. Take two consecutive tests, 24 hours apart.
 - 3. Collect one sample from the new water main and one from each branch line near the end.
 - a. Additional samples may be required on extremely long mains.
 - 4. Take samples to a state certified testing lab.
 - 5. Permanent sampling taps may be required at the direction of the Project Engineer.
- E. If initial disinfection fails to produce satisfactory bacteriological results, rechlorinate the mains and branch lines, flush and take new samples until satisfactory results are obtained.
 - 1. Do not place main in service until the Project Engineer has received safe bacteriological results obtained on 2 consecutive days.

3.10 RECORD DRAWINGS

- A. Conform to record drawing requirements in Section 01780 – Closeout Submittals.

END OF SECTION

**SECTION 02511
WATER SERVICE LINES**

PART 1 - GENERAL

1.01 SUMMARY

- A. This section includes the installation of water service lines complete with corporation stops, water meters, water meter boxes, yard hydrants and other appurtenances for community water service connections systems.

1.02 RELATED WORK

- A. Section 01339 – Submittal Procedures
- B. Section 02315 – Excavation, Trenching and Backfill
- C. Section 02920 – Topsoiling, Seeding, Fertilizing, and Mulch

1.03 REFERENCES

- A. AWWA C901 – Polyethylene (PE) Pressure Pipe and Tubing, 1/2 Inch through 3 Inch, For Water Service.

1.04 SUBMITTALS

- A. Submit in accordance with Section 01330 – Submittal Procedures
- B. Water Service Line
- C. Fittings
- D. Corporation Stops
- E. Saddles, Tees or Tapped Couplings
- F. Water meters and Boxes
- G. Freezeless Yard Hydrant

PART 2 - PRODUCTS

2.01 WATER SERVICE LINE AND APPURTENANCES

- A. Polyethylene Pipe
 - 1. IPS or CTS size pipe with a minimum pressure rating of 160 psi. Pipe shall conform to AWWA C901.
 - 2. CTS size pipe: DR 9 or DR 7.
 - 3. PS size pipe: IDR 7.

4. High density, ultra high molecular weight polyethylene pipe compound PE-3408 or 3406.
5. Stainless steel stiffeners on compression couplings made for DR 9 pipe.
6. Equal to Dripscope Ultra-Line water service pipe or Excel.

B. Saddles

1. PVC ASTM D2241 Pipe: Stainless steel double bolt saddle clamps equal to Cascade style CSC2 or Ford style FS202.
2. PVC C900 Pipe: Stainless steel single bolt saddle clamps equal to Ford style FS101.

C. Corporation Stops

1. Brass, with compression connection, unless otherwise specified.
2. IPS plastic pipe: A.Y. MacDonald 4704 – 33 or Mueller H-15029 with nonflare connections.
3. CTS plastic pipe: A.Y. McDonald 4704 – 22 or Mueller H-15028.
4. Copper service line: A.Y. McDonald 4704 – 22, Ford F1100, Mueller H – 15028, or equal with a nonflare connection for copper pipe.

D. Water Meter, Meter Setter and Box

1. Conform to the requirements of the rural water district or community standards.

E. FREEZELESS YARD HYDRANT

1. 3/4-inch, non-freezing, 3-foot bury, Woodford Iowa or approved equal.
2. Vacuum breaker, Watts NF8 for yard hydrant, or approved equal.

PART 3 - EXECUTION

3.01 WATER SERVICE LINE AND APPURTENANCES

- A. Install water service line of the size and material indicated on the Bid Schedule and/or drawings.
- B. Install at the locations shown on the drawings or as directed by the Project Officer.

1. Install to within 5 feet of the house or to house water line if present.
 - a. Connect to house water line if present.
 - b. Cap and mark with 2-inch by 4-inch wood post if house water line is not present.
- C. Refer to Section 02315 for excavation, trenching, backfilling, compaction, and separation distance.
- D. Minimum bury depth: 30 inches.
- E. Splices are not allowed in the service line without the written permission of the Project Officer.
- F. Use compression couplings for all connections.
- G. Install saddle at each corporation stop tapping location.
 1. All connections shall be live tapped through the corporation stop with an approved tapping machine.
- H. Water Meters and Boxes
 1. Install at the location shown on the drawings.

3.02 UTILITY CONFLICTS

- A. Refer to Section 02315 – Excavation, Trenching and Backfill.

3.03 TESTING

- A. Turn on each corporation stop and apply main pressure to the service line in the presence of the IHS representative before backfilling.
- B. Repair all visible leaks and retest the line until test is successfully completed at no cost to the owner.

3.04 BACTERIOLOGICAL SAMPLE

- A. Provide bacteriological sample for each service line after the line has been installed and flushed.
- B. No payment will be made for water lines until a negative bacteriological sample has been received.

3.05 CLEAN UP

- A. Refer to Section 02310 - Grading.

3.06 SEEDING

- A. Refer to Section 02920 – Topsoiling, Seeding, Fertilizing, and Mulching.

3.07 RECORD DRAWINGS

- A. Provide as-built information on each.

END OF SECTION

**CHEROKEE NATION
WATERLINE CONSTRUCTION SPECIFICATIONS
SECTION 02445
ROAD BORING AND CASING**

PART 1 - GENERAL

1.01 SUMMARY

- A. The work covered by this section includes boring and casing under roadways.

1.02 RELATED WORK

- A. Section 02315 – Excavation, Trenching, and Backfill

1.03 REFERENCES

- A. ASTM A53-94, Welded Steel Pipes, Zinc-Coated (Galvanized), Plain End - (GPE)

1.04 SUBMITTALS

- A. Encasement pipe.

PART 2 - PRODUCTS

2.01 ENCASEMENT PIPE

- A. Steel or High Density Polyethylene (HDPE)
- B. 0.25-inch minimum wall thickness.
- C. Meet ASTM A 53-94 and ASTM D 3350
- D. Size: as shown in the plans.

2.02 SPACERS AND END SEALS

- A. Spacers: APS Advance Model CI Polyethylene Casing Insulators or approved equal.
- B. End Seals: APS Advance Standard Model AW Wraparound w/ T304 stainless steel bandings or approved equal.

2.03 CARRIER PIPE

- A. Size and type shown on the plans.

2.04 VENT PIPING

- A. 2-inch galvanized steel, schedule 40, pipe, and fittings.

PART 3 -EXECUTION

3.01 PERMITS

- A. Obtain necessary permit from the local, County, or State Authority.
- B. Meet requirements of permit.

3.02 BORING

- A. Bore or jack under roadways as shown on the plans unless the Project Officer and/or Permitting Authority approve open cut in advance.
- B. Bore pits: refer to Section 02315 – Excavation, Trenching, and Backfill.
- C. Bore hole diameter same as outside diameter of casing.
- D. Pressure grout voids between encasement pipe and soil greater than 1-inch.
- E. Boring methods involving jetting or washing are not allowed.
- F. Seal each end of the encasement pipe until the piping is installed.

3.03 PIPE INSTALLATION

- A. Install skids on piping as shown in the detail drawing.
- B. Seal each end of the encasement pipe after piping is installed.
- C. Install vent piping at location and as shown on the plans.

END OF SECTION

**CHEROKEE NATION
WATERLINE CONSTRUCTION SPECIFICATIONS
SECTION 02446
DIRECTIONAL DRILLING**

PART 1 - GENERAL

1.01 SUMMARY

- A. The work covered by this section includes directional drilling method of installing piping under railroads, highways, streets, runways, levees, and other surface structures.

1.02 RELATED WORK

- A. Section 02315 – Excavation, Trenching, and Backfill

1.03 REFERENCES

- A. Use latest revision of all references.
- B. AWWA C901 Polyethylene (PE) Pressure Pipe and Tubing.

1.04 SUBMITTALS

- A. Refer to Section 01330 – Submittals
- B. Pipe
- C. Drilling method
- D. Joint Restraint

PART 2 - PRODUCTS

2.01 PIPE

- A. Sinclairpipe, Driscopipe, or approved equal.

2.02 TRANSITION FITTINGS

- A. IPE hdpe x pvc (http://www.hdpefittings.com/html/transition_fittings.html)
- B. JCM 215 - 216 Long Ductile Iron Couplings
(<http://www.jcmindustries.com/hdpecplg.html>)

- C. Or approved equal.

PART 3 - EXECUTION

3.01 DIRECTIONAL DRILLING.

- A. Directional drill and install pipe at the locations and of sizes shown on the drawings or as directed by the Project Engineer.
- B. Soil cover: 3 feet minimum
- C. Only Butt-Fused joints will be allowed.
- D. Cap both ends of pipe until connection to system.
- E. Provide joint restraint at connection with PVC pipe.

3.02 DISINFECTION

- A. The same procedure and requirements as the connecting pipe.

3.03 HYDROSTATIC TESTING

- A. The same procedure and requirements as the connecting pipe.

3.04 CONNECTING TO EXISTING SYSTEM (if required)

- A. Connection method subject to approval by Project Officer.
- B. Do not start Work until all material and equipment is on site.
- C. Proceed continuously without interruption until connection is complete.
- D. Testing:
 - 1. Maintain exposed connection.
 - 2. Place line into service.
 - 3. Visually inspect for leaks.
 - 4. Repair any leaks detected.
 - 5. Allow Project Officer to verify integrity of connection
- E. Backfill in accordance with section 02315 - Excavation, Trenching, and Backfill.

END OF SECTION