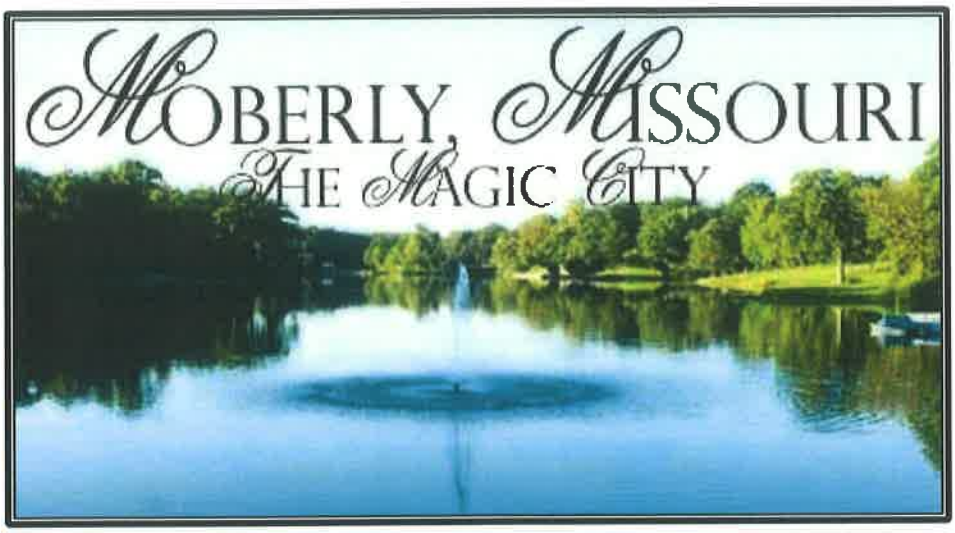


CITY OF MOBERLY, MISSOURI

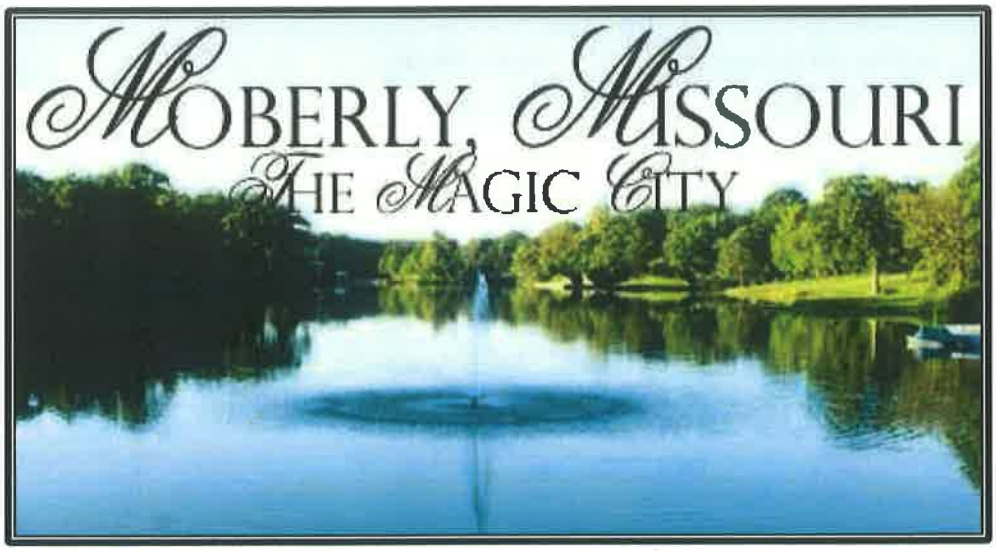
STANDARD SPECIFICATIONS FOR WATER MAIN CONSTRUCTION

Poepping, Stone, Bach & Associates, Inc.

PSBA

Engineers, Architects, Surveyors, GIS

Suite 248, 801 Broadway St., P.O. Box 190, Hannibal, MO 63401 Ph: 573-406-0541



CITY OF MOBERLY, MISSOURI

STANDARD SPECIFICATIONS FOR WATER MAIN CONSTRUCTION

I HEREBY CERTIFY THAT THESE SPECIFICATIONS AND DETAILS WERE PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MISSOURI.

MICHAEL J. PUROL, PE
MISSOURI LICENSED PROFESSIONAL ENGINEER NO. PE-2007002824
EXPIRES 12-31-2021

THIS SEAL COVER STANDARD SPECIFICATION SECTIONS 01000 THRU 01006 AND STANDARD DETAIL SHEETS 02001 THRU 02009.

PSBA
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CITY OF MOBERLY, MISSOURI
STANDARD SPECIFICATIONS FOR WATER MAIN CONSTRUCTION

TABLE OF CONTENTS

SECTION 01000
APPROVAL AND ACCEPTANCE

PART 1 – GENERAL

1.01 SUMMARY

A. These specifications are for the construction, replacement, extension, and alteration of water mains and water services under authority of the City of Moberly, Missouri.

B. The intent of these specifications and details is to specify the type and quality of all water main and service materials, installation, inspection, testing, and final acceptance by the City for all improvements, replacements, and extensions intended to be included as a part of the City's water distribution system.

C. All design, permitting, materials, and work shall be in accordance with applicable sections of:

1. City of Moberly Standard Specifications for Water Main Construction
2. City of Moberly, Missouri – Code of Ordinances, Chapter 42-Utilities
3. Missouri Department of Natural Resources Minimum Design Standards for Community Water Systems.
4. Missouri Standard Specification for Highway Construction, current edition
5. Approved, Project-Specific Special Provisions, Specifications, and Plans

D. The work shall consist of obtaining all required permits, approvals, and legal easements before beginning work. Work also includes furnishing all labor, materials, and equipment for the complete installation of water main extension and/or alterations, and appurtenances, in conformance with the approved lines and grades.

E. Modifications, alterations, or changes to City of Moberly, Missouri Standard Specifications and Details during the course or work must be submitted to the City for approval prior to performing work.

1.02 DEFINITIONS

A. City: City of Moberly, Missouri

B. Water Department: City Water Department

C. Enforcement Officer: City Director of Public Utilities or designated representative

D. Engineer: Licensed Professional Engineer in responsible charge for the project and licensed to perform services in the State of Missouri

E. Developer: Entity requesting water service construction, modifications, extensions, and/or alteration to the city water system. The Developer could be a public or private entity, such as the City or private Developer.

F. Contractor: Entity contracted by Developer to perform work on water main and services. The Contractor is responsible for constructing approved plans

G. Owner: Entity who is responsible for long term performance, maintenance, and operation of new water mains. The City will typically become the Owner upon final approval and acceptance by City. The Developer will be responsible for the project until final approval and acceptance.

H. Standard Specifications: City of Moberly, Missouri Specifications for Water Main Construction

1.03 DESIGN - GENERAL

A. All water main extensions or alterations shall be designed, signed, and sealed by an Engineer.

B. Water pressure in distribution systems below 20 pounds per square inch (psi) violate Missouri Safe Drinking Water Regulation 10 CSR 60-4.080 (9). The Missouri Department of Natural Resources considers pressures below 20 psi to be an imminent hazard to public health.

C. All water mains and systems shall be sized in accordance with a hydraulic analysis based on flow demands and pressure requirements. Distribution systems shall be designed to maintain at least 35 psi normal working pressure at ground level at all points in the distribution system under all conditions of design flow.

D. Systems designed for fire protection shall provide a minimum flow of 250 GPM for a duration of two hours. Water mains that are not designed to provide fire protection shall not have fire hydrants connected to them.

E. All water lines shall be buried a minimum 3.5 feet below grade, unless otherwise approved.

F. Water main dead ends shall be avoided, if possible. If unavoidable, dead ends shall have a fire hydrant, flushing hydrant, or other approved assembly for flushing purposes.

1. Flush assemblies shall have a gate valve and box the same size as the water main. Flush assembly details (other than fire hydrant) shall be included in the project specific plans.

G. Restrained joints, where specified, shall have thrust reinforcement using properly designed concrete thrust blocks or manufactured mechanical and harness restraints. All thrust restraint shall be designed based on the working pressure of the pipe and bearing pressure of the soil. Manufactured restraint is City preferred method for restraint. Concrete thrust blocking may be used in conjunction with manufactured restraint.

H. Generally, valves shall be located at intersections with other water mains, on both sides of railway, waterway, and bridge crossings.

1.04 DESIGN - SEPARATION REQUIREMENTS

A. Public health is paramount. To protect the public health, the following separation requirements shall be met for water lines near sanitary and storm sewer lines. These requirements apply to both conventional trench-type construction methods and trenchless construction methods including but not limited to directional drilling and utility jacking and boring. These requirements shall be considered minimum requirements. Additional requirements may be required as conditions of required permits.

B. The following factors should be design considerations for separation requirements:

1. Materials and type of joints for water and non-potable fluid pipes.

2. Soil conditions.

3. Service and branch connections into the water main and non-potable fluid.

4. Compensating variations in the horizontal and vertical separations.

5. Space for repair and alterations of water and non-potable fluid pipes.

6. Routing water mains around manholes.

C. Horizontal Separation Requirements

1. See Standard Details.

2. Water lines shall be located at least ten (10) feet horizontally from any existing or proposed line carrying non-potable fluids such as, but not limited to, drains, storm sewers, sanitary sewers, combined sewers, sewer service connections, inlets, manholes, and process waste or product lines. The distance shall be measured edge to edge.

3. Water mains may be located closer than ten (10) feet when:

   a. Local conditions prevent lateral separation.

   b. The water main invert is at least 18 inches above the crown of non-potable fluid lines.

   c. The water main is either in a separate trench or in an adjacent trench on an undisturbed earth shelf located on one side of the non-potable fluid line.

4. If separation requirements listed above cannot be met, the water line shall be placed in casing suitable for potable water in accordance with City Standard Specifications or the non-potable fluid line shall be re-constructed using pipe suitable for potable water use in accordance with Section 01001 – Standard Specification for Water Lines.

D. Vertical Separation Requirements

1. See Standard Details. The vertical separation from water lines and non-potable fluid lines shall be 18 inches.

   a. If the 18-inch vertical separation cannot be met for water lines above non-potable fluid lines, the water line shall be placed in casing suitable for potable water in accordance with City Standard Specifications and Details. Casing pipe shall be placed no closer than 4 inches above non-potable fluid pipe.

   b. For water lines placed 18 inches or more below a non-potable fluid line, the water line shall be placed in casing suitable for potable water in accordance with City Standard Specifications and Details. Adequate support shall be provided to prevent damage to utilities located above the water line.

   c. Where required, protective casing shall extend a minimum of 10 feet from non-potable fluid line measured perpendicular to the non-potable fluid line. Casing shall be sealed at each end according to City Standard Specifications and Details.

1.05 PRE – CONSTRUCTION SUBMITTALS

A. **Preliminary Submittal:** Project-specific special provisions, specifications, and plans shall be submitted to the City of Moberly for review and approval of any public water main alteration or extension. The submittal shall be prepared by an Engineer. Submittal shall include:

1. Design parameters based on flow demands and pressure requirements.

2. Proposed alignment and grade, details of connections to existing water systems, construction locations, location of valves, hydrants and other facilities, and proposed location of water services.

3. Materials list and manufacturer data sheets, catalog data, and illustrations for all proposed materials to be used for the project. Material test certificates and affidavits of compliance with applicable standards.

4. A work plan describing construction means, methods, sequencing, and scheduling.

5. Plan showing all existing utilities and identifying potential conflicts with proposed work. If utility relocation is required, the Developer and their Engineer, in conjunction with respective utility owners, shall provide a proposed utility relocation plan for approval. The relocation of existing utilities shall be incorporated into the overall construction project as well as appropriate demolition plan of abandoned utility facilities, as required.

6. If perception of or potential exists for contamination due to cross-connections or backflow, the design must include mitigation measures for control and prevention.

7. Other submittals detailed in other sections of City Standard Specifications

B. **Preliminary Submittal Review(s):** Project-specific special provisions, specifications, and plans shall be submitted to the City of Moberly for review and approval of any public water main alteration or extension. The submittal shall be prepared by an engineer licensed to practice in the State of Missouri. Submittal shall include:

1. At discretion of City, multiple iterations of the preliminary submittal review will be until all design and pertinent modifications are complete.

C. **Final Submittal:**

1. Final submittal to the City shall include Engineer's official seal, current date stamp, and signature on project-specific special provisions, specifications, and plans. Three (3) hard copies and one (1) electronic copy in .pdf format.

2. Submit approved Missouri Department of Natural Resources, Water Protection Program, Construction Permit including all stipulations. No work may begin until a copy of the approved permit has been provided to City.

3. Submit legally recorded copies of required utility easements, if any. No work may begin within proposed easements without having legally recorded permanent easements.

4. Submit approved Missouri Department of Transportation Highways and Transportation Commission, Permit to Work on Right of Way, if applicable.

1.06 INSPECTION

A. In general, all work shall be inspected by the Enforcement Officer. Inspection for acceptance of materials will be conducted as soon as practical after materials arrive on the job site. Inspections will be performed as work progresses.

B. The Enforcement Officer shall always have access for observation and inspection during the work. Access will be coordinated with the Contractor. The Contractor shall furnish all reasonable aid and assistance required by the Enforcement Officer for the proper inspection and examination of work and materials.

C. The Enforcement Officer reserves the right to reject materials and work not in compliance or accordance with approved plans and specifications.

D. The Enforcement Officer reserves the right to suspend work.

E. The Enforcement Officer shall be notified a minimum of two (2) working days for inspection and observation of all testing. Notifications are also required in accordance with other Standard Specifications.

F. Under no circumstance shall taps or connections be made to existing mains without approval. All taps will be coordinated by Contractor and conducted in the presence of Enforcement Officer.

1.07 POST – CONSTRUCTION FINAL SUBMITTAL

A. Upon successful completion of construction and obtaining required testing results meeting or exceeding performance requirements, the Developer shall submit:

1. Copies of all test reports, including failed tests.

2. Submit two (2) copies of as-built drawings to City showing all changes, deviations, or modifications to original plans. As-built drawings shall include reference swing tie measurements from identifiable landmarks to all valves. Each valve shall have at least two (2) reference swing tie measurements.

3. As-built drawings shall be completed by Engineer, dated and clearly marked with the name and company of the person illustrating the changes.

1.08 ACCEPTANCE

A. After Final Submittal and City Approval, the City will conditionally accept the work.

B. The Owner and Contractor shall warranty all work and materials for a period of one year. The Owner and Contractor will be responsible for repairing and replacing failures or damages resulting from poor workmanship and defective materials.

C. The Enforcement Officer will inspect the work periodically during the warranty period, document conditions, and notify Developer of repairs required, if any.

D. Final acceptance will be given when the warranty period ends, and all work and site conditions are to the satisfaction of the City.

END OF SECTION 01000

SECTION 01001
WATER LINES

PART 1 – GENERAL

1.01 SUMMARY

A. The design and construction of water main replacements, extensions, and alterations shall be in conformance with the City of Moberly Standard Specifications and Missouri Department of Natural Resources Minimum Design Standards for Missouri Community Water Systems.

B. The work shall consist of furnishing all labor, materials, and equipment for complete installation of water main replacements, extensions, alterations, and appurtenances, in conformance with the lines and grades shown on the plans, as established by the Engineer, or otherwise specified.

C. The Contractor shall employ skilled, qualified workers and supervision to perform work following generally accepted industry practices. The City reserves the right to suspend work if, in the opinion of the Enforcement Officer, this requirement is not being met.

D. If surface or ground contamination is suspected or encountered, notify the City immediately. The Developer and Contractor, in communication with the City, shall assess conditions and develop a plan for continued work including but not limited to: removal and disposal of contamination, specifying different water line materials and/or water line realignment.

1.02 DEFINITIONS

A. City: City of Moberly, Missouri

B. Water Department: City Water Department

C. Enforcement Officer: City Director of Public Utilities or designated representative

D. Engineer: Licensed Professional Engineer in responsible charge for the project licensed to perform services in the State of Missouri.

E. Developer: Entity requesting water service construction, modifications, extensions, or alterations to the city water system. The Developer could be a public or private entity, such as the City of Moberly or a private Developer.

F. Contractor: Entity contracted by Developer to perform work on water main and services. The Contractor is responsible for constructing approved plans.

G. Owner: Entity who is responsible for long term performance, maintenance, and operation of new water mains. The City will typically become the Owner upon final approval and acceptance by City. The Developer will be responsible for the project until final approval and acceptance.

H. AWWA: American Water Works Association

I. ASTM: American Society for Testing and Materials

J. ANSI: American National Standards Institute

K. MSS: Manufacturers Standardization Society of the Valve and Fitting Industry

1.03 RELATED WORK

A. Section 01000 – Approval and Acceptance

B. Section 01002 - Earthwork

C. Section 01003 - Directional Drilling

D. Section 01004 - Utility Jacking and Boring

E. Section 01005 - Pavement Repair

1.04 REFERENCES

A. American Water Works Association (AWWA)

C104 – Cement Mortar Lining for Ductile Iron Pipe and Fittings
C105 – Polyethylene Encasement for Ductile Iron Pipe Systems
C110 – Ductile Iron and Gray Iron Fittings
C111 – Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings
C115 – Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
C150 – Thickness Design of Ductile Iron Pipe
C151 – Ductile Iron Pipe, Centrifugally Cast
C153 – Ductile Iron Compact Fittings
C200 – Steel Water Pipe, 6 in. and larger
C207 – Steel Pipe Flanges for Water Works Service, sizes 4 in. through 144 in.
C600 – Installation of Ductile Iron Mains and their Appurtenances
C651 – Disinfecting Water Mains
C800 – Underground Service Line Valves and Fittings
C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 60 in.
M11 – Steel Pipe, A guide for Design and Installation
M23 – PVC Pipe Design and Installation

B. American Society for Testing and Materials (ASTM)

B88 – Seamless Copper Water Tube
D1248 – Polyethylene Plastics Extrusion Materials for Wire and Cable
D1784 – Rigid PVC Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds
D3139 – Standard Specification: Plastic Pressure Pipe Joints Using Flexible Elastomeric seals
F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. American National Standards Institute (ANSI)

B16.22 – Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

D. Manufacturers Standardization Society of the Valve and Fitting Industry (MSS)

SP-60 – Connecting Flange Joint Between Tapping Sleeves and Tapping Valves

1.05 NOTIFICATION

A. The Contractor shall notify the Enforcement Officer at least five (5) business days prior to commencing work.

1.06 SUBMITTALS

A. See Section 1000 – Approval and Acceptance

B. Work Plan detailing means, methods, equipment, sequencing, and schedule for pressure and leakage testing, disinfection and chlorination, and flushing.

1.07 JOB CONDITIONS

A. Interrupting Utility Service:

1. Utility Service to existing City customers shall not be interrupted unless approved by the Enforcement Officer and the existing utility provider.

2. If approval for an interruption of service is obtained, the Contractor shall provide an eight-hour notification to the Enforcement Officer and all affected occupants. The City Fire Department shall be notified at least 24-hours in advance.

3. The Contractor shall provide standby service, if required. Outages shall not exceed 6 hours and will be coordinated with the Enforcement Officer.

4. The Water Department is responsible for operation of in-service valves, including closure as needed. Closure by other entities will not be permitted.

5. The Contractor shall be responsible for preventing contamination of existing lines.

B. New water mains must be fully tested, disinfected, and approved before installing service line connections.

C. Whenever pipe laying is not actively in progress, open ends of all installed pipe and fittings shall be sealed water tight.

1.08 MATERIAL DELIVERY, STORAGE, AND HANDLING

A. Means and methods for material shipping, loading, transporting, unloading, storing, and placing shall prevent damage. Damaged and/or defective materials shall not be installed. The City reserves the right to reject all damaged or defective materials.

B. All materials shall be packaged, labeled, or otherwise marked with adequate, identifiable information to determine suitability for intended project application.

C. Materials shall be stored at a mutually agreed upon location. Materials shall not be stored directly on the ground. They shall be stored in a manner to ensure they are kept clean, dry, and free of foreign debris.

D. Materials shall be protected in a manner to prevent entrance of contamination or foreign debris.

1.09 BASIS OF PAYMENT

A. This section applies to projects where the City of Moberly is the responsible Developer/Owner.

B. Water Mains:

1. **Water main** will be measured and paid by the lineal foot of pipe along pipe centerline, including all labor, equipment, and materials required for installation. Unless otherwise identified as a bid item, unit cost shall include: excavation, backfill, fittings, joints, thrust blocks, tracer wire, erosion control, pavement repair, seeding, and cleanup.

2. **Valve and Valve Box** will be counted as a single unit and be paid on a per-each basis, including all labor, equipment, and materials required for installation. See Standard Details.

3. **Meter Setting and Meter Box** will be counted as a single unit and be paid on a per-each basis, including all labor, equipment, and materials required for installation. See Standard Details.

4. **Service Lines and Connections** will be paid for on a per each basis, including all labor, equipment, and materials required for installation. Unit cost will include connections at water main and connections on City side of meter setting. Unit cost shall include all taps, saddles, sleeves, corporation stops, curb stops, etc... See Standard Details.

5. **Fire Hydrants** will be paid for on a per each basis including, all labor, equipment, and materials required for installation. Valves and valve boxes will be paid for separately. Pipe and joints required from main to hydrant shall be included in unit cost.

6. **Casing Pipe** will be measured and paid by the lineal foot along casing centerline. Unit cost shall include insulating spacers and end seals. Product pipe will be paid for separately. Casing required for trenchless construction methods will be paid for separately.

7. Estimated quantities for bid items could change. If quantities increase, additional materials and associated work will be paid for at contract unit cost. Purchasing additional materials and performing additional work shall not be done without prior written approval from the Enforcement Officer.

8. Cost associated with all work and materials not specifically identified as a bid item shall be considered as incidental to other pay items.

9. Additional, extra, and/or changes in work must be approved by Enforcement Officer. Payment will be on basis of Contract documents regarding changes in work.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials shall conform to the latest AWWA, ASTM, ANSI, and MSS standards and specifications, and, where applicable, shall be certified by National Sanitation Foundation (NSF) or underwriters' laboratories (UL) for drinking water use.

B. All materials shall be suitable for use in potable drinking water systems.

C. All buried iron pipe and fittings shall be coated with manufacturer's standard exterior enamel coating.

D. Water mains shall be six (6) inches or greater.

2.02 DUCTILE IRON PIPE (DIP) AND FITTINGS

A. DIP Pipe:

1. Conform to AWWA C115, C150, and C151 unless otherwise specified.

2. Acceptable Manufacturers: American Cast Iron Pipe Company, U.S. Pipe Supply, EBBA Iron Sales, Inc., or approved equal.

3. Ductile iron pipe shall be used in commercial and industrial areas and may be used in residential areas.

B. DIP Joints:

1. Conform to AWWA C111 and C115, mechanical joints with ductile iron glands.

2. Conform to AWWA C110 and AWWA C115 push-on joints with neoprene gaskets.

3. Buried joints shall be push-on type unless restrained or mechanical joints are required, specified, or as shown on the drawings.

4. Restrained mechanical joints shall be EBBA Iron Megalug Series 1100 or approved equal. Bell harness joint restraint shall be EBBA Megalug Series 1700 or approved equal. Restrained joints will be required at all fittings, including bends, tees, crosses, fire hydrants, caps, plugs, and all pipe specified for joint restraint.

C. DIP Fittings:

1. Conform to AWWA C110 or C153, ductile iron with a pressure rating of 250 psi for flanged joint and pressure rating of 350 psi for mechanical joints.

D. DIP Lining:

1. Conform to AWWA C104, cement mortar for all DIP pipe and fittings.

2.03 POLYVINYL CHLORIDE PIPE (PVC) AND FITTINGS

A. PVC Pipe:

1. PVC pressure pipe shall conform to AWWA C900, Class DR 14 for pipe 12 inches or less and AWWA C905, class DR 14 for pipe greater than 12. PVC pipe and fittings shall be compatible and interchangeable with ductile iron pipe.

2. Acceptable Manufacturers: Certainteed Corporation, J-M Manufacturing Company, Inc., Diamond Plastics, Clow Corp, or approved equal.

3. PVC pipe materials shall be uniformly blended with un-plasticized PVC. Materials and finished product shall not be hazardous to humans. Materials shall not impact or alter taste, odor, or chemical composition of potable water.

4. PVC pipe shall have National Sanitation Foundation (NSF) seal and be made of virgin components in accordance with ASTM D1784 Class 12454-A or Class 12454-B. Manufacturer shall provide certifications of conformance with these requirements.

B. Joints:

1. ASTM D3139 with ASTM F477 Gaskets. Wall thickness in pipe bell shall not be less than pipe barrel. Pipe shall have reference marks on male end indicating proper seating into bell.

2. Buried joints shall be push-on type unless restrained or mechanical joints are required, specified, or as shown on the drawings.

3. Mechanical joint restraint shall be EBBA Iron Megalug Series 2000PV or approved equal. Bell harness joint restraint shall be EBBA Series 1900 or approved equal.

C. Fittings:

1. C900 and C905 PVC pipe shall use ductile iron pipe fittings. Fittings shall have a minimum pressure rating equal to or greater than the pipe.

2.04 GATE VALVES

A. Gate Valves shall conform to AWWA C509 with minimum design working pressure of 200 psi.

1. Gate valves shall be iron body, bronze trim, super seal or resilient seated, non-rising stem, opening counter clockwise, mechanical joint flanges with stainless steel hardware, and double O-ring stuffing seals.

2. Valves shall have a 2-inch operating nut for below ground applications and a hand-wheel for above ground applications.

3. Acceptable Manufacturers: Mueller, American, U.S. Pipe Valve and Hydrant, or approved equal.

2.05 VALVE BOXES

A. Three-section cast iron screw-type shaft adjustment, minimum 5-inch inside diameter with lid marked "water". See Standard Details.

B. Valve boxes must be compatible with valves.

2.06 TAPPING VALVES

A. Tapping valves shall meet requirements for gate valves except tapping valve shall be equipped with a raised lip constructed in accordance with MSS SP-60 for valve centering on the tapping saddle.

B. Acceptable Manufacturers: Mueller, American, U.S. Pipe Valve and Hydrant, or approved equal.

2.07 TAPPING SLEEVES

A. Tapping sleeves shall be stainless steel including all hardware. The seal shall be fully circumferential and gridded. Outlet flange dimensions and drilling shall comply with ANSI B16.1, class 150 and indexed according to MSS SP-60 to accept tapping valve.

B. Acceptable Manufacturers: American Darling 5 ¼ inch B-84-B, or approved equal.

2.08 FIRE HYDRANTS

A. Hydrants shall be dry barrel type with lubricating reservoir, 3 way, opening counter clockwise, and minimum 250 psi working pressure.

B. Hydrants shall have two (2) standard 2 ½ inch male hose connections and one (1) standard 4 ½ inch male pumper connection.

C. Acceptable Products: American Darling B-84-B, 5 ¼ inch or approved equal.

2.09 CASING PIPE

A. This section applies when casing is required around water mains to comply with sanitary and storm sewer separation requirements. Casing materials, including joints, shall be suitable for potable water. Casing size shall be large enough to allow unrestricted installation of product pipe, including casing spacers, pipe fittings, and joints.

B. Casing materials may be PVC, Steel, or High-Density Polyethylene (HDPE)

1. PVC casing shall be in accordance with this section.

2. Steel casing shall conform to AWWA C200 and AWWA M11, joined by fully welding in accordance with AWWA C206. Casing shall have a minimum wall thickness of 0.25-inch for casing up to 24 inches.

3. HDPE casing shall be in accordance with Section 01003 – Directional Drilling.

C. Projection type, non-metallic insulating spacers shall be used to support water main inside casing. Insulating spacers shall be RACI, Advance Products & Systems, or approved equal. Refer to manufacturer's product data for spacer type and size.

D. Synthetic rubber end seals shall be installed on each end of the casing pipe. End seals shall be Advanced Model Products – Model AC Pull-on or approved equal fastened tightly with stainless steel bands.

E. See Standard Details.

2.10 SERVICE FITTINGS

A. Corporation Stops for copper water services shall be Mueller Company Number H15020, H15008 or Ford Company number F1000-3, or approved equal.

B. Corporation stops for plastic services shall be Mueller Company number H15008, Haze Manufacturing Company number 5200-DF, Ford Company number F1000-4, or approved equal.

C. Corporation stops on PVC pipe shall be made with a saddle.

D. Copper shall be used under pavement structures or polyethylene tubing in casing pipe.

2.11 SERVICE TUBING

A. Copper Tube and Fittings

1. Copper service tubing 3/4-inch through 1-inch shall conform to ASTM B88 - Type K annealed and soft tempered for buried installations.

2. Fittings shall be wrought copper in accordance with ANSI 816.22, flared or compression type.

3. All copper lines installed in granular soils shall be encased in schedule 40 pvc pipe with solvent welded or compression type joints.

4. All service lines with sizes between ¾-inch and 1-inch shall be copper (or poly line with tracer wire) between the water main and meter.

B. Plastic Tube and Fittings

1. Plastic service tubing shall be ¾" minimum inner diameter and shall be plastic, 250 CTS, copper size.

2. Fittings shall be flared or compression type with stainless steel stiffeners.

2.12 METERS

A. Meters supplied by the City. See standard details for meter setting configurations and materials.

2.13 POLYETHYLENE ENCASEMENT

A. In general, the City does not require polyethylene encasement of ductile iron water mains and fittings. When project specific specifications require, use eight (8) mil (minimum) polyethylene in accordance with AWWA C105.

2.14 THRUST BLOCKS

A. Provide concrete thrust blocks where specified or shown on the plans. Concrete for thrust blocks may be from a City-approved locally available source with a minimum compressive strength of 3,000 psi.

B. See standard details

2.15 TRACER WIRE

A. Tracer wire shall be "blue" HDPE insulated single strand #12 AWG continuous copper clad steel tracer wire. Tracer wire shall be manufactured by Copperhead Industries LLC or approved equal.

2.16 WARNING TAPE

A. Warning tape shall be "blue" non-metallic, 3-inches wide and at least 5 mil thick. Warning tape shall have "Caution Buried Water Line" or similar warning printed on the tape. Tape shall be buried at least 2 feet above top of pipe.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify the actual locations (horizontal and vertical) of all utilities prior to beginning work. Protect all utilities from damage during construction. Damage to existing utilities shall be repaired to the satisfaction of the utility provider at Contractor's expense.

B. Establish line and grade to maintain minimum burial and separation requirements in coordination with Enforcement Officer and Engineer. The minimum burial depth for water mains shall be 3.5 feet, unless otherwise approved by Enforcement Officer. Notify Enforcement Officer and Engineer if conflicts with existing utilities or structures exist.

C. Prior to laying pipe, prepare trench subgrade and initial backfill in accordance with Section 01002 – Earthwork.

D. Trench excavations shall be protected in accordance with applicable Federal, State, and local regulations, Laws, and rules in accordance with OSHA 29 CFR part 1926. Trench and excavation stability shall be the responsibility of the Contractor.

E. All pipe, fittings, and joints shall be clean, and free of foreign debris. Pipe valves and fittings at existing line connections shall be swabbed with a 4 percent chlorine solution prior to connection.

F. Exclude entrance of foreign material if work is suspended or stopped.

1. Close ends of pipe with snug-fitting closures such as end caps.

2. Do not let water fill the trench. Include provisions to prevent flotation if water control measures are inadequate.

3. Remove water, sand, mud, and other undesirable material from trench before removal of end cap.

3.02 INSTALLATION

A. Pipe Laying

1. Perform only when weather and trench conditions are suitable. Do not lay in water.

2. Remove trash, debris, vegetation, snow, ice, water or other unsatisfactory materials from excavations.

3. All materials shall be carefully lowered into the trench using means and methods to prevent damage and entrance of foreign debris. Rolling or dropping materials will not be permitted. End hooks will not be permitted.

4. Commence laying at the downstream end of line and install pipe with spigot ends in the direction of flow. Bells shall be in the direction of the laying operations.

5. Open ends of water lines shall be adequately sealed to prevent intrusion of foreign debris during all work stoppages with a duration of 30 minutes or more.

B. Jointing

1. Join pipe in accordance with manufacturer's recommendations and AWWA specifications. Backfill in accordance with Section 01002 – Earthwork.

a. Clean and lubricate all joint and gasketed surfaces.

b. Employ means and methods to prevent damage during jointing.

c. Inspect joint openings and deflection for compliance with specifications.

2. All joint deflections shall be within manufacturers recommendations.

   a. Ductile iron pipe joint deflection shall conform to AWWA C600.

   b. PVC pipe may be deflected a maximum of 1.5 degrees per 20 feet.

3. Pipe expansion and contraction due to changes in temperature shall be monitored during construction. Previously joined pipe shall be inspected to ensure joints have not separated due to expansion and contraction.

C. Restrained Joints

1. Restrained joints shall be provided at all fittings, including bends, tees, crosses, fire hydrants, caps, plugs, and all pipe specified for joint restraint.

2. Restraint may be provided by properly designed thrust blocking, mechanical restraint, and bell harness restraint.

3. See Standard Details.

D. Cutting Pipe

1. Cut in neat manner without damage to pipe, even surfaces perpendicular to pipe centerline.

2. Ductile iron and steel pipe to be cut with carbide or diamond tip blade saw or other approved methods.

3. Remove burrs and sharp edges and smooth the pipe end by grinding.

4. Repair lining where required and as approved.

E. Closure Pieces

1. Connect two segments of pipeline or a pipeline segment and structure with short sections of pipe, fabricated for the purpose.

2. Location of joints, types of joints, pipe materials and strength classifications shall comply with specifications.

3. Sleeve couplings may be used:

   a. Gaskets shall be at least 3 inches from pipe ends.

   b. Spacer ring shall be identical to pipe end with clear space in closure less than ¼-inch.

F. Valves and Valve Boxes

1. Valves and valve boxes shall be set plumb

2. Valve box base section shall be centered over operating nut

3. Valve box upper section shall be set flush with finish grade

G. Polyethylene Encasement

1. When project specific specifications require use of polyethylene encasement, all valves and fittings shall be fully wrapped with polyethylene encasement in accordance with AWWA C105.

H. Casing Pipe

1. When typical trench-type construction techniques are used, subgrade preparation, bedding, initial backfill, and final backfill shall be in accordance with Standard Specification Section 01002 – Earthwork

2. When trenchless construction methods are used, installation shall be in accordance with Standard Specifications Section 01003 – Directional Drilling and Section 01004 – Utility Jacking and Boring

I. Remove plugs from existing pipe to complete connections to existing pipe. Removed plugs shall become the property of the City.

J. Furnish and install test plugs where necessary to properly complete required testing.

1. Test plugs shall be as manufactured by pipe supplier.

2. Plugs shall be push-on, flanged, mechanical joint or restrained as required for ductile iron pipe and shall be watertight against heads equal to the specified test pressure. See Standard Details.

3. Secure plugs in place to facilitate removal when required to connect pipe.

4. Restrain plugs to fittings where indicated.

K. Tracer Wire

1. Attach continuous tracer wire to top of water line, either taped, banded, or strapped at 5 feet to 7 feet intervals. Install according to manufacturer's recommendations.

2. Tracer wire shall be looped to the surface at all valve/valve boxes, fire hydrants, blow-air release chambers, and locations specified or as shown on the plans.

3. Prior to acceptance, Contractor shall perform conductivity testing for all tracer wire. Full continuity must be established prior to final acceptance.

L. Warning Tape

1. Install continuous "blue" warning tape at least 2 feet above all water lines.

3.03 WATER MAIN PRESSURE TESTING

A. General

1. All work shall be inspected and approved by the Enforcement Officer prior to backfilling. Contractor shall notify the Enforcement Officer and arrange for inspection and observation of all testing prior to commencing.

2. Contractor shall obtain approval from Enforcement Officer prior to making any connections to existing water lines. The Enforcement Officer or representative must be present during any connection activities. The Contractor shall coordinate connections with the Water Department.

3. The Contractor shall furnish all pumps, piping, labor and other materials and services necessary to bring the piping up to the specified test pressure. Pipe in the sections to be tested shall be sufficiently backfilled or center loaded, with thrust blocks installed.

B. Hydrostatic Pressure Test

1. After the pipe has been laid and partially backfilled, test connections shall be made, and the pipe filled with water. After all air removal, water shall be pumped in to bring the pipe to the specified pressure.

2. Unless otherwise specified, testing pressure shall be:

   a. 1.5 times the normal operating pressure (for the lowest point on the pipe line).

   b. At least 150 pounds per square inch (psi).

   c. Less than the rated pipe working pressure shall be used for testing for a period of one hour.

3. Pressure test period shall be at least one hour at testing pressure.

4. Any cracked or defective system components observed during this test shall be repaired or removed and replaced to satisfaction of City.

C. Leakage Test

1. After successful pressure test, leakage testing shall be performed.

2. Leakage test shall be maintained for a period of at least 3 hours. The maximum operating pressure of the pipe shall be used as leakage test pressure. Pressure shall be based on the elevation of the lowest point in the section being tested, corrected to test gauge elevation. Applicable provisions of AWWA C600 and C605 shall apply.

3. Allowable leakage in gallons per hour shall not be greater than the leakage defined by the following formula:

$$L = \frac{S * D * \sqrt{P}}{148{,}000}$$

L = Leakage allowance make-up water) - gallons per hour (gph)
S = length of pipe tested - feet
D = nominal diameter of the pipe - inches
P = average test pressure during hydrostatic test - pound per square inch (gauge)

4. All visible leaks shall be repaired regardless of leakage allowance.

5. All exposed pipe, fittings, valves, hydrants and joints shall be inspected and all evidence of moisture appearing on the surface of the ground during the test shall be investigated by the Contractor. Should the leakage test results exceed allowable leakage, the test

pressure shall be maintained for an additional period as directed by the City to facilitate location of leaks.

6. All pipe, fittings, valves, pipe joints, hydrants, and other materials which are found to be defective shall be removed and replaced with new, approved materials.

7. Pressure and leakage testing shall be repeated after repairing leaks and other defective work until results conform to specified requirements and approved by the City.

3.04 WATER MAIN DISINFECTION

A. The Contractor shall furnish all pumps, piping, taps, labor and other materials and services necessary to perform work.

B. One sampling tap shall be provided at the end of each line and a minimum of one tap per 1500 feet of pipe or as directed by the Enforcement Officer.

1. Sampling tap shall be as shown in AWWA C651, Figure 1. Use of hose or fire hydrant for sample collection is not permitted.

2. All disinfection, chlorination and flushing of the main will be done by the Contractor and in accordance with methods outlined in AWWA standard C651 – Disinfecting Water Mains.

   a. Before being placed into service, all new mains and repaired portions of, or extensions to, existing mains shall be chlorinated so that the initial chlorine residual is greater than 50 mg/L and chlorine residual greater than 25 mg/L after 24 hours in the pipe.

3. Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipe such that residual chlorine is less than 1 mg/L throughout the system or concentration directed by Enforcement Officer.

4. Following disinfection and flushing, the Contractor will collect bacteriological samples. Water from the new main shall remain isolated from other waters of the City system and shall not be made available for consumption until bacteriological testing verifies acceptable water quality.

   a. Bacteriological testing and sampling procedures will be in accordance with AWWA C651.

   b. Testing shall verify water samples are free of coliform bacteria contamination and is equal to or better than water quality in the distribution system.

   c. Water quality shall meet all drinking water standards of the Missouri Department of Natural Resources.

END OF SECTION 01001

SECTION 01002
EARTHWORK

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes specifications for earthwork, trenching, backfilling and compacting. The work shall consist of all labor, materials, and equipment required to install water main and appurtenances in accordance with contract documents, drawings, and specifications.

B. The Contractor shall employ skilled, qualified workers and supervision to perform work following generally accepted industry practices. The City reserves the right to suspend work if, in the opinion of the Enforcement Officer, this requirement is not being met.

C. If surface or ground contamination is suspected or encountered, notify the City immediately. The Developer and Contractor, in communication with the City, shall assess conditions and develop a plan for continued work including but not limited to: removal and disposal of contamination, specifying different sewer line materials, and line realignment.

1.02 DEFINITIONS

A. City: City of Moberly, Missouri

B. Water Department: City Water Department

C. Enforcement Officer: City Director of Public Utilities or designated representative.

D. Engineer: Licensed Professional Engineer in responsible charge for the project licensed to perform services in the State of Missouri.

E. Developer: Entity requesting water service construction, modifications, extensions, or alterations to the City water system. The Developer could be a public or private entity, such as the City of Moberly or a private Developer.

F. Contractor: Entity contracted by Developer to perform work on water main and services. The Contractor is responsible for constructing approved plans.

G. Owner: Entity who is responsible for long term performance, maintenance, and operation of new water mains. The City will typically become the Owner upon final approval and acceptance by City. The Developer will be responsible for the project until final approval and acceptance.

H. AWWA: American Water Works Association

I. ASTM: American Society for Testing and Materials

J. ANSI: American National Standards Institute

K. MSS: Manufacturers Standardization Society of the Valve and Fitting Industry

1.03 RELATED WORK

A. Section 01000 – Approval and Acceptance

B. Section 01005 - Pavement Repair

C. Section 01006 - Seeding

1.04 REFERENCE STANDARDS

A. ASTM D698 - Moisture-Density Relations of Soils and Soil Aggregate Mixtures, Using 5.5 lb. Rammer and 12-inch Drop.

B. ASTM D6938 – Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (shallow depth).

C. Missouri Standard Specification for Highway Construction.

1.05 NOTIFICATION

A. The Contractor shall notify the Enforcement Officer at least five (5) business days prior to commencing work.

1.06 SUBMITTALS

A. See Section 1000 – Approval and Acceptance.

B. Work Plan detailing means, methods, equipment, sequencing, and schedule for Earthwork.

C. Traffic control plan and required permits from jurisdictions having authority.

1.07 BASIS OF PAYMENT

A. This section applies to projects where the City of Moberly is the responsible Developer/Owner.

B. Trenching, backfilling, and compacting shall be included in the Contract unit cost of water main pipe.

C. Additional, extra, and/or changes in work must be approved by Enforcement Officer. Payment will be on basis of Contract documents regarding changes in work.

PART 2 - PRODUCTS

2.01 Materials shall be in accordance with Contract Documents, plans, specifications, and approved submittals.

2.02 BEDDING AND INITIAL BACKFILL

A. Granular bedding containing no clods, muck, sod, frozen material, roots or other deleterious material with a plasticity index not greater than 6 and meeting the following gradation requirements.

Sieve Size	Percent Passing
1.5 inch	100
#4	20-60
#200	0-6

2.03 FINAL BACKFILL

A. **Excavation Spoils:** suitable silt, sand, gravel, lean clay or combinations thereof containing no clods, muck, organics, frozen material, or other deleterious material from excavations. Maximum particle size shall be 3 inches.

1. If enough quantity of suitable materials is not available from excavation spoils, the Contractor shall identify and import suitable materials for backfill. Contractor shall dispose of all unsuitable material.

B. **Select Granular Backfill,** Section 1010, Missouri Standard Specification for Highway Construction. Material shall meet the following gradation:

Sieve Size	Percent Passing
3 inches	100
#40	20-60
#200	0-6

2.04 AGGREGATE BASE AND SURFACE

A. **Aggregate Base:** Type 5, Section 1007, Missouri Standard for Highway Construction.

B. **Aggregate Surface:** Grade A or B, Section 1006, Missouri Standards for Highway Construction.

2.05 CONTROLLED LOW-STRENGTH MATERIAL (FLOWABLE FILL)

A. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:

1. Portland Cement: ASTM C150/C150M, Type I or Type II.

2. Fly Ash: ASTM C618, Class C or F.

3. Normal-Weight Aggregate: ASTM C33/C33M, 3/4-inch nominal maximum aggregate size.

4. Water: ASTM C94/C94M.

5. Air-Entraining Admixture: ASTM C260/C260M.

B. Produce conventional-weight, controlled low-strength material with 100-psi compressive strength when tested according to ASTM C495/C495M and placed in the field with a slump between 9 and 11 inches tested in accordance with ASTM C143.

PART 3 - EXECUTION

3.01 GENERAL

A. Verify the actual locations (horizontal and vertical) of all utilities prior to beginning work. Protect all utilities from damage during construction. Damage to existing utilities shall be repaired to the satisfaction of the utility provider at Contractor's expense.

B. Establish line and grade to maintain minimum burial and separation requirements in coordination with Enforcement Officer and Engineer. Notify Enforcement Officer and Engineer if conflicts with

existing utilities or structures exist.

C. Trench excavations shall be protected in accordance with applicable Federal, State, and local regulations, Laws, and rules in accordance with OSHA 29 CFR part 1926. Trench and excavation stability shall be the responsibility of the Contractor.

D. Implement and maintain traffic control plan

3.02 WATER CONTROL

A. Develop and implement stormwater pollution prevention plan including erosion control measures. Prevent surface water and subsurface or ground water from entering excavations. The plan shall address water disposal if dewatering is required

B. Water from surface runoff, downspouts, and subsurface drains shall be managed and controlled by the Contractor through an approved site drainage system. Equipment and materials required to remove water from excavations shall be on-site and available for uses throughout construction.

C. Water disposal shall be the responsibility of the Contactor and completed in accordance with applicable federal, state, and local regulations.

3.03 PREPARATION

A. Clear and grub areas of excavation.

B. Backfilling and compaction shall not occur until the following conditions are satisfied:

1. Subgrade proof-compacting, required inspection, testing and acceptance by Enforcement Officer.

2. Soft, rutting, pumping, frozen or otherwise unsuitable soils in base of excavations shall be removed at direction of Enforcement Officer. Notify Enforcement Officer once subgrade elevations are reached. Excavate unsuitable soils within directed limits and replace with suitable materials approved by Enforcement Officer. Suitable materials could include but are not limited to bedding, initial backfill, and final backfill.

3. All trash, debris, vegetation, snow, ice, water or other unsatisfactory materials shall be removed from excavations.

3.04 EXCAVATION

A. Excavate trenches to approved subgrade elevations. Unless otherwise specified, the minimum trench width shall be at least one (1) foot greater than the outside diameter of the pipe.

B. If rock is encountered, it shall be excavated at least 12 inches wider than the outside diameter of the pipe and at least 6 inches deeper than planned subgrade elevation. Alternatively, pipe alignment and grade could be adjusted to avoid rock excavation if separation, burial, and joint restraint requirements are satisfied. If additional excavation is required, bedding material shall be used as backfill.

1. For City projects, notify Enforcement Officer and Engineer immediately if rock is encountered within excavation limits, and earthwork progress significantly slows or stops. Excavation in rock shall not progress unless approved by Enforcement Officer. The Enforcement Officer will provide guidance and specifications for rock excavation and backfilling on a case by case basis.

2. For City projects, unless identified as a bid item, additional cost for rock excavation will be paid for as additional work in accordance with Contract Documents regarding changes in work.

C. Stockpile materials acceptable for use as backfill and topsoil. Stockpile locations relative to excavations shall be incorporated into Contractor's responsibility for excavation stability. Place, grade, and shape stockpiles to promote positive drainage with adequate erosion control. Dispose unsuitable materials.

3.05 BACKFILLING

A. Proof-compact subgrade prior to placing bedding or laying pipe. Proof-compacting shall be performed in the presence of Enforcement Officer; approval is required before placing bedding to receive pipe.

B. Shape and compact bedding to provide uniform bearing of the pipe. Excavate bell holes to allow for unobstructed assembly of the joint. Make bell hole as small as practical. After the joint has been made, carefully fill bell hole with bedding material and compact.

C. After pipe laying, joining and aligning, place and compact bedding and initial backfill as shown on the plans. Ensure material is worked under the haunch of the pipe to provide adequate side support. Take precautions to prevent movement of the pipe during placement and compaction of haunching material.

D. Place and compact initial backfill to provide cover over the pipe. Use methods to prevent pipe damage or displacement.

E. In unpaved areas, place final backfill using methods to prevent pipe damage or displacement. Place final backfill in 6-inch loose lifts and compact. Leave material neatly mounded over the trench. Maintain trench and fill settled areas as they occur. Finish grade to eliminate uneven areas. Seed areas where required.

F. In paved areas, place and compact base and surface repairs in accordance with details and project specification Section 01005 - Pavement Repair. Place final backfill using methods to prevent pipe damage or displacement.

G. Jetting or water-settling backfill is prohibited, unless permitted by Enforcement Officer and Engineer.

3.06 COMPACTION

A. Compact materials in accordance with ASTM D698 and ASTM 6938 and according to the following table:

Material	Minimum Compaction	Maximum Loose Lift Thickness
Bedding and Initial Backfill	90%	4 inches
Suitable Excavation Spoils	90%	6 inches
Select Granular Backfill	95%	6 inches
Aggregate Base	95%	6 inches
Aggregate Surface	95%	6 inches
Bituminous Surface	98%	3 inches

B. Moisture condition (wetting or drying) fill as needed to achieve optimum moisture contents and required compaction.

C. Use compaction equipment capable of achieving required densities and avoid damage to pipe, adjacent utilities, and adjacent structures. Self-propelled, "heavy" roller or pad type vibratory rollers shall not be operated within 2 feet from top of pipe.

3.07 QUALITY CONTROL

A. Compaction quality control shall be provided by Contractor and will be incidental to Contract Unit costs. Quality control technicians and testing organizations shall be trained and certified to perform required testing in accordance with ASTM standards and specifications.

B. Quality control density testing frequency shall be in accordance with the following table:

Material	Testing Frequency per lift
Bedding and Initial Backfill	One test every 300 linear feet of trench
Suitable Excavation Spoils	One test every 300 linear feet of trench
Select Granular Backfill	One test at each pavement structure crossing
Aggregate Base	One test at each pavement structure crossing
Aggregate Surface	One test at each pavement structure crossing
Bituminous Surface	One test at each pavement structure crossing

C. Areas where testing indicates insufficient compaction shall be re-compacted, re-conditioned, re-worked until requirements are met to satisfaction of Owner and Engineer.

D. Controlled low strength material shall be tested in the field for slump and samples collected for comprehensive strength testing. Slump and comprehensive testing shall be in accordance with ASTM C143 and ASTM C495, respectively. Testing frequency shall be 1 set of tests per 100 cubic yards of material used. Slump shall be between 9 and 11 inches. Minimum compressive strength is 100 psi.

3.08 MAINTENANCE

A. The Contractor will demobilize equipment and restore the work site to the original condition. Backfill excavations and restore surfaces according to specifications and project drawings.

B. Remove all leftover materials, including unsuitable excavation spoils, trash, debris, and other construction waste in accordance with applicable federal and state laws and regulations.

C. Protect newly graded areas from traffic (except pavement crossings) and erosion. Keep free of trash and debris See Section 01005- Pavement Repair for pavement area maintenance.

D. Repair and re-establish grades in settled, eroded and rutted areas to specified tolerances during warranty period and to satisfaction of Enforcement Officer.

E. Where differential movement is measurable or observable along excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add appropriate backfill material, compact, and replace surface treatment according to project specifications and plans. Restore appearance, quality, and condition of surface or finish to match adjacent work to satisfaction of Enforcement Officer.

END OF SECTION 01002

SECTION 01003
DIRECTIONAL DRILLING

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes specifications for directional drilling installation methods for High Density Polyethylene (HDPE) pipe casing or steel pipe casing beneath traveled ways or at locations shown on the drawings. The Contractor shall provide all labor, materials, and equipment required to install casing in accordance with these specifications.

1.02 SUBMITTALS

A. Submit work plans, shop drawings, and product data for approval. Submittals shall include:

1. Detailed work plan and sequencing including procedures and schedule;
2. Proposed line and grade of casing pipe to maintain minimum burial depth, minimum separation requirements from existing utilities, and radius of curvature;
3. Proposed equipment including but not limited to: drilling rig, rotary torque capacity, thrust/pullback pressures, tensile load limit calculations, drill bits, mud system including pump and motor size, down-hole tools, guidance system with stated accuracy, and safety systems;
4. Pit locations;
5. Design, means, methods and materials for pit excavation support;
6. Pit dimensions showing relative location to traveled ways;
7. Dewatering methods;
8. Spoil removal methods;
9. Drilling fluids including water source;
10. Methods for monitoring drill fluid volumes and losses;
11. Product data;
12. Casing pipe material and size;
13. Casing pipe segment joining methods and procedures;
14. Product pipe spacers and casing pipe end seal materials;
15. Erosion control and stormwater pollution prevention plan;
16. Adverse conditions plan:
    a. Plan shall address means and methods of work, especially HDPE fusion welding, in adverse conditions such as freezing temperatures, precipitation, and wind and mitigation measures to eliminate resulting effect on pipe fusion and installation;
17. Remediation plan:
    a. Identify means and methods to remove obstructions at the boring face;
    b. Identify remedial measures for mitigating damage to existing facilities, and impacts to traveled ways, including ground subsidence and heaving;
    c. Identify remedial measures for excessive drill fluid loss;
18. Experience:
    a. Submit a list of at least five (5) successfully completed directional drilling projects using HDPE pipe sizes of at least 18 inches and lengths greater than 150 feet within the last five (5) years. Include project owner contact information references substantiating Contractor's experience; and,
19. As-Built Drawings showing horizontal and vertical alignment of completed casing installation. This submittal shall also include pullback pressure logs, volume of drilling fluid, and fluid losses, if any.

1.03 NOTIFICATION

A. The Contractor shall notify the Enforcement Officer at least two (2) business days prior to commencing work. All work shall be performed in the presence of the Enforcement Officer.

1.04 BASIS OF PAYMENT

A. Directional drilling shall be paid for by the lineal footage of casing installed along casing centerline. The unit price shall include:

1. Excavation, use, and backfilling of all pits;
2. Removal and disposal of spoils and drilling fluid;
3. Traffic control;
4. Verifying location and depth of all utilities within impacted area;
5. Casing pipe installation; and,
6. All labor, equipment, and materials required to complete the work.

B. The unit cost shall be for casing pipe and shall not include product pipe and installation.

C. Cost associated with all work and materials not specifically identified as a bid item shall be considered as incidental to other pay items.

D. Additional, extra, and/or changes in work must be approved by Enforcement Officer. Payment will be on basis of Contract documents regarding changes in work.

PART 2 – PRODUCTS

2.01 HIGH DENSITY POLYETHYLENE PIPE CASING

A. Materials shall be in accordance with Contract Documents, plans, specifications, and approved submittals.

B. All HDPE shall be manufactured from PE 4710 resin listed as TR-4 by the Plastic Pipe Institute (PPI). The resin shall meet ASTM D3350 with a minimum 445474C cell classification. The manufacturer shall certify the specified cell classification.

C. HDPE casing shall conform to ASTM F 714, ANSI and AWWA C906, and have an NSF-61 listing.

D. All pipe, fittings, and fusion equipment shall be provided by one supplier. Fusion equipment must be in satisfactory working order. All fusion equipment operators shall be qualified to perform heat fusing procedures.

2.02 STEEL PIPE CASING

A. Materials shall be in accordance with approved submittals.

B. Steel casing pipe shall meet or exceed ASTM A-139, Grade B with a minimum wall thickness of 0.25 inches and minimum yield strength of 35,000 psi. Steel casing shall be joined by fully welding around the entire circumference of the pipe. Welding shall conform to AWWA Standard C206.

2.03 CASING END SEALS

A. Synthetic rubber end seals shall be installed on each end of the casing pipe. End seals shall be Advanced Model Products – Model AC Pull-on or approved equal and fastened tightly with stainless steel bands.

2.04 INSULATING SPACERS

A. Projection type, non-metallic spacers shall be RACI, Advance Products & Systems, or approved equal. Refer to manufacturer's product data for spacer type and size.

2.05 DIRECTIONAL DRILLING EQUIPMENT

A. Directional drilling equipment shall consist of a hydraulically-powered directional drilling rig of sufficient capacity to perform the bore and pullback the casing pipe, a drilling fluid mixing, delivery and recovery system of sufficient capacity to successfully complete the crossing, a drilling fluid recycling system to remove solids from the drilling fluid, a guidance system to accurately guide boring operations, a vacuum truck of sufficient capacity to handle drilling fluid volume, and qualified personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.

B. The directional drilling rig shall consist of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle while recirculating pressurized drilling fluid mixture to a guidable drill head. The rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations. The rig shall be electrically grounded during drilling and pull-back operations. There shall be a system to detect electrical current from the drill string and an audible alarm that automatically sounds when an electrical current is detected.

C. Drilling fluid shall be composed of clean water and appropriate bentonite clay additives in accordance with approved submittals. Water shall be from source approved by Enforcement Officer and be contaminant free. Drilling fluids shall be thoroughly mixed and free of clumps or clods.

PART 3 - EXECUTION

3.01 GENERAL

A. Verify the actual locations (horizontal and vertical) of all utilities prior to beginning work. Protect all utilities from damage during construction. Damage to existing utilities shall be repaired to the satisfaction of the utility provider at Contractor's expense.

B. Construction means, methods, and materials shall be in accordance with approved submittals.

C. Entry and exit pit excavations shall be constructed in accordance with approved submittals. Excavations should be protected in accordance with applicable Federal, State, and Local regulations, laws, and rules. Excavation protection shall not be less than the standards and regulations established by OSHA 29 CFR Part 1926. Trench safety and stability shall be the responsibility of the Contractor, including placement of excavation spoils and control of water intrusion.

3.02 HANDLING OF MATERIAL

A. Handle pipes, conduits, casing, and ancillary items in such a manner as not to damage the material. Pipe rollers or other approved means shall be used during pullback operations to avoid damage to casing pipe and product pipe.

B. Damage to material shall be repaired to the satisfaction of the Enforcement Officer and, if required, replaced.

C. The Enforcement Officer maintains the authority to reject materials damaged or otherwise unsuitable for project use.

3.03 DRILLING FLUID

A. Disposal of drilling fluid and spoils will be the responsibility of the Contractor and shall be done in compliance with all Federal, State, and local regulations.

B. All drilling fluids and loose cuttings shall be contained in access pits or holding tanks for recycling and disposal. Drilling fluid returns into or on other areas shall be cleaned up and disposed of immediately. The Contractor shall notify the Enforcement Officer immediately if drilling fluid returns occur or are spilled in areas other than approved holding structures.

C. The Contractor shall provide adequate means and equipment for removing drilling fluid and spoils from access pits to mitigate potential overflows and provide for final disposal. Disposal equipment shall be present during all directional drilling operations.

3.04 DIRECTIONAL DRILLING

A. Perform directional drilling operations in accordance with approved submittals. The Contractor shall provide all material, equipment, and facilities required to perform directional drilling.

B. The drill path shall be accurately staked with alignment and entry/exit pits.

C. Pipe, conduit, and casing installation under traveled ways shall progress on a continuous basis without stoppage, except for adding sections, until the leading edge has reached the receiving pit. Engineering approval is required for variations from this specification.

D. Stop operations if ground movement is detected and implement the remediation plan in accordance with approved submittals. Immediately report movement to the Enforcement Officer. Repair any damages to traveled ways, including displacement (up or down) resulting from construction operations. Corrective actions shall be approved by the responsible authority. Mitigating repairs and associated costs will be the responsibility of the Contractor.

3.05 PILOT HOLE BORING

A. The entry angle, pilot hole, and boring process shall maintain a curvature that does not exceed allowable bending radius of casing or product pipe and in accordance with approved submittals.

B. The pilot hole shall be drilled along the Contractor submitted, and approved line, grade, and radius of curvature. No curves will be accepted with a radius more than approved curvature.

C. Drilling fluid pressures shall be monitored at all times during operations. Pressures shall be controlled to avoid hydraulic fracturing of subsurface materials and prevent structure and ground surface heaving.

D. Drilling fluid and cutting return shall be monitored at all times during operations. The volume of drilling fluids and spoil return anticipated shall be estimated based on subsurface conditions encountered. Excessive drilling fluid loss or excess spoil return shall be reported immediately to the Enforcement Officer. The Enforcement Officer will, in consultation with the Contractor, determine if corrective actions are required.

E. Contractor shall provide adequate containment, drilling fluid and spoil removal equipment and other means required to contain all fluid and spoils and/or remove it from site. No additional compensation will be allowed for containment or cleanup resulting from spillage, hydraulic fracturing, or other means leading to release of drilling fluids.

F. Alignment Adjustments and Restarts

1. The Contractor shall follow the approved alignment within specifications. If adjustments or restarts are required, the Contractor shall notify the Enforcement Officer for approval prior to adjusting.

3.06 CASING PIPE INSTALLATION

A. After the pilot hole is completed and approved, the enlarging phase of installation shall begin. The borehole diameter shall be increased to accommodate the pullback operations for the specified casing pipe size. The type of reamer shall be determined by subsurface soil conditions encountered during pilot hole drilling. The reamer type shall be selected by the Contractor and must be equipped with a swivel.

B. The maximum hole diameter shall be 1.25 times the casing pipe outside diameter. The Contractor may elect to perform multiple reaming passes. Multiple reaming passes will be completed at Contractor's expense.

C. Borehole stability shall be the responsibility of the Contractor. Open boreholes shall be stabilized using appropriate means to prevent collapse while still maintaining ability to perform work.

D. Once pullback operations have commenced, operations must continue without interruption until pipe is completely pulled into borehole. During pullback operations, Contractor will not apply more than the maximum safe pipe pull pressure at any time. If casing pipe becomes stuck, Contractor will cease pulling operations and allow any potential "suction lock" to subside and resume pulling operations. If pipe remains stuck, Contractor will notify Engineer. Engineer and Contractor will review available options and proceed accordingly.

E. Drilling fluid pressures shall be monitored at all times during operations. Pressures shall be controlled to avoid hydraulic fracturing of subsurface materials and avoid structure and ground surface heaving. Contractor shall provide adequate containment, drilling fluid and spoil removal equipment and other means required to contain all fluid and spoils and/or remove it from site. No additional compensation will be allowed for containment or cleanup resulting from spillage, hydraulic fracturing, or other means leading to release of drilling fluids.

F. Drilling fluid and cutting return shall be monitored at all times during operations. The volume of drilling fluids and spoil return anticipated shall be estimated based on subsurface conditions encountered. Excessive drilling fluid loss or excess spoil return shall be reported immediately to the Enforcement Officer. The Enforcement Officer will, in consultation with the Contractor, determine if corrective actions are required.

G. The casing pipe shall be protected and supported during pullback operations using rollers or other approved means to minimize damage.

3.07 OBSTRUCTIONS

A. The Enforcement Officer must be notified immediately if any obstruction is encountered that stops progress of operations. The Contactor shall review the situation with the Enforcement Officer and determine the feasibility of continuing drilling operations, switching to alternative methods, and/or modifying alignment/location of the jack and bore.

B. If continuing is deemed unfeasible or impractical, the obstructed pilot hole or casing shall be abandoned in place and filled completely with grout or other approved materials.

C. For City projects, substantiated cost of abandoned work resulting from unforeseen obstructions encountered will be paid for as additional work in accordance with Contract documents.

3.08 ALIGNMENT

A. The Contractor shall provide an accurate means to monitor horizontal and vertical positions of the casing during construction operations. The Enforcement Officer shall always have access to this information during the directional drilling process. If a magnetic guidance system is used, the Contractor shall identify any surface geo-magnetic anomalies and take appropriate corrective measures to ensure accurate spatial tracking of the drill stem.

B. The casing shall be installed within a tolerance of 6 inches from approved, line and grade over 100 feet. The tolerance will be adjusted proportionally for shorter or longer casing lengths; however, the maximum deviation for casing lengths longer than 150 feet shall be no more than 1 foot.

C. The alignment of casing shall be established to allow unrestricted insertion of the product pipe, including spacers, pipe bells, and restrained joints. If product pipe cannot be installed, the casing shall be abandoned and filled with grout or other approved materials. The Contractor shall establish another casing at a location approved by Enforcement Officer.

3.09 PRODUCT PIPE INSTALLATION

A. The product pipe shall be the size and type as specified or shown on the plans.

B. The end of product pipe shall be protected from damage during installation into the casing.

C. Product pipe shall have restrained joints within the casing.

D. The product pipe shall be supported in the casing pipe using projection-type non-metallic casing spacers.

1. The minimum number of spacer projections around the product pipe circumference shall equal the pipe diameter (i.e. a nominal 10-inch pipe shall have minimum of 10 projections). Refer to manufacturer's product data for spacer type and size.

2. Casing spacers shall fasten tightly onto the product pipe to prevent movement during installation.

3. The insulator spacing shall be installed to support the weight of the product pipe and contents. Spacers shall be placed a maximum of 2 feet from each side of a joint and evenly spaced along the product pipe at intervals not to exceed manufacturer's recommendations or 6 feet, whichever is less.

4. Double spacers shall be installed one foot from each end of the casing.

5. Projection type spacers shall be RACI, Advance Products & Systems, or approved equal.

3.10 SITE RESTORATION

A. The Contractor will demobilize equipment and restore the work site to the original condition. All excavations will be backfilled according to specifications and project drawings. Surface restoration shall be completed in accordance with Section 01005 – Pavement Repair and Section 01006 - Seeding.

B. Remove all excess spoils and dispose of in accordance will all federal, state, and local regulations.

END OF SECTION 01003

SECTION 01004
UTILITY JACKING AND BORING

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes specifications for jack and bore installation of steel casing beneath traveled ways. The Contractor shall provide all labor, materials, and equipment required to install casing in accordance with these specifications. This work shall consist of pushing/jacking a steel casing pipe with a boring auger rotating within the pipe to remove spoils as casing is advanced.

1.02 SUBMITTALS

A. Submit work plans, shop drawings, and product data for Engineer approval. Submittals shall include:

1. Work plan and sequencing;
2. Proposed line and grade of casing pipe to maintain minimum burial depth and separation requirements from existing utilities;
3. Equipment and site configuration;
4. Jacking and receiving pit locations;
5. Design, means, methods and materials for pit excavation support;
6. Pit dimensions showing relative location to traveled ways;
7. Dewatering methods;
8. Differential movement monitoring methods;
9. Excavation face loss prevention methods;
10. Spoil removal methods;
11. Drilling fluids;
12. Product data;
13. Casing pipe material and size;
14. Casing pipe segment joining methods and procedures;
15. Product pipe spacers and casing pipe end seal materials;
16. Erosion control and stormwater pollution prevention plan;
17. Remediation plan:
    a. Identify means and methods to remove obstructions at the boring face;
    b. Identify remedial measures for mitigating damage to existing facilities, and impacts to traveled ways, including ground subsidence and heaving;
18. Experience:
    a. Submit a list of at least five (5) successfully completed jack and bore projects greater than 50 feet within the last five (5) years including project owner contact information references substantiating jack and bore installer's experience; and,

19. As-Built Drawings showing horizontal and vertical alignment of completed jack and bore.

1.03 NOTIFICATION

A. The Contractor shall notify the Enforcement Officer at least two (2) business days prior to commencing work. All work shall be performed in the presence of the Enforcement Officer.

1.04 BASIS OF PAYMENT

A. This section applies to projects where the City of Moberly is the responsible Developer/Owner.

B. Jack and Bore shall be paid for by the lineal footage of casing measured along casing centerline. The unit price shall include:

1. Excavation, use, and backfilling of all pits;
2. Removal and disposal of spoils and drilling fluid;
3. Traffic control;
4. Verifying location and depth of all utilities within impacted area;
5. Casing pipe installation; and,
6. All labor, equipment, and materials required to complete the work.

C. The unit cost shall not include product pipe and installation.

D. Cost associated with all work and materials not specifically identified as a bid item shall be considered as incidental to other pay items.

E. Additional, extra, and/or changes in work must be approved by Enforcement Officer. Payment will be on basis of Contract documents regarding changes in work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials shall be in accordance with Contract Documents, plans, specifications, and approved submittals.

B. Steel casing pipe shall meet or exceed ASTM A-139, Grade B with a minimum wall thickness of 0.25 inches and minimum yield strength of 35,000 psi. Steel casing shall be joined by fully welding around the entire circumference of the pipe. Welding shall conform to AWWA Standard C206.

C. Synthetic rubber end seals shall be installed on each end of the casing pipe. End seals shall be Advanced Model Products – Model AC Pull-on or approved equal fastened tightly with stainless steel bands.

D. Projection type spacers shall be RACI, Advance Products & Systems, or approved equal. Refer to manufacturer's product data for spacer type and size.

PART 3 - EXECUTION

3.01 GENERAL

A. Verify the actual locations (horizontal and vertical) of all utilities prior to beginning work. Protect all utilities from damage during construction. Damage to existing utilities shall be repaired to the satisfaction of the utility provider at Contractor's expense.

B. Construction means, methods, and materials shall be in accordance with approved submittals.

C. Excavations shall be constructed in accordance with approved submittals. Excavations should be protected in accordance with applicable Federal, State, and local regulations. Excavations must meet or exceed regulations established by OSHA 29 CFR Part 1926. Trench safety and stability shall be the responsibility of the Contractor.

D. Disposal of excess spoils removed from the casing pipe shall be the responsibility of the Contractor and shall be done in compliance with all Federal, State, and local regulations.

3.02 HANDLING OF MATERIAL

A. Handle pipes, conduits, casing, and ancillary items in such a manner as not to damage the material.

B. Damage to material shall be repaired to the satisfaction of the Engineer or replaced at Contractor's expense.

C. The Enforcement Officer maintains the authority to reject materials damaged or otherwise unsuitable for project use.

3.03 JACK AND BORE

A. Perform jack and bore operations in accordance with approved submittals and the following requirements:

1. Unsupported excavation (open-hole) ahead of the casing will not be permitted. Mechanical arrangements or other devices shall be provided at the leading end of the carrier to prevent drilling ahead of the casing.

2. The use of water or slurry under pressure (jetting) or puddling shall not be permitted to facilitate boring, pushing, or jacking operations. Non-pressurized water or slurry is acceptable for use as a lubricant behind the cutter head.

3. Pipe, conduit, and casing installation under traveled ways shall progress on a continuous basis without stoppage, except for adding sections, until the leading edge has reached the receiving pit. Engineering approval is required for variations from this specification.

B. Employ methods to prevent loss of the excavation face in accordance with approved submittals.

C. Stop operations if ground displacement is detected and implement the remediation plan in accordance with approved submittals. Repair any damages to traveled ways, including displacement (up or down) resulting from construction operations. Corrective actions shall be approved by the Engineer. Mitigating repairs and associated costs will be the responsibility of the Contractor.

3.04 OBSTRUCTIONS

A. The Enforcement Officer must be notified immediately if any obstruction is encountered that stops progress of operations. The Contactor shall review the situation with the Enforcement Officer and determine the feasibility of continuing operations, switching to alternative methods, and/or modifying alignment/location of the jack and bore.

B. If continuing is deemed unfeasible or impractical, the obstructed pilot hole or casing shall be abandoned in place and filled completely with grout or other approved materials.

C. For City projects, substantiated cost of abandoned work resulting from unforeseen obstructions encountered will be paid for as additional work in accordance with Contract documents.

3.05 ALIGNMENT

A. The Contractor shall provide an accurate means to monitor horizontal and vertical positions of the casing during construction operations. The Enforcement Officer shall always have access to this information during the jack and bore process. If a magnetic guidance system is used, the Contractor shall identify any surface geo-magnetic anomalies and take appropriate corrective measures to ensure accurate spatial tracking of casing.

B. The casing shall be installed within a tolerance of 1 foot of approved line and grade over 100 feet. The tolerance may be adjusted proportionally for shorter or longer casing lengths; however, the maximum deviation for casing lengths longer than 150 feet shall be no more than 1.5 feet.

C. The alignment of casing shall be established to allow unrestricted insertion of the product pipe, including spacers, pipe bells, and restrained joints. If product pipe cannot be installed, the casing shall be abandoned and filled with grout or other approved materials. The Contractor shall establish another casing at a location approved by Enforcement Officer.

3.06 PRODUCT PIPE INSTALLATION

A. The product pipe shall be the size and type as specified or shown on the plans.

B. The end of product pipe shall be protected from damage during installation into the casing.

C. Product pipe shall have restrained joints within the casing.

D. The product pipe shall be supported in the casing pipe using projection-type non-metallic casing spacers.

1. The minimum number of spacer projections around the product pipe circumference shall equal the pipe diameter (i.e. a nominal 10-inch pipe shall have minimum of 10 projections). Refer to the manufacturer's product data for spacer type and size.

2. Casing spacers shall fasten tightly onto the product pipe to prevent movement during installation.

3. The insulator spacing shall be installed to support the weight of the product pipe and contents. Spacers shall be placed a maximum of 2 feet from each side of a joint and evenly spaced along the product pipe at intervals not to exceed manufacturer's recommendations or 6 feet, whichever is less.

4. Double spacers shall be installed one foot from each end of the casing.

5. Projection type spacers shall be RACI, Advance Products & Systems, or approved equal. Refer to manufacturer's product data for spacer type and size.

3.07 SITE RESTORATION

A. The Contractor will demobilize equipment and restore the work site to the original condition. All excavations will be backfilled according to specifications and project drawings. Surface restoration shall be completed in accordance with contract requirements, Section 01005 – Pavement Repair, and Section 01006 – Seeding.

END OF SECTION 01004

SECTION 01005
PAVEMENT STRUCTURE REPAIR

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes specifications for repairing and restoring aggregate, concrete, and asphalt concrete pavement structures in areas where trenches cross these features. The Contractor shall provide all labor, materials, and equipment required to perform work in accordance with these specifications.

1.02 RELATED WORK

A. Section 01002 – Earthwork

B. Section 01003 – Directional Drilling

C. Section 01004 – Utility Jacking and Boring

1.03 REFERENCE STANDARDS

A. ASTM D698 - Moisture-Density Relations of Soils and Soil Aggregate Mixture, using 5.5 lb. Rammer and 12 in Drop.

B. Missouri State Highway and Transportation Commission: Missouri Standard Specifications for Highway Construction, current edition, including Section 613 Pavement Repair

1.04 BASIS OF PAYMENT

A. This section applies to projects where the City of Moberly is the responsible Developer/Owner.

B. Pavement Structure Repair shall be paid for by the lineal foot at Contract unit cost for surfaces listed on bid form and plan quantities table. Culvert, mailbox, or other surface features required to be removed as a result of construction shall be included in Contract unit cost.

C. Cost associated with all work and materials not specifically identified as a bid item shall be considered as incidental to other pay items.

D. Additional, extra, and/or changes in work must be approved by Enforcement Officer. Payment will be on basis of Contract documents regarding changes in work.

PART 2 - MATERIALS

2.01 AGGREGATE BASE AND SURFACE COURSE MATERIALS

A. Aggregate Base: Type 5, Section 1007, Missouri Standard Specifications for Highway Construction.

B. Aggregate Surface: Grade A or B, Section 1006, Missouri Standard Specifications for Highway Construction.

2.02 BITUMINOUS SURFACE COURSE AND PATCHING MATERIALS

A. Prime Coat: Liquid Asphalt RC-MC Grade 30, Section 1015, Missouri Standard Specifications for Highway Construction.

B. Base Mix: MoDOT Base, Section 401, Missouri Standard Specifications for Highway Construction.

C. Tack Coat: SS-1 or SS-1H, Section 1015 Missouri Standard Specifications for Highway Construction.

D. Surface Mix: Type BP-1, Section 401, Missouri Standard Specifications for Highway Construction.

2.03 PORTLAND CEMENT CONCRETE

A. Portland Cement: Type I or Type II

B. Concrete Mix: Portland Cement Concrete Base and Pavement, class B-1, non-air entrained with material conforming to Section 502 and 1000, Missouri Standard Specifications for Highway Construction with a slump between 3 and 6 inches.

C. Water: potable

D. Reinforcement: #4 rebar placed 12 inches on center each way. Concrete shall be dowelled into existing with drilled and epoxy set #4 rebar dowels placed 18 inches on center.

PART 3 - EXECUTION

3.01 REPAIR

A. All trenches in traveled ways shall be repaired with either Bituminous Surface Course and Patching Materials or Concrete Material according to standard details.

B. All trenches in concrete sidewalk, driveways and roadways shall be repaired/replaced with concrete material according to standard details.

C. All trenches in aggregate surfaced pavement structures shall be replaced with Aggregate Base and Surface Course according to standard details.

D. Pavement replaced shall adhere to the following procedures:

1. Place granular backfill to provide temporary surface over trenches across traveled ways. Open to traffic for at least one week. Repair all potholes and level surface daily, adding additional material as needed. Base under the pavement shall be 8 inches thick.

2. After pavement has been open to traffic for one week, saw cut and remove existing pavement on both sides of trench, remove enough base course material, level, compact, and construct pavement patch per the project details.

3.02 COMPACTION

A. In accordance with Section 01002 Earthwork.

3.03 MAINTENANCE

A. Maintain surface repairs until final acceptance. Replace and repair areas where excessive displacement, rutting, raveling, or other unacceptable damages occur as a result of construction.

B. Repaired areas will be accepted at end of maintenance period and all pavement repairs are performing well without further damages.

END SECTION 01005

SECTION 01006
SEEDING

PART 1 – GENERAL

1.01 RELATED WORK

A. Section 01002 - Earthwork

B. Section 01003 – Directional Drilling

C. Section 01004 – Utility Jacking and Boring

1.02 REFERENCE STANDARDS

A. Missouri Standard Specification for Highway Construction, current edition.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver grass seed in original containers showing analysis of seed mixture, percentage of pure seed, year of production, net weight, date of packaging, and location of packaging. Damaged packages are not acceptable.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.04 BASIS OF PAYMENT

A. This section applies to projects where the City of Moberly is the responsible Developer/Owner.

B. Seeding cost shall be included in Contract unit cost for product pipe.

PART 2 - MATERIALS

2.01 SEED

A. Seed shall meet the following minimum percentages for purity and germination, and maximum percentage for weed seed. Vendor certification for each lot number of numbers with testing statement. Seed that has not been tested and certified within the last 1 year will be rejected

Type	Purity	Germination	Weed
Kentucky Blue Grass	85	80	<1.0
Perennial Rye	98	85	<1.0
Red Fescue	97	85	<1.0

2.02 FERTILIZER

A. Standard commercial fertilizer supplied separately or in mixtures and furnished in water tight containers. Each container shall be marked with weight and manufacturer's guaranteed analysis showing ingredient percentages.

B. Furnish a mixture of chemical ingredients providing total nitrogen, phosphoric acid, and potassium required based on soil analysis or as otherwise specified. Chemical ingredient tolerances shall be within 2 percent.

2.03 MULCH

A. Fresh wheat, rye, or oat straw, air dried. Non-toxic to vegetation and to the germination of seed, free from noxious seeds and weed seeds.

2.04 APPLICATION RATES

A. **Fertilizer:** provide total nitrogen, phosphoric acid, and potassium required based on soil analysis or as otherwise specified.

B. **Seed**

1.	Kentucky Blue Grass:	1.10 lbs/1,000 sq. ft.
2.	Perennial Rye:	0.60 lbs/1,000 sq. ft.
3.	Redtop: Red Fescue:	0.40 lbs/1,000 sq. ft.

PART 3 - EXECUTION

3.02 PREPARATION

A. When soil is in a tillable condition, cultivate to a depth of 4 inches, reducing soil particles to a size not larger than 2 inches. Moisture condition surface to receive seed.

B. Assure seed bed is level, smooth, and free of weeds, clods, stones, roots, and sticks. Moisture condition as needed.

C. Apply fertilizer and mix into the top 2 inches of soil. Apply within 48 hours prior to seeding.

3.03 SEEDING AND MULCHING

A. Uniformly sow seeds in two operations at right angles to each other. Within 12 hours after seeding roll areas at right angles to runoff with a lawn type roller. Do not over compact.

B. Within 24 hours of seeding apply mulch at 2 1/2 tons per acre. Stabilize vegetative mulch by embedding in soil to prevent mulch loss by wind or water erosion.

3.04 MAINTENANCE

A. Maintain surfaces until final acceptance and supply additional topsoil, seed, and fertilizer where necessary, including areas affected by erosion.

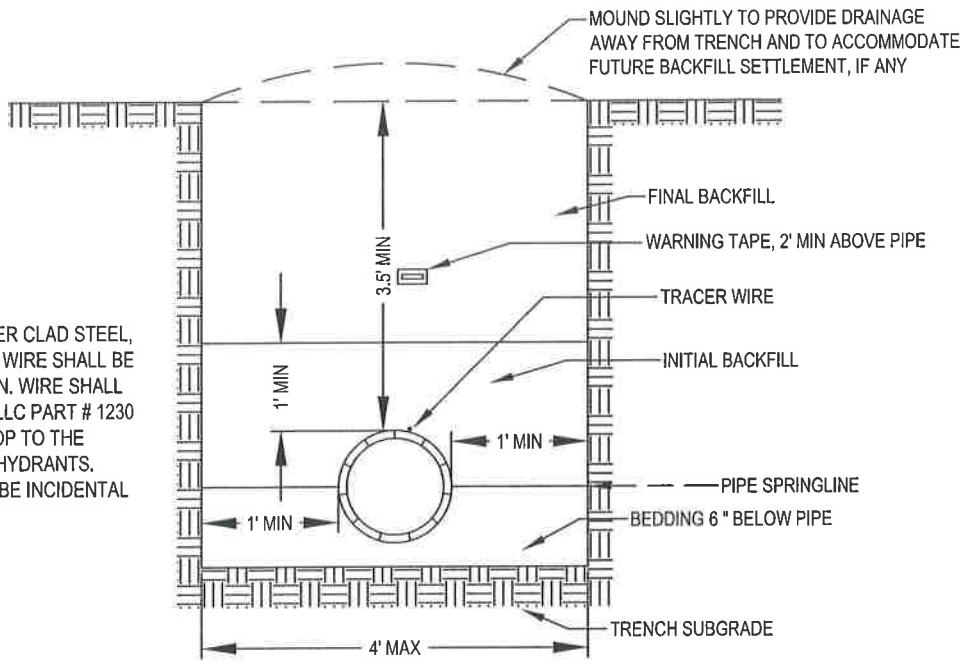
B. Replant damaged grass areas showing root growth failure, deterioration, bare or thin spots, and eroded areas.

C. Seeded areas will be accepted at end of maintenance period when seeded areas are properly established and otherwise acceptable.

END OF SECTION 01006

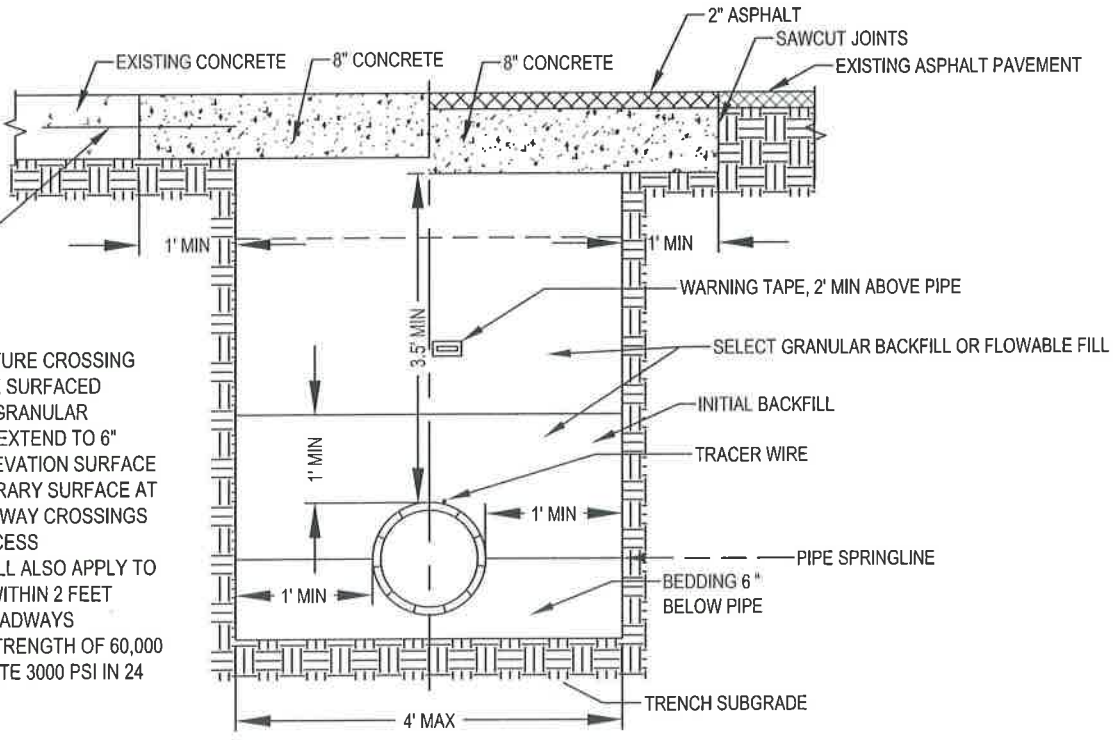
CITY OF MOBERLY, MISSOURI
STANDARD SPECIFICATIONS FOR WATER MAIN CONSTRUCTION

SECTION 2 – STANDARD DETAILS FOR WATER MAIN CONSTRUCTION



TRACER WIRE SHALL BE COPPER CLAD STEEL, CCS, (12 GAUGE AWG) TRACER WIRE SHALL BE ATTACHED TO THE WATER MAIN. WIRE SHALL BE COPPERHEAD INDUSTRIES LLC PART # 1230 HS OR EQUAL, WIRE SHALL LOOP TO THE SURFACE AT ALL VALVES AND HYDRANTS. COST OF TRACER WIRE SHALL BE INCIDENTAL TO UNIT COST OF PIPE.

WATER MAIN IN TRENCH TYPICAL INSTALLATION DETAIL- SEEDED SOIL SURFACE



NOTES: PAVEMENT STRUCTURE CROSSING

1. FOR AGGREGATE SURFACED AREAS, SELECT GRANULAR BACKFILL SHALL EXTEND TO 6" BELOW FINAL ELEVATION SURFACE
2. PROVIDE TEMPORARY SURFACE AT ROAD AND DRIVEWAY CROSSINGS TO MAINTAIN ACCESS
3. THIS DETAIL SHALL ALSO APPLY TO ALL TRENCHES WITHIN 2 FEET PARALLELING ROADWAYS
4. REBARS YIELD STRENGTH OF 60,000 PSI AND CONCRETE 3000 PSI IN 24 HOURS.

TYPICAL TRENCH INSTALLATION DETAIL-PAVEMENT STRUCTURE CROSSINGS

STANDARD DETAIL No. 02001 REVISION DATE: 10-08-2019

WATER MAIN CONSTRUCTION
TYPICAL WATER MAIN IN TRENCH INSTALLATIONS
CITY OF MOBERLY, MISSOURI

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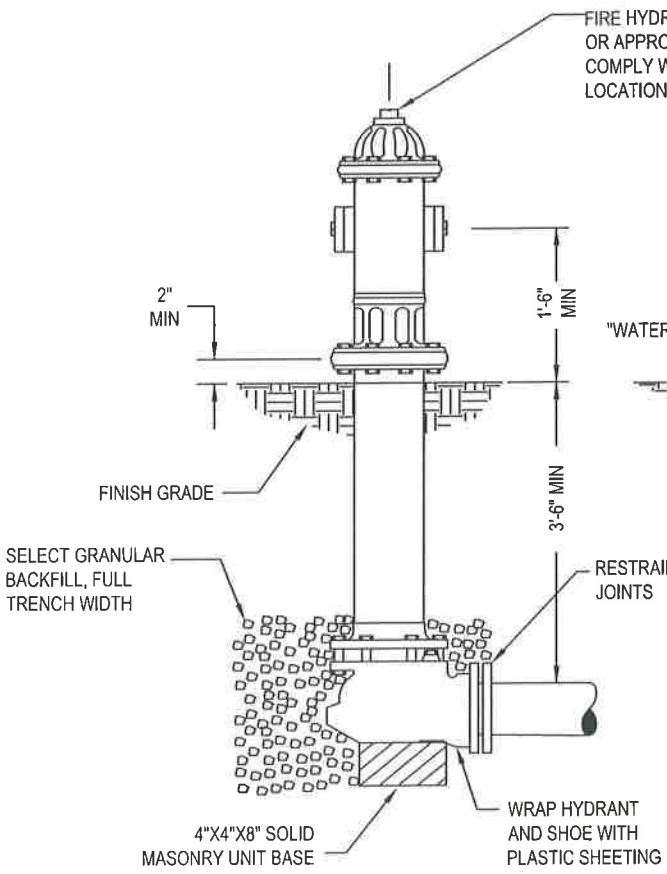
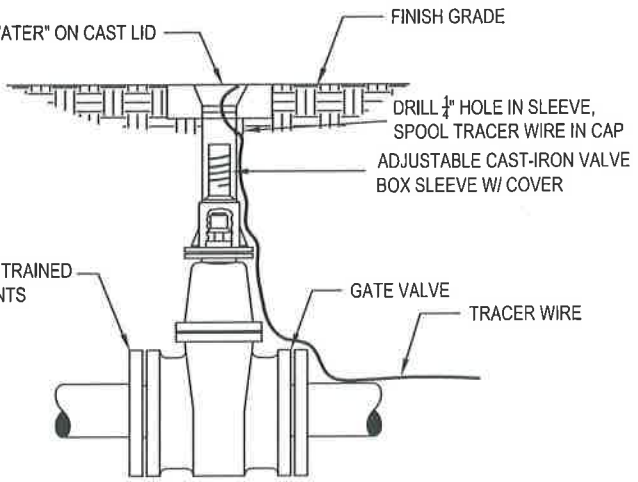
801 Broadway St., Suite 248, Hannibal, MO 63401

STATE OF MISSOURI
MICHAEL J. FUROL
NUMBER
PE-2007002824
REGISTERED PROFESSIONAL ENGINEER
2/26/20



FIRE HYDRANT ASSEMBLY, COMPLETE
NO SCALE



VALVE & VALVE BOX DETAIL
NO SCALE

STANDARD DETAIL No. 02002 REVISION DATE: 10-08-2019

WATER MAIN CONSTRUCTION
TYPICAL FIRE HYDRANT, VALVE & VALVE BOX INSTALLATIONS
CITY OF MOBERLY, MISSOURI

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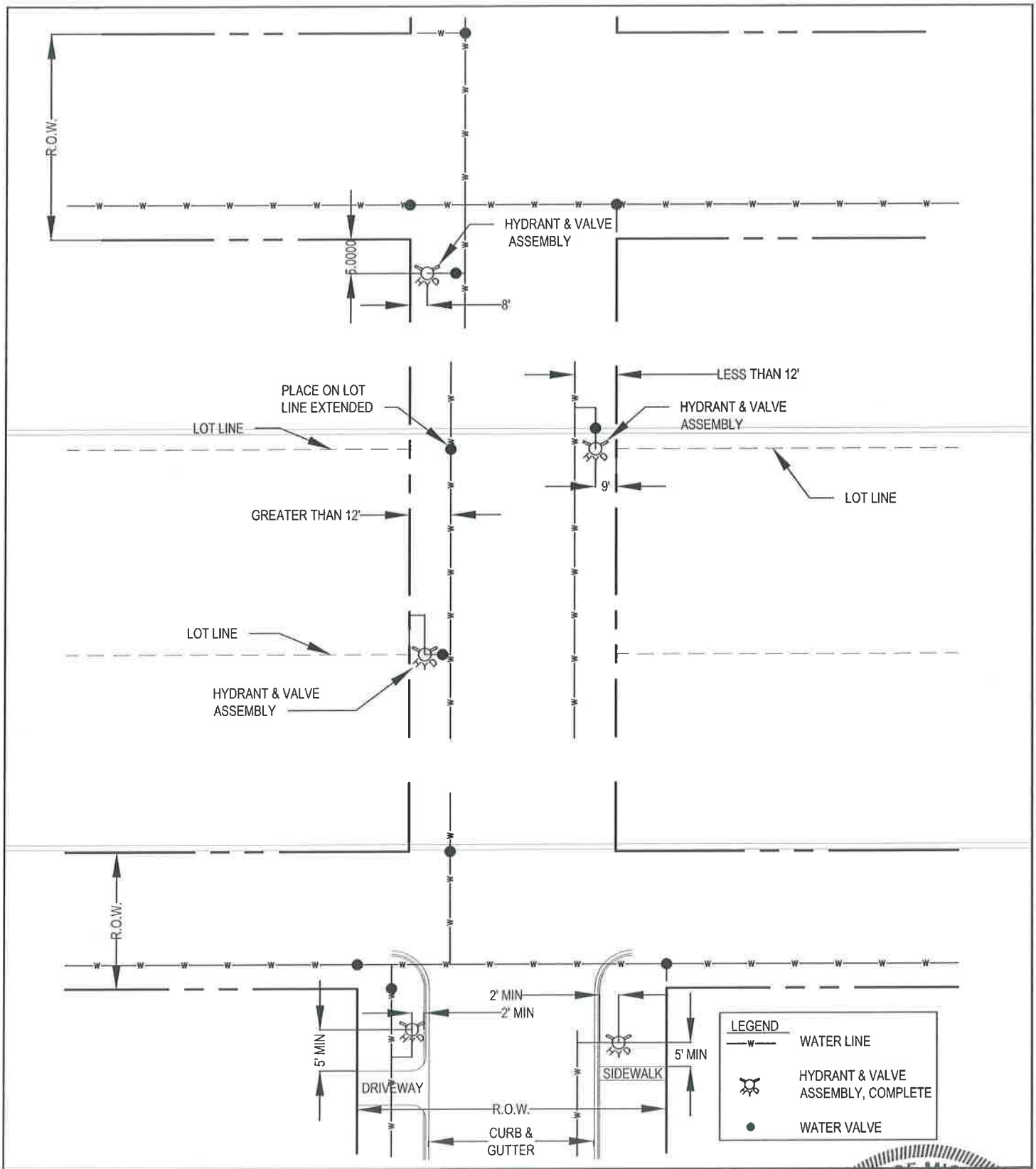
801 Broadway St., Suite 248, Hannibal, MO 63401

STATE OF MISSOURI
MICHAEL J. PUROL
NUMBER PE-2007002824
REGISTERED PROFESSIONAL ENGINEER
2/20/20



STANDARD DETAIL No. 02003 REVISION DATE: 10-08-2019

WATER MAIN CONSTRUCTION
TYPICAL FIRE HYDRANT AND VALVE LOCATIONS
CITY OF MOBERLY, MISSOURI

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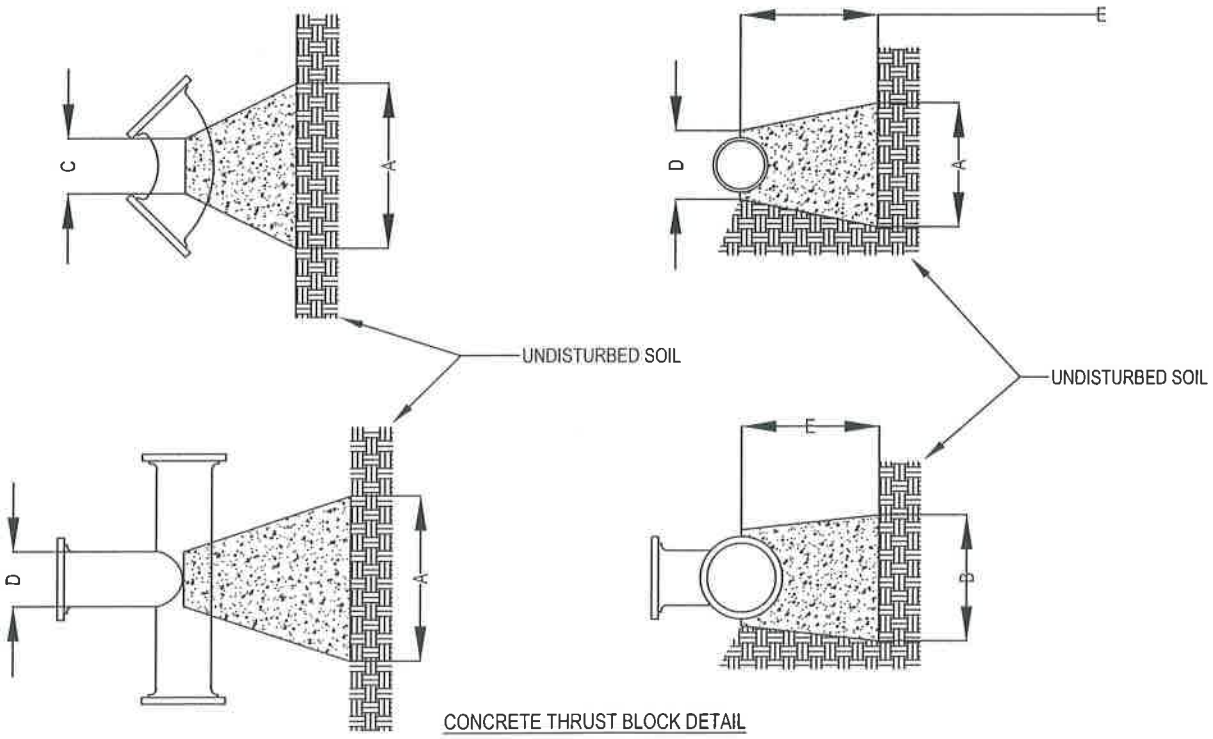
STATE OF MISSOURI
MICHAEL J. PUROL
NUMBER PE-2007002824
REGISTERED PROFESSIONAL ENGINEER
11/06/19

PIPE SIZE	FITTING	DISTANCE IN INCHES				
		A	B	C	D	E
6"	11.25 & 22.5°	12	12	8	10	12
	45°	27	12	8	10	12
	90°	33	18	8	10	12
	TEE/PLUG	24	18	8	10	12
8"	11.25 & 22.5°	18	15	8	10	12
	45°	33	15	8	10	18
	90°	42	24	8	10	18
	TEE/PLUG	30	24	12	10	18
10" & 12"	11.25 & 22.5°	27	24	12	12	18
	45°	51	24	12	12	24
	90°	63	36	12	12	30
	TEE/PLUG	45	36	12	12	24
14" & 16"	11.25 & 22.5°	33	33	12	16	18
	45°	69	33	12	16	30
	90°	84	48	12	16	36
	TEE/PLUG	60	48	12	15	30

NOTES: MANUFACTURED RESTRAINT IS THE CITY PREFERRED METHOD OF RESTRAINT. SEE STANDARD SPECIFICATIONS. CONCRETE THRUST BLOCKING MAY BE USED IN CONJUNCTION WITH MANUFACTURED RESTRAINTS.

1. THRUST BLOCKS ARE BASED ON A WORKING PRESSURE OF 200 P.S.I. & 2000 P.S.F. ALLOWABLE SOIL BEARING PRESSURE.
2. USE DIMENSIONS FOR NEXT LARGER SIZE FOR PIPE SIZES NOT SHOWN .
3. USE 3/8" PLYWOOD SEPARATOR BETWEEN BLOCKS AND PLUGS FOR EASE OF FUTURE REMOVAL.



CONCRETE THRUST BLOCK DETAIL
NOT TO SCALE
DETAIL E

STANDARD DETAIL No. 02004 REVISION DATE: 10-08-2019

WATER MAIN CONSTRUCTION
TYPICAL THRUST BLOCK INSTALLATIONS
CITY OF MOBERLY, MISSOURI

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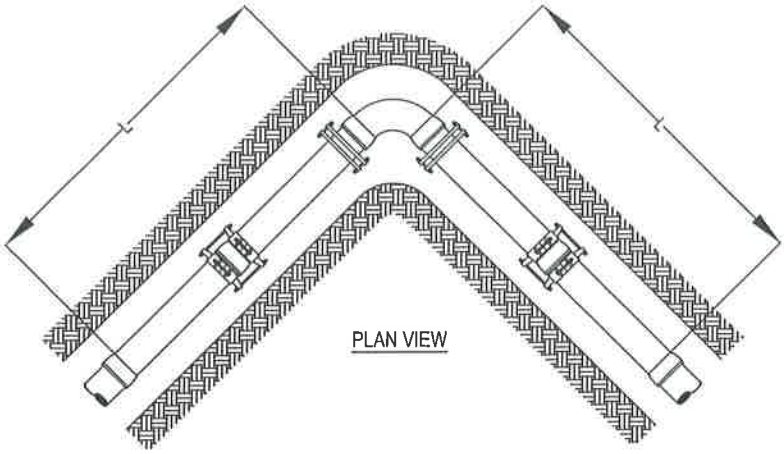
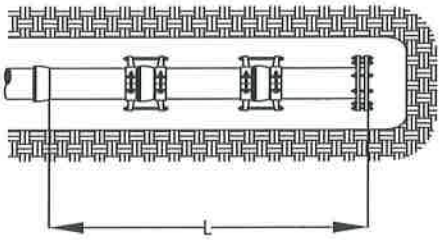
STATE OF MISSOURI
MICHAEL J. PUROL
NUMBER
PE-2007002824
REGISTERED PROFESSIONAL ENGINEER
7/26/19

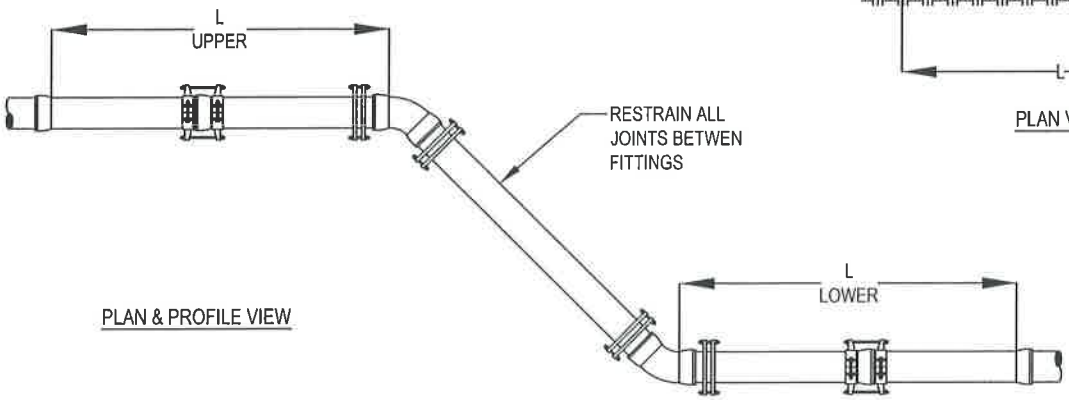
NOTES:
1. ALL JOINTS WITHIN LENGTH "L" OF FITTING MUST BE RESTRAINED
2. LENGTHS L, Lr, AND B TO BE SPECIFIED BY ENGINEER



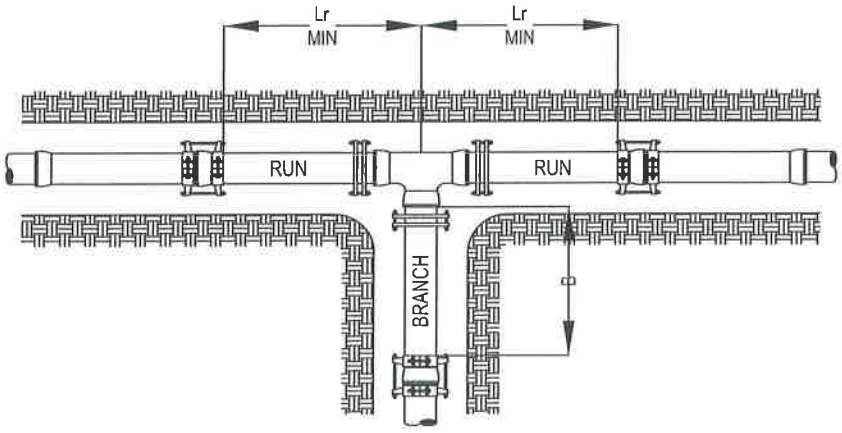
PLAN VIEW



PLAN VIEW



PLAN & PROFILE VIEW



PLAN VIEW

STANDARD DETAIL No. 02005 REVISION DATE: 10-08-2019

WATER MAIN CONSTRUCTION
TYPICAL RESTRAINED JOINT INSTALLATIONS
CITY OF MOBERLY, MISSOURI

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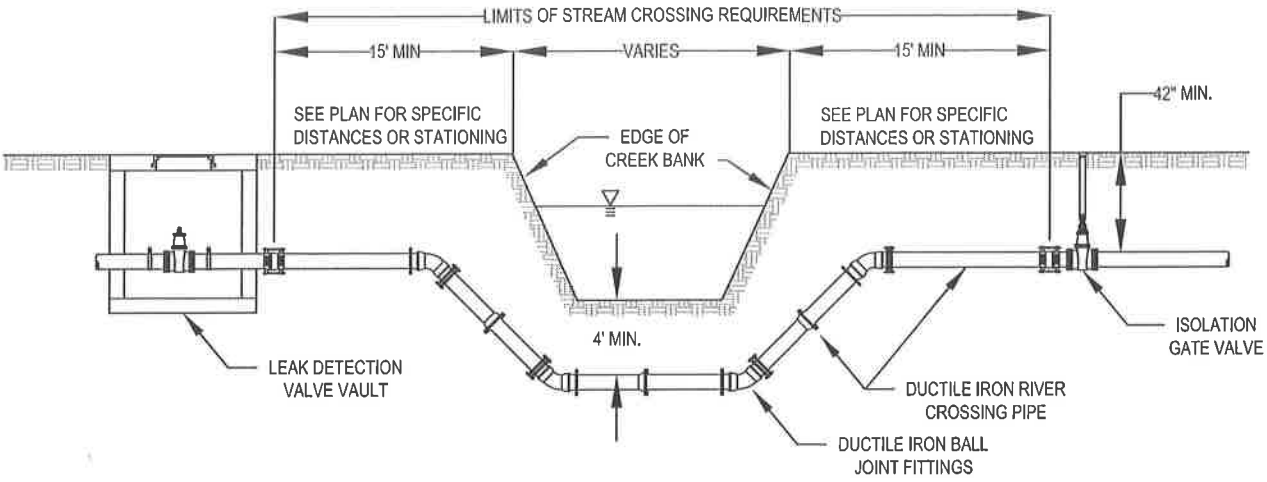
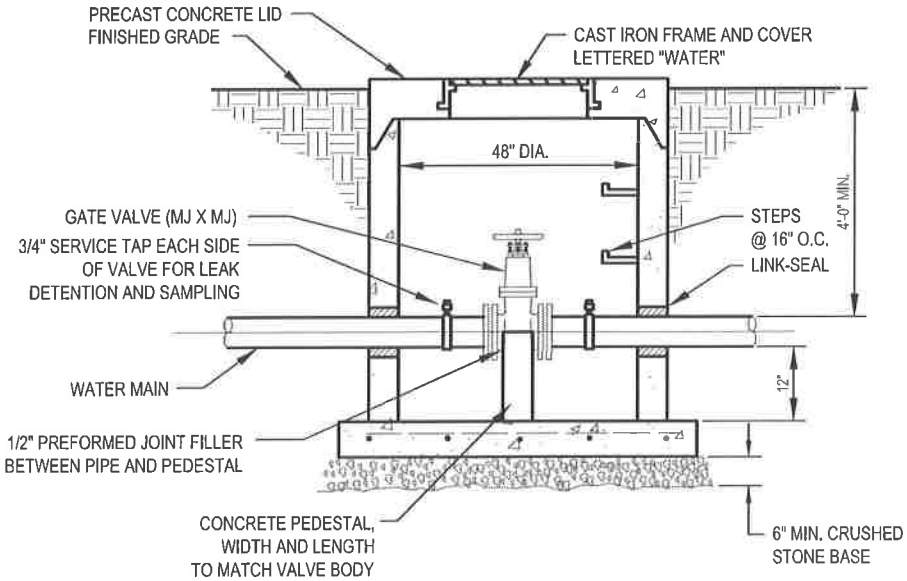


UNDERWATER CROSSING DETAIL
NOT TO SCALE



LEAK DETECTION VALVE VAULT DETAIL
NOT TO SCALE

UNDERWATER CROSSINGS SHALL COMPLY WITH THESE DETAILS AND CHAPTER 8.7.2.a OF THE DEPARTMENT OF NATURAL RESOURCES, MINIMUM DESIGN STANDARDS FOR MISSOURI COMMUNITY WATER SYSTEMS, ADOPTED 2013 FOR CROSSING FLOWING STREAMS 15 FEET TO 500 FT.

1. PIPE MATERIAL SHALL BE DUCTILE IRON RIVER CROSSING PIPE WITH FLEXIBLE WATERTIGHT JOINTS. MINIMUM 4-FT COVER OVER PIPE.
2. ADEQUATE SUPPORT / ANCHORAGE SHALL BE PROVIDED ON EACH SIDE OF STREAM. SEE PROJECT SPECIFIC REQUIREMENTS.
3. INSTALL EASILY ACCESSIBLE ISOLATION VALVES ON EACH SIDE OF CROSSING, NOT SUBJECT TO FLOODING.
4. PROVIDE AN ACCESSIBLE VALVE VAULT FOR INSTALLATION OF LEAK DETECTION EQUIPMENT.
5. TAP EACH SIDE OF VALVE IN VAULT TO ALLOW INSERTION OF A SMALL METER TO MEASURE LEAKAGE AND FOR SAMPLING.
6. PROTECT STREAM BANKS AT CROSSING. EXTEND RIVER CROSSING PIPE AT LEAST 15-FT BEYOND STREAM BANKS.

STANDARD DETAIL No. 02006 REVISION DATE: 02-26-2020

WATER MAIN CONSTRUCTION
TYPICAL WATER MAIN CREEK CROSSING
CITY OF MOBERLY, MISSOURI

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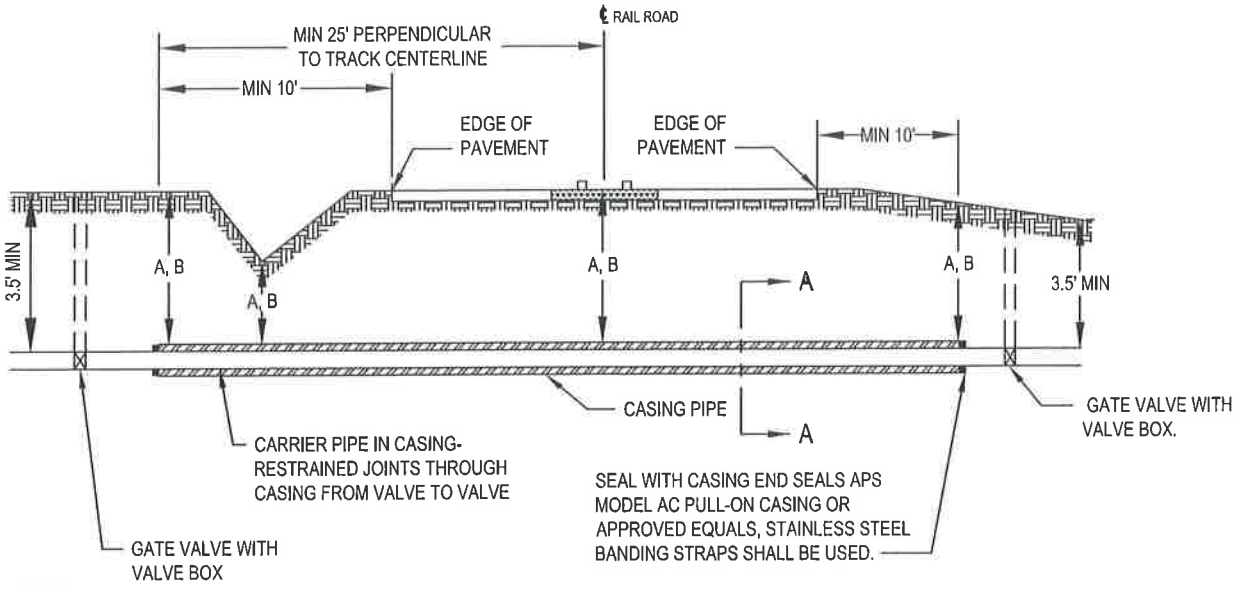
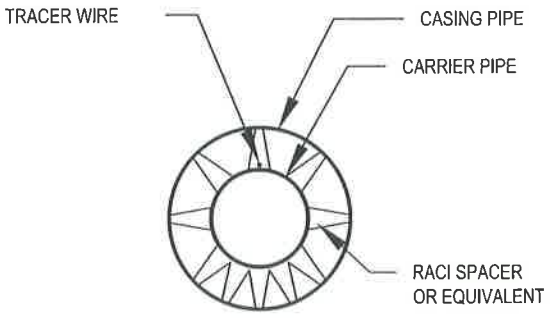


NOTES:

1. CONTRACTOR MEANS AND METHODS FOR TRENCHLESS CONSTRUCTION METHOD MUST BE APPROVED.
2. IF DIRECTIONAL DRILLING METHOD IS USED, THE MINIMUM EMBEDMENT DEPTH TO TOP OF FINISHED CASING SHALL BE 8 FEET.
3. SEE STANDARD SPECIFICATIONS FOR ALLOWABLE CASING PIPE MATERIALS.
4. CONTRACTOR SHALL OBTAIN NECESSARY PERMITS AND APPROVALS FROM APPROPRIATE REGULATORY AUTHORITY. ALL WORK SHALL MEET ALL REQUIREMENTS OF RESPONSIBLE REGULATORY AUTHORITY
5. CASING SPACERS SHALL BE RACI OR APPROVED EQUAL WITH STAINLESS STEEL BOLTS AND NUTS. CASING SPACERS SHALL BE INSTALLED AT INTERVALS NOT TO EXCEED MANUFACTURER'S SPECIFICATIONS OR 6' WHICHEVER IS LESS. DOUBLE SPACERS SHALL BE INSTALLED 1' FROM EACH END OF THE CASING. ONE CASING SPACER MUST BE WITHIN 2' OF EACH SIDE OF A PIPE JOINT. SPACERS SHALL HAVE A MINIMUM HEIGHT THAT EXCEEDS THE PIPE BELL HEIGHT AND RESTRAINED JOINT HEIGHT.
6. ALL JOINTS BETWEEN GATE VALVES SHALL BE RESTRAINED JOINTS.

NOTES:

A. MINIMUM COVER OVER CASING FOR ROADWAY CROSSINGS SHALL BE 4 FEET WITHIN LIMITS SHOWN
B. MINIMUM COVER OVER CASING FOR RAILWAY CROSSING SHALL BE 6 FEET WITHIN LIMITS SHOWN
C. COVER DEPTH GREATER THAN MINIMUMS MAY BE REQUIRED AS A CONDITION OF AUTHORITY HAVING JURISDICTION FOR ROAD OR RAILROAD



SECTION A

STANDARD DETAIL No. 02007 REVISION DATE: 10-08-2019

WATER MAIN CONSTRUCTION
TYPICAL WATER MAIN IN CASINGS
CITY OF MOBERLY, MISSOURI

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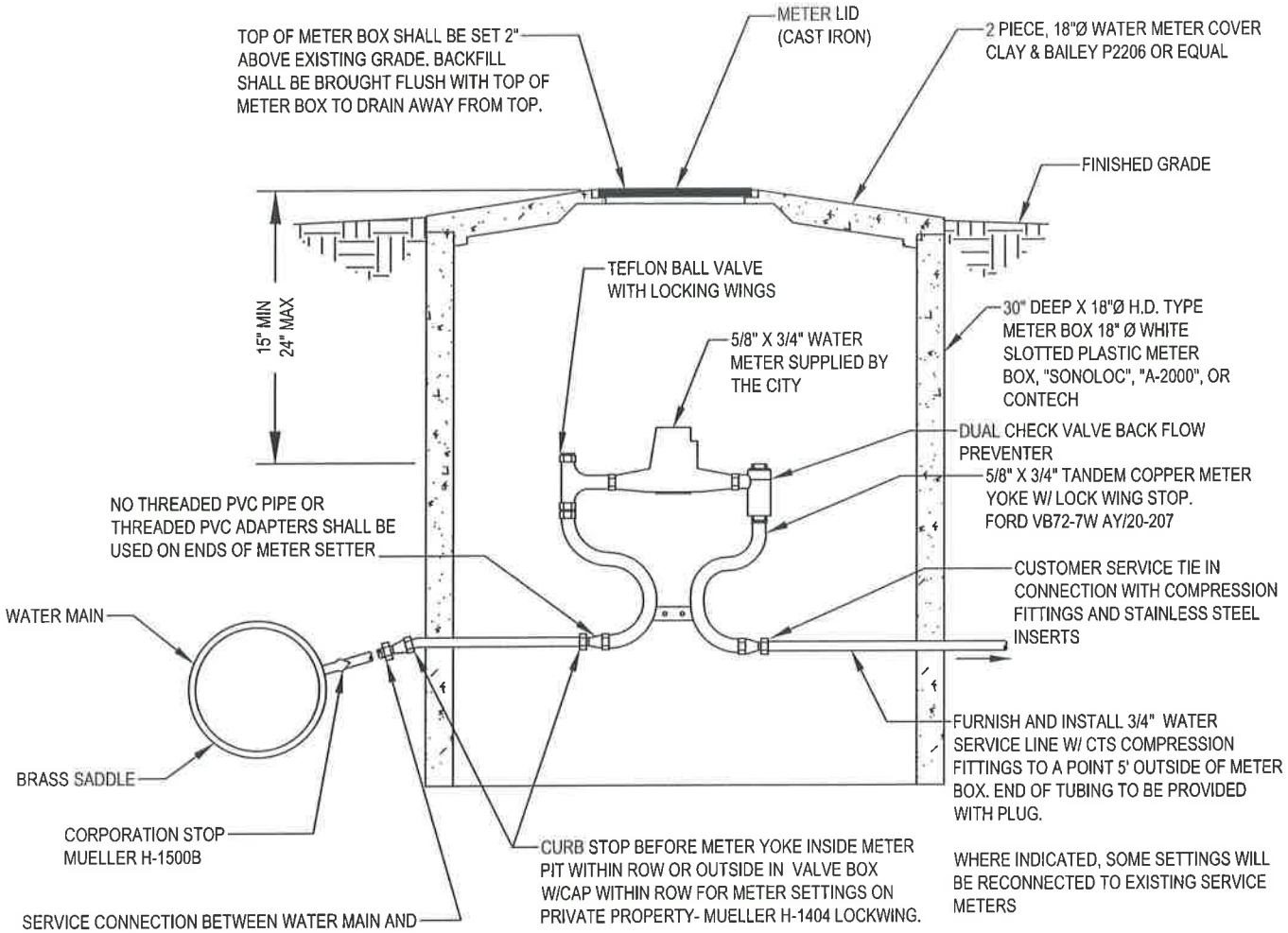
NOTES: ALL SERVICE LINES GREATER THAN 10' IN LENGTH REQUIRES TRACER WIRE.
WARNING TAPE SHALL BE PLACED OVER ALL SERVICE LINES CONSTRUCTED.



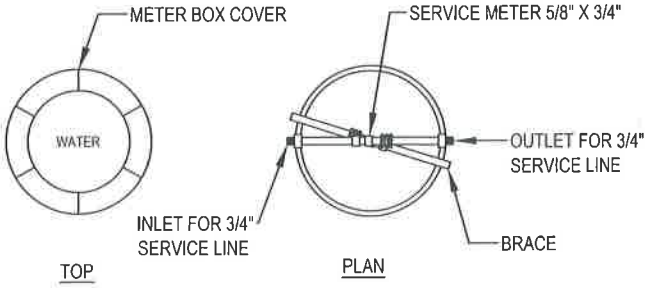
SERVICE CONNECTION BETWEEN WATER MAIN AND METER SHALL BE COPPER OR POLY TUBING. ALL COPPER LINES INSTALLED IN GRANULAR MATERIAL SHALL BE CASED. ALL POLY SERVICE LINES BETWEEN WATER MAIN AND METER SHALL BE CASED WITH TRACER WIRE . SADDLE CORPORATION STOPS SHALL HAVE STAINLESS STEEL STRAPS OR BE ALL BRASS

ON 1 1/2" OR LARGER SETTINGS A CURB STOP IS REQUIRED ON BOTH SIDES OF METER .

TYPICAL 5/8" X 3/4" METER SETTING AND SERVICE CONNECTION
NOT TO SCALE

IN SOME INSTANCES, METER SETTINGS, GREATER THAN 3/4" X 5/8" MAY BE SPECIFIED. 1" SETTINGS SHALL UTILIZE THE SAME CONFIGURATION SHOWN FOR 3/4" X 5/8" SETTINGS. 1 1/2" AND 2" METER SETTINGS SHALL BE INSTALED IN 30" DIA. X 36" PVC METER WELLS W/APPROPRIATE SETTER OR TUBE RISERS INCORPORATING ANGLE VALVE (W/PADLOCK WINGS) ON THE INLET.

ADDITIONAL BRACING SHALL BE PROVIDED AS REQUIRED FOR METER SUPPORT. CAST IRON METER COVER AND LID SHALL BE INSTALLED FOR THE SPECIFIC METER WELL DIAMETER. CUSTOMER SERVICE LINE SIZED TO MATCH THE SPECIFIC METER REQUIREMENTS SHILL BE INSTALLED TO A POINT 1'-0" OUTSIDE OF THE METER WELL. ALL METERS SHALL BE PROVIDED AND INSTALLED BY THE CONTRACTOR EXCEPT WHERE OTHERWISE NOTED ON THE PLANS.



STANDARD DETAIL No. 02008 REVISION DATE: 10-08-2019

WATER MAIN CONSTRUCTION
TYPICAL SERVICE CONNECTION AND METER SETTING
CITY OF MOBERLY, MISSOURI

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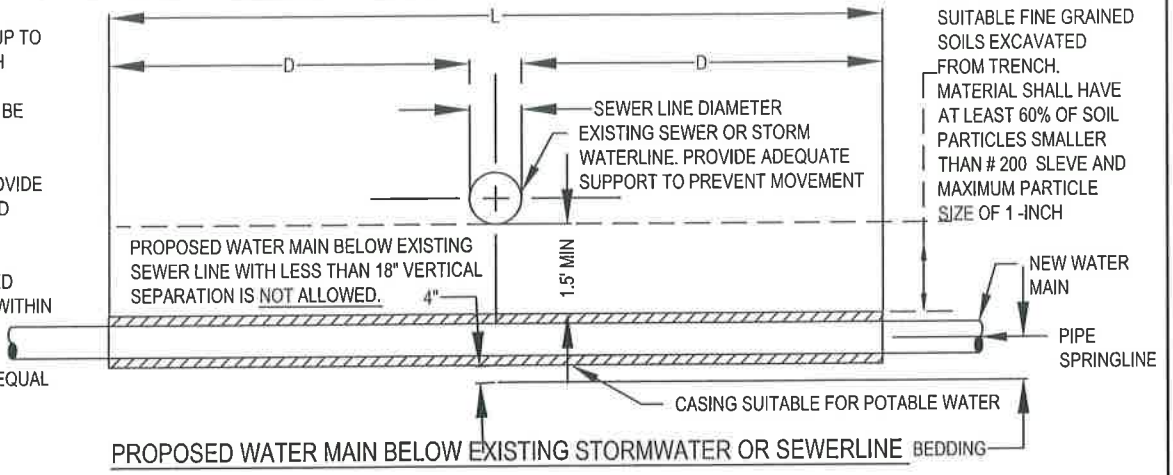
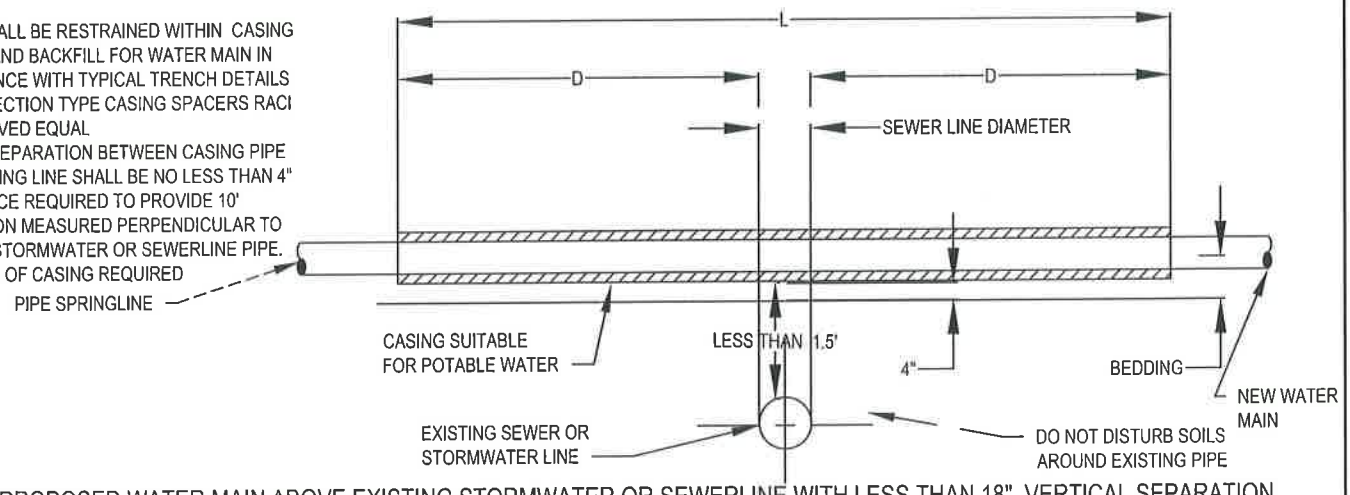
BACKFILL FROM 1' ABOVE PIPE UP TO SURFACE IN ACCORDANCE WITH TYPICAL TRENCH DETAILS
IN NO CASE SHALL WATER MAIN BE LESS THAN 1.5' BELOW STORM WATER OR SEWER LINE
D= DISTANCE REQUIRED TO PROVIDE 10 FEET SEPARATION MEASURED PERPENDICULAR TO EXISTING STORMWATER OR SEWER LINE
L= LENGTH OF CASING REQUIRED
JOINTS SHALL BE RESTRAINED WITHIN CASING
USE PROJECTION TYPE CASING SPACERS, RACI OR APPROVED EQUAL



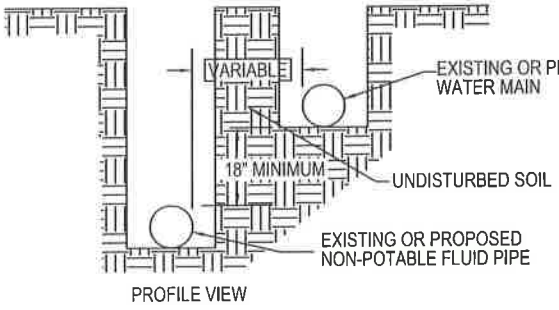
PROPOSED WATER MAIN BELOW EXISTING STORMWATER OR SEWERLINE

JOINTS SHALL BE RESTRAINED WITHIN CASING
BEDDING AND BACKFILL FOR WATER MAIN IN ACCORDANCE WITH TYPICAL TRENCH DETAILS
USE PROJECTION TYPE CASING SPACERS RACI OR APPROVED EQUAL
MINIMUM SEPARATION BETWEEN CASING PIPE AND EXISTING LINE SHALL BE NO LESS THAN 4"
D= DISTANCE REQUIRED TO PROVIDE 10' SEPARATION MEASURED PERPENDICULAR TO EXISTING STORMWATER OR SEWERLINE PIPE.
L= LENGTH OF CASING REQUIRED

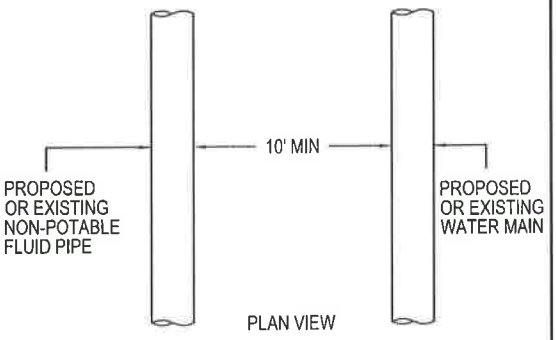


PROPOSED WATER MAIN ABOVE EXISTING STORMWATER OR SEWERLINE WITH LESS THAN 18" VERTICAL SEPARATION

PROPOSED SEWER (OR WATER) IS LOCATED 10 FEET OR LESS FROM EXISTING WATER (OR SEWER).



WATER AND NON-POTABLE SEPARATION REQUIREMENTS
(VERTICAL SEPARATION)



WATER AND NON-POTABLE SEPARATION REQUIREMENTS
(HORIZONTAL SEPARATION)

SEE CHAPTER 8.6.2 OF MINIMUM DESIGN STANDARDS FOR MISSOURI COMMUNITY WATER SYSTEMS, EFF. 12-10-2013 WHEN NOT PRACTICAL TO MAINTAIN 10-FOOT SEPARATIONS. Mo DNR APPROVAL REQUIRED ON CASE BY CASE BASIS. WATER MAIN MUST BE PLACED IN SEPARATE TRENCH AND 18-INCHES ABOVE TOP OF NON-POTABLE LINE WHILE MAINTAINING MINIMUM COVER REQUIREMENTS. WHEN SEPARATION REQUIREMENTS CANNOT BE OBTAINED, EITHER THE WATERLINE OR THE NON-POTABLE LINE SHALL BE CONSTRUCTED OF MECHANICAL OR MANUFACTURED RESTRAINED JOINT PIPE, FUSION WELDED PIPE, OR CASED IN A CONTINUOUS CASING. CASING PIPE MATERIAL SHALL MUST BE A MATERIAL THAT IS APPROVED FOR USE AS WATER MAIN. CAST-IN-PLACE CONCRETE IS NOT AN ACCEPTABLE ENCASEMENT.

STANDARD DETAIL No. 02009 REVISION DATE: 10-08-2019

WATER MAIN CONSTRUCTION
TYPICAL WATER MAIN SEPARATION REQUIREMENTS
CITY OF MOBERLY, MISSOURI

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