WATER DISTRIBUTION SYSTEM

IREDELL WATER CORPORATION

571 Jennings Road
Statesville, North Carolina 28625
www.iredellwater.com

PO Box 1844
Statesville, North Carolina 28687-1844

STANDARD SPECIFICATIONS AND DETAILS

November 2025

IMPORTANT NOTICE

This document is intended for the planning, design, and construction of water facilities that will be owned and operated by Iredell Water Corporation. It should not be utilized for any other purpose. Only the name brands presented herein may be used for water distribution applications. Equal brands can be used only upon specific approval in writing by Iredell Water Corporation. Particular attention should be given to the requirements of the North Carolina Department of Environmental Quality, Transportation, Health, and Natural Resources as they relate to this document.

TABLE OF CONTENTS

STANDARD WATER SPECIFICATIONS

STANDARD WATER DETAILS

SECTION 01 – MATERIAL SPECIFICATIONS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. All materials, equipment, and labor for water main construction shall be furnished in accordance with these specifications and in accordance with the Plans prepared by a Registered Professional Engineer licensed to practice in the state of North Carolina.

B. Unless superseded or modified in the Detailed Specifications, all materials, apparatus, supplies, methods of manufacture, or construction shall conform to the specifications contained in this Section. National material standards (ASTM, ANSI, AWWA, etc.) referred to herein shall be considered to be the latest revisions only.

C. Drinking water treatment chemicals shall comply with NSF/ANSI/CAN 60, and drinking water system components in contact with potable water shall comply with NSF/ANSI/CAN 61, in accordance with 15A NCAC 18C .1537 (latest revision).

D. The ENGINEER shall review, approve and furnish to Iredell Water Corporation for final approval a complete materials approval list, as specified in Part 3 – EXECUTION of this Section, prior to the installation of any system components.

E. For any products not listed in these specifications or requests to substitute a material that has been specified herein, the ENGINEER shall request in writing final approval from Iredell Water Corporation prior to purchase by the CONTRACTOR. Copies of literature and certifications shall be provided for review at the time of the written request.

PART 2 -- PRODUCTS

2.1 WATER PIPING

A. Ductile-Iron Pipe

1. Ductile iron pipe shall be of the size indicated on the Drawings and shall be in accordance with AWWA C150 and manufactured in accordance with AWWA C151.

2. Class numbers or pressure rating shall be clearly marked on the pipe and fittings at the factory.

3. Bituminous Outside Coating

(a) All ductile iron pipes shall have an outside pipe coating of an asphaltic material with a minimum of 1 mil thickness in accordance with AWWA C151. The final coat shall be continuous and smooth, being neither brittle when subjected to low temperatures nor sticky when exposed to hot sun. The coating shall adhere to the pipe at all temperatures.

4. Pipe Mortar Lining (Interior Lining)

(a) Line all ductile iron pipe and fittings with a cement mortar lining conforming to AWWA C104 except where other lining systems are specified by the ENGINEER.

5. Joints:

   (a) Slip Joints (Push-on)

      (1) Unless otherwise specified by the ENGINEER, pipe joints shall be slip-joint type.

      (2) Comply with AWWA C111.

      (3) Bells of "slip" joint pipe shall be contoured to receive a bulb-shaped circular rubber gasket, and plain ends shall have a slight taper to facilitate installation. The gasket and associated lubricant shall be furnished by the pipe manufacturer.

   (b) Mechanical Joints

      (1) Comply with AWWA C111.

      (2) Bolts for mechanical joints shall be high-grade steel, low alloy type, with tee head and American Standard threads. Mechanical joint gland shall be ductile or gray iron and shall utilize a plain rubber gasket.

      (3) Bolted mechanical pipe joints shall be used under all concrete structures and between all treatment structures for underground piping.

   (c) Flanged Joints

      (1) Comply with AWWA C110, C115, and ASME B16.1.

      (2) Flanged pipes shall have flanges with long hubs, shop fitted on the threaded end of the pipe.

      (3) Where required, flanges shall be tapped for stud bolts. Flanges shall be accurately faced at right angles to the pipe axis and shall be drilled smooth and true, and covered with coal tar pipe varnish or otherwise protected against corrosion of flange faces. Flange faces shall be cleaned to bare metal with wire brushed before installation of pipe.

      (4) Ductile iron flanged joint pipe shall be as specified by the ENGINEER. Pipes shall be ordered in lengths needed as no pipe shall be cut, threaded, or flanged in the field. All pipes shall have Class 125 flanges unless otherwise specified.

      (5) Flanged joints shall be made with through bolts of the required size. Bolts shall be zinc plated, with good and sound, well-fitting threads, so that the nuts may be turned freely by hand.

      (6) Flanged joints shall be made up using only full-face gaskets with a minimum thickness of 1/8-inch. Ring gaskets are not acceptable. Gasket material shall be rubber or approved equal as recommended by the Manufacturer.

      (7) Connecting flanges shall be in proper alignment and no external force shall be used to bring them together.

   (d) Restrained Joints

      (1) Restrained joints shall be the boltless type to include ductile iron locking segments and rubber retainers.

(2) Restrained pipe and fittings shall be Flex-Ring or Lok-Ring as manufactured by American Cast Iron Pipe Company, TR Flex as manufactured by US Pipe, Bolt-Lok as manufactured by Griffin Pipe Products, or approved equal.

B. PVC - Pressure Rated PVC

1. Comply with ASTM D2241 and ASTM D1784.
2. Maximum diameter: 16” nominal.
3. Pressure Class: Minimum allowable rating and thickness are as follows:

Nominal Diameter (inches)	**Material Type**
2" and smaller (Repair or short replacement)	200 psi, SDR 21, ASTM D2241
2" and smaller (New)	305 psi, SDR 13.5, ASTM D2241
4" - 12"	305 psi, SDR 14, AWWA C900 PVC
14" and larger	305 psi, SDR 14, AWWA C900 PVC

4. Sustained pressure and quick-burst pressure testing requirements shall be in accordance with ASTM 1598 and ASTM 1599, respectively.
5. The exterior of all PVC pipes shall bear a stamp that shows the AWWA certification, SDR, size, and NSF seal.
6. Fittings shall be ductile iron mechanical joint as described herein.
7. Joints:
   (a) The pipe shall have bell and spigot ends with push-on, O-ring rubber gasket, and compression-type joints meeting the requirements of ASTM D3139 and ASTM F477.
   (b) The lubricant used in making up the joints shall be furnished by the pipe manufacturer and shall be NSF-approved.
   (c) Seals: PVC flexible elastomeric.
   (d) Solvent-cement couplings are not permitted.

C. PVC - Scheduled PVC

1. Scheduled PVC shall be used only in above-ground, interior plumbing or for drain pipe.
2. Comply with ASTM D1784 and D1785.
3. Schedule: 40, 80, or as shown in the Drawings.
4. Fittings shall be ductile iron mechanical joint as described herein.
5. Joints:
   (a) The pipe shall have bell and spigot ends with push-on, O-ring rubber gasket, and compression-type joints meeting the requirements of ASTM D3139 and ASTM F477.
   (b) The lubricant used in making up the joints shall be furnished by the pipe manufacturer and shall be NSF-approved.

(c) Solvent-cement couplings are only permitted on above-ground, exposed piping or drain pipe. Solvent cement shall conform to ASTM D2564.

D. PVC - Fusible PVC

1. Fusible PVC pipe shall conform to AWWA C900, ASTM D2241 or ASTM D1785 for standard dimensions, as applicable.

2. Fusible PVC pipe shall be tested at the extrusion facility for properties required to meet all applicable parameters as outlined in AWWA C900, and applicable sections of ASTM D2241. Testing priority shall be in conformance with AWWA C900.

3. Fusion Technician shall be fully qualified by the pipe manufacturer to install fusible PVC pipe of the type(s) and size(s) being used. Qualification shall be current as of the actual date of fusion performance on the project.

4. Fusible PVC pipes shall be blue in color for potable water use.

5. Unless otherwise specified, fusible PVC pipe lengths shall be assembled in the field with butt-fused joints. The Contractor shall follow the pipe supplier's written guidelines for this procedure.

6. Acceptable fittings for use with fusible PVC pipe shall include standard ductile iron fittings conforming to AWWA C900/ANSI C110/A21.10, or AWWA/ANSI C153/A21.53 and AWWA/ANSI C111/A21.11.

E. High Density Polyethylene Pipe (HDPE)

1. HDPE pipe shall be NSF 14 and NSF 61.

2. Service lines of ¾ inch and 1 inch in diameter shall be Endot Endopure, manufactured to IPS (Iron Pipe Size) in compliance with ASTM D2239, ASTM F714, and AWWA C901. These lines must have a SIDR 7 rating (250 psi) and be made from PE4710 material and must be blue in color.

3. Service lines of 1.5 inches and 2 inches in diameter shall be Rehau Municipex, manufactured to SDR9 CTS (Copper Tube Sizes) according to ASTM F876, AWWA C904, and CSA B137.5. The service lines must be blue in color.

4. Water mains of 4 inches in diameter and larger shall be constructed from HDPE with a minimum rating of DR 11, capable of withstanding 200 psi. All materials must comply with the standards outlined in AWWA C906, ASTM D3035, and ASTM F714.

5. Permanent identification of piping service shall be provided by co-extruding longitudinal blue stripes into the pipes outside surface. The striping material shall be the same material as the pipe material except for color.

6. Joints

(a) Butt fusion or electrofusion welded in accordance with ASTM D3261.

7. Marking

(a) The net weight, pressure class or nominal thickness, sampling period, and manufacturer shall be marked on each pipe.

2.2 FITTINGS

A. General

1. All fittings for any type of water distribution piping shall be ductile iron.
2. Compact mechanical joint fittings shall be used for subsurface installations and compact flanged fittings shall be used for above-ground installations.
3. Coating and Lining:
   (a) Bituminous Coating: Comply with AWWA C110.
   (b) Cement-Mortar Lining: Comply with AWWA C104.

B. Restrained Mechanical Joint Fittings & Restrained Joint Retainer Glands

1. All mechanical joints shall utilize a mechanical joint restraint fitting.
2. Restrained mechanical joints for 2-inch PVC pipes shall utilize the Knuckle Joint Restraint, manufactured by HARCO Fittings.
3. For all mechanical joint fittings with diameters of 3 inches and above, the following specifications apply:
   (a) PVC pipes: Restraint fittings shall be GripRing, manufactured by Romac Industries, Inc.
   (b) Ductile Iron Pipes (DIP): Restraint fittings shall be Megalug Series 1110, manufactured by EBBA Iron, Inc.
   (c) Restraint fittings shall be designed to withstand 150 psi unless noted otherwise.
4. All specified restraint fittings must be installed in accordance with the respective manufacturers' guidelines to ensure proper functionality and adherence to performance standards.
5. Where watermain joint restraint is required by the use of retainer glands, the retainer glands shall comply with all applicable dimensions of ANSI/AWWA C111/A21.11 and shall be compatible with all bell and spigot (push-on) joint sockets of the standard.
6. All nuts, bolts, and tie-rod restraints used in tie-rod restraint systems shall be made of 304 stainless steel.

C. 2" Ductile Iron Fittings

1. Material: Grade 65-45-12 ductile iron in accordance with ASTM A536. Fittings shall have deep bell push-on joints with gaskets meeting ASTM F477. Transition gaskets are not allowed.

D. 3" through 64" Ductile Iron Fittings

1. Material: Ductile iron. Comply with AWWA C110.
2. Compact Fittings (mechanical joint and flanged): Comply with AWWA C153.

E. Tapping Sleeves

1. Tapping sleeves shall conform to AWWA C223 (latest revision) and shall be installed in accordance with Iredell Water Corporation standard details.

2.3 THREADED (TIE) RODS

A. Threaded (tie) rods shall be hot-dipped galvanized after fabrication. Tabs for tie rods shall be ductile iron duct lock, heat-treated tie bolts, hot-dipped galvanized, or hot-dipped galvanized steel plate per the Drawings.

2.4 FIRE HYDRANTS

A. Fire Hydrants shall conform to the standard specifications of the American Water Works Association (C502-24 or latest edition and revision thereof) and shall be of the three (3) way type. The hydrant valve opening shall not be less than four and one-half - (4- 1/2) inches. Each hydrant shall be equipped with two (2) two and one-half - (2-1A) inch hose connections and one (1) steamer connection. The hydrants shall be fitted with bell ends to accommodate the spigot end of six (6) inch ductile iron or PVC Plastic Pipe and have the standard one-and-one-half-inch pentagon left opening operating nut. Hydrant inlet shall incorporate a stab-fit design requiring the use of only one Type 304 stainless steel fastener. The joint shall be designed such that installation torque shall be 45 ft-lbs. or less. Joint to be configured with a one-piece full circumferential end ring and ductile iron grippers for an even distribution of thrust loads. Assembly of flange or mechanical joint restrainers using multiple fasteners or wedge bolts is not permitted. Restraint accessories shall be factory-installed.

B. American Darling hydrants with ALPHA restrained joint ends or Mueller hydrants with HYMAX restrained joint ends shall have hydrant inlets designed for multi-purpose material use with a wide range of outside diameters (O.D.) including ductile iron per AWWA C151, PVC per ASTM D1748 (Schedule 40 and 80), PVC per ASTM D2241 (SDR21), PVC per AWWA C900, HDPE per AWWA C906 SDR 9,11,13.5 and 17) and gray cast iron (classes A, B, C and D). The torque shall be per the manufacturer’s requirements.

C. The barrel of the hydrant shall be of proper length to permit a minimum of three-and-one-half (3- 1A) foot bury. Hydrant bury line shall be set true to grade. The valve shall be designed to close against the pressure of the distribution system and remain closed in the event of the upper part of the barrel being broken.

D. A flange shall be provided, above ground level, to permit adjusting the facing of the hydrant. The hydrant shall be so designed and constructed as to permit replacement of the upper portion of the barrel without digging.

E. Each nozzle shall have a cast iron cap, suitably attached to the hydrant barrel by means of a chain. Nozzle caps shall be provided with leather gaskets.

F. Hose nipples shall be of the removable type and shall conform to the existing hose nipples in use by the OWNER. On a new system, they shall have National Standard Threads on the hose connection side unless otherwise directed by the ENGINEER. The CONTRACTOR shall check existing nipples before ordering.

G. Two standard hydrant wrenches shall be furnished.

H. All fire hydrants furnished for this project shall be of the type known as "breakable" in order that the hydrant barrel may be broken without damaging the lower portion of the hydrant in case of an accident.

I. Acceptable hydrant manufacturers are Mueller or American Darling. Hydrant manufacturer and style (model) shall be approved before installation.

J. All fire hydrants and any portions of the hydrant assembly exposed to view (above adjacent ground elevation) shall be painted with two (2) or more evenly applied coats of yellow hydrant enamel paint.

K. 5" Storz Hydrant Adapter Connection shall be installed on all hydrants located within the City of Statesville city limits.

L. Iredell Water Corporation does not allow installation of flushing hydrants. For dead-end mains 6 inches and larger, provide a full fire hydrant assembly as the permanent blow-off as shown on the standard details.

2.5 YARD HYDRANTS

A. Yard Hydrants shall be 2 1/8" freeze-less post-type hydrants with 2" mechanical joint inlet. Each hydrant shall be equipped with one 2 ½" hose nozzle for fire with 1 ½" nipple and one standard ¾" hose nozzle for wash down. Provide and install 3 cubic feet of crushed stone at freeze drain.

2.6 FREEZE-PROOF HOSE BIBS

A. Freeze-proof hose bibs shall be bronze Nibco No. 74VB for threaded piping or equal. All hose bibs shall be freeze-proof.

2.7 BACKFLOW PREVENTION ASSEMBLIES (TEMPORARY FILL/FLUSH)

A. Assemblies used for temporary fill/flush connections shall comply with AWWA C511 (Reduced-Pressure Principle) and AWWA C510 (Double Check-Valve), latest revision, as applicable. Provide test cocks and integral shutoff valves as part of a testable assembly. See applicable Iredell Water Corporation Standard Details.

2.8 VALVES

A. All valves shall open counterclockwise (left) and close clockwise (right).

B. Ductile Iron Resilient Seated Gate Valves

1. Valves 2"-12" shall be resilient wedge type rated for 250 psig cold water working pressure. All ferrous components shall be ductile iron, ASTM A536. Valves 3"-12" shall be in full compliance with AWWA C515.

2. The words "D.I." or "Ductile Iron" shall be cast on the valve.

3. The wedge shall be ductile iron or bronze encapsulated with EPDM rubber. The wedge shall be symmetrical and seal equally well with flow in either direction. The gate valve stem and wedge nut shall be copper alloy in accordance with Section 4.4.5.1 of the AWWA C515 Standard. Stainless Steel stems are not acceptable. The NRS stem must have an integral thrust collar in accordance with Section 4.4.5.3 of AWWA C515 Standard. Two-piece stem collars are not acceptable. The wedge nut shall be independent of the wedge and held in place on three sides by the wedge to prevent possible misalignment.

4. Bolting materials shall develop the physical strength requirements of ASTM A307 and may have either regular square or hexagonal heads with dimensions conforming to ANSI B18.2.1. Metric-size socket head cap screws, therefore, are not allowed. The operating nut shall be constructed of ductile iron and shall have four flats at stem connection to ensure even input torque to the stem.
5. All gaskets shall be pressure-energized O-rings. Stem shall be sealed by three O-rings. The top two O-rings shall be replaceable with valve fully open and while subject to full rated working pressure. O-Rings set in a cartridge shall not be allowed.
6. Valves have thrust washers located with (1) above and (1) below the thrust collar to ensure trouble-free operation of the valve. All internal and external surfaces of the valve body and bonnet shall have a fusion-bonded-epoxy coating, complying with ANSI/AWWA C550, accoupled electrostatically prior to assembly. Valves shall be American Flow Control's Series 2500 Ductile Iron Resilient Wedge Gate Valve, Mueller Series A-2300 Ductile Iron Resilient Wedge Gate Valve or approved equal.
7. Valve inlet shall be designed for multi-purpose material use with a wide range of outside diameters (O.D.) including ductile iron per AWWA C151, PVC per ASTM D1748 (Schedule 40 and 80), PVC per ASTM D2241 (SDR21), PVC per AWWA C900, HDPE per AWWA C906 SDR 9,11,13.5 and 17) and gray cast iron (classes A, B, C and D). Valve inlets shall incorporate a stab-fit design requiring the use of only one Type 304 stainless steel fastener. The joint shall be designed such that installation torque shall be 45 ft-lbs. or less. Joint to be configured with a one-piece full circumferential end ring and ductile iron grippers for an even distribution of thrust loads. Assembly of flange or mechanical joint restrainers using multiple fasteners or wedge bolts is not permitted. Mechanical joint restrainers or integral joint restraints are allowed. Restraint accessories shall be factory-installed. If using American Flow Control valves with ALPHA restrained joints or Mueller valves with HYMAX restrained joints, the torque shall be per the manufacturer's requirements.

C. Swing Check Valves

1. Three (3") and larger shall be of the spring-loaded cushion swing type. The valves shall be constructed of heavy cast iron or cast steel designed to withstand the test pressure for the pipelines in which they are installed. Discs shall be of bronze or of alloy cast iron with bronze or stainless-steel disc rings. Pivot pins and bushings shall be of bronze or stainless steel. Disc seats shall be replaceable. Swing check valves shall be American Darling, Apco, or approved equivalent.

D. Resilient Seated Check Valve

1. Shall be American Flow Control Series 2100 or approved equal meeting the requirements of ANSI/AWWA C508. Valve must be installed in accordance with the respective manufacturers' guidelines to ensure proper functionality and adherence to performance standards.

2.9 VALVE BOXES

A. Valve Boxes

1. Each valve buried in the ground shall be provided with an approved type of valve box and cover. The boxes shall be adjustable or screw type.
2. The valve boxes shall be made of close-grained gray cast iron, in three pieces, comprising the lower or base pieces which shall be belled at the bottom to fit around the stuffing box gland and rest on the valve bonnet, the upper part of which shall be flared on the lower end to telescope on a socket

to receive the cap or cover. The cap or cover shall have the word "Water" cast on the upper surface in raised letters. All castings shall be thoroughly cleaned and heavily coated with asphalt or coal-tar varnish.

3. Each valve box shall be provided with a concrete valve marker/protector as detailed on the plan.

2.10 PRECAST CONCRETE VALVE BOX PROTECTOR RING

A. Each cast iron valve box located out of paved areas shall be installed with a 24" diameter, precast reinforced concrete protector ring.

2.11 COUPLINGS

A. All couplings and flange coupling adapters shall be Romac ALPHA Restraint or approved equal.

B. Integral, full circumferential, extended range, stab-fit, segmented, and serrated mechanical restraint system to provide a fully restrained and pressure rated connection on plain end pipe(s). Connection shall maintain a restrained, bubble tight seal under applied operating pressure(s), without the need for continuous bolt torque. For multipurpose use on similar or dissimilar pipe diameters on a variety of acceptable pressure class pipe materials; DI, CI, PVC (C900, C909 & IPS) and HDPE (DR 9 through 17 pipe stiffeners not required). Center Ring, End Ring(s), Bolt Guide(s) and Grippers are cast ductile iron, meeting or exceeding ASTM A536, Grade 65-45-12. Center Ring is Romacoat fusion bonded epoxy certified and listed to ANSI/NSF 61 & 372. End Ring(s) and Bolt Guide(s) are Romabond polyester. Segmented grippers are machine sharpened, heat treated, and Xylan 1424 coated. Gaskets are SBR (or optional NBR) compounded for water and sewer service to ASTM D2000, certified & listed ANSI/NSF.

2.12 PRESSURE GAUGES

A. Furnish and install pressure gauges of the types indicated where shown on the Drawings.

B. Each gauge shall be equipped with the following items unless recommended otherwise by the manufacturer:

1. A ¼” N.P.T. lower connection

2. A three-way cock or tee and two (2) union cocks with nipples on each side

3. A union cock

4. A pulsation dampener

C. Where gauge diameter and pressure range are not indicated, provide a pressure gauge with a 4 ½” diameter gauge and a pressure range so that the normal operating reading shall be the midpoint of the range.

D. The Diaphragm Seals shall separate the sewage from the water in the pressure gauges by means of Teflon coated 316 stainless steel diaphragms. The diaphragm seals shall accept the specified threaded pressure gauges and have a bleeder screw in the top housing of the seal. Each seal shall contain a ¼” flushing connection in the lower housing and withstand the test pressure specified for the line to which it will be attached.

E. All pressure gauges shall be separated from the pipeline by a diaphragm seal. Gauges on potable water lines do not need diaphragm seals.

2.13 WALL SEAL

A. Furnish modular type seals where called for on the Drawings and where necessary to provide waterproof penetrations through walls, floors, and ceilings. Provide Link-Seals or approved equal.

2.14 STRAINERS

A. Provide strainers downstream of traps, at inlets to pressure-reducing valves, and elsewhere as indicated.

B. Strainers shall be of the quick-opening single basket type with a total strainer area equal to or greater than size times the pipe area. The strainer basket shall have not less than a 20% open area. Provide strainers as follows:

C. For pipes 2” and smaller, provide strainers with bronze body (ASTM B 62) and a stainless-steel basket.

D. For pipes larger than 2”, provide strainers with iron body (ASTM A 48) with a stainless-steel basket.

2.15 NEW WATER SERVICES

A. Copper Setter (Meter Setter) shall be of copper and brass, domestic manufacture, and of the proper size for the service on which they are installed. The setters shall be equipped with a dual check valve outlet and padlock wings on the key valve. Inlet and outlet connections shall be made by the same manufacturer.

1. ¾” Copper setters shall be Mueller B2404 R2 N (5/8x3/4x7) or approved equal.

2. 1” Copper setters shall be Mueller B2404 R2A N (1x10) or approved equal.

3. 2” Setter - Mueller 105B2423-2-01N (2x12) or approved equal.

B. Corporation Stops shall be of brass, domestic manufacture and of the proper size for the service on which they are installed. Where dictated by the tapping angle, eighth or quarter bend couplings shall be provided.

1. ¾” & 1”: Mueller Company, Part #H15005 with brass Insta-tite adapters for coupling to IPS service pipe shall be provided. No substitutes allowed.

2. 2”- Mueller Company Ball Corp MIP x 110 CTS compression, Part #B-25028N with stainless steel pipe insert.

C. Tapping Saddles

1. Tapping Saddles on PVC lines shall conform to AWWA C800 and saddle body to be made of bronze with a hinged brass strap. Saddle shall be designed for use on PVC pipe, and provide full circle support without cracking or distorting the pipe. The pressure capabilities shall equal, but not exceed the working pressure rating of the PVC pipe up to 200 PSIG. The seal between the pipe and top plate shall be provided through an EPDM O-Ring, permanently cemented to the underside of the clamp body.

(a) ¾” or 1” taps: Mueller S-13000 Series with CC taper threads

(b) 2”- Mueller DR2S Service Saddles with FIP threads or Romac 202S with FIP threads or approved equal

2. Tapping Saddles on Ductile Iron lines shall conform AWWA C800 and saddle body to be made of ductile iron, coated with fusion bonded black nylon and with straps made of heavy gauge Stainless Steel, Type 304 (18-8), per ASTM A 240. All bolts and nuts shall be Stainless Steel also. Nuts shall be coated to prevent galling. Pressure shall be rating of pipe up to 350 psi maximum.
   (a) ¾" or 1": Mueller DR2S Service Saddles with CC taper threads or Romac 202S with CC taper threads or approved equal
   (b) 2"- Mueller DR2S Service Saddles with FIP threads or Romac 202S with FIP threads or approved equal

D. Service Pipe and Fittings:
   1. Polyethylene Tubing:
      (a) Tubing:
         (1) ¾" or 1" Tubing: ENDOT Endopure Polyethylene PE IPS 250 psi. No substitutes allowed.
         (2) 2" tubing: Rehau Munipex Tubing CTS- Must use stainless steel pipe inserts on all connections. No substitutes allowed.
   2. Fittings:
      (a) ¾" or 1" Fittings: Mueller Brass Insta-tite connections for IPS, manufactured by Mueller Company.
      (b) 2" Fittings: Mueller Brass 110 CTS compression fittings using stainless steel pipe inserts.

E. Pipe Connection:
   1. ¾" and 1" pipe connections between corporation stop and meter setter shall be Insta-tite type, for IPS service pipe manufactured by Mueller Company. Part number is the same for ¾" or 1".
      (a) Corporation Side of Setter (INLET):
         (1) Multipurpose x IPS Insta-tite (Mueller #: H14229N) no substitutes allowed.
   2. Customer Side of Setter (OUTLET):
      (a) Multipurpose x FIP Conn. (Mueller # H14222N) or equal, must be approved.
      (b) 18" brass nipple to customer private valve/PRV/or backflow device.
   3. 2" pipe connections between corporation stop and meter setter shall be 110 CTS compression style manufactured by Mueller Company. Stainless Steel pipe inserts must be used at all connections.
      (a) Corporation Side of Setter:
         (1) 2" 110 CTS x MIP (Mueller #: H15428N) no substitutes allowed. Must use SS pipe insert.

F. Meters
   1. Shall be provided by the OWNER.
   2. Meter manufacturer shall supply meters that comply with the latest revision of AWWA C700, AWWA C702, AWWA C708 and AWWA C715, as applicable.

G. Meter Boxes

1. ¾" and 1" shall be TriCast 1118 meter box. No substitute allowed.
2. 2" meter boxes shall be Carson 1730-18 or NDS 1730 flare boxes. No substitute allowed.

H. Meter Box Lid

1. ¾" and 1" shall be TriCast Solid 1118 Poly Lid with 2 pieces of #5 Rebar. No substitutes allowed.
2. 2" shall be HDPE Flush Lid with Cast Iron Reader. No substitute allowed.

2.16 CONCRETE

A. Cement

1. Comply with ASTM C150, Type I - Normal or Type II - Moderate Sulfate Resistant.
   (a) Type: Portland.
   (b) Color: white.
   (c) Fineness: No more than 10 percent retained on a No. 325 mesh screen when tested in accordance with ASTM C430.

B. Normal Weight Aggregates

1. Comply with ASTM C33.
2. Coarse Aggregate Maximum Size: According to ACI 318.
   (a) Aggregate shall consist of clean crushed stone or gravel having hard, strong, uncoated particles free from injurious amounts of soft, thin, elongated, or laminated pieces, alkali, organic, or other deleterious matter.
   (b) The maximum permissible percentage of elongated particles is 5 percent by weight. Elongated particles are those defined as having a length equal to or greater than 5 times the width.
   (c) The fineness modulus of the coarse aggregate shall not vary more than ±0.3 percent.
   (d) Fine Aggregate shall consist of sand, stone screening, or other inert materials with similar characteristics having clean, strong, durable, uncoated grains and free from lumps, soft or flaky particles, clay, shale, alkali, organic matter, or other deleterious substances with reactivity to alkali in cement.
3. Lightweight Aggregate: Comply with ASTM C33.
4. Water: Comply with ACI 318.
   (a) Potable.

C. Admixtures

1. Do not use admixtures that have not been incorporated and tested in the accepted mixes unless otherwise authorized in writing by the ENGINEER.
2. Use admixtures in strict accordance with the manufacturer's written instructions. Proportion design mix using the proposed admixtures at optimum recommended dosages.

3. Air Entrainment: Comply with ASTM C260.
4. Chemical: Comply with ASTM C494.
   (a) Provide admixtures certified by the manufacturer to be compatible with other admixtures and containing not more than 0.1 percent chloride ions.
   (b) Type A - Water Reducing.
   (c) Type D - Water Reducing and Retarding.
   (d) Type E - Water Reducing and Accelerating.
   (e) Type F - Water Reducing, High Range.
   (f) Type G - Water Reducing, High Range, and Retarding.
5. Fly Ash: Comply with ASTM C618, Class C, or Class F.
   (a) Loss of ignition shall be less than 3 percent, and all fly ash shall be a classified processed material.
6. Silica Fume: Comply with ASTM C1240.
7. Plasticizing: Comply with ASTM C1017.
   (a) Type II, plasticizing and retarding.
8. Prohibited Admixtures: Calcium chloride thiocyanates or admixtures containing more than 0.1 percent chloride ions.

D. Joint Devices and Filler
1. Joint Filler:
   (a) Description: Asphalt-impregnated fiberboard or felt.
   (b) Comply with ASTM D1751.
   (c) Profile: Tongue-and-groove.
2. Sealant and Primer: two-part mineral filled epoxy polyurethane.

E. Concrete Mix
1. Select proportions for normal weight concrete according to ACI 301, Method 1 or Method 2.
2. If Method 1 is used, use an independent testing facility acceptable to ENGINEER for preparing and reporting proposed mix designs.
3. Submit written reports to ENGINEER of each proposed mix for each class of concrete at least 25 days prior to start of work.
4. Do not begin concrete production until mixes have been reviewed by ENGINEER.
5. Performance and Design Criteria:
   (a) Compressive Strength: 5000 psi at 28 days.
   (b) Cement Type: ASTM C150.

(c) Aggregate Type:

(1) Unless otherwise specified all aggregate shall be normal weight aggregate.

(d) If the average strength of the laboratory control cylinders shows the concrete to be below the specified design strength, the aggregate proportions and water content may be changed by the ENGINEER, who, in addition to such changes, may require core tests.

(e) Maximum Water-Cement Ratio:

(1) Concrete used in sanitary structures and floor slabs: 0.45.

(2) Air-entrained concrete exposed to freezing and thawing: 0.53.

(3) Do not add water at the site without permission from the ENGINEER's Field Representative.

a. Do not add water to concrete after adding high-range water-reducing (HRWR) admixtures to mixture.

(4) Any water which is added shall be recorded on the Delivery Ticket and Test Report.

(f) Air Content:

(1) Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or subjected to hydraulic pressure shall have the following air content depending on aggregate used:

a. No. 467 aggregate (1½"): 5.5 ± 1 percent

b. No. 57 (1") or No. 67 (¾"): 6.0 ± 1 percent

(2) Other Concrete (not exposed to freezing, thawing, or hydraulic pressure)

a. 2.0-4.0%

(g) Maximum Fly Ash Content: 10 to 20 percent of cementitious materials by weight.

(h) Maximum Slag Content: 25-50 percent of cementitious materials by weight.

(i) Slump: 2-4 inches before the addition of an HRWR.

(1) Addition of water at the site for concrete mix with insufficient slumps (slumps less than the maximum specified herein) will not be permitted. Concrete delivered to the project with a slump less than the minimum or greater than the maximum specified shall be rejected and discarded off-site.

(2) A tolerance of up to, but not exceeding, 1 inch above the indicated maximum shall be allowed for individual batches in any one day's pour provided the average of the most recent ten batches within the same pour does not exceed the maximum limits. No tolerance will be permitted for individual batches when less than ten (10) batches are delivered for one day's pour.

(j) Adjustment to Concrete Mixes

(1) Mix design adjustments may be requested when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to OWNER and as accepted by ENGINEER.

(2) Submit laboratory test data for revised mix design and strength results and get approval from the ENGINEER before using it in work.

(k) Cold Weather:

(1) Use accelerating admixtures in cold weather.

(2) Use of admixtures will not relax cold-weather placement requirements.

(l) Hot Weather: Use set-retarding admixtures.

(m) Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, or admixtures containing calcium chloride unless otherwise specified and approved in mixture designs.

(n) Add air entrainment admixture to concrete mix for Work exposed to freezing and thawing, hydraulic pressure, or deicing chemicals.

(o) For concrete exposed to deicing chemicals, limit fly ash, pozzolans, silica fumes, and slag content as required by applicable code.

(p) Use a water reducing admixture or HRWR in concrete as required for placement and workability.

(q) An HRWR is required for all concrete in walls and for other concrete which is pumped.

(1) It is optional for other concrete which is not pumped.

(r) Average Compressive Strength Reduction: Permitted according to ACI 318.

(s) Ready-Mixed Concrete: Mix and deliver concrete according to ASTM C94.

(t) For concrete structures greater than 3 feet in thickness, the temperature of the mix shall be controlled by approved methods to a temperature not greater than 70°F at the time of placement.

(u) During hot weather or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 will be required as follows:

(1) When air temperatures are between 80 degrees F. and 90 degrees F., reduce the mixing and delivery time from 1-1/2 hours to 1 hour.

(2) When outside air temperatures are above 90 degrees F, reduce the mixing and delivery time from 1-1/2 hours to 45 minutes.

(v) Site-Mixed Concrete: Mix concrete according to ACI 318.

F. Accessories

1. Bonding Agent:

(a) Description: Polyvinyl acetate, Latex emulsion.

(b) Subject to compliance with requirements, provide product equal to one of the following:

(1) Polyvinyl Acetate (Interior Only)

a. "Weld-Crete;" Larsen Products Corp.

(2) Latex Emulsion

a. "Bonding Agent J40;" Dayton Superior Corp

b. "L&M Everbond;" Laticrete

c. "Acrylic Bondcrete;" The Burke Co

d. "SBR Latex;" Euclid Chemical Co

e. "Daraweld C;" W.R. Grace & Co.

2. Epoxy Adhesive

(a) ASTM C881, two component materials suitable for use on dry or damp surfaces

(b) Provide material "Type", "Grade", and "Class" to suit project requirements.

(c) Products

(1) Subject to compliance with requirements, provide product equal to one of the following:

a. "Thiopoxy"; W.R. Grace & Co.

b. "Sikadur-32 Hi Mod"; Sika Corporation

c. "Euco Epoxy 452"; Euclid Chemical Co

3. Vapor Retarder:

(a) Description: Clear polyethylene film.

(b) Comply with ASTM E1745, Class C, or ASTM E154.

(c) Thickness: 6 mils.

(d) Type: As recommended for below-grade application.

(e) Joint Tape: As recommended by manufacturer.

4. Non-shrink Grout:

(a) Description: Premixed compound consisting of non-metallic aggregate, cement, and water-reducing and plasticizing agents.

(b) Comply with ASTM C1107.

(c) Minimum Compressive Strength: 2,400 psi in 48 hours and 7,000 psi in 28 days.

5. Concrete Repair Grout

(a) For the repair of defective areas of concrete

(b) For vertical and overhead surfaces, use one of the following or an approved equal:

(1) "Five Star Structural Concrete V/O;" Five Star Products, Inc

(2) "Verticoat;" Euclid Chemical Co

(3) "Sikatop 122-PLUS;" Sika Corporation

(c) For horizontal surfaces, use one of the following or an approved equal:

(1) "Five Star Structural Concrete;" Five Star Products, Inc

(2) "Sikatop 122-PLUS;" Sika Corporation

6. Concrete Reinforcing Fibers:

   (a) Description: High-strength industrial-grade fibers specifically engineered for secondary reinforcement of concrete.

   (b) Comply with ASTM C1116.

   (c) Tensile Strength: 130 ksi.

   (d) Toughness: 15 ksi.

   (e) Fiber Length: 3/4 inch.

   (f) Fiber Count: 34 million/lb.

7. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

   (a) Cement Binder: ASTM C150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.

   (b) Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

   (c) Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.

   (d) Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C109.

8. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

   (a) Cement Binder: ASTM C150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.

   (b) Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

   (c) Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.

   (d) Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C109.

9. Surface Coating for all exposed concrete except where otherwise shown shall be "Thoroseal" as manufactured by the BASF Corporation, or an approved equal.

2.17 SITE CLEARING

A. Herbicide: Approved by the authority having jurisdiction.

B. Tree wound paint: Bituminous-based paint of standard manufacture specially formulated for tree wounds.

C. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb./ft. remaining flexible from minus 60 to plus 200 degrees F inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 8 feet apart.

1. Height: 4 feet.

2. Color: High-visibility orange, nonfading.

2.18 SEEDING AND MULCHING

A. Topsoil

1. Topsoil shall be from stockpiles created from stripping and required excavation. Should additional topsoil be required in excess of that obtained from stripping and excavation, the contractor shall obtain material from other sources on the site where authorized by the OWNER, or from approved sources off the site. The topsoil shall be natural, friable soil, possessing characteristics of representative soils in the vicinity that produce heavy growths of crops of grass. It shall be obtained from naturally well-drained areas, shall be reasonably free from subsoil, brush, objectionable weeds, and other litter, and shall be free from toxic substances, clay lumps, stones, roots, and other objects larger than 1 inch in diameter, or any other material which might be harmful to plant growth or be a hindrance to grading, planting, and maintenance operations.

B. Fertilizer

1. Fertilizer shall be the product of an approved commercial fertilizer manufacturer and shall be 10-10-10 grade, uniform in composition, free-flowing material suitable for application with approved standard equipment. The fertilizer shall conform to the applicable State fertilizer laws and shall be delivered to the site in bags or other convenient containers, each fully labeled and bearing the name, trademark, and warranty of the producer.

C. Lime

1. Lime shall be ground limestone containing not less than 85% of total carbonates and shall be ground to such fineness that at least 50% will pass through a 100-mesh sieve and at least 90% will pass through a 20-mesh sieve. Coarser materials will be acceptable provided the specified rates of application are increased proportionately based on quantities passing the 100-mesh sieve, but no additional payment will be made for the increased quantity.

D. Seed

1. Seed shall be from the same or previous year's crop. Each variety of seed shall have a percentage of germination not less than 90, a percentage of purity not less than 85, and shall have not more than one percent weed content.

2. Seed shall be delivered in sealed containers bearing the dealer's guaranteed analysis.

E. Mulch shall be one of the following:

1. Straw Mulch

(a) Straw Mulch shall be straw from wheat or oats. Materials for securing mulch may be one of the following.

(1) Mulch Netting: Lightweight plastic, cotton, jute, wire, or paper nets shall be used.

(2) Peg and Twine: Bailing twine and softwood pegs 1/2" x 1" x 12".

(3) Liquid Mulch Binder: RC-2 cut back asphalt conforming to the requirements of Federal Specifications SS-A67IA, and asphalt emulsion shall conform to the requirements of Federal Specification SS-A-674, Type V.

2. Peat Mulch

(a) Provide peat moss in natural, shredded, or granulated form, of fine texture, with a pH range of 4 to 6.

3. Fiber Mulch

(a) Biodegradable dyed-wood cellulose-fiber mulch, nontoxic, free of plant growth- or germination-inhibitors, with a maximum moisture content of 15% and a pH range of 4.5 to 6.5

(b) Seed: Seed used shall bear the official "certified seed" label inspected by the North Carolina Crop Improvement Association. Seed that has become wet, moldy, or otherwise damaged in transit or storage will not be acceptable. The seed used shall be that shown in the seeding schedule specified herein or on the plans.

F. Tackifier shall be one of the following:

1. Asphalt Emulsion Tackifier

(a) Asphalt emulsion, ASTM D 977, Grade SS-1, non-toxic and free of plant growth- or germination-inhibitors

2. Non-Asphalt Tackifier

(a) Colloidal tackifier recommended by the fiber-mulch manufacturer for slurry application, nontoxic, and free of plant growth or germination inhibitors.

2.19 EROSION CONTROL

A. Stone and Geotextile Materials

1. Stone:

(a) Erosion Control Stone

(1) Comply with NCDOT Standard Specifications for Roads and Structures.

(b) Drainage Stone

(1) Drainage stone, washed, uniformly graded mixture of crushed stone, or crushed or uncrushed gravel conforming to Coarse Aggregate No. 57 or ASTM C33 to be used as specified.

(c) Check Dam

(1) Class B erosion control stone shall be used.

2. Geotextile Fabric: Furnish according to the State of North Carolina Department of Environmental Quality standards.

   (a) Separator geotextile fabric shall be a woven slit film or monofilament synthetic fabric consisting of polyester or polypropylene to be approved by ENGINEER. Geotextile shall be treated to resist degradation due to exposure to ultraviolet light.

3. Silt Fence: Comply with North Carolina DEQ Erosion and Sediment Control Planning and Design Manual, Latest Revision

   (a) Use a synthetic filter fabric of at least 95% by weight of polyolefins or polyester, which is certified by the manufacturer or suppliers as conforming to the requirements in ASTM D 6461, shown in the following table:

Temporary Silt Fence Material Property Requirements					
	Test Material	**Units**	**Supported Silt Fence[1]**	**Unsupported[1] Silt Fence**	**Type of Value**
Grab Strength	ASTM D 4632	N (lbs)			
Machine Direction			400	550	MARV
			(90)	(90)	
X-Machine Direction			400	450	MARV
			(90)	(90)	
Permittivity	ASTM D 4491	sec-1	0.05	0.05	MARV
Apparent Opening Size[2]	ASTM D 4751	mm	.060	0.60	Max MARV[3]
		(US Sieve #)	(30)	(30)	
Ultraviolet Stability	ASTM D 4355	% Retained Strength	70% after 500h of exposure	70% after 500h of exposure	Typical

[1] Silt Fence support shall consist of 14-gauge steel wire with a mesh spacing of 150 mm (6 inches), or prefabricated polymer mesh of equivalent strength.

[2] These default values are based on empirical evidence with a variety of sediment. For environmentally sensitive areas, a review of previous experience and/or site or regionally specific geotextile tests in accordance with Test Method D 5141 should be performed by the agency to confirm suitability of these requirements.

[3] As measured in accordance with Test Method D 4632.

   (1) Synthetic filter fabric should contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature of 120°F

   (b) Posts for sediment fences shall be steel with a minimum unit weight of 1.25 lb/linear ft with a minimum length of 5 ft. Steel posts shall have projections to facilitate fastening of the fabric.

   (c) For reinforcement of standard strength filter fabric, use wire fence with a minimum 14 gauge and a maximum mesh spacing of 6 inches.

2.20 PAVING AND SURFACING

A. Select Fill

1. The CONTRACTOR shall place select fill as necessary to complete the shoulders, subgrade foundation, and replacement for removed unsuitable material in accordance with NCDOT Section 200, Clearing and Grubbing, and as specified.

B. Gravel

1. All work including materials associated with gravel shall be in accordance with NCDOT Section 545, Incidental Stone Base unless otherwise noted.

C. Aggregate Stabilization

1. All work including materials associated with Aggregate Stabilization shall be in accordance with NCDOT Section 510, Aggregate Stabilization unless otherwise noted.

D. Aggregate Base Course (ABC)

1. All work including materials associated with Aggregate Base Course shall be in accordance with NCDOT Section 520, Aggregate Base Course unless otherwise noted.

(a) Type "A" or "B" aggregate in accordance with NCDOT Section 1010 will be acceptable for this project.

E. Asphalt Tack Coat

1. All work including materials associated with asphalt tack coat shall be in accordance with NCDOT Section 605, Asphalt Tack Coat unless otherwise noted.

F. Asphalt Concrete Base Course (ACBC)

1. All work including materials associated with asphalt concrete base course shall be in accordance with NCDOT Section 610, Asphalt Concrete Plant Mix Pavements unless otherwise noted.

(a) The job mix formula CONTRACTOR proposes to use shall be delivered to the ENGINEER at least 2 weeks prior to beginning paving operations.

G. Asphalt Concrete Surface Course (ACSC)

1. All work including materials associated with asphalt concrete surface course shall be in accordance with NCDOT Section 610, Asphalt Concrete Plant Mix Pavements unless otherwise noted.

(a) The job mix formula CONTRACTOR proposed to use shall be delivered to the ENGINEER at least two 2-weeks prior to beginning paving operations.

H. Rigid Portland Cement Concrete Pavement

1. All work including materials associated with rigid concrete pavement shall be as specified.

(a) Class A concrete shall be used.

(b) Placement shall be as specified and NCDOT Section 700, General Requirements for Portland Cement Concrete Paving, and Section 710, Concrete Pavement unless otherwise noted.

I. Rigid Concrete Pavement Reinforcing

1. Reinforcing, when applicable, shall be as shown on the Drawings and as specified.

2.21 DISINFECTION OF WATER UTILITY PIPING SYSTEMS

A. Comply with AWWA C651-23 or latest edition and revision thereof.

B. Disinfection Chemicals

1. Sodium Hypochlorite: Comply with AWWA B300-24 or latest edition and revision thereof.

2.22 BORING AND JACKING

A. Casing Pipe

1. Casing Pipe shall be spiral welded steel pipe meeting ASTM Specification A139, Grade B, having a minimum yield strength of 35,000 psi.

2. The minimum size casing and wall thickness required is as follows:

Carrier Pipe	**Casing Pipe**	**Wall Thickness NC DOT**
3/4” and 1” Service Schedule 40 PVC	N/A	N/A
4-Inch Ductile Iron or PVC	8”	0.188”
6-Inch Ductile Iron or PVC	12”	0.188”
8-Inch Ductile Iron or PVC	16”	0.250”
12-Inch Ductile Iron or PVC	20”	0.250”

B. Carrier Pipe

1. The carrier pipe shall be as specified in appropriate sections of these specifications for the type of pipe to be installed.

C. Steel Pipe Coatings

1. Exterior and interior surfaces of steel pipes shall be coated in accordance with AWWA C203.

2. Additional coating requirements, if any, may be included in the encroachment agreement between the OWNER and the North Carolina Department of Transportation or Railroad owner. The encroachment agreement is included and made a part of the Contract Documents.

D. Carrier Pipe Spacers

1. Upon completion of the installation of the steel pipe encasement, the contractor shall furnish and install casing spacers on the carrier pipe.

2. Wood skids are not an acceptable method of supporting the carrier pipe.

3. Carrier Pipe Supports within Steel Casing shall be steel plate, cold-formed structural collar with flanges, and a minimum of four support legs welded to the collar. Each support leg shall have a foot or skid welded on the end extending beyond the front and back edge of the collar. The front and rear of each foot shall be angled inwardly towards the collar to serve as a stable, effective skid during the installation of the carrier pipe. The carrier support shall be securely fastened to the carrier pipe with a heavy-duty ½" grade 5 bolt and locking nut passing between the flanges,

compressing the collar against the carrier pipe. The support device shall be a "Spider" or approved equal.

4. A minimum spacing of 2 spiders per joint of carrier pipe shall be required in order to prevent sagging of carrier pipe. The spiders shall be spaced evenly along the carrier pipe such that each spider supports the same unit weight of the carrier main. Refer to the manufacturer's recommendations for spacing and size of spacers based on the size and type of the carrier pipe.

E. Casing End Seals

1. Casing end seals shall be used to completely close both openings on either side of the casing. These end seals shall be pull-on (seamless) or wrap-around with stainless steel straps for securing the carrier pipe and the casing. End seals shall be constructed of specially compounded synthetic rubber with a minimum thickness of 1/8- inch.

F. The aforementioned specifications for boring and jacking are also acceptable for use in open cut pipe installation locations.

2.23 UNDERGROUND UTILITY DETECTION SYSTEM

A. Trace Wire

1. Open Trench

(a) Trace wire shall be #14 AWG Copper Clad Steel with a minimum 250 lb. break load and a minimum 30 mil HDPE insulation thickness.

(b) Detectable tracer tape shall be three (3) inches wide, bearing continuous message "WATER LINE", made of plastic or other permanent material, blue in color and shall be buried continuously above the water main or service lateral at a depth of eighteen (18) inches below finished grade.

2. Directional Drilling/Boring

(a) Trace wire shall be #12 AWG Copper Clad Steel with a minimum 1,150 lb. break load and a minimum 45 mil HDPE insulation thickness.

3. Pipe Bursting/Slip Lining

(a) Trace wire shall be 7x19 stranded 304 Stainless Steel with a minimum 3,700 lb. break load and a minimum 45 ml HDPE insulation thickness.

B. Connectors

1. All mainline trace wires must be interconnected in intersections, mainline tees, and mainline crosses. At tees, the three wires shall be joined using a single 3-way lockable connector. At crosses, the four wires shall be joined using a 4-way connector. Use of two 3-way connectors with a short jumper wire between them is an acceptable alternative.

2. Direct bury wire connectors shall include 3-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion and shall be installed in a manner to prevent any uninsulated wire exposure.

3. Non-locking friction fit, twist-on, or taped connectors are prohibited.

C. Acceptable Products

1. The following products have been deemed acceptable and appropriate. These products are a guide only to help you choose the correct applications for your tracer wire project.

(a) Copper-clad Steel (CCS) trace wire

(1) Open Trench

a. Copperhead part # 1430-HS

(2) Directional Drilling/Boring

a. Copperhead part # 1245*EHS

(3) Pipe Bursting/Slip Lining

a. Copperhead part # PBX-50

(b) Connectors

(1) Copperhead 3-way locking connector part # LSC1230*

(2) DryConn 3- way Direct Bury Lug: Copperhead Part # 3WB-01

(c) Termination/Access

(d) Non-Roadway access boxes applications

(1) Trace wire access boxes Grade level Copperhead adjustable lite duty Part # LD14*TP

(e) Concrete / Driveway access box applications

(1) Trace wire access boxes Grade level Copperhead Part # CD14*TP 14”

(f) Fire hydrant trace wire access box applications

(1) Above ground two terminal with 1” conduit. Copperhead part # T3-75-F (Cobra T3 Test Station, denoting “F” includes mounting flange)

(g) Grounding

(1) Drive in Magnesium Anode

a. Copperhead Part # ANO-1005 (1.5 lb)

PART 3 -- EXECUTION

3.1 MATERIALS APPROVAL LIST

A. The ENGINEER shall review, approve and furnish to Iredell Water Corporation for final approval two (2) copies of the materials approval list (provided on the next page) prior to the installation of any system components.

MATERIALS APPROVAL LIST

SUBMIT TO:
Iredell Water Corporation
571 Jennings Road
Statesville, North Carolina 28625

DATE: _____
PROJECT NAME: _____
PROJECT ADDRESS: _____
SUBMITTED BY: _____

Item Description Model/Type	Size	Manufacturer

****END OF SECTION****

SECTION 02 – PROJECT REQUIREMENTS

PART 1 -- PROJECT REQUIREMENTS

1.1 RESPONSIBILITY FOR MATERIALS AND EQUIPMENT

A. Items Furnished by CONTRACTOR

1. CONTRACTOR shall be fully responsible for all materials and equipment which he has furnished. All items shall be unloaded promptly after arrival. All charges for demurrage due to negligence or delay by CONTRACTOR shall be paid by CONTRACTOR. Materials shall be handled by methods which will prevent damage. Materials shall be protected from exposure to the elements. All material shall be stored in accordance with the General Equipment Stipulations.

1.2 PREPARATION FOR SHIPMENT

A. All materials shall be suitably packaged to facilitate handling and protect against damage during transit and storage. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of ENGINEER. Each item, package, or bundle of material shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

1.3 LAND FOR CONSTRUCTION PURPOSES

A. Any additional area required by CONTRACTOR shall be obtained from property owners by and at the expense of the CONTRACTOR. The OWNER shall not be liable for any damages caused by the CONTRACTOR to such premises. Yard areas shall be kept neat and clean.

B. The CONTRACTOR shall hold and save the OWNER free and harmless from liability of any nature or kind arising from any use, trespass, or damage occasioned by his operation on premises or third persons.

C. CONTRACTOR shall immediately move stored materials or equipment if any occasion arises, as determined by OWNER, requiring access to the storage area. Material or equipment shall not be placed on the property of OWNER until OWNER has agreed to the location to be used for storage.

1.4 EASEMENTS AND RIGHTS-OF-WAY

A. The easements and rights-of-way for the pipelines will be provided by OWNER. CONTRACTOR shall confine his construction operations within the limits indicated on the Drawings.

B. CONTRACTOR shall use due care in placing construction tools, equipment, excavated materials, and pipeline materials and supplies in order to avoid damage to property and interference with traffic.

1.5 ON PRIVATE PROPERTY

A. Easements across private property are indicated on the Drawings. CONTRACTOR shall set stakes to mark the boundaries of construction easements across private property.

B. CONTRACTOR shall furnish, without charge, competent persons from his force and such tools, stakes, and other materials as OWNER may require in staking out the boundaries of construction easements. CONTRACTOR will not be required to provide an instrument person. The stakes shall be protected and maintained until completion of construction and cleanup.

C. CONTRACTOR shall not enter any private property outside the designated construction easement boundaries without written permission from the owner of the property.

1.6 WORK WITHIN HIGHWAY AND RAILROAD RIGHTS-OF-WAY

A. Permits shall be obtained by OWNER. All Work performed and all operations of CONTRACTOR, his employees, or Subcontractors, within the limits of railroad and highway rights-of-way, shall be in conformity with the requirements and be under the control (through OWNER) of the railroad or highway authority owning, or having jurisdiction over and control of, the right-of-way in each case. All work within the Highway and Railroad Rights-of-Way shall conform to the requirements of those sections of the specifications. The CONTRACTOR shall provide all bonds and insurance required by the governing agency.

1.7 NOTICES TO OWNERS AND AUTHORITIES

A. CONTRACTOR shall, as provided in General Conditions, notify OWNERS of adjacent property and utilities when prosecution of the Work may affect them. When it is necessary to temporarily deny access to property, or when any utility service connection must be interrupted, CONTRACTOR shall give notices sufficiently in advance to enable the affected persons to provide for their needs. Notices will conform to any applicable local ordinance and, whether delivered orally or in writing, will include appropriate information concerning the interruption and instructions on how to limit inconvenience caused thereby. Utilities and other concerned agencies shall be contacted at least 24 hours prior to cutting or closing streets or other traffic areas or excavating near underground utilities or pole lines.

1.8 LINES AND GRADES

A. All Work shall be done to the lines, grades, and elevations indicated on the Drawings.

B. Basic horizontal and vertical control points will be established or designated by OWNER and are shown on the Drawings. These points shall be used as datums for the Work. All additional survey, layout, and measurement Work shall be performed by CONTRACTOR as a part of the Work.

C. CONTRACTOR shall provide an experienced instrument person, competent assistants, and such instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement Work. In addition, CONTRACTOR shall furnish, without charge, competent persons from his force and such tools, stakes, and other materials as OWNER may require in establishing or designating control points, in establishing or designating control points, in establishing construction easement boundaries, or in checking survey, layout, and measurement Work performed by CONTRACTOR.

D. CONTRACTOR shall keep OWNER informed, a reasonable time in advance, of the times and places at which he wishes to do Work, so that horizontal and vertical control points may be established, and any checking deemed necessary by ENGINEER may be done with minimum inconvenience to ENGINEER and minimum delay to CONTRACTOR.

E. CONTRACTOR shall remove and reconstruct Work which is improperly located.

1.9 CONNECTIONS TO EXISTING FACILITIES

A. Unless otherwise specified or indicated, CONTRACTOR shall make all necessary connections to existing facilities, including structures, drain lines, and utilities such as water, sewer, gas, telephone, and electric. In each case, CONTRACTOR shall receive permission from OWNER or the owning utility prior to undertaking connections. CONTRACTOR shall protect facilities against deleterious substances and damage. Connections to existing facilities which are in service shall be thoroughly planned in advance, and all required equipment, materials, and labor shall be on hand at the time of undertaking the connections. Work shall proceed continuously (around the clock) if necessary, to complete connections in the minimum time. Operation of valves and other appetences on existing utilities, when required, shall be by or under the direct supervision of the owning utility.

1.10 UNFAVORABLE CONSTRUCTION CONDITIONS

A. During unfavorable weather, wet ground, or other unsuitable construction conditions, CONTRACTOR shall confine his operations to Work which will not be affected adversely by such conditions. No portion of the Work shall be constructed under conditions which would adversely affect the quality or efficiency thereof, unless special means or precautions are taken by CONTRACTOR to perform the Work in a proper and satisfactory manner.

1.11 CUTTING AND PATCHING

A. As provided in General Conditions, CONTRACTOR shall perform all cutting and patching required for the Work and as may be necessary in connection with uncovering Work for inspection or for the correction of defective Work.

B. CONTRACTOR shall perform all cutting and patching required for and in connection with the Work, including but not limited to the following:

1. Removal of improperly timed Work
2. Removal of samples of installed materials for testing
3. Alteration of existing facilities
4. Installation of new Work in existing facilities

C. CONTRACTOR shall provide all shoring, bracing, supports, and protective devices necessary to safeguard all Work and existing facilities during cutting and patching operations. CONTRACTOR shall not undertake any cutting or demolition which may affect the structural stability of the Work or existing facilities without OWNER'S concurrence. Materials shall be cut and removed to the extent indicated on the Drawings or as required to complete the Work. Materials shall be removed in a careful manner, with no damage to adjacent facilities or materials. Materials which are not salvable shall be removed from the site by CONTRACTOR. All Work and existing facilities affected by cutting operations shall be

restored with new materials, or with salvaged materials acceptable to ENGINEER, to obtain a finished installation with the strength, appearance, and functional capacity required. If necessary, entire surfaces shall be patched and refinished. At any time when CONTRACTORS will be crossing city streets with heavy equipment or open cutting said streets, it will be necessary to get a permit from the controlling agency for such action. CONTRACTORS with equipment entering OWNER or Department of Transportation maintained streets shall not spill debris or deposit mud, dirt, etc., on these streets without immediate cleanup. After two warnings, cleanup may be done by OWNER forces and back charged to the offending CONTRACTOR.

1.12 CLEANING UP

A. CONTRACTOR shall keep the premises free at all times from accumulations of waste materials and rubbish. CONTRACTOR shall provide adequate trash receptacles about the site and shall promptly empty the containers when filled. Volatile wastes shall be properly stored in covered metal containers and removed daily. Wastes shall not be buried or burned on the site or disposed of into storm drains, sanitary sewers, streams, or waterways. All wastes shall be removed from the site and disposed of in a manner complying with local ordinances and antipollution laws. Adequate cleanup will be a condition for recommendation of progress payment applications. CONTRACTOR shall keep streets and roadways clean and accessible at all times. Street and roadway cleaning shall be required by and to the satisfaction of the authority having jurisdiction over the street or roadway.

1.13 APPLICABLE CODES

A. References in the Contract Documents to local codes mean the following:

1. North Carolina Building Code
2. North Carolina Occupational Safety and Health Standards for General Industry
3. North Carolina Administrative Code, Title 15A Department of Environment Quality, Subchapter 18C - Water Supplies - Rules Governing Public Water Systems
4. Other standard codes which apply to the Work are designated in the Specifications.

1.14 NSF CERTIFICATION

A. The following materials that come in contact with the treated water shall have certification to ANSI/NSF 60 or 61.

1. Joining and sealing materials, such as solvents, cements, welding materials, and gaskets.
2. Pipe and fittings.
3. Coatings, linings, and paints.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

****END OF SECTION****

SECTION 03 – CONSTRUCTION SURVEYING

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. Provide construction surveying required in the execution of the Project.

B. Provide surveying to be used for documenting construction and for the preparation of Record Drawings.

C. The CONTRACTOR shall retain the services of a registered land surveyor licensed in the State of North Carolina to perform all surveying.

1.2 SUBMITTALS

A. Submit name and address of registered land surveyor to be used on this project to the ENGINEER within 5 days of the Notice to Proceed.

B. On request of the ENGINEER, submit documentation to verify accuracy of surveying work.

C. Submit construction record of items required to be surveyed. The Drawing must be sealed by a registered land surveyor.

D. An electronic file in DWG format, containing survey points of both horizontal (x, y) and vertical (tops and inverts, or Z) information shall be provided. Additional requirements specified in Section 03, Part 1, 1.8 “Record Drawing Documentation”.

E. Final as-builts shall be submitted in PDF format and as a hard copy (one copy, 32”x24” size).

1.3 DATUM

A. The CONTRACTOR shall be responsible for correctly locating all lines and grades and for performing all measuring as required for the construction and completion of the Work from established reference points and information as shown in the Contract Drawings.

B. All horizontal data shall be tied to the North Carolina State Plane Coordinate System, NAD 83. These drawings shall constitute the project record documents.

C. All vertical data shall be tied to the North Carolina State Plane Coordinate System, NAVD 88 coordinates.

1.4 SURVEY REFERENCE POINTS

A. Only such primary control lines, monuments, and benchmarks (if any) will be set by the OWNER as the OWNER determines to be necessary to control the establishment of the lines and grades required for completion of the Work. In general, these will consist of the primary horizontal and vertical control points indicated on the Contract Drawings. All other stakes or markers required to establish the lines and grades required for the completion of the Work shall be the responsibility of the CONTRACTOR.

B. Primary control monuments set by the OWNER shall be carefully preserved by the CONTRACTOR. In case such monuments are destroyed or damaged, they will be replaced at the CONTRACTOR's expense.

1.5 SURVEYS FOR LAYOUT AND PERFORMANCE

A. Surveying Requirements

1. Perform all surveys for layout and performance of the Work, reduce the field notes, and make all calculations and drawings necessary to carry out such work. The CONTRACTOR shall check the relative positions of all monuments and benchmarks to be used and shall report any damaged or out-of-position monuments to the ENGINEER at once. The CONTRACTOR shall check such relative positions each time the CONTRACTOR uses such monument or benchmark.

B. Equipment and Personnel

1. The CONTRACTOR's instruments and other survey equipment shall be accurate, suitable for the surveys required in accordance with recognized professional standards, and in proper condition and adjustment at all times. Perform all surveys under the direct supervision of a professional land surveyor or engineer currently licensed or registered in the State of North Carolina.

C. Field Notes and Records

1. Furnish the original pages of all survey records to the ENGINEER at intervals required by the ENGINEER. Furnish each field notebook to the ENGINEER when filled or completed.

D. Use by the ENGINEER

1. The ENGINEER may at any time use line and grade points and markers established by the CONTRACTOR. The CONTRACTOR's surveys are a part of the work and may be checked by the ENGINEER at any time. The CONTRACTOR shall be responsible for any lines, grades, or measurements which do not comply with specified or proper tolerances, or which are otherwise defective, and for any resultant defects in the work. The CONTRACTOR shall conduct resurveys or check surveys to correct errors indicated by review of the field notebooks or by check surveys performed by the ENGINEER.

1.6 SURVEYING FOR PREPARATION OF RECORD DRAWINGS

A. The following items are required to be surveyed by a registered land surveyor to be used in the preparation of Record Drawings.

1. Valves
2. Hydrants
3. Blow-offs
4. Meters
5. Existing underground utilities (water, sewer, and storm drains) along with any related appurtenances. The survey of water utilities shall encompass fittings (tees, elbows, reducers, etc.) and casing pipes.

1.7 SURVEYING ACCURACY AND TOLERANCES IN SETTING SURVEY STAKES

A. Surveying Accuracy

1. Control

(a) Control traverse field surveys and computations, including surveys of main control lines to determine horizontal and vertical alignment of major structure components, shall meet the accuracy requirements for Second Order, Class I Surveys as specified by the National Oceanic and Atmospheric Administration (NOAA).

2. Staking

(a) Staking for construction or equipment installations shall meet the accuracy requirements for Second Order, Class II Surveys as specified by NOAA.

B. Tolerances

1. The tolerances generally applicable in setting survey stakes shall be as set forth above. Such tolerances shall not supersede stricter tolerances required by the Contract Drawings or Specifications and shall not otherwise relieve the CONTRACTOR of responsibility for measurements in compliance therewith.

1.8 RECORD DRAWING DOCUMENTATION

(a) The CAD file must contain public utility infrastructure and plat information within a single drawing in DWG format, that was constructed during the project.

(1) Files in DXF, DWF, or DGN format are not acceptable.

(2) The drawing must be a “stand-alone” without the necessity of attaching Reference or XREF files or modifying layers.

(3) The CAD file must be saved in the current CAD version.

(b) The infrastructure shall be drawn in the file for as-built locations as surveyed and certified by a Professional Land Surveyor.

(1) All as-built survey data collection must be within an accuracy tolerance of 0.10’ horizontal and 0.05’ vertical, based on the project’s horizontal and vertical datum.

(2) The data must be projected in North Carolina State Plane Coordinates: North American Datum 1983 (NAD 83), Vertical Datum tied into NAVD88, and units are US Survey Feet.

(c) Public/private utility infrastructure, along with any related appurtenances, and plat information must be organized into separate layers according to feature type and drawn as polylines and blocks (except for annotation). All layers must be turned on and visible/unfrozen.

(1) Layer names should be intuitive and descriptive of the objects on that layer.

(2) Features must be clearly segregated into their appropriate layer, and not appear on other unrelated layers.

(3) Remnants of lines or points used in the development of the drawing but not representative of actual real-world features (trim lines, transit points, etc.) should be removed from the drawing.

(4) Features that should appear in the drawing on separate layers are listed below. Any additional features not listed are optional and must also be on separate layers with clear, understandable layers names. Existing elevation contours are not needed and should not be included within the provided file.

a. All pipes should be lines under the same layer. Valves, hydrants, meters, blow-offs, and other fittings must be included.

b. The attributes of the pipes should include the following:

1) Pipe ID

2) Northing

3) Easting

4) Upstream structure ID

5) Upstream invert

6) Downstream structure ID

7) Downstream invert

8) Pipe diameter

9) Pipe material

c. Include an updated, as-built pipe network.

1) If a pipe network is not available, include an SDF file with the as-built pipe network information.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

****END OF SECTION****

SECTION 04 – ON-SITE CONSTRUCTION OBSERVER RESPONSIBILITIES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The Resident Project Representative (RPR) will be ENGINEER's representative at the Site, will act as directed by and under the supervision of ENGINEER, and will confer with ENGINEER regarding RPR's actions.

1.2 DUTIES AND RESPONSIBILITIES

A. General

1. RPR's dealings in matters pertaining to the Work in general shall be with ENGINEER and CONTRACTOR. RPR's dealings with Subcontractors shall only be through or with the full knowledge and approval of CONTRACTOR. RPR shall generally communicate with OWNER only with the knowledge of and under the direction of ENGINEER.

B. Schedules

1. Review the progress schedule, schedule of Shop Drawing and Sample submittals, and Schedule of Values prepared by CONTRACTOR and consult with ENGINEER concerning acceptability.

C. Conferences and Meetings

1. Attend meetings with CONTRACTOR, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings, and prepare and circulate copies of minutes thereof.

D. Liaison

1. Serve as ENGINEER's liaison with CONTRACTOR. Working principally through CONTRACTOR's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.

2. Assist ENGINEER in serving as OWNER's liaison with CONTRACTOR when CONTRACTOR's operations affect OWNER's On-Site operations.

3. Assist in obtaining from OWNER additional details or information, when required for proper execution of the Work.

E. Interpretation of Contract Documents

1. Report to ENGINEER when clarifications and interpretations of the Contract Documents are needed and transmit to CONTRACTOR clarifications and interpretations as issued by ENGINEER.

F. Shop Drawings and Samples

1. Record date of receipt of Samples and CONTRACTOR-approved Shop Drawings.

2. Receive Samples that are furnished at the site by the CONTRACTOR and notify ENGINEER of the availability of samples for examination.

3. Advise ENGINEER and CONTRACTOR of the commencement of any portion of the Work requiring a Shop Drawing or Sample submittal for which RPR believes that the submittal has not been approved by ENGINEER.

G. Modifications

1. Consider and evaluate CONTRACTOR's suggestions for modifications in Drawings or Specifications and report such suggestions, together with RPR's recommendations, if any, to ENGINEER. Transmit to CONTRACTOR in writing decisions as issued by ENGINEER.

H. Review of Work and Rejection of Defective Work

1. Conduct on-site observations of CONTRACTOR's work in progress to assist ENGINEER in determining if the Work is in general proceeding in accordance with the Contract Documents.

2. Report to ENGINEER whenever RPR believes that any part of CONTRACTOR's work in progress is defective, will not produce a completed Project that conforms generally to the Contract Documents, or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise ENGINEER of that part of work in progress that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.

I. Inspections, Tests, and System Start-Ups

1. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate OWNER's personnel, and that CONTRACTOR maintains adequate records thereof.

2. Observe, record, and report to ENGINEER appropriate details relative to the test procedures and systems start-ups.

J. Records

1. Prepare a daily report or keep a diary or log book, recording CONTRACTOR's hours on the Site, Subcontractors present at the Site, weather conditions, data relative to questions of Change Orders, Field Orders, Work Change Directives, or changed conditions, Site visitors, deliveries of equipment or materials, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to ENGINEER.

2. Record names, addresses, fax numbers, e-mail addresses, website locations, and telephone numbers of all Contractors, Subcontractors, and major Suppliers of materials and equipment.

3. Maintain records for use in preparing Project documentation.

K. Reports

1. Furnish ENGINEER with periodic reports as required of the progress of the Work and of CONTRACTOR's compliance with the Progress Schedule and schedule of Shop Drawing and Sample submittals.

2. Draft and recommend to ENGINEER proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from CONTRACTOR.

3. Immediately notify ENGINEER of the occurrence of any Site accidents, emergencies, acts of God endangering the Work, force majeure or delay events, damage to property by fire or other causes, or the discovery of any Constituent of Concern or Hazardous Environmental Condition.

L. Payment Requests

1. Review applications for payment with CONTRACTOR for compliance with the established procedure for their submission and forward with recommendations to ENGINEER, noting particularly the relationship of the payment request to the Schedule of Values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

M. Certificates, Operation and Maintenance Manuals

1. During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals, and other data required by the Contract Documents to be assembled and furnished by CONTRACTOR are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to ENGINEER for review and forwarding to OWNER prior to payment for that part of the Work.

N. Completion

1. Participate in ENGINEER's visits to the Site to determine Substantial Completion, assist in the determination of Substantial Completion, and the preparation of a punch list of items to be completed or corrected.

2. Participate in ENGINEER's final visit to the Site to determine completion of the Work, in the company of OWNER and CONTRACTOR, and prepare a final punch list of items to be completed and deficiencies to be remedied.

3. Observe whether all items on the final list have been completed or corrected and make recommendations to ENGINEER concerning acceptance and issuance of the notice of acceptability of the work.

1.3 LIMITATIONS OF AUTHORITY

A. The RPR shall not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of ENGINEER's authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of CONTRACTOR, Subcontractors, or Suppliers.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences, or procedures of CONTRACTOR's work.

5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of OWNER or CONTRACTOR.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by ENGINEER.

7. Accept Shop Drawing or Sample submittals from anyone other than CONTRACTOR.

8. Authorize OWNER to occupy the Project in whole or in part.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

****END OF SECTION****

SECTION 05 – PROJECT MEETINGS

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The ENGINEER shall schedule and administer a pre-construction meeting, periodic progress meetings, and specially called meetings throughout the progress of the work. The ENGINEER shall:

1. Prepare agenda for meetings.
2. Make physical arrangements for meetings.
3. Preside at meetings.
4. Keep a record of the meeting, including significant proceedings and decisions.
5. Reproduce and distribute copies of the record within five working days after each meeting.
   (a) To participants in the meeting.
   (b) To parties affected by decisions made at the meeting.

B. Representatives of the CONTRACTOR, subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

C. The CONTRACTOR shall provide an updated schedule at each Project meeting.

D. The CONTRACTOR shall attend meetings to ascertain that work is expedited consistent with Contract Documents and construction schedules.

1.2 PRE-CONSTRUCTION MEETING

A. The ENGINEER shall schedule a pre-construction meeting in accordance with the following:

1. Location
   (a) A central site, convenient for all parties, designated by the OWNER.
2. Attendance
   (a) ENGINEER
   (b) RESIDENT PROJECT REPRESENTATIVE (RPR)
   (c) OWNER’s Representative
   (d) CONTRACTOR's Superintendent
   (e) Major Subcontractors
   (f) Major suppliers
   (g) Utilities
   (h) Others as appropriate

3. Agenda
   (a) Distribution and discussion of
      (1) List of major subcontractors and suppliers
      (2) Projected Construction Schedules
   (b) Critical work sequencing
   (c) Major equipment deliveries and priorities
   (d) Project Coordination
      (1) Designation of responsible personnel
   (e) Procedures and processing of
      (1) Field decisions
      (2) Proposal requests
      (3) Submittals
      (4) Change Orders
      (5) Applications for Payment (monthly date of Payment to be determined)
   (f) Adequacy of distribution of Contract Documents
   (g) Procedures for maintaining Record Documents
   (h) Use of premises
      (1) Office, work, and storage areas
      (2) OWNER's requirements
      (3) Construction facilities, controls, and construction aids
      (4) Temporary utilities
      (5) Housekeeping procedures
      (6) Safety

1.3 PROGRESS MEETINGS

A. The ENGINEER will schedule regular progress meetings.
   1. The progress meetings will be held approximately every 30 days with the first meeting 30 days after the pre-construction meeting or no later than 30 days after the date of Notice to Proceed.

B. ENGINEER, OWNER, or CONTRACTOR may hold or call meetings as required by progress of the work.

C. Location of the meetings
   1. Project field office of CONTRACTOR or ENGINEER

D. Attendance

1. OWNER's Representative
2. ENGINEER
3. RPR
4. CONTRACTOR's Superintendent
5. Subcontractors as appropriate to the agenda
6. Suppliers as appropriate to the agenda
7. Others as appropriate

E. Agenda

1. Review, and approval of minutes of previous meeting
2. Review of work progress since previous meeting
3. Field observations, problems, conflicts
4. Problems which impede Construction Schedule
5. Review of off-site fabrication, delivery schedules
6. Measures and procedures to maintain projected schedule
7. Revisions to Construction Schedule
8. Progress, schedule, during succeeding work period
9. Coordination of schedules
10. Review submittal schedules; expedite as required
11. Maintenance of quality standards
12. Pending changes and substitutions
13. Review proposed changes for
    (a) Effect on Construction Schedule and on completion date
    (b) Effect on other contracts of the project
14. Construction Schedule
15. Critical/long lead items
16. Other business

F. The CONTRACTOR is to attend progress meetings and is to study previous meeting minutes and current agenda items, in order to be prepared to discuss pertinent topics such as deliveries of materials and equipment, progress of the work, etc.

G. The CONTRACTOR is to provide a current submittal log at each progress meeting.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

****END OF SECTION****

SECTION 06 – PROJECT RECORD DOCUMENTS

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. Maintain at the site for the OWNER one record copy of the following:

1. Drawings
2. Specifications
3. Addenda
4. Change Orders and other Modifications to the Contract
5. ENGINEER's Field Orders or written instructions
6. Approved Shop Drawings, Working Drawings, and Samples
7. Field Test records
8. Construction photographs
9. All other construction-related permits

1.2 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples in CONTRACTOR'S field office apart from documents used for construction.

1. Provide files and racks for storage of documents.
2. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with CSI format.

C. Maintain documents in a clean, dry, legible, condition and in good order. Do not use record documents for construction purposes.

D. Make documents and samples available at all times for inspection by the ENGINEER.

E. As a prerequisite for monthly progress payments, the CONTRACTOR is to exhibit the currently updated "Project Record Documents" and survey data in accordance with Specification Section 04 – Responsibilities of Resident Project Representative for review by the ENGINEER and OWNER.

1.3 MARKING DEVICES

A. Provide felt tip marking pens for recording information in the color code designated by the ENGINEER.

1.4 RECORDING

A. Label each document "PROJECT RECORD" in neat, large, printed letters.

B. Record information concurrently with construction progress.

1. Do not conceal any work until the required information is recorded.

C. Record Drawings

1. Surveying Requirements

(a) Provide surveying in accordance with Specification Section 03 – Construction Surveying.

2. Provide the following information on the Record Drawings.

(a) Location of pipes and conduits with changes from the approved design noted

(b) Location of valves

(c) Location of hydrants

(d) Location of blow-offs

(e) Location of meters

(f) Location of pipe fittings

(g) Location and elevation of structures including rim, pipe inverts, and vent elevations

(h) Location and elevation of equipment foundation pads

(i) Final grade including contours at one-foot intervals

3. Maintain Record Drawings of all work and subcontracts, continuously as the job progresses. A separate set of prints, for this purpose only, shall be kept at the CONTRACTOR's field office at all times.

4. These drawings shall be kept up-to-date and are required to be certified by the ENGINEER at the time invoices are submitted for progress payments. The ENGINEER may withhold progress payments if Record Drawings are not kept current.

5. The ENGINEER will furnish the CONTRACTOR a complete set of full-size copies of the Contract Drawings for the purpose of making prints for Record Drawings.

6. Deviations from the drawings, utilities, services, mechanical and electrical lines, details, and other work shall be incorporated on the Record Drawing prints in red ink; neat and clearly legible.

7. No work shall be permanently concealed until the required information has been recorded.

8. Where the Contract Drawings are not of sufficient size, scale, or detail, the CONTRACTOR shall furnish its own drawings for incorporation of details and dimensions.

9. Change Orders

(a) Changes to the Contract Drawings as the result of Change Orders shall be incorporated on the prints, and these changes shall be identified by Change Order number and effective date.

(b) When revised Contract Drawings are issued as the basis of, or along with, Change Orders, these revised drawings shall be incorporated into the Record Drawing set with appropriate annotation. Drawings deleted by Change Order will not be part of the Record Drawing set. The OWNER will furnish the CONTRACTOR with reproductions of such revised OWNER-furnished Contract Drawings.

(c) The final submittal of Record Drawings shall be stamped "Project Record ", signed and dated in blue ink by the CONTRACTOR, and shall be delivered to the ENGINEER prior to the final inspection.

D. Specifications and Addenda; legibly mark each Section to record the following:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.

2. Changes made by Work Change Directive, Field Order, or Change Order.

E. Shop Drawings (after final review and approval)

1. CONTRACTOR shall submit one hard copy and one electronic copy in PDF format of record drawings for each process equipment, piping, electrical system, and instrumentation system. Additional requirements specified in Section 03, Part 1, 1.8 “Record Drawing Documentation”.

1.5 SUBMITTALS

A. At Contract close-out, deliver Record Documents to the ENGINEER for the OWNER.

B. Final payment will not be released without delivery of the Record Documents to the ENGINEER.

C. Accompany submittal with transmittal letter in duplicate, containing:

1. Date

2. PROJECT title and number

3. CONTRACTOR's name and address

4. Title and number of each Record Document

5. Signature of CONTRACTOR or his authorized representative

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

****END OF SECTION****

SECTION 07 – OPERATION AND MAINTENANCE DATA

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. This section includes procedural requirements for compiling and submitting operation and maintenance data required to complete the project.

1.2 SERVICES OF MANUFACTURER'S REPRESENTATIVE

A. Equipment, when furnished, shall include the cost of a competent representative of the manufacturers of all equipment to supervise the installation, adjustment, and testing of the equipment and to instruct the OWNER's operating personnel on operation and maintenance.

B. This supervision may be divided into two or more time periods as required by the installation program or as directed by the ENGINEER.

C. See the detailed Specifications for additional requirements for furnishing the services of manufacturer's representatives.

D. A certificate in the form attached to this Section, from the manufacturer and signed by OWNER's representative stating that the installation of the equipment is satisfactory, that the unit has been satisfactorily tested, is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication, and care of the unit shall be submitted for each piece of equipment indicated above.

E. For equipment furnished under other Divisions, the CONTRACTOR shall furnish the services of accredited representatives of the manufacturer only when some evident malfunction or overheating makes such services necessary in the opinion of the ENGINEER.

1.3 OPERATING MANUALS

A. CONTRACTOR shall submit to the ENGINEER one hard copy and one electronic copy in PDF format of operation and maintenance instructions covering all equipment furnished.

1. The manual for each piece of equipment shall be a separate document with the following specific requirements:

(a) Contents

(1) Table of contents and index

(2) Brief description of each system and components

(3) Starting and stopping procedures

(4) Special operating instructions

(5) Routine maintenance procedures

(6) Manufacturer's printed operating and maintenance instructions, parts list, illustrations, and diagrams

(7) One copy of each wiring diagram

(8) One copy of each approved shop drawing and each CONTRACTOR's coordination and layout drawing

(9) List of spare parts, manufacturer's price, and recommended quantity

(10) Name, address, and telephone numbers of local service representatives.

(b) Material

(1) Loose-leaf on 60-pound, punched paper

(2) Holes reinforced with plastic cloth or metal

(3) Page size, 8-1/2-in by 11-in

(4) Diagrams, illustrations, and attached foldouts as required, of original quality, reproduced by dry copy method

(5) Covers: oil, moisture, and wear-resistant 9 x 12 size

(c) Submittals to the ENGINEER

(1) Submit three preliminary copies of manuals shall be submitted to the ENGINEER no later than 15 days following approval of the shop drawings for each piece of equipment.

(2) Provide three final copies of complete manuals prior to testing.

1.4 CONTENTS

A. Table of Contents

1. Provide title of Project, names, addresses, and telephone numbers of ENGINEER, subconsultants, and CONTRACTOR with name of responsible parties; schedule of products and systems, indexed to content of the volume.

B. For Each Product or System

1. List names, addresses, and telephone numbers of Subcontractors and suppliers; including local source of supplies and replacement parts.

C. Product Data

1. Mark each sheet to clearly identify specific products and component parts, and data applicable to installation.

2. Delete inapplicable information.

D. Drawings

1. Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

2. Do not use Project Record Documents as maintenance drawings.

E. Type Text

1. As required to supplement product data.
2. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified.

F. Warranties and Bonds

1. Provide warranties and bonds information for all installed equipment and each major component to the ENGINEER.

1.5 MANUAL FOR EQUIPMENT AND SYSTEMS

A. For each Item of Equipment and Each System provide the following:

1. Overview of System and description of unit or system, and component parts.
2. Identify function, normal operating characteristics, and limiting conditions.
3. Include performance curves, with engineering data and tests and complete nomenclature and commercial number of replaceable parts.
4. Panelboard Circuit Directories including electrical service characteristics, controls and communications, and color-coded wiring diagrams as installed.
5. Operating Procedures
   (a) Include start-up, break-in, and routine normal operating instructions and sequences; regulation, control, stopping, shutdown, and emergency instructions; and summer, winter, and any special operating instructions.
6. Maintenance Requirements
   (a) Routine procedures and guide for troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
   (b) Servicing and lubrication schedule, and list of lubricants required.
   (c) Manufacturer's printed operation and maintenance instructions.
   (d) Sequence of operation by controls manufacturer.
   (e) Original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
7. Control diagrams by controls manufacturer as installed.
8. CONTRACTOR's coordination drawings, with color-coded piping diagrams as installed.
9. Charts of valve tag numbers, with the location and function of each valve, keyed to flow and control diagrams.
10. List of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
11. Test and balancing reports as specified.

12. Additional Requirements:

    (a) As specified in individual product specification Sections.

1.6 INSTRUCTION OF OWNER PERSONNEL

A. Before final inspection, fully instruct OWNER's designated operating and maintenance personnel in the operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon time.

B. Use operation and maintenance manuals as the basis for instruction. Review contents of the manual with personnel in detail to explain all aspects of operation and maintenance.

C. Prepare and insert additional data in Operation and Maintenance Manual when the need for such data becomes apparent during instruction.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

****END OF SECTION****

SECTION 08 – CAST-IN-PLACE CONCRETE

PART 1 -- GENERAL

1.1 SUMMARY

A. Section Includes Cast-in-Place Concrete for the following Items:

1. Foundation walls.
2. Footings.
3. Supported slabs.
4. Slabs on grade.
5. Control, expansion, and contraction joint devices.
6. Equipment pads.
7. Thrust blocks.
8. Manholes.

1.2 REFERENCE STANDARDS

A. Reference the “Latest Edition” of all Standards unless noted otherwise.

B. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 302.1R - Guide to Concrete Floor and Slab Construction.
3. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
4. ACI 305R - Guide to Hot Weather Concreting.
5. ACI 306.1 - Standard Specification for Cold Weather Concreting.
6. ACI 309 - Consolidation of Concrete.
7. ACI 318 - Building Code Requirements for Structural Concrete.

C. ASTM International:

1. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
2. ASTM C33 - Standard Specification for Concrete Aggregates.
3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
4. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
5. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
6. ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens.

7. ASTM C143 - Standard Test Method for Slump of Hydraulic-Cement Concrete.
8. ASTM C150 - Standard Specification for Portland Cement.
9. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
10. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
11. ASTM C219 - Standard Terminology Relating to Hydraulic Cement.
12. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
13. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
14. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
15. ASTM C430 - Standard Test Method for Fineness of Hydraulic Cement by the 45-µm (No. 325) Sieve.
16. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
17. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
18. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
19. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
20. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic- Cement Concrete.
21. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
22. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete.
23. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
24. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
25. ASTM E154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
26. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
27. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
28. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

D. State of North Carolina Department of Transportation

1. Standard Specifications for Roads and Structures, latest revision.

1.3 COORDINATION

A. Specification Section 05 – Project Meetings.

B. Schedule delivery of trucks in order to prevent delay of placing after mixing.

C. Coordinate placement of water stops with erection of concrete formwork and placement of form accessories.

1.4 SUBMITTALS

A. Product Data: Submit data on attachment accessories, admixtures, dry shake finish materials, and others as requested by ENGINEER.

B. Design Data:

1. Submit concrete mix design for each concrete strength.

(a) Strength data for establishing standard deviation and required overstrength factor will be considered suitable if the concrete production facility has certified records consisting of at least 30 consecutive tests in one group or the statistical average for two groups totaling 30 or more tests representing similar materials and project conditions. Records of these tests shall be submitted with the proposed design mix.

(b) If standard deviation exceeds 800 psi or if no suitable records are available, select proportions to produce an average strength of at least 1200 psi greater than the required compressive strength of concrete. If standard deviations are less than 600 psi, the minimum overstrength factor required in the design mix shall be in accordance with ACI 318.

2. Submit separate mix designs if admixtures are required for the following:

(a) Hot and cold weather concrete Work.

(b) Air entrained concrete Work.

C. Identify mix ingredients and proportions, including admixtures.

1. Identify chloride content of admixtures and whether chlorides were added during manufacture.

2. Identify amounts of mixing water to be withheld for later addition at the project site.

D. Submit chemical and physical analysis of all cement and fly ash delivered to the batch plant seven (7) days prior to use of the cement or fly ash.

E. Submit a copy of mill test reports on all cement delivered to the job 7 days prior to use of the cement. Cube strength from mill tests shall have a tolerance of ±600 psi.

F. Materials Certificates

1. Provide materials certificates in lieu of materials laboratory test reports when permitted by ENGINEER.

2. Manufacturer and CONTRACTOR, certifying that each material item complies with, or exceeds, specified requirements, shall sign materials certificates for the following:
   (a) Cementitious materials.
   (b) Admixtures.
   (c) Fiber reinforcement.
   (d) Floor and slab treatments.
   (e) Bonding agents.
   (f) Adhesives.
   (g) Semirigid joint filler.
   (h) Joint-filler strips.
   (i) Repair materials.

G. Qualification Data: For Installer and Manufacturer.

H. Manufacturer Instructions: Submit installation procedures and interfacing required with adjacent Work.

I. Field Quality-Control Submittals: Indicate results of CONTRACTOR-furnished tests and inspections.

1.5 CLOSEOUT SUBMITTALS

A. Specification Section 06 – Project Record Documents.

B. Batch Tickets: For each load of concrete, provide the following information:
   1. Design mix designation
   2. Exact time cement, water, and aggregate were discharged into the mix
   3. Compressive strength of mix
   4. Amount of water added to the mix.

C. Submit records each month of all concrete pours showing exact location of pour, date of pour, quantity of pour, temperature at time of pour, and class of concrete.

D. Project Record Documents: Record actual locations of embedded utilities and components concealed from view in finished construction.

1.6 QUALITY ASSURANCE

A. Do not begin concrete production until mixes have been approved by the ENGINEER.
   1. Perform Work according to ACI 301 and ACI 318.

B. Comply with ACI 305R when pouring concrete during hot weather.
   1. When the ambient air temperature is above 75 degrees F, an approved admixture designed to retard the rate of set shall be used for all concrete placed.

2. The temperature of the concrete as placed shall not exceed 90ºF. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. Fresh concrete with temperatures 90 degrees F. or above shall be discarded off-site.
3. Cool reinforcing by wetting sufficiently so that steel temperatures will be nearly equal to the ambient air temperature.
4. Provide windbreaks around the perimeter of the area where concrete is being placed.
5. The amount of cement used in the job is computed for the temperature indicated on the approved design mix. Increase the weight of the cement at the rate of 12 lbs. per cubic yard for each 10 degrees F. above the concrete mix temperature.

C. Comply with ACI 306.1 when pouring concrete during cold weather (temperatures 40 degrees F. or below during placement or temperatures 40 degrees F. or below within five (5) days after the concrete is placed).
1. Do not use frozen materials or materials containing ice or snow.
2. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

D. Acquire cement and aggregate from one source for work and obtain admixtures from a single source from a single manufacturer.

E. Where applicable, perform Work according to North Carolina Department of Transportation standards and the more stringent requirements specified herein.

1.7 QUALIFICATIONS

A. Installer: Employ on-project personnel qualified as ACI-certified Flatwork Technician and Flatwork Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer: Experienced in manufacturing ready-mixed concrete products and complying with ASTM C94 requirements for production facilities and equipment.
1. Certified according to NRMCA's "Certification of Production Facilities."

1.8 AMBIENT CONDITIONS

A. Maintain concrete temperature after installation at a minimum of 50 degrees F for a minimum of seven days.

B. Maintain high-early strength concrete temperature after installation at a minimum of 50 degrees F for a minimum of three days.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Concrete shall conform to Specification Section 01 - Material Specifications.

PART 3 -- EXECUTION

3.1 EXAMINATION

A. Verify requirements for concrete cover over reinforcement.

B. Verify that anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION

A. Removal of Existing Concrete:

1. See Drawings for locations of existing walls and slabs to be removed.
2. See Drawings for dowels and other requirements which may not be stated below.
3. Where new concrete is to be placed against the cut surface of an existing wall or slab, the wall or slab may be saw cut clear through or it may be saw cut 1" deep (minimum) on exposed surfaces and the remainder chipped away.
4. If chipping is done, take precautions not to damage the existing concrete which is to remain.
5. Where the cut surface of the wall or slab is to be exposed to water or earth but not exposed to view, saw cut the wall or slab clear through.
6. At all exposed rebars, chip out the concrete around the rebar for a distance of 2" and to a depth of 1/4".
7. Apply concrete repair grout to the chipped-out area with a trowel to obtain a 1/2" cover over the rebar.
8. Where the cut surface of the wall or slab is to be exposed-to-view, roughen the entire cut surface to obtain a 1/8" amplitude.
9. Apply concrete repair grout to forms to achieve a smooth surface with at least 1" thickness.

B. Previously Placed Concrete:

1. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent.
2. Remove laitance, coatings, and unsound materials.

C. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout.

D. Remove mud, oil, debris, ice, or other materials that may adversely affect or reduce the bond from formwork, reinforcement, and concrete substrates.

E. Remove water from areas receiving concrete before concrete is placed.

F. Apply temporary protective covering to lower 2' of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.

G. Preparation of Subgrade for Slabs on Grade:

1. The subgrade shall be well drained and of adequate and uniform loadbearing nature. The in-place density of the subgrade soils shall be at least the minimum required in the specifications. The bottom of an undrained granular base course shall not be lower than the adjacent finished grade.

2. The subgrade shall be free of frost before concrete placing begins.

3. If the temperature inside a building where concrete is to be placed is below freezing, raise the temperature and maintain it above 50 degrees F. long enough to remove all frost from the subgrade.

4. The subgrade shall be moist at the time of concreting. If necessary, dampen it with water in advance of concreting. Do not allow freestanding water on the subgrade or any muddy or soft spots when the concrete is placed.

3.3 INSTALLATION

A. Placing Concrete:

1. Soil bottoms at foundation systems are subject to laboratory testing as directed by the ENGINEER. Place concrete immediately after approval of foundation excavations.

2. Place Crushed Stone Fill, 6 inches in depth, under all concrete floors in contact with the ground. Compact stone as thoroughly as possible by tamping and rolling.

3. Moisten wood forms immediately before placing concrete where form coatings are not used.

4. Place concrete according to ACI 304. Handle concrete from the mixer to the place of final deposit as rapidly as practical by methods which will prevent separation or loss of ingredients and in a manner which will assure that the required quality concrete is obtained.

   (a) Concrete placed by pumping shall conform to the recommendations of ACI 304.2R.

5. Notify testing laboratory and ENGINEER a minimum of 24 hours prior to commencement of operations.

6. Deposit concrete at final position, preventing segregation of mix.

7. Place concrete for each panel continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness or section as determined by predetermined construction joints.

8. Place concrete continuously between predetermined expansion, control, and construction joints.

9. Do not interrupt successive placement and place each layer while the preceding layer is still plastic to avoid cold joints.

10. Consolidate concrete with mechanical vibrating equipment supplemented by hand spading, rodding, or tamping so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

    (a) Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

(b) Do not use vibrators to transport concrete inside forms.

(c) Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine.

(d) Place vibrators to rapidly penetrate the placed layer and at least 6" into the preceding layer.

(e) Do not insert vibrators into lower layers of concrete that have begun to set.

(f) At each insertion, limit the duration of vibration to the time necessary to consolidate concrete and complete the embedment of reinforcement and other embedded items without causing segregation of mix.

11. Ensure that reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement.

    (a) Do not drop concrete at a vertical distance greater than five feet.

    (b) To place concrete lifts greater than five feet, use a hose, drop chute, or other approved method.

12. Install vapor retarder under interior slabs on grade according to ASTM E1643. Place vapor retarder sheeting with longest dimension parallel with direction of pour.

13. Lap joints minimum 6 inches and seal watertight by taping edges and ends.

14. Repairs:

    (a) Repair vapor retarder damaged during placement of concrete reinforcement.

15. Using vapor retarder material, lap over damaged areas minimum 6 inches and seal watertight.

16. Place floor slabs in indicated checkerboard or saw-cut pattern. Well house floors shall only be continuous slabs.

    (a) Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

    (b) Bring slab surfaces to correct level with straightedge and strike off.

    (c) Use bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows.

    (d) Do not sprinkle water on the plastic surface. Do not further disturb slab surfaces before starting finishing operations.

17. Maintain accurate records of concrete placement, including:

    (a) Date of pour

    (b) Area poured

    (c) Temperature at time of pour

    (d) Location

    (e) Quantity

    (f) Average air temperature during curing period

(g) Date forms scheduled for removal

(h) Date form removal completed

(i) Test samples taken and test cylinder serial numbers

(j) Strength of test cylinders at 7 and 28 days.

(k) Method of reshoring (number of floor, etc.)

18. Joints:

(a) Locate joints in slabs on grade to divide the slab in areas not in excess of 800 sq. ft. Well house floors shall only be continuous slabs.

(b) The maximum distance between joints in slabs on grade at all points of contact between slabs on grade and vertical surfaces such as foundation walls and elsewhere shall be as indicated.

(c) All exposed joints in the slabs on grade shall have the edges tooled and the crack and groove formed by the edging tool filled with a polyurethane joint sealant. No Form-A-Key or similar metal form joints will be permitted.

(d) At exposed construction joints, recess the pre-molded fill on a minimum of ½- inch, and fill the remaining section with a joint seal and as specified herein.

19. Isolation Joints in Slabs on Ground

(a) Construct isolation joints with ½-inch expansion joint material in slabs on ground at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

(b) Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

20. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

21. Joint Filler:

(a) Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

(b) Prepare, clean, and install joint filler according to manufacturer's written instructions.

(c) Use joint sealant for all exposed joints in exterior paving slabs, sidewalks, where concrete slabs abut concrete walls, and in exposed joints in slabs on grade.

(d) Separate slabs on grade from vertical surfaces with joint filler.

(e) Place joint filler in floor slab pattern placement sequence; set top to required elevations; secure to resist movement by wet concrete.

(1) Install joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

(2) Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants are indicated.

(f) All exposed construction joints in the slabs on grade shall have the edges tooled and the crack and groove formed by the edging tool filled with a polyurethane joint sealant.

22. Saw-Cut Joints:

(a) Saw-cut joints within 12 hours after placing.

23. Use a 3/16-inch-thick blade.

(a) Cut into 1/4 depth of slab thickness.

24. Screeding:

(a) Screed floors, slabs on grade, and concrete which is to receive other construction level to avoid excessive skimming or grouting.

(b) Surface Flatness: FF 20.

(c) Screed slab surfaces with a straightedge and strike off to correct elevations.

B. Concrete Finishing:

1. Provide formed concrete surfaces to be concealed or not-exposed-to-view in the finished work with a standard rough form finish.

(a) NOTE: Interior faces of walls of water retaining structures are not considered to be concealed.

(b) This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding ¼ inch in height rubbed down or chipped off.

2. Provide formed concrete and other areas as indicated on Drawings with smooth form finish.

(a) Also used on formed concrete surfaces that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp proofing, veneer plaster, or other similar system.

(b) Immediately after forms are removed, repair and patch defective areas with fins or other projections and fill all pinholes and other voids larger than ¼ inch with a cement grout.

(c) Compress mortar into voids with a firm rubber trowel or float.

(d) After mortar dries, wipe off surface with burlap.

3. Provide formed concrete surfaces to be exposed-to-view with smooth-rubbed finish.

(a) This would include exposed wall surfaces extending to one foot below grade or one foot below the water line.

(b) Use smooth, high quality forms.

(c) Chip away all high spots.

(d) Within 72 hours after forms are removed, fill all air bubbles and small holes with a sand-cement-bonding agent grout proportional to match the wall finish.

(e) Rub the entire surface of wall with a fine abrasive stone to create a smooth surface, free of all form marks and holes.

(f) Do not finish wall by leaving a thin "plastered" layer of grout.

(g) For repair of defective areas with holes deeper than ½ inch, see “Concrete Surface Repairs” contained herein.

4. Finish concrete floor surfaces according to ACI 302.1R.

5. Wood float surfaces receiving a trowel finish, membrane or elastic waterproofing, membrane or elastic roofing, or terrazzo with full-bed setting system.

   (a) After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating.

   (b) Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both.

   (c) Consolidate surface with power driven floats, or by hand floating if area is small or inaccessible to power units.

   (d) Check and level surface plane to tolerances of FF 20 FL 15. Cut down high spots and fill low spots.

   (e) Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, sandy texture.

6. Steel trowel surfaces receiving carpeting, resilient flooring, seamless flooring, thin-set quarry tile, thin-set ceramic tile, and other thin film finish coatings.

   (a) After floating, begin first trowel finish operation using a power-driven trowel.

   (b) Begin final troweling when surface produces a ringing sound as trowel is moved over surface.

   (c) Consolidate concrete surface by final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of FF 20 FL 17. Grind smooth surface defects which would telegraph through applied floor covering system.

   (d) At all interior ramps, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

7. Steel trowel surfaces indicated to be exposed.

8. Apply non-slip broom finish to well house slabs, exterior concrete platforms, parking surfaces, exterior concrete walks, steps, ramps, walkways, tank slabs, channel slabs, and elsewhere as indicated.

   (a) Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route or drawing burlap belt across the surface.

9. Apply scratch finish to slab surfaces to receive a grout overlay or other bonded surface finishes.

   (a) After the concrete has been placed, consolidated, struck off, and leveled to a Class C tolerance, the surface shall be roughened with stiff brushes or rakes before a final set (within two hours after placing to ensure a permanent bond between base slab and applied cementitious materials).

10. In areas with floor drains, maintain floor elevation at walls and pitch surfaces uniformly to drains as indicated on Drawings.

11. At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surface unless otherwise shown.

C. Miscellaneous Concrete Items

1. Curbs:

(a) Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

2. Filling In:

(a) Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated.

(b) Mix, place, and cure concrete, as specified, to blend with in-place construction.

(c) Provide other miscellaneous concrete filling indicated or required to complete the Work.

3. Equipment Bases and Foundations:

(a) Provide machine and equipment bases and foundations as shown in Drawings.

(b) Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from the manufacturer furnishing machines and equipment.

(c) Grout base plates and foundations as indicated, using specified non shrink grout.

(d) Use non-metallic grout for exposed conditions, unless otherwise indicated.

4. Steel Pan Stairs:

(a) Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

D. Curing and Protection:

1. Cure concrete floor surfaces as specified.

3.4 FIELD QUALITY CONTROL

A. Testing and Inspecting: The CONTRACTOR shall employ a concrete testing laboratory to provide all laboratory testing services on the project and a concrete technician to perform all quality control tests on concrete and materials used to batch concrete. The testing agency shall meet the requirement of ASTM E329. Testing and inspecting shall be performed by OWNER's testing laboratory according to ACI 318.

B. Such tests will be provided and paid for by the CONTRACTOR, including tests which reveal non-conformance with the Specifications and all succeeding tests for the same area, until conformance with the Specifications is established shall be at the expense of the CONTRACTOR.

C. Provide and maintain adequate facilities on the project for the testing laboratory to locate the required testing equipment and for safe storage area for test cylinders. Provide all casual labor needed to assist

the concrete technician in obtaining samples of concrete and concrete materials and moving and transporting cylinders and materials which are being tested.

D. Concrete Inspections:

1. Continuous Placement Inspection: Inspect for proper installation procedures.
2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.

E. Strength Test Samples:

1. Sampling Procedures: Comply with ASTM C172.
   (a) Each sample shall be obtained from a different batch of concrete on a random basis, avoiding any selection of the test batch other than by a number selected at random before commencement of concrete placement.
2. Cylinder Molding and Curing Procedures:
3. Comply with ASTM C31.
   (a) Cylinder Specimens: Standard cured, except when field cured specimens are requested by ENGINEER.
4. Sample concrete and make one set of four cylinders for every 50 cu. yd. or less of each class of concrete placed each day, and for every 5,000 sq. ft. of surface area for slabs and walls.
5. If volume of concrete for a class of concrete would provide less than five sets of cylinders, take samples from five randomly selected batches, or from every batch if less than five batches are used.
6. Make one additional cylinder during cold weather concreting and field cure.
7. When the total quantity of concrete with a given mix design is less than 50 cu. yd., the strength test may be waived by the ENGINEER if, in his judgment, adequate evidence of satisfactory strength is provided, such as strength test results for the same kind of concrete supplied on the same day and under comparable conditions to other work or other projects.

F. Field Testing:

1. Slump Test Method: Comply with ASTM C143
   (a) One test at point of truck discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
2. Air Content Test Method: Comply with ASTM C173 or ASTM C231.
   (a) One test for each day's pour of each type of air entrained concrete.
3. Temperature Test Method: Comply with ASTM C1064.
   (a) Test hourly when air temperature is 40°F and below, and when 80°F and above; and each time a set of compression test specimens made.

4. Compressive Strength Concrete:
   (a) Measure slump and temperature for each sample.
   (b) Measure air content in air-entrained concrete for each sample.
   (c) Determine unit weight of concrete sample for each strength test.

G. Cylinder Compressive Strength Testing:
1. Test Method: Comply with ASTM C39.
2. Test Acceptance: According to ACI 318.
   (a) Compressive strength tests for laboratory-cured cylinders will be considered satisfactory if the averages of all sets of three consecutive compressive strength test results equal or exceed the 28-day design compressive strength of the type of class of concrete; and, no individual strength test falls below the required compressive strength by more than 500 psi.
   (b) If compressive strength tests fail to meet these requirements, the concrete represented by these tests will be considered deficient and subject to additional testing, including, but not limited to core testing, and/or removal at the CONTRACTOR's expense.
3. Test one cylinder at seven days.
4. Test two cylinders at 28 days.
   (a) The test result shall be the average of the strengths of the two specimens tested at 28 days.
   (b) If one specimen in a test manifests evidence of improper sampling, molding, or testing, it shall be discarded and the strength of the remaining cylinder shall be considered the test result.
   (c) Should both specimens in the test show any of the above defects, the entire test shall be discarded.
5. Retain one cylinder for later testing when requested by ENGINEER.
6. Dispose of remaining cylinders if testing is not required.

H. Core Compressive Strength Testing:
1. The testing laboratory may make additional tests of in place concrete when compressive strength test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by ENGINEER.
2. Sampling and Testing Procedures: Comply with ASTM C42.
3. Test Acceptance: According to ACI 318.
4. Drill three cores for each failed strength test from failed concrete.
5. CONTRACTOR shall pay for such tests when unacceptable concrete is verified.

I. Concrete Surface Repairs:
1. Allow ENGINEER to inspect concrete surfaces immediately upon removal of forms.

2. Honeycombing or Embedded Debris in Concrete:

   (a) Not acceptable.

   (b) Notify ENGINEER upon discovery.

3. Patch imperfections as directed by ENGINEER.

   (a) Cut out honeycombs, rock pockets, voids over ½ inch in diameter and holes left by tie rods and bolts down to solid concrete, but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surfaces. Expose reinforcing steel with at least ¾ inch clearance all around.

   (b) Dampen all concrete surfaces in contact with patching concrete, and brush with a neat cement grout coating or concrete bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of the same materials to provide concrete of the same type or class as the original adjacent concrete. Place, compact, and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

   (c) Fill holes extending through concrete by means of a plunger type gun or other suitable device from the least exposed face to insure complete filling.

   (d) Remove stains and other discolorations that cannot be removed by cleaning all exposed surfaces.

   (e) Repair isolated random cracks and single holes not over 1 inch in diameter by the dry-pack method. Groove the top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen all cleaned concrete surfaces and brush with a neat cement grout coating. Place dry-pack, consisting of 1 part Portland cement to 2-1/2 parts fine aggregate passing a no. 16 mesh sieve using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match the existing surface.

   (f) Fill in holes and openings left in concrete structures for the passage of work by other trades, unless otherwise shown or directed, after the work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in- place construction. Provide all other miscellaneous concrete filling shown or required to complete work.

   (g) At defective areas exposed-to-view, the ENGINEER may substitute a sand-cement grout applied with a bonding agent to more closely match the color of the wall.

   (h) Correct high areas in unformed surfaces by grinding, after the concrete has cured at least 14 days. Correct low areas in unformed surfaces during, or immediately after, completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the ENGINEER.

J. Defective Concrete:

1. Description: Concrete that fails to reach the required design compressive strength after 28 days as evidenced by the compressive strength test or concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.

2. Do not patch, fill, touch up, repair, or replace exposed concrete except upon express direction of ENGINEER for each individual area.

3. Defective concrete shall be corrected as directed at the CONTRACTORs expense, without extension of time, therefore. The CONTRACTOR shall also be responsible for the cost of corrections to any other work affected by or resulting from corrections to the concrete work.

K. All concrete structures which will retain water or wastewater under normal operating conditions shall be filled with water prior to backfilling and final exterior painting and tested for leaks. Unless otherwise specified by the ENGINEER, the tank shall remain filled with water for a period of seven (7) days. Any leaks, damp spots, or other defects found shall be repaired and made watertight to the satisfaction of the ENGINEER. The first 48 hours of the test are utilized to allow the concrete to absorb water. After the first 48 hours of the test, the water level shall be noted and monitored for the remaining five (5) days. A reduction in water greater than 0.1 percent per 24 hours shall be considered excessive and shall constitute failure of the leak test. (NOTE: Rainfall and evaporation must be considered during calculation of water loss. Rainfall shall be added to, and evaporation shall be deducted from the measured loss to determine net liquid loss.)

****END OF SECTION****

SECTION 09 – SITE CLEARING

PART 1 -- GENERAL

1.1 SCOPE SUMMARY

A. Furnish all labor, equipment, materials, and incidentals necessary to perform and complete clearing site of incidental paving and curbs, debris, grass, trees, and other plant life in accordance with the plans. All materials and procedures shall conform to Specification Section 01 – Material Specifications.

B. Section Includes:

1. Removing surface debris.
2. Removing designated paving, curbs, and other above- and below-grade site improvements.
3. Removing designated trees, shrubs, and other plant life.
4. Protecting existing vegetation to remain.
5. Excavating and stockpiling topsoil.

1.2 SUBMITTALS

A. Product Data: Submit data for herbicide and tree wound paint. Indicate compliance with applicable codes for environmental protection.

B. Existing Conditions: Submit documentation of existing trees and plantings, adjoining construction, and site improvements that establish construction conditions that might be misconstrued as damage caused by site clearing.

C. Use sufficiently detailed photographs or videotapes.

D. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

E. Record Drawings: Identify and accurately show locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil. Includes the zone where plant roots grow.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, as indicated on Drawings, or as designated by the ENGINEER.

E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 QUALITY ASSURANCE

A. Conform to applicable codes for environmental requirements, disposal of debris, burning debris on site, and use of herbicides.

B. Perform all work and provide materials in accordance with the requirements of federal, state, and local authorities having jurisdiction.

C. Comply with Federal Insecticide, Fungicide, and Rodenticide Act (Title 7 U.S.C. Section 136) for requirements on CONTRACTOR's licensing, certification, and record keeping. Contact the command Pest Control Coordinator prior to starting work.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Site clearing materials shall conform to Specification Section 01 – Material Specifications.

PART 3 -- EXECUTION

3.1 EXAMINATION

A. Specification Section 05 – Project Meetings: Verification of existing conditions before starting work.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Wrap a 1-inch blue vinyl tie-tape flag around each tree trunk 54 inches above the ground.

C. Identify waste area and salvage area for placing removed materials.

D. Work on adjoining property will not be permitted without the written consent of the property owner and the ENGINEER. This includes, but is not limited to, temporary access to the Work, storage of materials, and any ground-disturbing activities.

3.2 PREPARATION

A. Call NC811 utility locating service not less than three working days before performing Work.

B. Request underground utilities to be located and marked within and surrounding construction areas.

C. The ENGINEER will designate all areas of growth or individual trees that are to be preserved due to their desirability for landscape or erosion control purposes.

D. Do not commence site clearing operations until temporary erosion and sedimentation control and plant/tree protection measures are in place as specified.

E. Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

F. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from OWNER and authorities having jurisdiction.

G. Keep roads and walks free of dirt and debris at all times unless otherwise permitted by OWNER or authorities having jurisdiction. When permitted, dirt and debris shall be cleaned, swept, and removed at the end of each workday.

H. Provide alternate routes around closed or obstructed traffic ways if required by OWNER or authorities having jurisdiction.

3.3 PROTECTION

A. Locate, identify, and protect utilities indicated to remain, from damage.

B. Notify the ENGINEER immediately of damage to or an encounter with an unknown existing utility line. Repair damage to existing utility lines that is indicated or made known to the CONTRACTOR prior to the start of clearing and grubbing operations at no additional cost to the OWNER.

C. Do not interrupt utilities serving facilities occupied by OWNER or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to the requirements indicated:

D. Notify ENGINEER not less than three (3) days in advance of proposed utility interruptions.

E. Do not proceed with utility interruptions without ENGINEER's written permission.

F. Protect trees, plant growth (including root structure), and features designated to remain, as final landscaping.

G. Trim all branches of trees to remain to such heights and in such manner as may be necessary to prevent interference with construction operations. Cut smoothly and neatly close to the whole of the tree or to main branches without splitting or crushing. Paint the cuts with an approved tree wound paint.

H. Encircle the drip line of trees or groups of trees that are to remain adjacent to the work with plastic protection-zone fencing as may be necessary to protect them from piled material, equipment, or equipment operation.

I. Chip the removed tree branches and stockpile them in approved areas, if approved by ENGINEER, or dispose of them off-site.

J. Protect all cultivated hedges, shrubs, and plants that might be injured by project operations. Promptly heel in any trees or shrubbery necessary to be removed and replanted. Perform heeling in and replanting under the direction of a licensed and experienced nurseryman. Replant in their original position all removed shrubbery and trees after construction operations have been substantially completed and care for until growth is reestablished.

K. Remove trees, cultivated hedges, shrubs, plants, and other landscape features injured by equipment operations to such a degree as to affect their growth or diminish their beauty or usefulness, and replace with equivalent, undamaged trees and landscape features.

L. Obtain ENGINEER’s approval before replacement.

M. Protect benchmarks, survey control points, and existing structures from damage or displacement.

N. Protect existing site improvements to remain from damage during construction.

O. Restore damaged improvements to their original condition, as acceptable to OWNER.

P. The following practices are prohibited within plant protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
8. Heat sources, flames, ignition sources, and smoking.

Q. Do not direct vehicle or equipment exhaust towards protection zones.

3.4 CLEARING

A. Clearing consists of the felling and cutting up, or the trimming of trees and the satisfactory disposal of the trees and other vegetation together with the down timber, snags, brush, and rubbish occurring within the areas to be cleared. Trees and other vegetation, except such individual trees, groups of trees, and vegetation, as indicated on the plans to be left standing, shall be cut off flush with or below the original ground surface trees, stumps, roots, brush, and other vegetation in areas to be cleared.

B. Perform clearing only within the limits established by the plans, specifications, or the ENGINEER.

C. Prevent damage by falling trees to trees left standing, to existing structures and installations, and to those under construction. When such damage occurs, repair, remove, or otherwise resolve all damaged areas, utilizing generally accepted practices at no additional cost to the OWNER.

D. Remove trees and shrubs within marked areas and where indicated. Remove stumps, main root ball, root system, logs, organic and metallic debris, brush, and refuse to a depth of not less than 18 inches below the original soil surface in areas indicated to be grubbed and in areas indicated as construction areas under this contract.

E. Use only hand methods for grubbing within protection zones.

F. In embankment areas, when the depth of embankment exceeds 42 inches in height, sound stumps shall be cut off not more than 6 inches above the existing ground level and not grubbed. Unsound or decayed stumps shall be removed to a depth of approximately 2 feet below the natural ground surface.

G. Fill depressions made by grubbing with suitable material and compact as specified to make the new surface conform with the existing adjacent surface of the ground.

H. Clear undergrowth and deadwood, without disturbing subsoil.

I. Apply herbicide in accordance with the manufacturer’s label to remaining stumps to inhibit growth.

3.5 REMOVAL

A. Remove debris, rock, demolished materials, extracted plant life, and waste materials, and legally dispose of them off-site.

B. Remove paving, curbs, slabs, gutters, and aggregate base as indicated on Drawings.

C. Unless existing, full-depth joints coincide with the line of demolition, neatly saw-cut along the line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.

D. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following the coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

E. Remove abandoned utilities. Indicated removal termination point for underground utilities on Record Documents.

F. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

G. Consider felled timber from which saw logs, pulpwood, posts, poles, ties, or fuelwood can be produced as saleable timber. Trim limbs and tops, and saw into saleable lengths for saw logs, pulpwood, poles, ties, and for fuelwood and stockpile in designated salvage area. Timber, steel and other merchantable goods and materials removed incidental to clearing and grubbing shall remain the property of individual property owners unless otherwise directed.

H. Continuously clean up and remove waste materials from the site. Do not allow materials to accumulate on site.

3.6 TOPSOIL EXCAVATION

A. Remove sod and grass before stripping topsoil.

B. Excavate topsoil to a depth of 6 inches from areas to be further excavated, re-landscaped, or regraded, without mixing with foreign materials for use in finish grading.

C. Remove subsoil and non-soil materials, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

D. Do not excavate wet topsoil. Handle topsoil only when the topsoil is dry or slightly moist.

E. Stockpile topsoil without intermixing with subsoil in area designated on site to depth not exceeding 6 feet and protect from erosion.

F. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

G. Grade and shape stockpiles to drain surface water.

H. Do not stockpile topsoil within protection zones.

I. Cover to prevent windblown dust and erosion by water.

J. Stockpile material until disposal.

K. Remove excess topsoil not intended for reuse and unsuitable topsoil from site.

****END OF SECTION****

SECTION 10 – SEEDING AND MULCHING

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. The CONTRACTOR shall furnish all labor, materials, equipment, and incidentals necessary to perform all necessary operations to topsoil, fine grade, fertilize, mulch, and maintain temporary and permanent seeding of all graded, cleared, or disturbed areas during construction to provide vegetative cover to all disturbed areas as shown on the Drawings and as specified here. The work covered by this section shall be in conformance with the latest version of the local and state Department of Transportation.

1.2 REFERENCE STANDARDS

A. The work covered by this section shall be in conformance with Sections 1615, 1620, and 1660 of the "Standard Specifications for Roads and Structures", latest edition, published by the North Carolina Department of Transportation and with Section 6.11 of the "Erosion and Sediment Control Planning and Design Manual" published by the Land Quality Section of the North Carolina Department of Natural Resources and Community Development unless otherwise stated herein. All seeds shall be certified by the N.C. Crop Improvement Association.

1.3 SUBMITTALS

A. Submit to the ENGINEER for review complete shop drawings for all materials and equipment furnished under this Section, including seed mixtures and product label information.

B. Samples of all materials shall be submitted for inspection and acceptance upon ENGINEER's request.

C. Certification of grass seed from seed vendor for each grass-seed mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

D. Certification of each seed mixture for sod, identifying sod source, including name and telephone number of suppliers.

E. Certification by Limestone and Fertilizers manufacturer that the products supplied comply with requirements of the North Carolina Fertilizer Law and with the current applicable Rules and Regulations adopted by the North Carolina Department of Agriculture.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Seeding and mulching materials shall conform to Specification Section 01 – Material Specifications.

PART 3 -- EXECUTION

3.1 SEEDBED PREPARATION

A. Prior to or during grading and tillage operations, the ground surface shall be well-drained, and cleared of all brush, roots, stones larger than 2 inches in diameter, or any other material which may hinder proper grading, tillage, or subsequent maintenance operations.

B. Chisel compacted areas and spread topsoil 3 inches deep over adverse soil conditions, with stockpiled topsoil. Contractor shall reserve sufficient topsoil for seedbed preparation.

C. Rip the entire area to 4 to 6-inch depth.

D. Remove all loose rocks, roots, and other obstructions leaving the surface reasonably smooth and uniform.

E. Fine Grading

1. Areas to be seeded shall be graded as shown in the drawings or as directed and all surfaces shall be left in an even and properly compacted condition to prevent the formation of depressions where water will stand. Areas to be topsoiled shall be graded to a smooth surface and to a grade that will allow topsoiling to finished grade.

F. Topsoiling

1. Immediately prior to placing topsoil, the subgrade, where excessively compacted by traffic or other causes, shall be loosened by scarifying to a depth of at least 2 inches to permit bonding of the topsoil to the subgrade. Topsoil shall be uniformly spread by approved equipment in sufficient quantity to provide a compacted layer of 4 inches in thickness over the designated areas and in such a manner that planting can proceed with little additional soil preparation or tillage. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to the proposed planting or to proper grading. Topsoil shall be graded to the lines indicated or as directed and any irregularities in the surface resulting from topsoiling or other operations shall be corrected to prevent formations of depressions where water will stand.

G. Apply agricultural limestone and fertilizer uniformly and mix with soil.

H. Tillage

1. After topsoiled areas required to be seeded have been brought to the grades shown on the plans and as specified, they shall be thoroughly tilled to a depth of 3 inches by approved methods, until the condition of the soil is acceptable to the ENGINEER. Any objectionable undulations or irregularities in the surface resulting from tillage or other operations shall be removed before planting operations are begun. The work shall be performed only during periods when satisfactory results are likely to be obtained. When conditions are such, by reason of drought, excessive moisture, or other factors, that results are not likely to be satisfactory, the ENGINEER will stop the work and it shall be resumed only when, in his opinion, the desired results are likely to be obtained.

2. Continue tillage until a well-pulverized, firm, reasonably uniform seedbed is prepared 4 to 6 inches deep.

3.2 LIMESTONE, FERTILIZER AND SEED

A. General

1. Seasonal limitations for seeding operations, the kinds and grades of fertilizers, the kinds of seed, and the rates of application of limestone, fertilizer, and seed shall be as shown in the seeding schedule.

B. Equipment to be used for the application, covering, or compaction of limestone, fertilizer, and seed shall have been approved by the ENGINEER before being used on the project. Approval may be revoked at any time if equipment is not maintained in satisfactory working condition, or if the equipment operation damages the seed.

C. Limestone, fertilizer, and seed shall be applied within 24 hours after completion of seedbed preparation unless otherwise permitted by the ENGINEER, but no limestone or fertilizer shall be distributed, and no seed shall be sown when the ENGINEER determines that weather and soil conditions are unfavorable for such operations.

D. During the application of fertilizer, adequate precautions shall be taken to prevent damage to structures or any other appurtenances. The CONTRACTOR shall either provide adequate covering or change methods of application as required to avoid such damage. When such damage occurs, the CONTRACTOR shall repair it, including any cleaning that may be necessary.

E. Limestone and Fertilizer

1. Limestone may be applied as a part of the seedbed preparation, provided it is immediately worked into the soil. If not so applied, limestone and fertilizer shall be distributed uniformly over the prepared seedbed at a specified rate of application and then harrowed, raked, or otherwise thoroughly worked or mixed into the seedbed.

2. If liquid fertilizer is used, storage containers for the liquid fertilizer shall be located on the project and shall be equipped for agitation of the liquid prior to its use. The storage containers shall be equipped with approved measuring or metering devices which will enable the ENGINEER to record at any time the amount of liquid that has been removed from the container. Application equipment for liquid fertilizer, other than a hydraulic seeder, shall be calibrated to ensure that the required rate of fertilizer is applied uniformly.

F. Seeding

1. Seed shall be distributed uniformly over the seedbed at the rate indicated in the seeding schedule, and immediately harrowed, dragged, raked, or otherwise worked to cover the seed with a layer of soil. The depth of covering shall be as directed by the ENGINEER. If two kinds of seed are to be used which require different depths of covering, they shall be sown separately.

2. When a combination seed and fertilizer drill is used, fertilizer may be drilled in with the seed after limestone has been applied and worked into the soil. If two kinds of seed are being used which require different depths of covering, the seed requiring the lighter covering may be sown broadcast or with a special attachment to the drill or drilled lightly following the initial drilling operation.

3. When a hydraulic seeder is used for the application of seed and fertilizer, the seed shall not remain in water containing fertilizer for more than 30 minutes prior to application unless otherwise permitted by the ENGINEER.

4. Immediately after seed has been properly covered, the seedbed shall be compacted in the manner and degree approved by the ENGINEER.

G. Seed on a freshly prepared seedbed and cover seed lightly with seeding equipment or cultipack after seeding.

H. Mulch

1. General

(a) Mulch immediately after seeding and anchor mulch. All seeded areas shall be mulched unless otherwise indicated on the plans or directed by the ENGINEER. Application rate of mulch shall be indicated in the seeding schedule.

2. Mulch shall be applied within 36 hours after the completion of seeding unless otherwise permitted by the ENGINEER. Care shall be exercised to prevent displacement of soil or seed or other damage to the seeded area during the mulching operations.

3. Mulch shall be uniformly spread by hand or by approved mechanical spreaders or blowers that will provide an acceptable application. An acceptable application will be that which will allow some sunlight to penetrate and air to circulate but also partially shade the ground, reduce erosion, and conserve soil moisture.

4. Uniformly spread the mulching material over the designated areas to a loose depth of 1/2 to 1-1/2 inches. Loosen or make fluffy the mulch material from compacted bales before spreading in place. Unless directed otherwise, begin mulching at the top of the slopes and proceed downward.

5. Anchor straw by one of the following methods:

(a) Netting

(1) Securely anchor straw or hay mulch by using engineer-approved netting anchored to the ground with pegs or staples to prevent it from floating as the vegetation grows. Instead of this anchorage, the contractor may secure mulch by heavy biodegradable twine fastened by pegs or staples to form a grid with 6 to 10 feet spacing.

(b) Tackifier

(1) Treat straw or hay with a tackifier. Blow from a machine, and uniformly deposit over designated areas in one operation. The contractor may apply the tackifier as an overspray in a separate operation after placing the straw or hay.

(c) Crimping

(1) Immediately after spreading, anchor the mulch in the soil by using a mulch crimper consisting of a series of dull, flat discs with notched edges. Space the 20-inch diameter discs at about 8-inch centers. Equip the crimper with a ballast compartment to allow adjusting the weight for depth control.

(2) Impress the mulch into the soil 1 1/2 to 2 1/2 inches deep in one pass of the crimper. This process may require more than one pass of the crimper to ensure adequate anchoring of the mulch.

I. Mulch Binding

1. Mulch shall be held in place using devices approved by the ENGINEER as per the manufacturer's recommendations. During application, the CONTRACTOR shall take adequate precautions to prevent damage to structures or appurtenances.

J. Inspect all seeded areas and make necessary repairs or reseedings within the planting season, if possible. If stand is less than 60% established, the entire area shall be reseeded according to specifications using the original lime, fertilizer and seeding rates.

3.3 MODIFICATIONS

A. When adverse seeding conditions are encountered due to steepness of slope, height of slope, or soil conditions, the ENGINEER may direct or permit that modifications be made in the above requirements which pertain to incorporating limestone into the seedbed; covering limestone, seed, and fertilizer; and compaction of the seedbed.

1. Such modifications may include but not be limited to the following.

(a) The incorporation of limestone into the seedbed may be omitted on (a) cut slopes steeper than 2:1 (b) on 2:1 cut slopes when a seedbed has been prepared during the excavation of the cut and is still in an acceptable condition; or (c) on areas of slopes where the surface of the area is too rocky to permit the incorporation of the limestone.

(b) The rates of application of limestone, fertilizer, and seed on slopes 2:1 or steeper or on rocky surfaces may be reduced or eliminated.

(c) Compaction after seeding may be reduced or eliminated on slopes 2:1 or steeper, on rocky surfaces, or on other areas where soil conditions would make compaction undesirable.

B. Consult a Conservation Inspector on maintenance treatment and fertilization after the permanent cover is established.

C. Soil amendments

1. As detailed in the drawings.

3.4 SEEDING

A. Temporary Seeding

1. Seeding Schedule

Temporary Non-Wetland Seeding Schedule		
Dates	**Seeding Mixtures Species**	**Application Rate**
Jan 1 – May 1	Rye Grain	120 lbs./acre
	Kobe Lespedeza	50 lbs./acre
May 1 – Aug 15	German Millet	40 lbs./acre
Aug 15 – Dec 30	Rye Grain	120 lbs./acre

2. Maintenance

   (a) Winter, Early Spring, and Summer

      (1) Refertilize if growth is not fully adequate. Reseed, refertilize, and mulch immediately following erosion or other damage.

   (b) Fall

      (1) Repair and refertilize damaged areas immediately. Topdress with 50 lbs/acre of nitrogen in March. If it is necessary to extend temporary cover beyond June 15 overseed with 50 lbs/acre Kobe Lespedeza in late February or early March.

3. Temporary seeding must be followed up with permanent seeding as soon as practical.

B. Permanent Seeding

1. Seed all disturbed areas of construction.

2. No seeding should be undertaken in windy or unfavorable weather, when the ground is too wet to rake easily, when it is in a frozen condition, or too dry.

3. Immediately following this preparation, permanent seed shall be uniformly applied and lightly raked into the surface. Lightly roll the surface and water with fine spray. Permanent seed shall be applied at the rates as detailed on the drawings or for the Piedmont region as shown in the NC DEMLR manual.

   (a) The best seeding dates are between September 1 through September 30 and February 15 through March 20.

   (b) Possible seeding dates are between September 1 through October 31 and February 15 through April 30.

4. The CONTRACTOR shall keep all seeded areas watered and in good condition. Reseeding shall be done if and when necessary until a good, healthy, uniform growth is established over the entire area seeded.

5. On slopes, the CONTRACTOR shall provide against washouts by an approved method. Any washout that occurs shall be regraded and reseeded at the CONTRACTOR'S expense until good sod is established.

3.5 MAINTENANCE

A. The CONTRACTOR shall maintain all seeded areas in a condition approved by the ENGINEER until final acceptance of the Contract. Maintenance shall include, but not be limited to, repair of seeded areas, irrigation, and weed control. Protection shall be provided for all seeded areas against trespassing and damage. Slopes shall be protected from damage due to erosion, settlement, and other causes and shall be repaired promptly.

B. If growth is less than fully adequate, refertilize in the second year, according to soil tests or topdress with 500 lbs/acre 10-10-10 fertilizer. Reseed, fertilize, and mulch damaged areas immediately.

C. All seeded areas shall be inspected on a regular basis and any necessary repairs or reseedings made within the planting season, if possible.

D. The CONTRACTOR shall be responsible for the proper care and maintenance of the seeded areas until the work under the entire contract has been completed and accepted by the ENGINEER. Maintenance shall consist of repair and replacement of eroded areas, watering, refertilizing, reliming, reseeding, and re-mulching as necessary to provide an even, fixed growth of grass. In addition, the CONTRACTOR shall provide protection against traffic and shall erect the necessary barricades and warning signs immediately after planting is completed.

E. Mowing

1. The seeded areas shall be mowed with approved mowing equipment as per the seeding schedule. If weeds or other undesirable vegetation threaten to smother the planted species, such vegetation shall be removed at no cost to the OWNER.

3.6 INSPECTION AND TESTING

A. Fertilizer and Lime

1. The ENGINEER shall be furnished with duplicate copies of invoices for all fertilizer and lime used on the project. Invoices for fertilizer shall show the grade furnished. Invoices for lime shall show the total minimum carbonates and minimum percentages of the material furnished that pass 100-mesh and 20-mesh sieve. Upon completion of the project, a final check of the total quantities of fertilizer and lime used will be made against the total area topsoiled and seeded, and if the minimum rates of application have not been met, the ENGINEER may require the distribution of additional quantities of these materials to make up the minimum application specified at no additional cost to the OWNER.

B. Seed

1. The ENGINEER shall be furnished duplicate signed copies of a statement from the Vendor, certifying that each container of seed delivered is fully labeled and in full accordance with the specifications in this section and the seeding schedule.

****END OF SECTION****

SECTION 11 – EROSION AND SEDIMENTATION CONTROLS

PART 1 -- GENERAL

1.1 SUMMARY

A. Scope of Work:

1. Furnish all labor, equipment, materials, and incidentals necessary to implement erosion and sedimentation control methods in accordance with the plans. All materials, testing, and procedures shall be of the type specified herein.

B. Section Includes:

1. Temporary Silt Fencing
2. Diversion Channels.
3. Utility Trenches.
4. Check Dams.
5. Sediment Basins.
6. Sediment Traps.
7. Inlet Protection.
8. Site Stabilization.

1.2 REFERENCES

A. Reference the “Latest Edition” of all Standards unless noted otherwise.

B. ASTM International:

1. ASTM C33 – Standard Specification for Concrete Aggregates.

C. North Carolina Department of Environmental Quality

1. Erosion and Sediment Control Planning and Design Manual

D. North Carolina Department of Transportation

1. Standard Specifications for Roads and Structures

E. Local Authorities Having Jurisdiction

1. Where local authorities having jurisdiction have requirements more restrictive than those referenced in this section, all sediment and erosion control measures shall be designed, constructed, and maintained in accordance with the most restrictive of these requirements.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and material samples on geotextiles.

B. Test Reports: Indicate certified tests results for precast concrete at manufacturing facility and granular backfill.

C. Manufacturer's Certificate: Submit material certificates signed by manufacturer and CONTRACTOR certifying Products including posts, filter stone, riprap, and other products (if requested) meet or exceed specified requirements.

D. Drawings: Submit scaled drawings of changes in facilities shown on Drawings and additional facilities proposed by CONTRACTOR.

1. Submit any proposed facilities or materials different from those shown on the Drawings or specified herein.

1.4 QUALITY ASSURANCE

A. All construction activities required under this project shall comply with the North Carolina Sedimentation Pollution Control Act of 1973 and the rules and regulations promulgated pursuant to the provisions of that law.

B. Install and maintain erosion control devices as required to function properly and to satisfy the representatives of the North Carolina Department of Environmental Quality (NCDEQ), Department of Energy, Mineral, and Land Resources (DEMLR), local authorities having jurisdiction, and the ENGINEER.

1. Any time delays experienced due to a shutdown by the N. C. Land Quality Section, other authorities having jurisdiction, or due to unanticipated corrective work will not receive any time extensions to the contract.

2. The CONTRACTOR is responsible for installing all devices necessary to control runoff from the site, regardless of any conditions of the permit or design by the ENGINEER.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Erosion and sedimentation control materials shall conform to Specification Section 01 – Material Specifications.

PART 3 -- EXECUTION

3.1 EXAMINATION

A. Verify compacted subgrade is acceptable and ready to support devices and imposed loads.

B. Verify gradients and elevations of base or foundation for other work are correct.

3.2 GENERAL SCHEDULE

A. Notify the appropriate State of North Carolina Department of Environmental Quality officials and/or other local authorities having jurisdiction of construction commencement and schedule pre-construction conference, if required, with State officials, local authorities, and ENGINEER.

B. Install construction entrances, silt fence, stone drains, check dams, and other measures as shown on the approved plan. Clear only as required to install these devices.

C. Once temporary erosion and sedimentation control measures are in place, begin clearing and grubbing. Delay grading in areas that would reduce the minimum dimensions of sediment control basins. Stockpile topsoil and suitable fill material. Install silt fence around stockpile areas. Dispose of unsuitable soils and all other waste materials off-site in a legal manner.

1. Seed temporary diversions, berms, and basins immediately after construction.

D. Groundcover shall be provided according to the following schedule:

Ground Stabilization Chart		
Site Area Description	**Stabilization**	**Timeframe Exceptions**
Dikes, swales, ditches, and slopes	7 Days	None
High-Quality Water (HQW) zones	7 Days	None
Slopes steeper than 3:1	7 Days	If slopes are 10’ or less in length and are not steeper than 2:1, 14 days are allowed
Slopes 3:1 or flatter	14 Days	7 days for slopes greater than 50’ in length
All other areas with slopes flatter than 4:1	14 Days	None, except for perimeters and HQW zones

3.3 TEMPORARY SILT FENCING

A. Provide silt fences where shown on the Drawings and as necessary to prevent erosion.

B. Install silt fence in accordance with the details shown on the Drawings.

C. Posts to be 1.33 lb/linear foot steel.

D. Install silt fence on low side of stockpiles and in locations shown on the Drawings. Extend fence around approximately 90% of the perimeter of the stockpile.

3.4 DIVERSION CHANNELS

A. Provide diversion ditches and dikes as necessary or as shown on the approved plans to prevent concentrated flow of water across disturbed areas.

B. Windrow excavated material on low side of channel.

C. Compact to 95 percent maximum density.

D. On entire channel area, apply soil supplements and sow seed as specified.

E. Mulch seeded areas with hay as specified.

3.5 UTILITY TRENCHES

A. Stockpile excavated material on the opposite side of the utility trenches from the watercourses to the extent that is permissible.

1. In the event that stockpiles are placed on the watercourse side of the trench, provide silt fence or silt berms with stone filter outlets along the entire length of the stockpile that is on the watercourse side of the trench. The placement of these measures shall be at no additional cost to the OWNER.

3.6 SEDIMENT BASINS AND TEMPORARY SEDIMENT TRAPS

A. Construct sediment basins and temporary sediment traps in accordance with NCDEQ Erosion and Sediment Control Planning and Design Manual and requirements of local authorities having jurisdiction to indicated shape(s) and depth(s).

B. Provide a settling basin with a gravel filter outlet for all water pumped from trenches or dewatering equipment. Pumping of that water directly into any stream, pond, or watercourse is prohibited.

3.7 CHECK DAM

A. Construct temporary check dams in accordance with NCDEQ Erosion and Sediment Control Planning and Design Manual and requirements of local authorities having jurisdiction.

B. Construct check dams to dimensions shown on the Drawings.

C. Rip rap shall not exceed 24" in height at center and slope shall be 2:1.

3.8 INLET PROTECTION

A. Construct all temporary inlet protection measures in accordance with NCDEQ Erosion and Sediment Control Planning and Design Manual and requirements of local authorities having jurisdiction.

B. Each type of inlet protection required shall be as shown in the drawings.

C. Fabric Inlet Protection

1. Space 2 x 4-inch wood (or equivalent metal) stakes evenly around the perimeter of the inlet a maximum of three feet apart, and securely drive them into the ground a minimum of 24” deep.

2. To provide needed stability, frame with 2 x 4-inch wood strips around the crest of the overflow area at a maximum of 1.5 feet above the drop inlet crest.

3. Place the bottom 12 inches of fabric in a trench and backfill the trench with at least four inches of crushed stone or 12 inches of compacted soil.

4. Fasten fabric securely to the stakes and frame so that joints overlap to the next stake.

5. It may be required to build a dike on the down-slope side of the inlet to prevent bypass flow.

D. Curb Inlet Protection

1. Lay concrete blocks on pavement 6” from curb inlet. Place blocks against the drain inlet for lateral support.

2. Place at least one concrete block on its side in each bottom row of blocks.
3. Place wire mesh with ½" openings over all block openings used for drainage.

3.9 SITE STABILIZATION

A. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time to minimize soil erosion, siltation, and water and air pollution to adjacent properties and walkways caused by operations. Comply with the applicable regulations of all authorities having jurisdiction relating to pollution prevention and control. In the event of conflict between such regulations and the requirements of the Specifications, the more restrictive requirements shall apply.

B. Exercise every reasonable precaution throughout the life of the project to prevent the eroding of soil and the silting of rivers, streams, lakes, reservoirs, other water impoundments, ground surfaces, or other property.

C. Construct, stabilize, and activate erosion controls before site disturbance within tributary areas of those controls.

1. Maintain diversions, inlet protection, and sediment basins until site is completely stabilized.

D. Stockpile and waste pile heights shall not exceed 35 feet. Slope stockpile sides at 2: 1 or flatter.

E. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 20 days.

1. During non-germinating periods, apply mulch at recommended rates.
2. Stabilize disturbed areas which are either at finished grade or will not be disturbed within one year as specified.

F. Stabilize diversion channels, sediment traps, and stockpiles immediately.

G. All areas to be paved shall be stabilized with stone as soon as they are brought to final grade.

H. Pipe Outlet Stabilization

1. Ensure that the subgrade for the riprap and filter fabric follows the required lines and grades as shown on the drawings. Compact any fill required in the subgrade to the density of the surrounding undisturbed soil. Low areas in the subgrade on undisturbed soil shall be filled by increasing the thickness for the riprap.
2. The riprap and filter fabric shall conform to the specified grade and dimension as shown on the drawings.
3. Riprap may be placed by machine, but take care to avoid damaging the filter fabric.
4. Protect the filter fabric from puncturing and tearing during installation. Repair damaged fabric by removing the riprap and placing a new piece of fabric over the damaged area. All connecting joints shall overlap a minimum of 12 inches in all directions. Replace the entire filter fabric as directed by the OWNER or ENGINEER.
5. The minimum thickness of the riprap shall be 1.5 times the maximum stone diameter.

6. Construct the apron on zero grade with no over fall at the end. The top of the riprap at the downstream end shall be level with the receiving area.
7. Construct the apron so it is properly aligned with the receiving stream.
8. Immediately after construction, stabilize all disturbed areas with the proper vegetate cover.

3.10 FIELD QUALITY CONTROL

A. Inspect erosion control devices on a weekly basis and after each runoff event until permanent vegetation has been established. Required corrective/maintenance measures shall be implemented immediately.

B. Structures and measures that shall be inspected include:

1. Inlet Protection: Replace any fabric that collapses, tears, decomposes, or becomes ineffective will be replaced immediately. Remove sediment deposits behind fence when sediment accumulates to six inches.
2. Construction Entrance & Exit: Inspect construction entrances and exits for condition of surface. Top-dress with new stone when needed.
3. Silt Fence: Any fabric that collapses, tears, decomposes, or becomes ineffective, will be replaced immediately.
4. Rock Check Dams and Stone Drains: Inspect for significant erosion around the edges and between dams. Install protective riprap liners in portions of the channel where erosion occurs. Remove sediment accumulated behind the dams as required to prevent damage to channel vegetation. Add stones to dams as required to maintain design height and cross-section.
5. Pipe Outlet Stabilization: Inspect riprap structure after heavy rains to see if any erosion around or below the structure or if stones have been dislodged. Immediately make all necessary repairs to prevent future damage.

3.11 CLEANING

A. When sediment accumulation in sedimentation structures has reached a point one-third depth of sediment structure or device, remove and dispose of sediment and restore the structure to its original constructed conditions.

1. Replace the contaminated part of the gravel.
2. Check the structure for damage and maintain the spillway at a minimum of 1.5 feet below the low point of the embankment.
3. Repair damage immediately. When settlement of the embankment occurs, place fill 6 inches above the design grade. Replace riprap when displaced from the spillway.

B. Remove sediment deposits behind silt fence when sediment accumulates to 6".

C. Clean channels when depth of sediment reaches approximately one-half channel depth.

D. Do not damage structures or devices during cleaning operations.

E. Do not permit sediment to erode into construction or site areas or natural waterways during cleaning procedures.

F. Clean sediment transported onto public roads at the end of each day. Sediment shall be removed by shoveling or sweeping and be transported to a controlled disposal area. Street washing shall be allowed after sediment is removed in this manner.

3.12 CLOSEOUT ACTIVITIES

A. When construction is complete and all areas are stabilized, call for an inspection by an environmental inspector.

B. If site is approved, removed any temporary diversion channels, re-grade to natural grade or as shown on plans and seed or stabilize any resulting bare areas.

C. When vegetation has become established, call for a final site inspection by an environmental inspector. Obtain certificate of completion and remove all erosion control measures within 30 days. Restore and stabilize areas disturbed during removal.

****END OF SECTION****

SECTION 12 – PAVING AND SURFACING

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. Furnish all labor, equipment, and materials and perform all operations in connection with the construction of asphalt concrete pavement, asphalt concrete overlay, reinforced concrete pavement, gravel roads, concrete curb and gutter, repair and reconstruction of existing asphalt concrete pavement, repair of existing gravel roads, and pavement markings complete as specified herein and as detailed on the Drawings.

B. All new roads including the replacement of portions of the existing roads shall be to the limits, grades, thicknesses, and types as shown in the Drawings.

1. Patches for pipe crossings and areas damaged during the construction work shall be asphalt and/or gravel, depending upon the material encountered, unless otherwise indicated.

1.2 STANDARD SPECIFICATIONS

A. Except as otherwise provided in the Specifications or on the plans, all work shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Roads and Structures, latest edition unless otherwise noted except that any reference to "NCDOT", "Department" or "Unit" shall mean the "OWNER".

B. Except with the approval of the ENGINEER, the placing of concrete or asphalt concrete surface paving shall be subject to the seasonal and weather restrictions set forth in NCDOT Standard Specifications for Roads and Structures.

1.3 QUALITY CONTROL

A. CONTRACTOR will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

B. Testing agency will conduct and interpret tests and state in each report whether the tested work complies with or deviates from specified requirements.

C. All testing shall be in accordance with NCDOT Specifications.

D. Asphalt Thickness

1. In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

E. Asphalt Surface Smoothness

1. Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances per NCDOT Specifications.

F. Asphalt In-Place Density

1. Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.

2. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.

3. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

4. At least 2 core samples shall be taken.

5. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements. CONTRACTOR will be responsible for all additional testing due to unacceptable tests.

1. Testing Frequency

(a) Tests shall be performed in sufficient numbers to ensure that the specified density is being obtained. Frequency and location will be chosen by ENGINEER. A bid allowance will be used to compensate CONTRACTOR for testing.

H. Related Work

1. Cast-in-Place Concrete:

(a) MP 1 AASHTO

(b) M81 AASHTO

(c) M82 AASHTO

(d) T96 AASHTO

(e) T176 AASHTO

PART 2 -- MATERIALS

2.1 MATERIALS

A. Paving and surfacing materials shall conform to Specification Section 01 – Material Specifications.

PART 3 -- EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in the direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Revise minimum weight or type of vehicle in first subparagraph below if required.
3. Proof roll with an approved piece of equipment having a single-axle weight of at least 10 tons.
4. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PAVEMENT CUTTING

A. Where the existing pavement is to be cut for the installation of pipe or other utilities, the CONTRACTOR shall cut the pavement neatly in advance of trenching. All pavement shall be cut to a straight edge with the method of cutting subject to approval of the ENGINEER. Pavement shall be cut 12 inches wider on each side of the excavated area. Ragged or irregular edges will be redone. Concrete pavement shall be cut with suitable concrete saw-cutting equipment.

3.3 SURFACE PREPARATION

A. Subgrade

1. The subgrade where shown on the Drawings shall be aggregate stabilized by the addition and mixing of coarse aggregate with the top 3 inches of subgrade in accordance with NCDOT Section 500-2, Construction Methods.

(a) If the base course is designed to be used as a temporary travel surface, the additional thickness shall be placed, compacted, and maintained until the permanent surface is placed. When preparing the base course for the final surface course, the base course material shall be undercut to the thickness to accommodate the surface course(s) and removed from the site, unless otherwise directed by the ENGINEER. The final thickness of the base shall be within a tolerance of plus or minus 1/2 inch of the base thickness required on the plans.

(b) Backfilling with soil above an elevation to accommodate the final base thickness, to be cut out and replaced with base material at a later date, will not be allowed.

B. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that the prepared subgrade is ready to receive paving.

C. Tack Coat

1. Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal/sq yd
2. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
3. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Proof-roll prepared subgrade surface to check for unstable areas and areas requiring additional compaction. Proof-rolling of prepared subgrade will conform to the NCDOT Section 260, Proof Rolling unless otherwise noted. OWNER's Representative shall observe proof-roll.

E. Notify OWNER's Representative of unsatisfactory conditions. Do not begin paving work until deficient subbase areas have been corrected and are ready to receive paving. Allow to dry until proper condition to receive paving. Subsurface shall be free of any ice or debris.

F. Exercise care in applying bituminous materials to avoid smearing of adjoining concrete surfaces. Remove and clean damaged surfaces. Asphalt shall be feathered to match the elevation of adjoining concrete or asphalt pavement.

3.4 PRIME COAT

A. Shall be applied to non-bituminous base course beneath bituminous plant mixed pavements unless otherwise shown in the plans. The prime coat shall be applied only when the surface to be treated is dry and the atmosphere temperature in the shade is 40° F or above. Prime coat shall not be applied when the weather is foggy or rainy. The base shall be clear of debris, dirt, clay, or other deleterious material prior to placing the prime coat.

B. Application of the prime coat shall consist of asphalt grade AASHTO 81 for Grade RC-70 except Kinematic viscosity at 140° F, centistokes shall be a minimum of 30 and a maximum of 60; the distillate, percentage of volume of total distillate to 680°F, shall be as follows:

TO 374°F 15 MINIMUM

TO 437°F 55 MINIMUM

TO 500°F 75 MINIMUM

TO 600°F 90 MINIMUM

and the residue from the distillate to 680°F volume percentage of sample difference shall be a minimum of 50 or of shall be of asphalt grade AASHTO 82. The prime coat shall be applied at a rate of 0.18 to 0.45 gallons per square yard at an application temperature of 90° to 130°F.

3.5 AGGREGATE BASE COURSE

A. The base course of all paving shall be ABC.

1. Aggregate Base Course shall be in accordance with the NCDOT 1010 Type B. Aggregate base course material shall consist of crushed stone, crushed stone, crushed or uncrushed gravel, and other similar materials displaying hard, strong durable particles free from adherent coatings. All aggregate shall be from approved sources in accordance with NCDOT Section 1005

2. ABC shall be of the thickness shown on the Drawings and formed true to crown and grade.

3. Gravel roads, including repair to existing gravel roads, shall be ABC.

4. No fill material except new ABC shall be placed on top of existing gravel.

3.6 ASPHALT CONCRETE BASE COURSE

A. Asphalt concrete base course shall be placed and compacted on the aggregate base course in layers not to exceed 2 inches and at the rate of not less than 110 pounds per square yard per inch of thickness.

1. Thicknesses shall be as shown in the Drawings.

3.7 ASPHALT CONCRETE SURFACE COURSE

A. Prior to placement of the asphalt concrete surface course, the base/binder course shall be inspected for damage or defects and repaired to the satisfaction of the ENGINEER.

B. The surface course shall conform to NCDOT Type SF9.5B. Pavement shall be replaced within the same week that it is cut. If inclement weather delays pavement replacement, the CONTRACTOR shall not cut additional pavement until he has notified the ENGINEER and received specific permission and instructions. Any deviation from this schedule could subject the CONTRACTOR to immediate shut-down or non-payment of additional work performed until pavement repair is complete.

1. The bituminous plant mix placement and compaction shall conform to NCDOT Section 610. If directed by the ENGINEER, density control and determination shall be in accordance with NCDOT Section 610-10 and 610-13.

2. The surface of the base/binder course shall be approved by the ENGINEER.

C. An asphalt tack coat shall be applied to the surface of the approved base/binder course as described in NCDOT Section 605.

1. Equipment for applying the tack coat shall be power-oriented pressure spraying or distributing equipment suitable for the materials to be applied and approved by the ENGINEER.

D. The asphalt concrete surface course shall be placed and compacted on the base/binder course in layers not to exceed 2 inches and at the rate of not less than 110 pounds per square yard per inch of thickness.

1. Thicknesses shall be as shown in the Drawings.

3.8 PORTLAND CEMENT CONCRETE PAVING

A. Portland Cement Concrete shall be placed over a compacted sub-base of CABC stone with the surface damp at time of placement. The concrete patch shall equal the thickness of the surrounding pavement but shall not be less than 6 inches thick. The concrete shall be handled to prevent segregation and kept free from mud, soil, or other foreign matter.

1. Concrete placement shall not be undertaken or shall be discontinued when any of the following conditions exist:

(a) When the descending air temperature in the shade and away from artificial heat reaches 40°F.

(b) When the subgrade or base course is frozen.

(c) When the temperature of the concrete mix exceeds 90°F.

(d) When the time after batching exceeds 90 minutes.

B. Concrete finishing shall consist of screeding and floating to assist consolidation. The surface texture shall closely resemble the texture of the surrounding pavement. A uniform surface texture shall be applied by burlap dragging or other method acceptable to the ENGINEER. The use of excessive water during finishing will not be permitted.

C. Concrete curing shall be accomplished with spray compounds, polyethylene film, or other methods acceptable to the ENGINEER. In no instance shall the method of curing be allowed to damage the

finished surface. Any concrete with excessive surface damage will be considered defective work and removed and replaced at the CONTRACTOR's expense.

D. Concrete shall be protected from cold for a minimum of 72 hours through thermal blankets or other means acceptable to the ENGINEER. Thermal protection will be required whenever the air temperature is expected to fall below 40°F. Concrete damaged as the result of freezing shall be removed and replaced at the CONTRACTOR's expense.

3.9 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

3.10 COMPACTION

A. Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving per NCDOT Specifications.

3.11 TOLERANCES

A. Thickness

1. Compact each course to produce the thickness indicated within the following tolerances:

(a) Surface Course

(1) Plus 1/4 inch, no minus

(b) Crowned Surfaces

(1) Test with crowned template centered and at a right angle to crown. Maximum allowable variance from template is ¼ inch.

B. Surface Smoothness

1. Compact each course to produce a surface smoothness within the following tolerances as determined by using a l0-foot straight edge applied transversely or longitudinally to paved areas:

(a) Surface Course

(1) 1/8 inch

(b) Crowned Surfaces

(1) Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.12 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified.

B. Allow paving to age for 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply marking in accordance with drawings and NCDOT Specifications.

3.13 JUNCTION WITH OTHER PAVING

A. Where new asphalt concrete pavement abuts existing asphalt concrete pavement, the existing pavement shall be cut back to ensure obtaining the specified compaction of the new pavement courses and interlocking adjoining courses.

1. Existing subbase courses shall be cut back from the subgrade level of the new pavement on a one-on-one slope into the existing pavement.

2. The asphalt courses of the existing pavement shall be removed for an additional 12 inches back from the slope.

3. The edge of the existing asphalt courses shall be saw cut straight and true.

4. The faces between new and existing asphalt courses shall receive an application of tack coat.

B. Where new rigid concrete pavement abuts existing rigid concrete or asphalt concrete paving, the existing paving shall be saw-cut straight and true.

1. An expansion joint of a ½-inch minimum thickness with filler material and sealant shall be placed between the new concrete pavement and the existing rigid concrete or asphalt concrete paving.

3.14 ASPHALT CONCRETE OVERLAY

A. Where asphalt concrete is to be placed over an existing asphalt or rigid concrete surface, the surfaces shall be thoroughly cleaned by power brooming.

B. A tack coat shall be applied in accordance with NCDOT Section 605, Asphalt Tack Coat, of the NCDOT Specifications prior to installing the overlay.

3.15 SIGNAGE

A. Erect signs in accordance with NCDOT Specifications.

3.16 DISPOSAL

A. Remove excavated materials from project site and legally dispose of them.

****END OF SECTION****

SECTION 13 – MISCELLANEOUS WORK AND CLEANUP

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required to do the miscellaneous work not specified in other sections but obviously necessary for the proper completion of the work as shown on the Drawings.

B. When applicable the CONTRACTOR shall perform the work in accordance with other sections of this Specification.

C. When no applicable specification exists, the CONTRACTOR shall perform the work in accordance with the best modern practice and/or as directed by the ENGINEER.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Materials required for this Section shall be the same quality of materials that are to be restored.

B. Where possible, the CONTRACTOR may re-use existing materials that are removed.

PART 3 -- EXECUTION

3.1 CROSSING AND RELOCATING EXISTING UTILITIES

A. This Item includes any extra work required in crossing culverts, water courses, including brooks and drainage ditches, storm drains, gas mains, water mains, electric, telephone, gas, and water services, and other utilities.

B. This work shall include but is not limited to the following: bracing, hand excavation, and backfill (except screened gravel) and any other work required for crossing the utility or obstruction not included for payment in other items of this specification.

C. In locations where existing utilities cannot be crossed without interfering with the construction of the work as shown on the Drawings, the CONTRACTOR shall remove and relocate the utility as directed by the ENGINEER or cooperate with the Utility Companies concerned if they relocate their own utility.

D. At pipe crossings and where designated by the ENGINEER, the CONTRACTOR shall furnish and place screened gravel bedding so that the existing utility or pipe is firmly supported for its entire exposed length.

E. The bedding shall extend to the mid-diameter of the pipe crossed.

3.2 CLEANING UP DURING CONSTRUCTION

A. Execute periodic cleaning to keep the work, the site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris, resulting from construction operations.

B. Provide onsite containers for the collection of waste materials, debris, and rubbish.

C. Remove waste materials, debris, and rubbish from the site periodically and dispose at an approved facility.

D. Upon approval of the OWNER, selected waste may be disposed of at the active construction and demolition disposal area on the site.

3.3 FINAL CLEANING

A. The CONTRACTOR shall remove all construction material, excess excavation, buildings, equipment, and other debris remaining on the job as a result of construction operations and shall restore the site of the work to a neat and orderly condition.

B. All surfaces disturbed by the CONTRACTOR in the work shall be restored to a condition equal to or better than that which existed prior to commencement of the work, except as otherwise specified herein.

C. Prior to final completion or OWNER occupancy, ENGINEER shall conduct an inspection of all work areas to verify that the entire work area is clean.

D. All cuts, fills and slopes shall be neatly dressed off to the required grade or subgrade, as indicated on the plans.

3.4 INCIDENTAL WORK

A. Do all incidental work not otherwise specified, but obviously necessary to the proper completion of the Contract as specified and as shown on the Drawings.

B. Pipe drains, headwalls, catch basins, curbs, and gutters, and all incidental drainage structures shall be restored using like materials and details at no additional cost to the OWNER. The CONTRACTOR shall maintain drainage during construction.

C. Grassed areas shall be restored at no additional cost to the OWNER. Disturbed areas shall be covered with two (2) inches of topsoil, furnished by the CONTRACTOR from an approved source and of approved quality, then shall be fertilized, and seeded to match existing adjoining areas. All ditches shall be restored to their existing grade, line, and cross-section.

D. Paved surfaces shall be restored in accordance with the provisions of Specification Section 12.

3.5 TEMPORARY FACILITIES

A. The CONTRACTOR shall furnish, install, maintain, and remove all temporary facilities required for construction or called for in the specifications.

****END OF SECTION****

SECTION 14 – DISINFECTION AND TESTING OF WATER UTILITY PIPING SYSTEMS

PART 1 -- GENERAL

1.1 SUMMARY

A. Scope of Work

1. Furnish all labor, equipment, materials, and incidentals necessary to perform and complete the disinfection of potable water lines and appurtenances in accordance with the plans. All products and procedures shall be of the type and class specified herein.

2. Section includes disinfection of potable water distribution system. Testing and reporting of results.

1.2 REFERENCE STANDARDS

A. Reference the “Latest Edition” of all Standards unless noted otherwise.

B. American Water Works Association

1. AWWA B300-24 – Hypochlorites

2. AWWA C651-23 – Disinfecting Water Mains

C. North Carolina Administrative Code

1. 15A NCAC 18C – Rules Governing Public Water Systems

1.3 SUBMITTALS

A. Product Data: Submit manufacturer information for proposed chemicals.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Specification Section 06 – Project Record Documents: Requirements for submittals.

B. Disinfection Report: Type and form of disinfectant used.

C. Date and time of disinfectant injection start and completion.

D. Test locations.

E. Name of person collecting samples.

F. Initial and 24-hour disinfectant residuals in treated water in ppm for each outlet tested.

G. Date and time of flushing start and completion.

H. Disinfectant residual after flushing [in ppm] for each outlet tested.

1.5 QUALITY ASSURANCE

A. Perform Work according to AWWA C651 and 15A NCAC 18C.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Disinfection Chemicals shall conform to Specification Section 01 - Material Specifications.

PART 3 -- EXECUTION

3.1 EXECUTION EXAMINATION

A. Verify that piping system has been cleaned, inspected, and pressure tested. Coordinate activity with OWNER and ENGINEER.

3.2 PROCEDURE

A. Provide required equipment to perform the work of this Section.

B. Taps shall be made at the extremities of the line for introducing sodium hypochlorite and for monitoring chlorine concentration and collecting samples.

C. Flush lines to remove sediment and other foreign matter. Required flow and openings to flush pipelines at 3 ft/sec are described in AWWA C651 Section 4.4.2 (Preliminary Flushing). Disinfection when replacing or repairing an existing pipe shall follow the procedures described in AWWA C651 Section 4.11 (Disinfection Procedures When Cutting into or Repairing Existing Pipe) by swabbing with a minimum 1 percent chlorine solution.

Pipe Diameter, in.	Flow Required to Produce 3.0 ft/sec (approx.) Velocity in Main, gpm.	Size of Tap Used, in.		
		1	1 1/2	2
		Number of Taps Required on Pipe*		
4	120	1	-	-
6	260	-	1	-
8	470	-	2	-
10	730	-	3	2
12	1,060	-	-	3
16	1,880	-	-	5

*Number of taps on pipe based on 3.0-ft/sec discharge through 5 ft of galvanized iron (GI) pipe with one 90° elbow.

D. Introduce sodium hypochlorite solution into the piping system to provide a uniform distribution of chlorine throughout the piping system. Powdered hypochlorite and hypochlorite tablets shall not be added directly to piping systems.

E. All pipes, valves, fittings, and appurtenances connected to and forming a part of a potable water supply shall be disinfected in accordance with the procedures described in AWWA C651 Section 4.4.3 (The Continuous Feed Method).

F. A solution of water containing concentrated sodium hypochlorite with 65% available chlorine shall be introduced into the line by regulated pumping.

G. The solution shall be of such concentration that the line shall have a uniform minimum concentration of not less than 50 ppm total chlorine immediately after introduction.

H. The table below provides the required quantity of 65% sodium hypochlorite compound to be contained in solution in each 1,000-foot section of line to yield the specified minimum concentration of 50 ppm.

Nominal Pipe Diameter (inches)	Pounds Concentrated Sodium Hypochlorite (65%) per 1,000-feet of Pipe
2	0.10
3	0.24
4	0.42
6	0.94
8	1.68
10	2.61
12	3.77
14	5.13
16	6.70
20	10.51
24	15.10

I. The sodium hypochlorite solution shall be distributed in the piping system by manipulating the chemical feed pump, the introduction of potable water, hydrants, and taps at the extremities of the line to produce an even distribution of chlorine throughout the piping system.

J. Pipelines may, at the option of the CONTRACTOR and in coordination with the OWNER and ENGINEER, be chlorinated in sections isolated by means of gate valves or other approved means.

K. All valves on the lines being disinfected shall be opened and closed several times during the disinfection contact period, except those used to isolate the pipe from the main system.

L. **Disinfecting shall take place in the presence of the ENGINEER.**

M. The chlorine solution shall remain in contact with the interior surfaces of the piping system for a period of 24 hours, minimum.

N. The ENGINEER shall test the free residual chlorine after 24 hours and ensure that it is at least 25 ppm.

O. Disinfecting shall be repeated as often as necessary and as directed by the ENGINEER and/or the OWNER until the minimum requirements are reached.

P. The CONTRACTOR shall exercise extreme caution to ensure that the sodium hypochlorite solution does not enter active water mains.

Q. Disposal:

1. Neutralize disinfectant solution before disposal.

2. Legally dispose of disinfection solution off the project site.

R. After water mains have been disinfected and flushed, the CONTRACTOR shall collect samples for turbidity and bacteriological analysis. Payment for testing shall be borne by the CONTRACTOR.

S. **All sampling shall be done in the presence of the ENGINEER or a representative of a certified laboratory and shall follow proper chain of custody procedures.**

T. The requirements of AWWA C651 shall dictate the number and locations of samples to be collected and tested based on the length and configuration of the constructed system. No water samples shall be collected from a fire hydrant.

U. Bacteriological tests shall be performed by a State Certified Laboratory and satisfactory results shall be obtained prior to placing the system into service per NC DEQ Rules Governing Public Water Systems 15A NCAC 18C .1001.

V. Test results shall be provided to the ENGINEER by the authorized testing agency/firm immediately upon completion of the testing procedure.

W. If test results are unsatisfactory, the CONTRACTOR shall re-flush and re-sample the line at no additional cost to the OWNER. If check samples fail then the disinfection procedure shall be repeated until two (2) consecutive tests, taken 24 hours apart, provide acceptable results.

X. If bacteriological tests of the samples indicate that the water quality is satisfactory, the OWNER may elect to place the water mains in service upon final approval from the North Carolina Department of Environmental Quality. If final approval is not granted within 30 days, bacteriological tests must be repeated.

Y. Replace permanent system devices that were removed for disinfection.

3.3 PRESSURE TESTING

A. Procedure

1. The pressure/leakage test of water mains shall be in accordance with Standard AWWA C600 (ductile-iron pipes), and AWWA C605 (PVC Pipes), allowable leakage shall not exceed that determined by the following formula:

2. $L = (SD\sqrt{P})/148,000$

   L = Allowable leakage in gallons per hour

   S = Length of line tested in feet

   D = Nominal diameter of pipe, in inches

   P = Average test pressure, in psi - 150% of the average system pressure in the area, but not less than 125% of the normal working pressure at the highest elevation shall be used as P value. In general, hydrostatic pressure should be at least 150 psi.

3. Where practicable, pipelines shall be tested in lengths between line valves or plugs of no more than 2,000 feet.

4. Pipelines shall be tested before backfilling at joints, except where otherwise required by necessity, local ordinance, or public convenience.

5. **Duration of test shall be not less than 2 hours where joints are exposed, and not less than 24 hours where joints are covered, unless directed by the ENGINEER.**

6. All visible leaks at exposed joints, and all leaks evident on the surface where joints are covered, shall be repaired and leakage minimized, regardless of total leakage as shown by the test.

7. All pipes, fittings, and other materials found to be defective under test shall be removed and replaced at the CONTRACTOR's expense.

8. Lines which fail to meet tests shall be repaired and retested as necessary, until test requirements are complied with.

9. Pipelines with resilient gasket materials should be held under normal operating pressure at least 3 days before testing.

3.4 WELL DISINFECTION

A. Well shall be disinfected before collecting water samples for determining microbiological quality. Disinfection shall follow the requirements of 15A NCAC 02C.0111 as follows:

1. Any person constructing, repairing, testing, or performing maintenance or installing a pump in a water supply well shall disinfect the well upon completion of construction, repairs, testing, maintenance, or pump installation.

2. Any person disinfecting a well shall perform disinfection in accordance with the following procedures:

   (a) Chlorination

      (1) Hypochlorite shall be placed in the well in sufficient quantities to produce a chlorine residual of a least 100 parts per million (ppm) in the well. Stabilized chlorine tablets or hypochlorite products containing fungicides, algaecides, or other disinfectants shall not be used to confirm the concentration of the chlorine residual.

      (2) The hypochlorite shall be placed in the well by one of the following or equivalent methods:

a. Granular hypochlorite may be dropped in the top of the well and allowed to settle to the bottom; or

b. Hypochlorite solutions shall be placed in the bottom of the well by using a bailer or by pouring the solution through the drill rod, hose, or pipe placed in the bottom of the well. The solution shall be flushed out of the drill rod, hose, or pipe by using water or air.

(3) The water in the well shall be agitated or circulated to ensure thorough dispersion of the chlorine.

(4) The well casing, pump column, and any other equipment above the water level in the well shall be rinsed with the chlorine solution as a part of the disinfecting process.

(5) The chlorine solution shall stand in the well for a period of 24 hours or more.

(6) The well shall be pumped until there is no detectable total chlorine residual in water pumped from the well before the well is place in use.

****END OF SECTION****

SECTION 15 – BORING AND JACKING

PART 1 -- GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of pipe boring and jacking is shown in the Drawings and specified herein.

1.2 MATERIAL CERTIFICATION AND SHOP DRAWINGS

A. Material Certification stating that the casing materials furnished under this Section conform to all applicable provisions of the corresponding Specifications.

B. The Certification shall state compliance with the applicable standards (ASTM, AWWA, etc.) for fabrication and testing.

1.3 QUALITY ASSURANCE

A. Codes and regulations

1. Comply with all Federal, State, and local laws, ordinances, rules, and regulations affecting the work under this section.

2. All work in this section will conform to the NCDOT “Policies and Procedures for Accommodating Utilities on Highway Rights of Way”. Specific attention is directed to those rules and regulations promulgated by the Department of Labor, Occupational Safety and Health Administration, "Safety and Health Regulations for Construction".

B. Use of right-of-way

1. All working operations of the CONTRACTOR, Subcontractors, and/or their agents or employees must be subordinate to the free and unobstructed use of the right-of-way for the passage of traffic without delay or danger to life, equipment, or property.

2. Conduct all operations in such a manner that all work will be performed below road level and without obstruction of the roadbed.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Boring and jacking materials shall conform to Specification Section 01 - Material Specifications.

PART 3 -- EXECUTION

3.1 PRECAUTIONS AND SAFETY

A. Inspection

1. Examine the areas and conditions under which the boring is to be installed and become familiar with the conditions under which the work will be performed and with all necessary details as to the orderly prosecution of the work.

2. Notify the ENGINEER in writing of conditions detrimental to the proper and timely completion of the work.

3. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

B. CONTRACTOR shall have all utilities located by ULOCO and/or other suitable locating service. CONTRACTOR shall contact North Carolina 811 System at least three full days prior to the beginning of any work, and/or contact private owners to locate any private utilities.

C. Responsibility

1. The omission from the Drawings and Specifications of any details required for the satisfactory installation of the work in its entirety shall not relieve the CONTRACTOR of full responsibility for providing such necessary items.

D. Safety

1. Provide all necessary bracing, bulkheads, and/or shields to ensure complete safety to all traffic at all times during the progress of the work and perform the work in such a manner as to not interfere with normal traffic over the work.

3.2 INSTALLATION

A. Casing Pipe

1. Casing pipe is required in open cut pipe installation locations.

2. Where required, smooth wall steel pipe shall be jacked through dry bores slightly larger than the pipe, bored progressively ahead of the leading edge of the advancing pipe. As the boring and jacking operation progresses, each new section of the encasement pipe shall be butt-welded to the section previously jacked in place.

3. Installation of casing pipe, where indicated on the plans, unless otherwise instructed by the ENGINEER or OWNER, shall be by boring and jacking as specified herein, and at lengths to extend between 2 and 3 feet beyond the edge of the roadway pavement and/or curb.

4. Suitable pits or trenches shall be excavated for the operation and for placing the end joints of the pipe.

5. Where necessary, they shall be securely sheeted and braced to prevent caving. In groundwater, they shall be properly dewatered to provide dry working conditions.

6. Construction shall be done in a manner that will not interfere with the operation of traffic and shall not weaken the roadbed or structure.

7. Jacks for forcing the pipe through the soil shall have a jacking head constructed in such a manner as to apply uniform pressure around the ring of the pipe.

8. The pipe to be jacked shall be set on guides, braced together, to properly support the section of the pipe and direct it to the proper line and grade.

9. In general, soil material shall be excavated just ahead of the pipe, using the boring auger, the excavated material removed through the pipe, and the pipe forced through the soil into the excavated space.

10. The diameter of the excavation shall conform to the outside diameter and circumference of the pipe as closely as practicable.
11. When boring and jacking of pipe is once begun the operation shall be carried on without interruption, insofar as practicable, to prevent the pipe from becoming firmly set in the embankment.
12. If an obstruction is encountered during the dry boring operation, the casing shall be inspected by the Engineer and determined if it may be removed or left in place. In both cases, the void shall be completely filled with 25-PSI grout before moving to another boring site.
13. Any pipe damaged in boring and jacking operations shall be removed and replaced by the CONTRACTOR at his expense.
14. The pits or trenches excavated to facilitate boring and jacking operations shall be backfilled immediately after the operation has been completed.
15. Unacceptable bores are those with excessive deflection or deflections in the bore resulting in less than 30 inches of soil cover above the casing, whereupon the direction of the ENGINEER, shall require the bore to be abandoned. No bores will be accepted with a depth of more than 60 inches to top of casing without prior approval from ENGINEER and OWNER. The abandonment procedure will be at the CONTRACTOR's expense and will consist of cutting off the excess pipe, capping the remaining pipe in place, then filling the abandoned pipe with Portland cement grout (1:3 parts cement to sand) at sufficient pressure to fill all voids before moving to a new location.

B. Carrier Pipe

1. The carrier pipe shall be placed within the casing to the line and grade shown on the Drawings using skids or rollers to prevent damage to the bells.
2. The pipe shall be thick enough to allow for clearance between bells and casing bottom.
3. The carrier pipe shall extend a minimum of 2 feet past casing pipe on each end.
4. The carrier pipe shall be fully supported along its entire length within the casing pipe. Carrier Pipe Supports within Steel Casing shall be steel plate, cold-formed structural collar with flanges and a minimum of four support legs welded to the collar. Each support leg shall have a foot or skid welded on the end extending beyond the front and back edge of the collar. The front and rear of each foot shall be angled inwardly towards the collar to serve as a stable, effective skid during installation of the carrier pipe. The carrier support shall be securely fastened to the carrier pipe with a heavy-duty ½ " grade 5 bolt and locking nut passing between the flanges, compressing the collar against the carrier pipe. The support device shall be a "Spider" or approved equal.
5. The CONTRACTOR shall install an end seal on each end of the casing pipe so that the annular space between the casing and carrier pipe is sealed.
6. No blocks or spacers shall be wedged between the pipe and the top of the casing.

C. Variation of Alignment

1. Lateral Alignment

(a) Variation in the final position of the pipe from the line and grade established by the ENGINEER will be permitted only to the extent of 1% in lateral alignment.

2. Vertical Alignment

(a) Where the carrier pipe is to be laid on a uniform grade (i.e., gravity sewer line or gravity storm drain) the variation in vertical alignment will be as follows:

Carrier Pipe Size	% Grade Tolerance
8	±0.04
10	±0.028
12	±0.022
14	±0.017
15	±0.015
16	±0.014
18	±0.012
20	±0.01
21	±0.01
24	±0.008

(b) In no instance shall the grade of the carrier pipe be less than the minimum grade required by Owner or State Regulations.

3.3 GROUT

A. Boring and jacking operations shall be done as rapidly as possible and simultaneously so as to prohibit voids, cave-ins, or settlement and minimize interference with the traffic in the vicinity of the operation.

1. Should the CONTRACTOR encounter voids in excess of 3 inches, he shall install grout holes of a size suitable for injecting grout.

2. Grout holes shall be installed at intervals not exceeding 10-feet.

3. Grout, consisting of a mixture of 1:2 Portland cement and sufficient water to produce a flowable mixture, shall be injected into the void under sufficient pressure to prevent settlement.

4. No additional compensation will be paid for grouting.

3.4 END SEALS

A. The ends of the casing shall be closed.

B. End seal shall consist of flexible rubber seal with stainless steel clamps.

3.5 ABANDONMENT OF BORE

A. Abandonment of bore shall only be allowed where the bores are not guaranteed.

B. Should the CONTRACTOR encounter an obstruction during the dry bore operation which prohibits further extending of the bore, the CONTRACTOR shall terminate the bore if approved by ENGINEER.

1. The CONTRACTOR shall remove the boring auger and the casing pipe.

2. The void created by the removal of the pipe shall be filled with grout as specified heretofore at a minimum pressure of 25 pounds per square inch.
3. CONTRACTOR shall provide suitable temporary forms to retain the grout within the limits of the former casing pipe.
   (a) Form shall be removed after the grout has set.
4. The CONTRACTOR shall move to another bore site as directed by the ENGINEER.

3.6 RESTORATION

A. Repair all damage and restore the property to its original condition at no additional cost to the OWNER.

3.7 OPEN CUT PIPE INSTALLATION

A. The aforementioned specifications for boring and jacking are also acceptable for use in open cut pipe installation locations.

****END OF SECTION****

SECTION 16 – HORIZONTAL DIRECTIONAL DRILLING

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The work specified in this section consists of furnishing and installing underground utilities using the horizontal directional drilling (HDD) method of installation, also commonly referred to as directional boring or guided horizontal boring. This work shall include all services, equipment, materials, and labor for completely and properly installing, testing, and restoring underground utilities and environmental protection and restoration.

B. Guided horizontal boring is a method of trenchless construction using a surface-launched steerable drilling tool controlled from a mobile drilling frame and includes a field power unit, mud mixing system, and mobile spoils extraction system. The drilling frame is sited and aligned to bore a pilot borehole that conforms to the planned installation of the main. The drilling frame is set back from an access pit that has been dug and a high-pressure fluid jet tool head that uses a mixture of bentonite clay and water is launched. Pits are normally dug at the starting point and ending point of the proposed pipe installation and are used to align the tool head, to attach other equipment, and to collect and remove excess spoils. Using an electronic guidance system, the tool head is guided through the soil to create a pilot borehole. Upon reaching the endpoint joint, the tool head is removed and a reamer with the product pipe attached is joined to the drill string and pulled back through the borehole. In large-diameter installations, pre-reaming of the borehole will usually be done prior to attaching the product pipe for the final pullback. A vacuum spoils extraction system removes any excess spoils generated during the installation. The connections, manholes, or other appurtenances are then completed at both the starting point and ending point locations, and the surface is restored to its original condition.

1.2 QUALITY ASSURANCE

A. The requirements set forth in this document specify a wide range of procedural precautions necessary to ensure that the very basic, essential aspects of a proper directional bore installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this specification. Adherence to the specifications contained herein, or the ENGINEER's approval of any aspect of any directional bore operation covered by this specification, shall in no way relieve the CONTRACTOR of the ultimate responsibility of providing a satisfactory completion of the work authorized under the Contract.

1.3 QUALIFICATIONS

A. Guided boring contractors shall have actively engaged in the installation of pipe using guided boring for a minimum of three years.

B. Field supervisory personnel employed by the Guided Boring Contractor shall have at least three years of experience in the performance of the work and tasks as stated in the Contract Documents.

1.4 SUBMITTALS

A. Submit documentation showing three years of guided boring experience. Information must include, but not be limited to, date and duration of work, location, pipe information (Le. length, diameter,

depth of installation, pipe material, etc.), project OWNER information, (Le. name, address, telephone number, contact person), and the contents handled by the pipeline (water, wastewater, etc.).

B. Submit a list of field supervisory personnel and their experience with guided boring operations. At least one of the field supervisors listed must be at the site and be responsible for all work at all times when guided boring operations are in progress. Guided boring operations will not proceed until the resume(s) of the CONTRACTOR's field supervisory personnel have been received and reviewed by the ENGINEER.

C. Submit the following drawings and documents:

1. Working drawings and written procedures describing a general work plan outlining the procedure and schedule to be used to execute the project including details of the proposed method of installation. This will include, but not be limited to, size, capacity, and setup requirements of equipment; location and siting of drilling and receiving pits; dewatering if applicable; method of fusion and type of equipment for joining pipe; type of cutting tool head; and method of monitoring and controlling line and depth. The work plan shall demonstrate the thoughtful planning required in successfully completing the project. If the CONTRACTOR determines that modifications to the method and equipment as stated in the submittal is necessary during construction, the CONTRACTOR will submit a plan describing such modifications, including the reasons for the modification.

2. Bentonite drilling mud products information (MSDS); special precautions necessary; method of mixing and applying; and method of removing spoils.

PART 2 -- PRODUCTS

2.1 GENERAL

A. The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback the pipe, a drilling fluid mixing & delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations, and trained and competent 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.

2.2 MATERIALS

A. High-Density Polyethylene Pipe (HDPE) and fittings shall conform to Specification Section 01 – Material Specifications. All additional appurtenances such as tees, gaskets, flange adaptors, etc., including Fusible PVC, shall conform the material specifications. The Contractor shall supply the pipe and fittings and include its price in the bid. All pipes installed by guided boring shall be fused by an approved butt fusion or electro-fusion technique according to the manufacturer's specifications.

2.3 DRILLING SYSTEM

A. Drilling Rig

1. The directional drilling machine shall consist of a hydraulically powered system to rotate, push, and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand

the pulling, pushing, and rotating pressure required to complete the crossing. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations.

B. Drill Head

1. The drill head shall be steerable by changing its rotation and shall provide the necessary cutting surfaces and drilling fluid jets.

C. Mud Motors

1. Mud motors, if required, shall be of adequate power to turn the required drilling tools.

D. Drill Pipe

1. Drill pipe shall be constructed of high-quality 4130 seamless steel tubing, grade D or better, with threaded box and pins. Tool joints should be hardened to 32-36 RC.

2.4 GUIDANCE SYSTEM

A. The Guidance System shall be of a proven type and shall be set up and operated by personnel trained and experienced with this system. The Operator shall be aware of any magnetic anomalies and shall consider such influences in the operation of the guidance system if using a magnetic system.

B. The guided boring system will have the capability of boring and installing a continuous run without intermediate pits of a minimum distance for the following pipe diameters:

Product Pipe Size (inches)	**Minimum Boring Distance (feet)**
1½	500
2-4	450
6	400
8	350
10-16	300

C. The guidance system shall have the capability of accurately measuring vertical (depth) position, horizontal position, and roll. The guidance system must meet the following specifications in soft homogenous soils:

Depth (inches)	**Vertical Accuracy (inches)**	**Horizontal Accuracy (inches)**
18-96	+/- 1	+/- 2
97-144	+/- 2	+/- 4
145-180	+/- 4	+/- 6
181-300	+/- 6	+/- 12

301-480	+/- 10	+/- 24

2.5 DRILLING FLUID SYSTEM

A. Mixing System

1. A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid composed of bentonite clay, potable water, and appropriate additives. Mixing system shall be able to molecularly shear individual bentonite particles from the dry powder to avoid clumping and ensure thorough mixing. The drilling fluid reservoir tank shall be sized for adequate storage of the mud. Mixing system shall continually agitate the drilling fluid during drilling operations.

B. Drilling Fluids

1. Drilling fluid shall be composed of clean water and an appropriate additive. Water shall be from a clean source with a pH of 8.5 – 10 and/or as per mixing requirements of the manufacturer. Water of a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate or equal. The water and additives shall be mixed thoroughly and be absent of any clumps or clods. No hazardous additives may be used. Drilling fluid shall be maintained at a viscosity sufficient to suspend cuttings and maintain the integrity of bore wall.

C. Delivery System

1. The mud pumping system shall have a minimum capacity to supply mud in accordance with the drilling equipment pull-back rating at a constant required pressure. The delivery system shall have filters in line to prevent solids from being pumped into the drill pipe.

2.6 OTHER EQUIPMENT

A. Pipe Rollers

1. Pipe rollers, if required, shall be of sufficient size to fully support the weight of the pipe while being hydro-tested and during pull-back operations. A sufficient number of rollers shall be used to prevent excess sagging of pipe.

B. Pipe Rammers

1. Hydraulic or pneumatic pipe rammers may only be used if necessary and with the authorization of ENGINEER.

C. Restrictions

1. Other devices or utility placement systems for providing horizontal thrust other than those previously defined in the preceding paragraphs shall not be used unless approved by the ENGINEER prior to commencement of the work. Consideration for approval will be made on an individual basis for each specified location. The proposed device or system will be evaluated prior to approval or rejection on its potential ability to complete the utility placement satisfactorily without undue stoppage and to maintain line and grade within the tolerances prescribed by the particular conditions of the project.

PART 3 -- EXECUTION

3.1 GENERAL

A. The ENGINEER must be notified 48 hours in advance of starting work. The directional bore shall not begin until the ENGINEER is present at the job site and agrees that proper preparations for the operation have been made. The ENGINEER's approval for beginning the installation shall in no way relieve the CONTRACTOR of the ultimate responsibility for satisfactorily completing the work as authorized under the Contract. It shall be the responsibility of ENGINEER to provide inspection personnel at such times as appropriate without causing undue hardship by reason of delay to the CONTRACTOR.

3.2 SITE CONDITIONS

A. Drilling operations must not interfere with, interrupt, or endanger surface and activity upon the surface. CONTRACTOR must comply with all applicable jurisdictional codes and OSHA requirements.

B. The ENGINEER shall be notified immediately if any obstruction is encountered that stops the forward progress of drilling operations.

C. When rock stratum, boulders, underground obstructions, or other soil conditions that impede the progress of drilling operations are encountered, the CONTRACTOR and ENGINEER shall review the situation and jointly determine the feasibility of continuing drilling operations, making adjustments or switching to an alternative construction method.

D. Dewatering

1. The type of dewatering method will be at the option of the CONTRACTOR. When water is encountered, the CONTRACTOR must provide a dewatering system of sufficient capacity to remove water, keeping any excavations free of water until the backfill operation is in progress. Dewatering shall be performed in a manner where removal of soil particles is held to a minimum.

3.3 DRILLING PROCEDURE

A. Site Preparation

1. Prior to any alterations to the work site, CONTRACTOR shall photograph or videotape the entire work area, including entry and exit points. One copy of photographs or video tape shall be given to ENGINEER and one copy shall remain with CONTRACTOR for a period of one year following the completion of the project.

2. The work site, as indicated on drawings, within the right-of-way, shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to be made. CONTRACTOR shall confine all activities to designated work areas.

3. Excavate required pits in accordance with the working drawings.

4. The drilling procedures and equipment shall provide protection for workers, particularly against electrical shock. As a minimum, grounding mats, grounded equipment, hot boots, hot gloves, safety glasses, and hard hats shall be used by crewmembers. The drilling equipment shall have an audible alarm system capable of detecting electrical currents.

(a) During drilling operations all equipment shall be effectively grounded and incorporate a system that protects operating personnel from electrical hazards. The system shall be equipped with an audible alarm that can sense if contact is made with an energized electric cable. Proper operation of the alarm system will be confirmed prior to the drilling of the tunnel. All equipment will be connected to ground with a copper conductor capable of handling the maximum anticipated fault current. Crew members operating drilling equipment and handling rods will do so while standing on grounded wire mesh mats, ensuring that all equipment is grounded, and wearing hot boots, hot gloves, safety glasses, and hard hats. Crewmembers operating handheld locating equipment will wear hot boots.

5. Removal of trees, landscaping, pavement, or concrete shall be performed as specified.

B. Drill Path Survey

1. The entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on drawings. If CONTRACTOR is using a magnetic guidance system, drill path will be surveyed for any surface geomagnetic variations or anomalies.

C. Environmental Protection

1. CONTRACTOR shall place silt fence between all drilling operations and any drainage, wetland, waterway, or other area designated for such protection by the Contract Documents, state, federal, and local regulations. Additional environmental protection necessary to contain any hydraulic or drilling fluid spills shall be put in place, including berms, liners, turbidity curtains, and other measures. CONTRACTOR shall adhere to all applicable environmental regulations. Fuel or oil may not be stored in bulk containers within 200 feet of any water body or wetland.

D. Safety

1. CONTRACTOR shall adhere to all applicable state, federal, and local safety regulations. All operations shall be conducted in a safe manner. Safety meetings shall be conducted at least weekly with a written record of attendance and topic submitted to ENGINEER.

E. Pipe

1. Pipe shall be welded/fused together in one length if space permits. Pipe may be placed on pipe rollers before pulling into the borehole with rollers spaced close enough to prevent excessive sagging of pipe.

F. Pilot Hole

1. The entry angle of the pilot hole and the boring process shall maintain a curvature that does not exceed the allowable bending radii of the product pipe.

2. The CONTRACTOR shall follow the pipeline alignment as shown on the Drawings, within the specifications stated. If adjustments are required, the CONTRACTOR shall notify the ENGINEER for approval prior to making the adjustments.

3. Pilot hole shall be drilled on bore path with no deviations greater than 5% of depth over a length of 100 feet. In the event that pilot does deviate from bore path more than 5% of depth in 100 feet, CONTRACTOR will notify ENGINEER, and ENGINEER may require CONTRACTOR to pull-back and re-drill from the location along bore path before the deviation.

4. In the event that a drilling fluid fracture, inadvertent returns, or returns loss occurs during pilot hole drilling operations, CONTRACTOR shall cease drilling, wait at least 30 minutes, inject a quantity of drilling fluid with a viscosity exceeding 120 pascal-seconds as measured by a March funnel and then wait another 30 minutes. If mud fracture or returns loss continues, CONTRACTOR will cease operations and notify ENGINEER. ENGINEER and CONTRACTOR will discuss additional options, and work will then proceed accordingly.

G. Reaming

1. Upon successful completion of pilot hole, CONTRACTOR will ream bore hole to a minimum of 25% greater than outside diameter of pipe using the appropriate tools. CONTRACTOR will not attempt to ream at one time more than the drilling equipment and mud system are designed to safely handle.

2. Reaming diameter will not exceed 1.5 times the diameter of the product pipe being installed.

3.4 DRILLING FLUID

A. Drilling fluid will be a mixture of water and bentonite clay. The CONTRACTOR will be responsible for making provisions for a clean water supply for the mixing of drilling fluid. The fluid will be inert.

B. The fluid should remain in the tunnel to ensure the stability of the tunnel, reduce drag on the pulled pipe, and provide backfill with the annulus of the pipe and tunnel.

C. Connections between the pump and drill pipe shall be relatively leak-free. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and properly disposed of. A berm, a minimum of 12 inches high, shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits, and drilling fluid recycling system (if used) to prevent spills into the surrounding environment. Pumps and/or vacuum truck(s) of sufficient size shall be in place to convey excess drilling fluid from containment areas to storage facilities.

D. Disposal of excess drilling fluid and spoils will be the responsibility of the CONTRACTOR who must comply with all relevant regulations, right-of-way, and workspace and permit agreements. Excess drilling fluid and spoils will be disposed of at an approved location. The CONTRACTOR is responsible for transporting all excess drilling fluid and spoils to the disposal site and paying any disposal costs. Excess drilling fluid and spoils will be transported in a manner that prevents accidental spillage onto roadways. Excess drilling fluid and spoils will not be discharged into sanitary or storm drain systems, ditches, or waterways.

E. Drilling fluid returns (caused by fracturing of formations) at locations other than the entry and exit points will be minimized. The CONTRACTOR will immediately clean up any drilling fluid that surfaces through fracturing. Mobile spoils removal equipment capable of quickly removing spoils from entry or exit pits and areas with returns caused by fracturing will be present during drilling operations to fulfill these requirements.

3.5 INSTALLING PIPE

A. The pipe being pulled into the tunnel will be protected and supported so that it moves freely and is not damaged by stones and debris on the ground during installation.

B. After successfully reaming bore hole to the required diameter, CONTRACTOR will pull the pipe through the bore hole. In front of the pipe will be a swivel. Once pull-back operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole. During pull-back operations, CONTRACTOR will not apply more than the maximum safe pipe pull pressure at any time.

C. Pullback forces will not exceed the allowable pulling forces for the product pipe.

D. In the event that the pipe becomes stuck, CONTRACTOR will cease pulling operations to allow any potential hydro-lock to subside and will then recommence pulling operations. If the pipe remains stuck, CONTRACTOR will notify ENGINEER. ENGINEER and CONTRACTOR will discuss options, and then work will proceed accordingly.

E. The CONTRACTOR shall allow sufficient lengths of product pipe to extend past the termination point to allow connections to the new pipeline. Pulled pipe shall be allowed 14 days of stabilization prior to making tie-ins. The length of extra product pipe will be at the CONTRACTOR's discretion.

3.6 PIPE TESTING

A. Pressure test HDPE piping according to the following:

1. Test Pressure: Not less than 150 psig based on the elevation of the highest point of the line or section under test.

2. The pressure testing of an HDPE line section shall be tested separately from the PVC and DIP line sections.

3. Maximum duration for pressure test, including the initial and final phase of the test, shall not exceed eight (8) hours. If the test is not completed due to leakage, equipment failure, etc., depressurize the test section and then allow it to "relax" for at least eight (8) hours before bringing the test section up to test pressure again.

4. Introduce water from a temporary connection made in the pressure main or as approved by ENGINEER and OWNER. Bleed as much air as possible.

5. Slowly fill (approximately one foot per second) section to be tested with water; expel air from piping at high points. Pressure shall be applied to the main by means of a hand pump for small lines or by use of a mechanical pump for larger lines.

6. Initially, the pressure within the test section shall be raised to approximately 160 psi and then allowed to be idle (no additional make-up water to be injected) for approximately 3 hours. During this 3-hour period, the test section shall be allowed to stabilize and come to an equilibrium stage. No additional make-up water shall be injected into the test section during this 3-hour stabilization period unless the line pressure drops below 140 psi. In this case, make-up water shall only be injected into the test section to maintain a minimum of 140 psi (during the 3-hour stabilization period).

7. The final phase of the pressure test shall involve injecting make-up water to achieve an "Initial test pressure" of 150 psi (minimum) / 155 psi (maximum). The test section is then allowed to be idle (no additional make-up water to be injected) for a period of 2 hours. After this 2-hour period, make-up water is injected to re-establish the "initial test pressure."

8. Maintain pressure within plus or minus 5 psi of test pressure.

9. Leakage shall not be permitted for HDPE piping. Hydrostatic pressure testing shall comply with ASTM F2164, which requires zero leakage. All joints shall be inspected and verified watertight prior to testing.

3.7 CLEANUP

A. The CONTRACTOR shall maintain the work site in a neat and orderly condition throughout the period of work.

B. After completing the work at the site, the CONTRACTOR shall remove debris, surplus material, and temporary structures erected by the CONTRACTOR. The site shall be restored to a condition equal to or better than the existing condition prior to being disturbed.

C. All excavations will be backfilled and compacted to 95% of original density. Landscaping will be restored to its original. All drilling mud shall be disposed of by the CONTRACTOR.

3.8 RECORD KEEPING

A. CONTRACTOR shall maintain a daily project log of drilling operations and a guidance system log with a copy given to ENGINEER at completion of project. Record Drawings shall be certified as to accuracy by the CONTRACTOR.

****END OF SECTION****

SECTION 17 – WATER DISTRIBUTION SYSTEM

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The extent of work under this item includes providing and installing all pipe, pipe fittings, valves, hydrants, etc. as shown on the Drawings and described herein necessary to make complete and serviceable the water distribution system.

1.2 QUALITY ASSURANCE

A. General

1. Class numbers or pressure rating shall be clearly marked on the pipe and fittings at the factory.

B. Piping

1. All water piping shall be NSF-approved and shall bear the NSF seal of approval.

C. Codes and Standards

1. Comply with the provisions of the following codes and standards except as otherwise shown or specified.

(a) AWWA

(b) NC DEQ Rules Governing Public Water Systems 15A NCAC 18C

(c) Recommended Standards for Water Works (Commonly referred to as the Ten State Standards)

1.3 SUBMITTALS

A. Material Certificates

1. All material submittals must be approved by the ENGINEER and Iredell Water Corporation.

2. Provide notarized materials and certificates signed by the material manufacturer. Certify that each material item complies with the specified requirements and was purchased for this project. CONTRACTOR shall provide a piping schedule, denoting all pipe materials, sizes, specifications (NSF, ASTM, AWWA, etc.), location, etc.

B. Shop Drawings

1. Submit shop drawings on all flanged fittings, valves, operators, gates, and special items including torque tubes, hangers, supports, and brackets.

PART 2 -- PRODUCTS

2.1 WATER PIPING

A. General Requirements

1. All materials shall be first quality with smooth interior and exterior surfaces, free from cracks, blisters, honeycombs, and other imperfections, and true to industry-specified shapes and forms throughout. All materials shall be subject to the inspection of the ENGINEER at the plant, trench, or other point of delivery, for the purpose of culling and rejecting material that does not conform to the requirements of these specifications. Such material shall be marked by the ENGINEER, and the CONTRACTOR shall remove it from the project site upon notice being received of its rejection.
2. The use of couplings will not be allowed except as necessary and approved by the ENGINEER.
3. When the work requires the use of a transition coupling, the use of such couplings shall be as approved by the ENGINEER. When the nominal diameter of the pipe does not change, an approved transition coupling may be used, as necessary.
4. Where the nominal diameter of an existing water line changes as part of a rehabilitation project, an appropriate ductile iron, mechanical joint reducer, as specified for fittings, shall be used to joint these materials. The appropriate gaskets shall be selected based on the outside diameter(s) of the material(s) being joined. All gaskets shall be as specified.
5. All rubber gaskets for DIP pipe and fittings shall be in accordance with AWWA C111 and ASTM F477 for PVC pipe and fittings. All gaskets shall be a product of the pipe manufacturer, made specifically for the pipe being installed, and shall match the shape and configuration of the joint.

B. Materials

1. All materials, apparatus, supplies, methods of manufacture, or construction shall conform to Specification Section 01 – Material Specifications.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. General

1. Pipe and fittings shall be laid as directed by the ENGINEER and located as shown on the Drawings.

B. Trench Excavation and Backfill

1. Excavation shall conform to the lines and grades shown on the drawings. No trench shall be opened more than four hundred (400) feet in advance of the completed pipework without the written permission of the ENGINEER. The lines of excavation of trenches shall be made so there will be a clearance of at least eight (8) inches on each side of the barrel of the pipe. The depth of the trench shall be such that the top of the pipe shall not be less than three feet below finish grade. Excavation shall not be carried below the established grades and any excavation below the required level shall be backfilled and thoroughly tamped as directed by the ENGINEER, at the CONTRACTOR's expense. Bell holes shall be excavated accurately by hand as required by manufacturer's specifications.

2. During excavation, the CONTRACTOR shall separate materials suitable for backfill from those which are not as defined in Paragraph 3.5 of this section. Suitable material shall be stockpiled near the trench for use as backfill. Unsuitable material shall be removed immediately or shall be stockpiled separately for dewatering or drying or for later removal.
3. Should unstable soil, organic soil, or soil types classified as inorganic clays or inorganic silts (Class IV, Unified soil classification CL or lower) be encountered at the bottom of pipe trenches or structure excavations, such soils shall be removed to a depth and width determined by the ENGINEER and properly disposed of offsite. The resulting undercut shall be backfilled and compacted with sandy soils that meets or exceeds the requirements of Class I or Class II soils, Unified Class SP or better. Placement and compaction shall conform to specifications herein.
4. All necessary dewatering, pumping, and bailing shall be performed in such a manner as to keep the trench in a satisfactory condition for pipe laying.
5. Do not use the following materials for pipe foundation or trench backfill within the zones indicated below.
   (a) All zones: material classified as peat (PT) or organic (OL)(OH) under the Unified Soil Classification (USC) System, ASTM D2487 or material too wet or too dry to achieve minimum compacted density requirements.
6. Six inches beneath pipe: soft or unstable material and rock.
7. Beside pipe: Any material containing more than 75% fines passing #200 sieve.
8. Where no excavated material is suitable for backfill, furnish suitable material from borrow sites at no additional cost to the OWNER.
9. Backfilling shall be done with material free from large clods, frozen earth, organic material, or any foreign matter.
10. Around the pipe and to a depth of 8 to 12 inches above the pipe the backfill shall be carefully placed and compacted in layers not to exceed 6-inches compacted thickness. The backfill material shall be select and free of rock. Do not place backfill material on either side of the water main that is finer than the material upon it is placed. Backfill with coarser material to the top of the pipe.
11. Twelve (12) inches above the crown of the pipe the backfill may contain rock but less than 6 inches in diameter. Backfill layers shall be horizontal and not exceed 12 inches loose thickness or 8 inches compacted.
12. Compaction shall be performed with suitable pneumatic compactors or approved equal. Compaction equipment specifically designed for trench compaction shall be present and operational at the job site and shall be utilized throughout the length and depth of the trench to achieve uniform compaction density.
13. Compaction Density shall be determined by the Standard Proctor Test (ASTM D698).
14. Surplus material shall be disposed of by the CONTRACTOR at his expense.
15. Clean shoulders and pavement of excess material immediately after backfilling is complete.

C. Laying Water Mains, Hydrants and Specials

1. Installation of ductile-iron pipes and appurtenances shall meet the requirements of AWWA C600 and AWWA C153/A21.53, latest revision.
2. Installation of PVC pipes and fittings shall meet the requirements of AWWA C605, AWWA C900, AWWA C905, ASTM D2241 and ASTM D1785, latest revision.
3. Water main crossings of roads maintained by NCDOT and any paved development road, whether private or public, must be encased in a steel pipe.
4. Proper and suitable tools for the safe and convenient handling and laying of pipe shall be used, and great care shall be taken to prevent the pipe coating from being damaged, particularly on the inside of the pipes.
5. All pipe shall be carefully examined for cracks and other defects and no pipe or castings shall be laid which is known to be defective. If any pipe or other casting is discovered to be cracked, broken, or defective, after being laid, it shall be removed and replaced by sound pipe, without further charge.
6. Before laying pipe, the inside of the bell and the outside of the spigot of the pipe shall be thoroughly cleaned.
7. Pipe shall be laid to conform accurately to the lines and grades established by the ENGINEER. The pipe shall be properly bedded as shown on the plans and per manufacturer recommendations.

D. Jointing Mechanical Joint Pipes

1. Joining Existing Bell and Spigot to New Mechanical Joint
   (a) Due to the difficulty that may be encountered in attempts to make such a connection of this type, an adapter having a fitting bell and a M.J. socket may be used by the CONTRACTOR.
2. Cleaning and Assembling Joints
   (a) Clean last 8” outside the spigot, and the inside of the bell of mechanical joint pipe to remove oil, grit, tar (other than standard coating) and other foreign matter from the joint and then paint area clean with an approved soap solution. The ductile iron gland shall then be slipped on the spigot end of the pipe with the extension of the gland toward the socket or bell end. The rubber gasket shall be painted with the soap solution and placed on the spigot end with thick edge toward the gland.
3. Bolting of Joints
   (a) Push entire section of pipe forward to seat spigot end in the bell. Press gasket into place within the bell, being careful to have the gasket evenly located around the entire joint. Move ductile iron gland along the pipe into position for bolting, insert all bolts and screw nuts up tightly with fingers. Tighten all nuts with a suitable (preferably torque-limiting) wrench. Tighten nuts that are spaced 180 degrees apart alternately in order to produce equal pressure on all parts of the gland.

E. Jointing Rubber Gasket Pipe (Bell Tite, Tyton or Equivalent)

1. Cleaning Joint and Gasket

   (a) Clean gasket and spigot and inside of bell thoroughly to remove all direct and other foreign matter.

2. Inserting Gaskets

   (a) Insert gasket furnished by the pipe manufacturer into the gasket set in the bell. Gasket shall be properly seated in the grooves provided in the pipe bell.

3. Lubricating Gasket and Pipe Spigot

   (a) Using a non-toxic vegetable soap, apply a film by hand to the inside surface of the gasket that comes into contact with the entering pipe and to the first 1" of the spigot end of the entering pipe. Use only lubricant specified by the pipe manufacturer.

4. Final Assembling of Joint

   (a) Align entering pipe with the bell to which it is to be joined. Enter the spigot end into the bell until it just makes contact with the gasket. Apply sufficient pressure to force the spigot end past the gasket up to solid contact with the bell.

5. Field Cutting Pipe

   (a) When it is necessary to field cut pipe with rubber gaskets, chamfer the cut end 1/8 inch x 30 degrees before inserting it into a rubber gasket bell.

6. Fittings

   (a) Fittings shall be installed where and as shown on the plans or as directed by the ENGINEER. All bends, wyes, plugs, and all other fittings requiring such shall be sufficiently backed, blocked, or braced to preclude the possibility of their blowing off the main.

7. Restrained Joints

   (a) Restrained joints shall be installed where and as shown on the plans or as directed by the ENGINEER.

   (b) Restrained joints are required to prevent movement of system piping caused by forces in or on buried piping tees, valves, branches, bends, plugs, etc.

   (c) All restrained joint systems shall have a pressure rating equal to or greater than that of the pipe on which they are installed.

F. Connections to Existing Mains

1. All work shall comply with the latest revision of applicable AWWA standards and *Rules Governing Public Water Systems* Rule .0406. No service connection shall be made to plumbing that is not in compliance with the NC State Building Code and applicable local codes.

2. Per the standard details, new mains shall be connected by a temporary backflow prevention assembly to fill, pressure test, flush, and disinfect prior to tie-in. See Section 14 – Disinfection and Testing of Water Utility Piping Systems for pressure testing, disinfection and bacteriological testing requirements.

3. Where installation is governed by NCDOT or another Authority Having Jurisdiction (AHJ), follow that agency's cross-connection procedures and requirements.

4. Assemblies shall meet the latest revision of AWWA C511 (Reduced-Pressure Principle) and AWWA C510 (Double Check-Valve), as applicable.

5. Connection types requiring Department review are listed in the *Rules Governing Public Water Systems* Rule .0406(b)(3). Where the Plumbing Code does not address a condition, follow .0406(b)(4).

6. The CONTRACTOR shall make connection to the existing mains when and as directed by the ENGINEER. In no case shall the CONTRACTOR shut off the water or operate the fire hydrants or gate valves of the existing distribution system. In case it becomes necessary to delay the cut-off, such instructions shall be given and obeyed without recourse. At no time shall the CONTRACTOR operate any valves, gates, pumps, etc. All these operations must be done by OWNER personnel.

7. In making connections to the existing distribution system, valves shall be set as shown on the plans or at such designated place as the ENGINEER may direct. If due to unforeseen conditions, these locations have to be changed or additional valves or fittings added, the CONTRACTOR shall install the valves or fittings at the new locations upon approval by the ENGINEER. Payment for special fittings or couplings will not be made unless approved by the ENGINEER prior to installation.

8. If connection to existing mains requires an interruption of service, the CONTRACTOR shall schedule the connection for a time that is most convenient to the affected customers as determined by the ENGINEER. Adequate notice shall be provided to those customers who will experience a disruption in service due to the connection. Once the service interruption is approved, the CONTRACTOR shall ensure that all necessary labor, materials, and equipment are on-site before commencing work, and shall keep the service interruption to a minimum.

9. A minimum of forty-eight (48) hours' notice is required to those customers who will be put out of service by the connection. The service interruption shall be kept to an absolute minimum. Work must be completed until service is restored.

G. Concrete Blocking

1. All turns, fittings, etc., that induce pressure which would cause separation of pipe, breakage, etc., shall be blocked with 3,000 psi concrete. Blocking shall be formed and placed in such a manner that the pressure to be exerted at the point of blocking shall be transferred to firm, undisturbed earth at a maximum load of 2,000 LBS. per square foot. The CONTRACTOR shall ensure that blocking at all tees, bends, hydrants, plugs, etc., shall be sufficient to contain all pressure exerted by the pipe up to a pressure of 150 psi hydraulic pressure within the pipe. Blocking shall be constructed as shown on the Drawings. The CONTRACTOR shall also be responsible for any damage or repairs caused by blowouts of any insufficiently blocked pipe.

H. Valves, Specials, and All Other Appurtenances are to be placed as shown on the drawings or at the location and in the manner designated by the ENGINEER. Any omissions of any of these appurtenances shall be corrected by the CONTRACTOR without expense to the OWNER. Each valve box shall be provided with a standard concrete valve box protector/marker as shown on the plans and fitted with an operating nut extension, as required.

I. Hydrants shall be set true to grade, with the standpipe plumb. Beneath and around the base of the hydrant and to a point one foot above drip, at least ¼ cubic yard of #67 stone shall be placed, and the trench filled with earth.

J. New Water Service

1. Service connections shall be installed at locations as designated by the Owner. Installation shall be made in a manner acceptable to the ENGINEER. The service connection shall be installed as recommended by the Manufacturer and left open for inspection by Iredell Water Corporation or the ENGINEER.

2. New water services between ¾“ and 2” must be encased in a minimum of Schedule 40 PVC pipe installed by open cut.

3. Taps

(a) Proper size taps shall be made on the distribution line. A corporation stop, with the proper bend and service pipe adapter, shall be installed in the tap.

4. Service Pipe shall be connected to the corporation stop adapter. Pipe shall be cut to the required length and properly laid in the service ditch. Adequate provisions shall be made to protect against expansion and contraction.

5. Backfill of ditches and cleanup of the work area shall meet approval of the Engineer.

3.2 RELATION OF WATER MAINS TO SEWERS, OTHER UTILITIES AND WATERWAYS

A. Lateral Separation of Sewers and Water Mains

1. Water mains shall be laid at least 10 feet laterally from existing or proposed sewers, unless local conditions or barriers prevent a 10-foot lateral separation; in which case:

(a) The water main shall be laid in a separate trench with the elevation of the bottom of the water main at least 18 inches above the top of the sewer; or

(b) The water main shall be laid in the same trench as the sewer with the water main located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.

B. Crossing a Water Main over a Sewer

1. Whenever it is necessary for a water main to cross over a sewer, the water main shall be laid at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer, unless local conditions or barriers prevent an 18 inch vertical separation, in which case both the water main and sewer shall be constructed of ferrous materials and with joints that are equivalent to water main standards for a distance of 10 feet on each side of the point of crossing.

2. When making crossings with less than 18” vertical separation, a full length of pipeline pipe shall be centered over the sewer to be crossed so that joints will be equidistant from the sewer and as remote therefrom as possible. If 18 inches of separation cannot be met, justification must be provided for review per Rule .0906(f) of the Rules Governing Public Water Systems. The installation shall be as specified in *Rules Governing Public Water Systems* Rule .0906.

C. Crossing a Water Main under a Sewer

1. Whenever it is necessary for a water main to cross under a sewer, both the water main and the sewer shall be constructed of ferrous materials and with joints equivalent to water main standards for a distance of 10 feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing.

2. When making crossings with less than 18" vertical separation, a full length of pipeline pipe shall be centered over the sewer to be crossed so that joints will be equidistant from the sewer and as remote therefrom as possible. If 18 inches of separation cannot be met, justification must be provided for review per Rule .0906(f) of the Rules Governing Public Water Systems. The installation shall be as specified in *Rules Governing Public Water Systems* Rule .0906.

D. Crossing of a Water Main under Other Utilities

1. The installation shall be as specified in *Rules Governing Public Water Systems* Rule .0904. Crossings of other utilities must have a minimum of 12 inches of vertical separation between the outside of the water main and the outside of other utilities. If impractical to maintain separation per Rule .0904, justification of the deviation must be provided in accordance with Rule .0904(c).

E. Underwater Crossings

1. For underwater stream crossings, provide a minimum cover of 5 feet over the pipe, in accordance with the Recommended Standards for Water Works (Ten State Standards) §8.9.2, which is incorporated by reference in 15A NCAC 18C .0503 (latest revision).

2. Where the 5-foot cover cannot be achieved, submit justification for approval by the reviewing authority.

3. Valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair. The valves shall be easily accessible and not subject to flooding.

3.3 INSULATION OF PIPING

A. All outdoor piping 4" in diameter and smaller which is not buried shall be insulated except where specifically stated otherwise on the Drawings or in these specifications. Provide heat tape and controls as recommended by manufacturer for temperatures down to -10 °F. This requirement shall also apply to piping in vaults. The piping shall be insulated with 1" thick polyfoam with the insulation laminated to an outside jacket of PVC with a finished color of white. The material shall be furnished in standard 25' rolls with insta-grip closure. Fittings and valves shall be insulated with preformed white insulated fitting covers with 1" thick polyurethane foam insert. Pipe insulation shall be wrapped around pipe and trac locked down in position. Insulation shall be held in place by sealing trac with fastener-weld or equal. All butt joints and fitting covers shall be sealed with silicone sealant and then taped in place to provide a vapor barrier. Installation procedures and accessory materials shall all be in accordance with the pipe insulation manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

A. Field Tests and Inspections

1. The ENGINEER will conduct field inspections and witness field tests specified in these specifications. The CONTRACTOR shall perform field tests and provide labor, equipment, and

incidentals required for testing. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the Drawings and specifications.

2. Testing

   (a) Tests shall be as specified.

****END OF SECTION****

SECTION 18 – UNDERGROUND UTILITY DETECTION SYSTEM

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. The work covered by this section consists of all work necessary to furnish and install the pipeline tracer wire and detectable tracer tape system used to locate buried underground pipelines.

B. All materials used on this project must have a preliminary inspection by the ENGINEER or OWNER before being used for construction purposes. Rejection of materials not meeting specifications shall be immediately removed from the job site.

1.2 SUBMITTALS

A. The CONTRACTOR shall submit to the ENGINEER shop drawings for all products and components provided under this specification section to be used for the construction of this project.

PART 2 -- PRODUCTS

2.1 COLOR CODING

A. All trace wire and detectable tracer tape shall have HDPE insulation intended for direct bury, blue color coated per APWA standard for the specific utility being marked.

2.2 MATERIALS

A. Underground utility detection system materials shall conform to Specification Section 01 - Material Specifications.

PART 3 -- INSTALLATION

3.1 GENERAL

A. Trace wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, proper locating of wire without loss or deterioration of low frequency (512Hz) signal for distances in excess of 1,000 linear feet, and without distortion of signal caused by multiple wires being installed in close proximity to one another.

B. Detectable tracer tape shall be buried continuously above the water main or service lateral at a depth of eighteen (18) inches below finished grade.

C. Trace wire systems must be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed.

D. Any damage occurring during installation of the trace wire must be immediately repaired by removing the damaged wire and installing a new section of wire with approved connectors. Taping and/or spray coating shall not be allowed.

E. Trace wire shall be installed at the bottom half of the pipe and secured (taped/tied) at 10’ intervals.

F. Trace wire must be properly grounded as specified.

G. Trace wire on all service laterals/stubs must terminate at valve boxes, meter boxes, or vaults.

H. At all mainline dead-ends, trace wire shall go to ground using an approved connection to a drive-in magnesium grounding anode rod, buried at the same depth as the trace wire. (See Grounding)

I. Mainline trace wire shall not be connected to existing conductive pipes. Treat as a mainline dead-end, ground using an approved waterproof connection to a grounding anode buried at the same depth as the trace wire.

J. All service lateral trace wires shall be a single wire, connected to the mainline trace wire using a mainline to lateral lug connector, installed without cutting/splicing the mainline trace wire.

K. In occurrences where an existing trace wire is encountered on an existing utility that is being extended or tied into, the new trace wire and existing trace wire shall be connected using approved splice connectors and shall be properly grounded at the splice location as specified.

3.2 TERMINATION/ACCESS

A. All trace wire termination points must utilize a valve box (above-ground valve boxes or grade level/in-ground valve boxes as applicable), specifically manufactured for this purpose.

B. A minimum of 2 ft. of excess/slack wire is required in all trace wire access boxes or valve boxes after meeting the final elevation.

3.3 SERVICE LATERALS ON PUBLIC PROPERTY

A. Trace wire must terminate at an approved grade level/in-ground trace wire access box, or valve or meter boxes located at the edge of the road right-of-way, and out of the roadway.

3.4 SERVICE LATERALS ON PRIVATE PROPERTY

A. Trace wire must terminate at the meter or valve box at the end of Iredell Water Corporation’s ownership of the service lateral.

3.5 HYDRANTS

A. Trace wire must terminate at an approved above-ground trace wire access box, properly affixed to the hydrant grade flange. Affixing with tape or plastic ties shall not be acceptable.

3.6 LONG RUNS, IN EXCESS OF 500 LINEAR FEET WITHOUT SERVICE LATERALS OR HYDRANTS

A. Trace wire access must be provided utilizing an approved grade level/in-ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway. The grade level/in-ground trace wire access box shall be delineated using a minimum 48” polyethylene marker post, color-coded per APWA standard for the specific utility being marked.

3.7 GROUNDING

A. Trace wire must be properly grounded at all dead ends/stubs.

B. Grounding of trace wire shall be achieved by use of a drive-in magnesium grounding anode rod with a minimum of 20ft of #14 red HDPE insulated copper clad steel wire connected to anode (minimum 0.5 lb.) specifically manufactured for this purpose and buried at the same elevation as the utility.

C. When grounding the trace wire at dead ends/stubs, the grounding anode shall be installed in a direction 180 degrees opposite of the trace wire, at the maximum possible distance.

D. When grounding the trace wire in areas where the trace wire is continuous and neither the mainline trace wire nor the grounding anode wire will be terminated at/above grade, install grounding anode directly beneath and in line with the trace wire. Do not coil excess wire from grounding anode. In this installation method, the grounding anode wire shall be trimmed to an appropriate length before connecting to trace wire with a mainline to lateral lug connector.

E. Where the anode wire will be connected to a trace wire access box, a minimum of 2 ft. of excess/slack wire is required after meeting the final elevation.

3.8 WATER SYSTEM

A. A mainline trace wire must be installed, with all service lateral trace wires properly connected to the mainline trace wire, to ensure full tracing/locating capabilities from a single connection point.

B. Lay mainline trace wire continuously, by-passing around the outside of fittings on the North or East side.

C. All conductive and non-conductive service lines shall include tracer wire.

3.9 PROHIBITED PRODUCTS AND METHODS

A. The following products and methods shall not be allowed.

1. Uninsulated trace wire
2. Trace wire insulations other than HDPE
3. Trace wires not domestically manufactured
4. Non-locking, friction fit, twist on or taped connectors
5. Brass or copper ground rods
6. Wire connections utilizing taping or spray-on waterproofing
7. Looped wire or continuous wire installations that have multiple wires installed side- by-side or in close proximity to one another
8. Trace wire wrapped around the corresponding utility
9. Brass fittings with trace wire connection lugs
10. Connecting trace wire to existing conductive utilities

3.10 TESTING

A. All new trace wire installations shall be located using typical low frequency (512Hz) line tracing equipment, witnessed by the contractor, engineer and facility owner as applicable, prior to acceptance of ownership.

B. This verification shall be performed upon completion of rough grading and again prior to final acceptance of the project.

C. Continuity testing in lieu of actual line tracing shall not be accepted.

****END OF SECTION****

WATER DISTRIBUTION SYSTEM

571 Jennings Road
Statesville, North Carolina 28625
www.iredellwater.com

PO Box 1844
Statesville, North Carolina 28687-1844

STANDARD WATER DETAILS

November 2025

GENERAL NOTES:

1. CONTRACTOR SHALL HAVE COMPLETE SET OF PLANS AS WELL AS ALL PERMIT APPROVALS ON THE JOB SITE AT ALL TIMES

2. CONSTRUCTION AND MATERIALS SHALL BE IN ACCORDANCE WITH IREDELL WATER CORPORATION STANDARDS AND SPECIFICATIONS.

3. CONTRACTOR IS FULLY RESPONSIBLE FOR CONTACTING ALL APPROPRIATE PARTIES AND ASSURING THAT UTILITIES ARE LOCATED PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. CALL 811 FOR UTILITY LOCATING SERVICES 72 HOURS PRIOR TO COMMENCEMENT OF ANY WORK. CONTRACTOR SHALL VERIFY LOCATION AND DEPTH OF ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION. ALL COSTS ASSOCIATED WITH ANY DAMAGE TO EXISTING UTILITIES RESULTING FROM THE CONTRACTOR'S FAILURE TO ADEQUATELY PROTECT THE EXISTING UTILITIES DURING CONSTRUCTION SHALL BE BORNE SOLELY BY THE CONTRACTOR.

4. CONTRACTOR SHALL NOTIFY IREDELL WATER CORPORATION A MINIMUM OF ONE WEEK PRIOR TO INTERRUPTING WATER SERVICE TO MAKE CONNECTIONS ON TIE-INS TO EXISTING WATER SUPPLY.

5. DATE AND TIME FOR SHUTDOWN SHALL BE COORDINATED WITH AND SHALL BE AT THE DISCRETION OF IREDELL WATER CORPORATION.

6. CONTRACTOR SHALL HAVE ALL MATERIALS, TOOLS, EQUIPMENT AND SUFFICIENT PERSONNEL
ON SITE PRIOR TO BEGINNING WORK TO MINIMIZE ANY POSSIBLE SHUTDOWN TIME.

7. WATER SERVICES MAY BE SHUTDOWN FOR A MAXIMUM OF FOUR HOURS. ALL WORK SHALL CONTINUE UNINTERRUPTED UNTIL ALL WATER SERVICE IS RESTORED.

8. EXISTING VALVES SHALL BE OPERATED AND CLOSED ONLY BY IREDELL WATER CORPORATION PERSONNEL.

9. UTILITY EASEMENTS SHALL BE A MINIMUM OF 20 FEET WIDE FOR A SINGLE UTILITY PIPELINE, AND A MINIMUM OF 30 FEET WIDE FOR PIPES DEEPER THAN 16 FEET. FOR MULTIPLE PIPES, EASEMENT SHALL PROVIDE A MINIMUM OF 10 FEET CLEARANCE ON EITHER SIDE OF EACH PIPE. EASEMENT PLATS SHALL BE RECORDED AS IREDELL WATER CORPORATION EASEMENT.

10. SHORING WILL BE ACCORDING TO OSHA TRENCHING STANDARDS PART 1926 SUBPART P, OR AS AMENDED.

11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR RELOCATION OF EXISTING UTILITIES IF REQUIRED DURING INSTALLATION OF NEW WORK.ANY RELOCATION OF EXISTING UTILITIES MUST BE COORDINATED WITH THE AFFECTED UTILITY COMPANY.

12. CONTRACTOR SHALL MAKE EVERY EFFORT TO SAVE PROPERTY IRONS, MONUMENTS, OTHER PERMANENT POINTS AND LINES OF REFERENCE AND CONSTRUCTION STAKES. PROPERTY IRONS, MONUMENTS, AND OTHER PERMANENT POINTS OF REFERENCE DESTROYED BY THE CONTRACTOR SHALL BE REPLACED BY A REGISTERED LAND SURVEYOR AT THE CONTRACTOR'S EXPENSE.

13. CONTRACTOR SHALL CLEAR AND GRUB ALL UTILITY EASEMENTS, AS DIRECTED BY THE ENGINEER, TO INSTALL NEW WATER MAINS. ON ROADWAY RIGHT-OF-WAYS, THE CONTRACTOR SHALL ONLY REMOVE THE TREES MARKED ON THE PLANS AND SHALL MAKE EVERY EFFORT DURING CONSTRUCTION TO PROTECT THE TREES THAT WILL NOT BE REMOVED.

14. EXISTING BUILDING LOCATIONS ARE APPROXIMATE AND SHOWN FOR INFORMATION ONLY.

15. ALL DRIVEWAYS SHALL BE REPAIRED TO PRE-EXISTING CONDITIONS OR BETTER AS SOON AS CONSTRUCTION HAS PASSED.

16. CONTRACTOR SHALL REPLACE ALL DRIVEWAY PIPES AND OTHER DRAINAGE PIPES/CULVERTS THAT ARE DISTURBED WHILE INSTALLING THE WATER LINE WITH NEW PIPES/CULVERTS. IF CULVERTS NEED TO BE REMOVED AND REPLACED, THEY SHALL BE AT THE SAME INVERTS UNLESS OTHERWISE APPROVED BY THE OWNER OR ENGINEER. ALL PIPE/CULVERTS SHALL MEET THE REQUIREMENTS OF NCDOT.

17. THE CONTRACTOR SHALL SUPPORT ALL UTILITY POLES AS NECESSARY. THE CONTRACTOR SHALL COORDINATE UTILITY POLE SUPPORT WITH THE APPROPRIATE UTILITY COMPANIES.

18. CONTRACTOR SHALL RESTORE/REPLACE ALL SIGNS, MAILBOXES, ETC. ENCOUNTERED DURING CONSTRUCTION TO ORIGINAL CONDITION.

19. THE CONTRACTOR SHALL RESTORE ALL DISTURBED AREAS TO THE EXISTING GRADE UNLESS OTHERWISE NOTED ON THE DRAWINGS.

20. ALL ROADWAY DITCHES DISTURBED DURING CONSTRUCTION SHALL BE RESTORED TO PRE-CONSTRUCTION CONDITION OR BETTER AND CONFORM TO NCDOT REQUIREMENTS. ALL DITCHES SHALL BE LINED WITH STRAW AND NET MATTING UNLESS OTHERWISE NOTED.

21. THE CONTRACTOR SHALL REMOVE EXISTING FENCING AS REQUIRED TO INSTALL THE WATERLINES AND REPLACE WITH NEW FENCING OF THE SAME TYPE.

22. ALL EXCAVATED MATERIAL SHALL BE PLACED WITHIN THE LIMITS OF DISTURBANCE DURING WATERLINE INSTALLATION. THE CONTRACTOR SHALL PROVIDE THE NECESSARY SEDIMENT AND EROSION CONTROL MEASURES TO CONTROL RUN-OFF. ALL EXCESS EXCAVATED MATERIAL SHALL BE REMOVED FROM THE CONSTRUCTION SITE AND DISPOSED OF LEGALLY.

23. CONTRACTOR TO VERIFY FINAL FIRE HYDRANT LOCATIONS WITH ENGINEER. PER NCDOT, FIRE HYDRANTS MUST BE A MINIMUM OF 5' BEHIND THE DITCH LINE.

24. MINIMUM COVER OF 36" FOR WATER MAINS

25. CONTRACTOR SHALL INSTALL A COPPER TRACER WIRE AND DETECTABLE TAPE WITH PROPOSED PVC WATER MAIN AND INDIVIDUAL SERVICE LINES FOR FUTURE LOCATING.

26. ALL VALVES, HYDRANTS, AND FITTINGS SHALL BE MECHANICAL, RESTRAINED JOINTS WITH "GRIP RING" BY ROMAC INDUSTRIES, INC. WHEN INSTALLED ON PVC PIPE AND RESTRAINED WITH MEGALUG, SERIES 1100 AS MANUFACTURED BY EBBA IRON OR APPROVED EQUAL WHEN INSTALLED ON DUCTILE IRON PIPE. THIS IS IN ADDITION TO REQUIRED CONCRETE BLOCKING.

27. ALL VALVES SHALL OPEN COUNTERCLOCKWISE (LEFT) AND CLOSE CLOCKWISE (RIGHT).

28. CONTRACTOR WILL NOTIFY IREDELL WATER A MINIMUM OF 48 HOURS PRIOR TO FILLING OR FLUSHING ANY MAINS.

29. DISINFECTING SHALL TAKE PLACE IN THE PRESENCE OF THE ENGINEER.

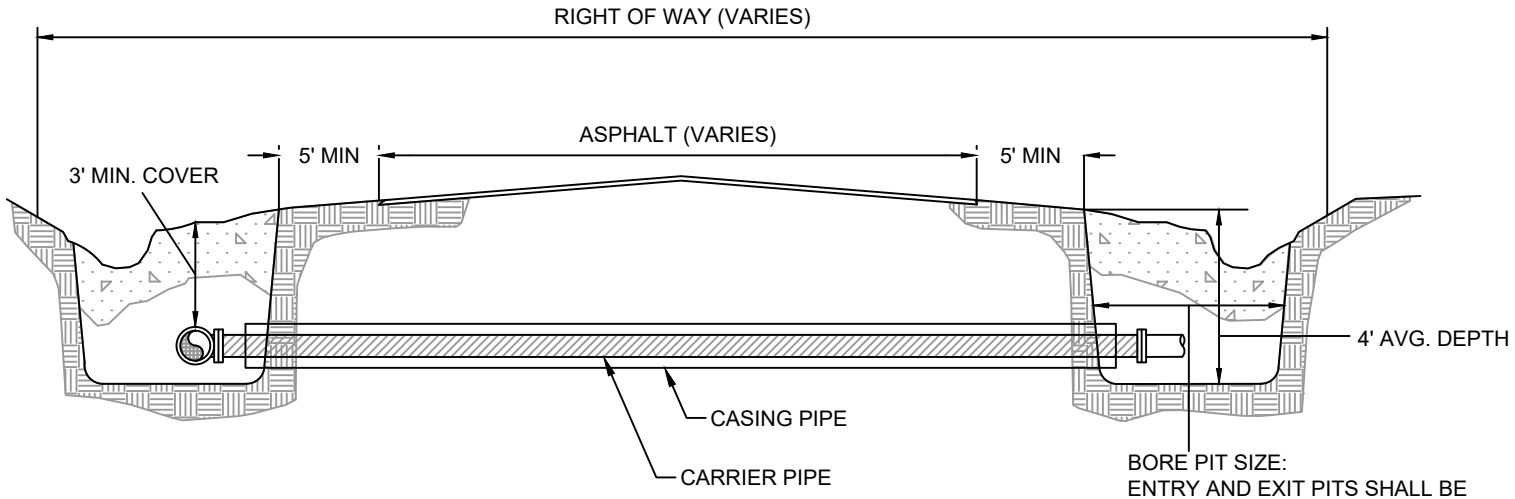
30. THE CONTRACTOR SHALL FURNISH AND INSTALL 3 VALVES AT EACH INTERSECTION IF THE WATERMAIN CREATES OR WILL CREATE A LOOP. THE CONTRACTOR SHALL FURNISH AND INSTALL 2 VALVES AT EACH INTERSECTION OF A DEAD-END MAIN WITH NO FUTURE EXTENSIONS POSSIBLE.

DRAWN BY:	AVT
DATE:	05/13/2024
REVISION:	

W – 1

GENERAL NOTES

IREDELL WATER CORPORATION



BORING DIAGRAM

PIPE CASING SCHEDULE

CARRIER PIPE	CASING PIPE
2"	4"
4"	8"
6"	12"
8"	16"
10"	18"
12"	20"

NOTE:
1. CASING PIPE JOINTS SHALL BE CONTINUOUS WELDED WITHOUT DEFLECTION
2. CARRIER PIPE SHALL BE SUPPORTED WITH SPIDERS, SIZED PER MANUFACTURER'S RECOMMENDATIONS. ENDS OF CASING PIPE SHALL BE SEALED WITH FLEXIBLE CASING SEALS
3. COMPLETED CASING PIPE INTERIOR SHALL BE SWABBED WITH LUBRICANT PRIOR TO CARRIER INSTALLATION
4. CARRIER PIPE SHALL BE PULLED THROUGH CASING PIPE.
5. ALL OPEN CUT INSTALLATIONS UNDER NCDOT, CITY MAINTAINED AND/OR PRIVATE DEVELOPMENT ROADS REQUIRE INSTALLATION OF CASING PIPE

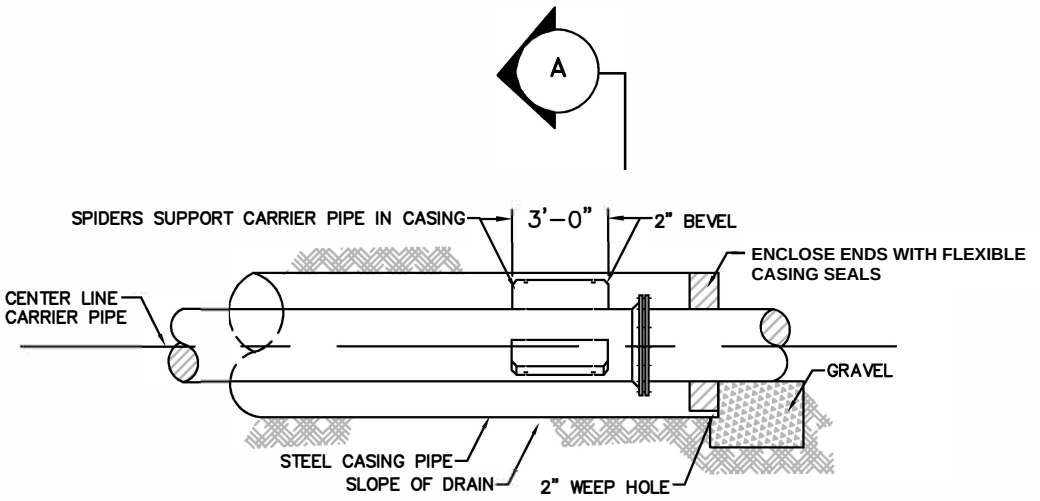
DRAWN BY:	JGA/AVT
DATE:	05/02/2022
REVISION:	05/13/2024

W-1A

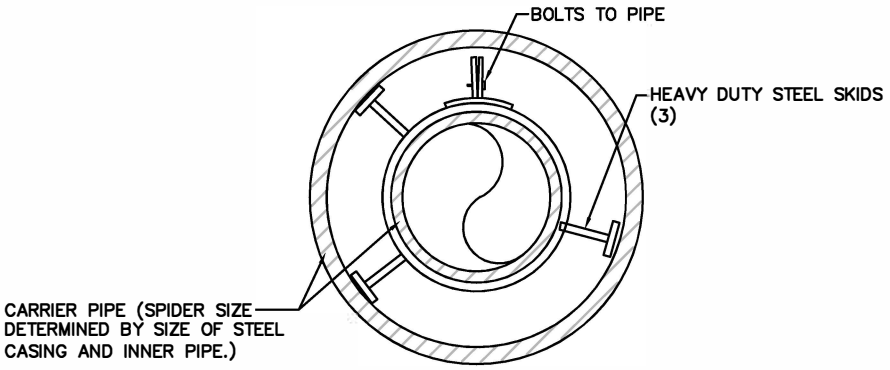
JACK AND BORE AND OPEN CUT STEEL CASING PART 1

NOT TO SCALE

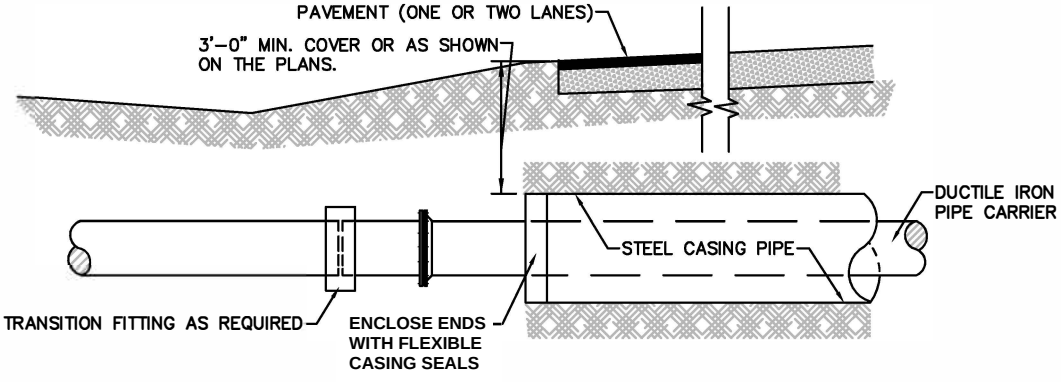
IREDELL WATER CORPORATION



ELEVATION



SECTION "A"



PROFILE

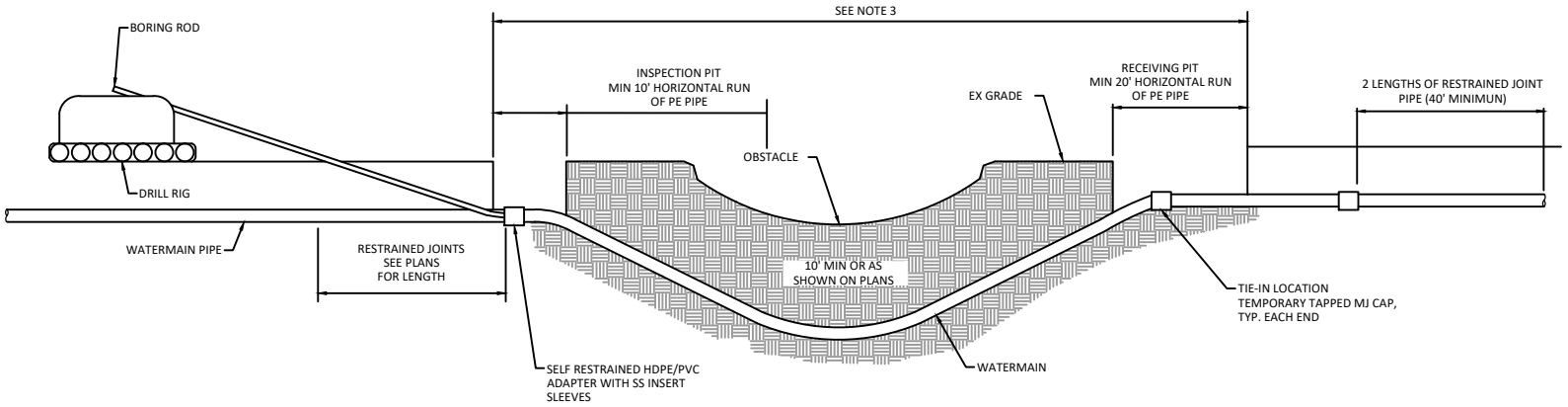
IREDELL WATER CORPORATION

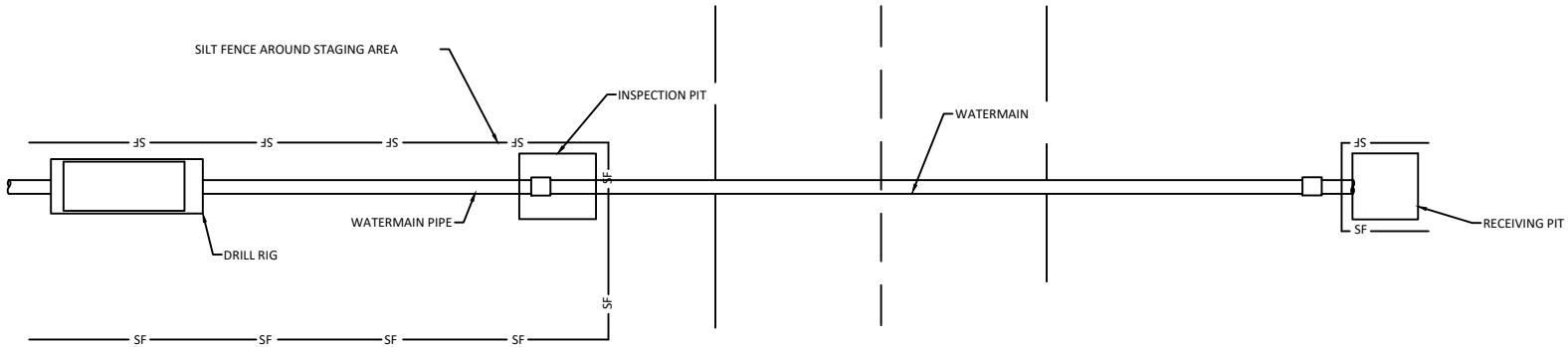
JACK AND BORE AND OPEN CUT STEEL CASING PART 2

NOT TO SCALE

DRAWN BY:	JGA
DATE:	06/13/2022
REVISION:	

W-1B





NOTES:

1. A PLAN & PROFILE SHALL BE PROVIDED FROM ENTRY TO EXIT FOR EACH DIRECTIONAL BORE SECTION BY THE BORE CONTRACTOR.
2. ALL BORE SECTIONS SHALL BE HYDROSTATICALLY TESTED PER SPECIFICATIONS UPON COMPLETION OF INSTALLATION & PRIOR TO PLACING THE PIPELINE INTO SERVICE.
3. LENGTH OF CROSSING, LOCATION OF INSPECTION PIT, NUMBER OF PIPE JOINTS, LOCATION OF BORE MACHINE, AUGER ENTRANCE LOCATION, & TIE-IN POINTS ARE TO BE APPROVED BY ENGINEER PRIOR TO START OF WORK.
4. THE BORE DEVELOPED FOR THE LEAD-IN END OF THE PIPE SHALL BE KEPT TO A MINIMUM DIAMETER FOR THE PIPE INSTALLATION. THE LEAD-IN END SHALL BE PULLED THROUGH WITHOUT THE MH FLANGE ATTACHED FOR LARGER THAN 6" PIPE INSTALLATIONS. THE MJ FLANGE FOR SAID LEAD-IN END SHALL BE INSTALLED AFTER THE PIPE INSTALLATION WITH THE USE OF A SPLIT MG FLANGE.
5. TRACERWIRE SHALL BE #12 AWG COPPER CLAD STEEL WITH A MINIMUM 1,150 LB. BREAK LOAD AND A MINIMUM 45 MIL HDPE INSULATION THICKNESS.

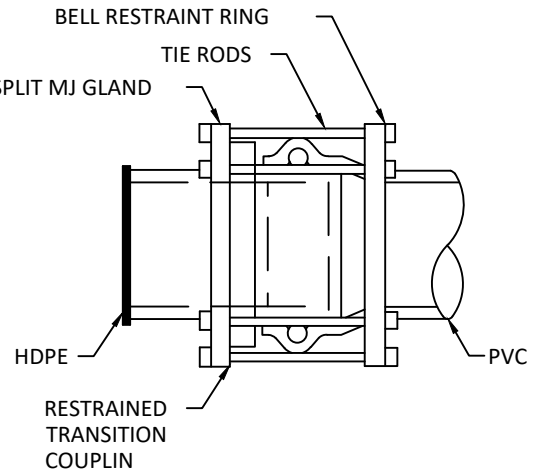
DRAWN BY:	JGA
DATE:	05/20/2022
REVISION:	05/13/2024

W-2A

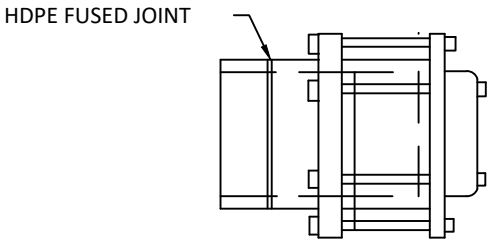
HORIZONTAL DIRECTIONAL DRILL PART 1

NOT TO SCALE

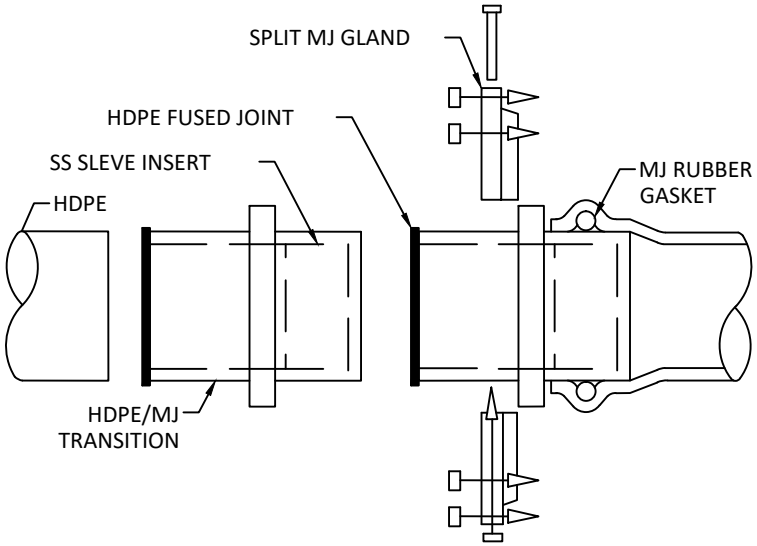
REDELL WATER CORPORATION



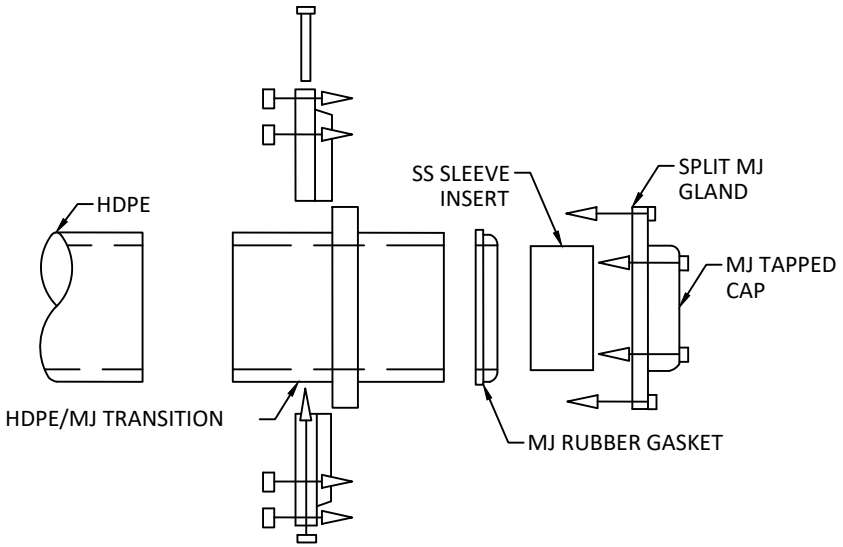
HDPE / PVC TRANSITION ASSEMBLED



HDPE / MJ TRANSITION ASSEMBLED



HDPE / PVC TRANSITION ASSEMBLY



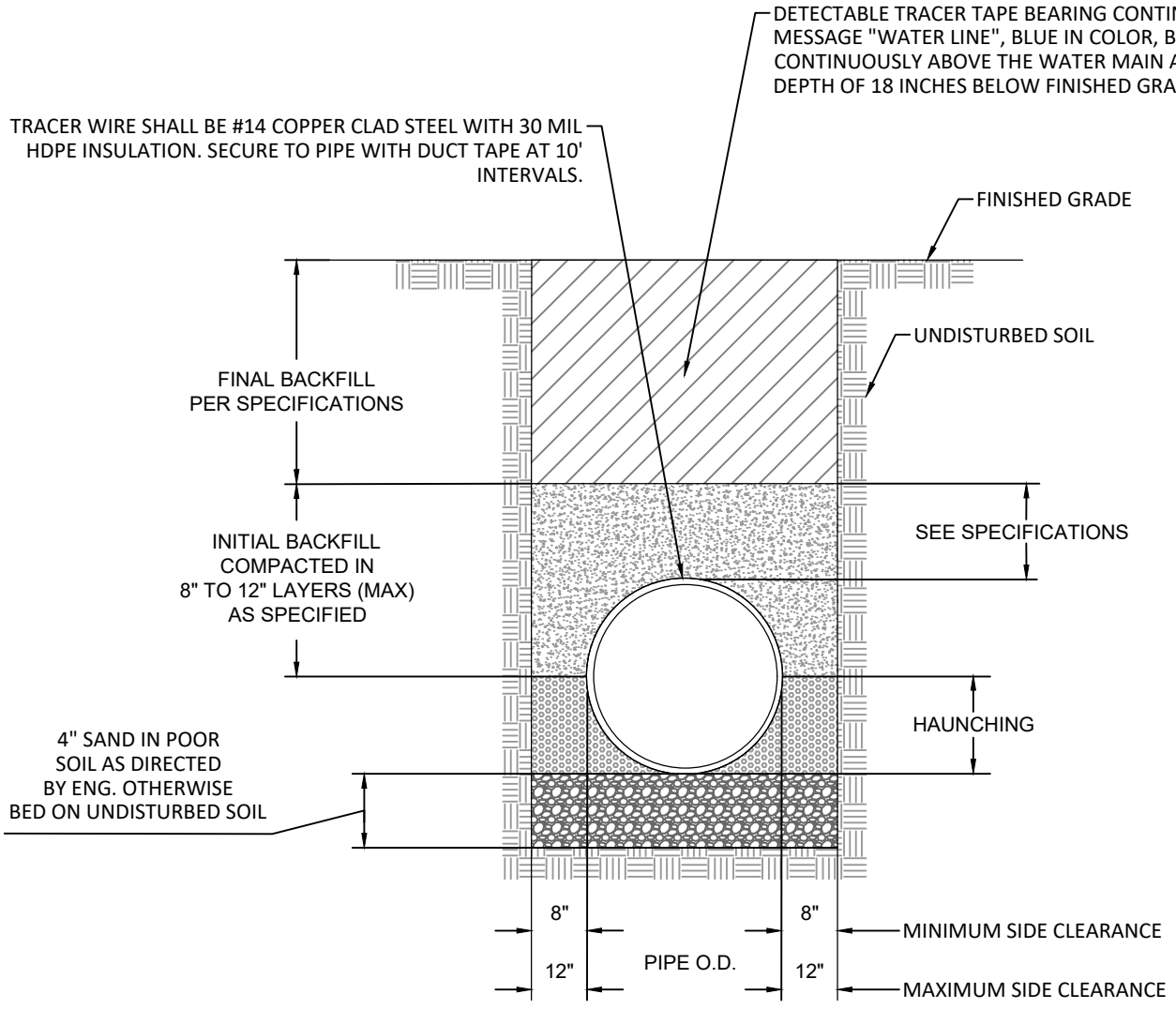
HDPE / MJ TRANSITION ASSEMBLY

DRAWN BY:	JGA	W-2B
DATE:	05/20/2022	
REVISION:	05/13/2024	

HORIZONTAL DIRECTIONAL DRILL PART 2

NOT TO SCALE

IRBELL WATER CORPORATION



BEDDING REQUIRED FOR PVC

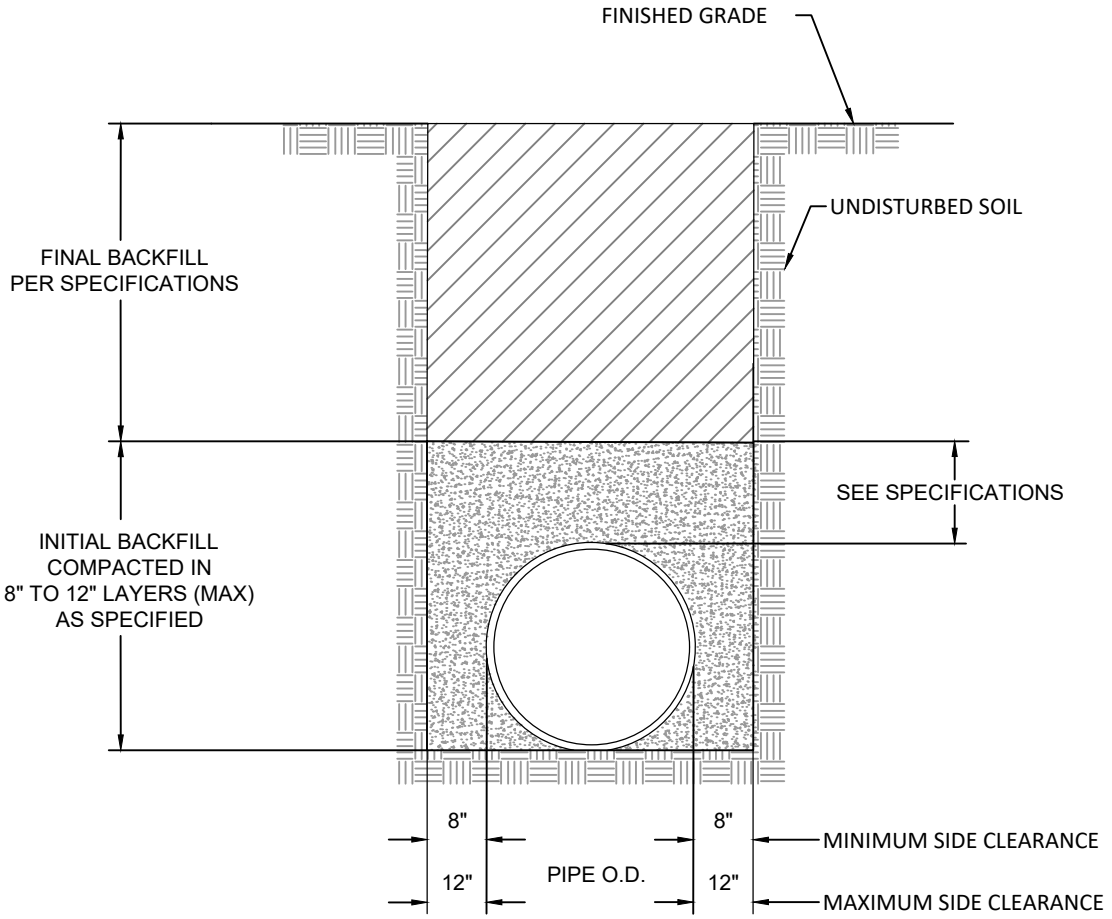
IREDELL WATER CORPORATION

PIPE TRENCH PART 1

NOT TO SCALE

DRAWN BY:	JGA
DATE:	05/20/2022
REVISION:	05/13/2024

W–3A



BEDDING REQUIRED FOR DIP

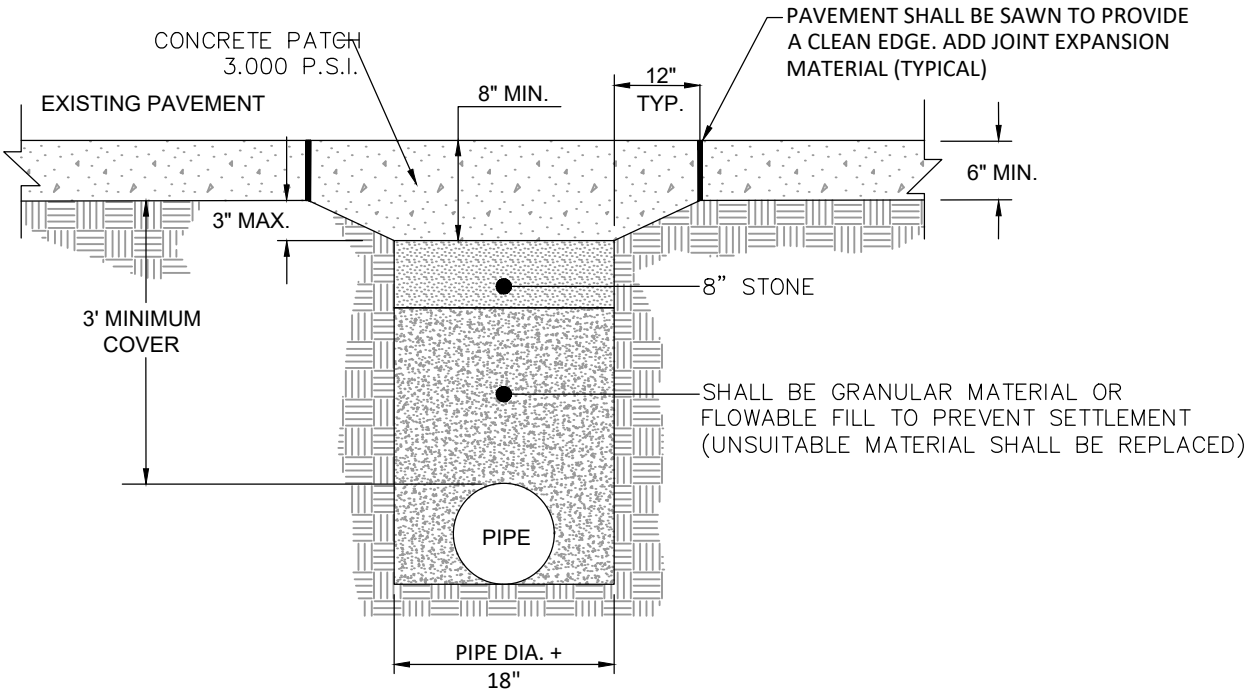
IREDELL WATER CORPORATION

PIPE TRENCH PART 2

NOT TO SCALE

DRAWN BY:	JGA
DATE:	05/20/2022
REVISION:	05/13/2024

W–3B



TRENCH AND PAVEMENT REPAIR - PRIVATE DRIVES AND ROADS

NOTES:

1. ALL TRAFIC CONTROL MUST CONFORM TO THE LATEST EDITION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES AND NCDOT STANDARDS.
2. ALL PAVEMENT CUTS SHALL BE REPAIRED ON THE SAME DAY. IF CONDITIONS DO NOT PERMIT A PERMANENT REPAIR WITHIN THE GIVEN TIME LIMIT, PERMISSION TO MAKE A TEMPPORARY REPAIR MUST BE OBTAINED FROM THE ENGINEER.
3. CONCRETE TRENCH CAP ON ASPHALT STREETS SHALL BE USED ONLY DURING INCLEMENT WEATHER WHEN ASPHALT PLANTS ARE NOT OPERATING.
4. IN ALL OPEN TRENCHES, BACKFILL SHALL BE COMPACTED TO 95% MAXIMUM DRY DENSITY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYNG COMPACTION REQUIREMENTS BY SOILS TESTING CERTIFIED BY A LICENSED PROFESSIONAL GEOTECHNICAL ENGINEER.
5. BACKFILL WITH A HIGH CLAY CONTENT, HIGH SHRINK-SWELL POTENTIAL, OR HIGH MOISTURE CONTENT THAT CANNOT MEET COMPACTION REQUIREMENTS SHALL BE DEEMED UNSUITABLE AND SHALL BE REPLACED WITH SUITABLE BACKFILL MATERIAL.
6. ALL PAVEMENT PATCHES SHALL PROVIDE A UNIFORM AND SMOOTH DRIVING SURFACE.

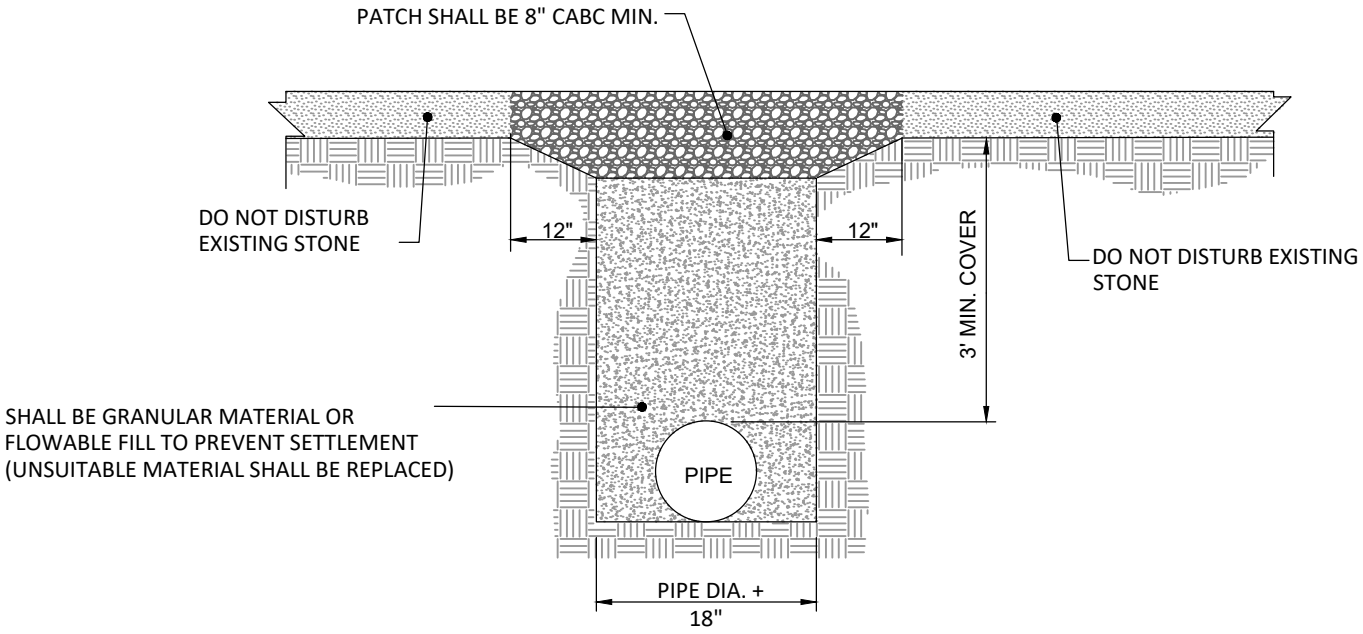
IREDELL WATER CORPORATION

TRENCH AND CONCRETE REPAIR
FOR PRIVATE DRIVES AND ROADS
PART 1

NOT TO SCALE

DRAWN BY:	JGA
DATE:	05/20/2022
REVISION:	11/22/2024

W–4A



TRENCH AND PAVEMENT REPAIR - PRIVATE DRIVES AND ROADS

NOTES:

1. ALL TRAFIC CONTROL MUST CONFORM TO THE LATEST EDITION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES AND NCDOT STANDARDS.
2. ALL PAVEMENT CUTS SHALL BE REPAIRED ON THE SAME DAY. IF CONDITIONS DO NOT PERMIT A PERMANENT REPAIR WITHIN THE GIVEN TIME LIMIT, PERMISSION TO MAKE A TEMPPORARY REPAIR MUST BE OBTAINED FROM THE ENGINEER.
3. CONCRETE TRENCH CAP ON ASPHALT STREETS SHALL BE USED ONLY DURING INCLEMENT WEATHER WHEN ASPHALT PLANTS ARE NOT OPERATING.
4. IN ALL OPEN TRENCHES, BACKFILL SHALL BE COMPACTED TO 95% MAXIMUM DRY DENSITY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYNG COMPACTION REQUIREMENTS BY SOILS TESTING CERTIFIED BY A LICENSED PROFESSIONAL GEOTECHNICAL ENGINEER.
5. BACKFILL WITH A HIGH CLAY CONTENT, HIGH SHRINK-SWELL POTENTIAL, OR HIGH MOISTURE CONTENT THAT CANNOT MEET COMPACTION REQUIREMENTS SHALL BE DEEMED UNSUITABLE AND SHALL BE REPLACED WITH SUITABLE BACKFILL MATERIAL.
6. ALL PAVEMENT PATCHES SHALL PROVIDE A UNIFORM AND SMOOTH DRIVING SURFACE.

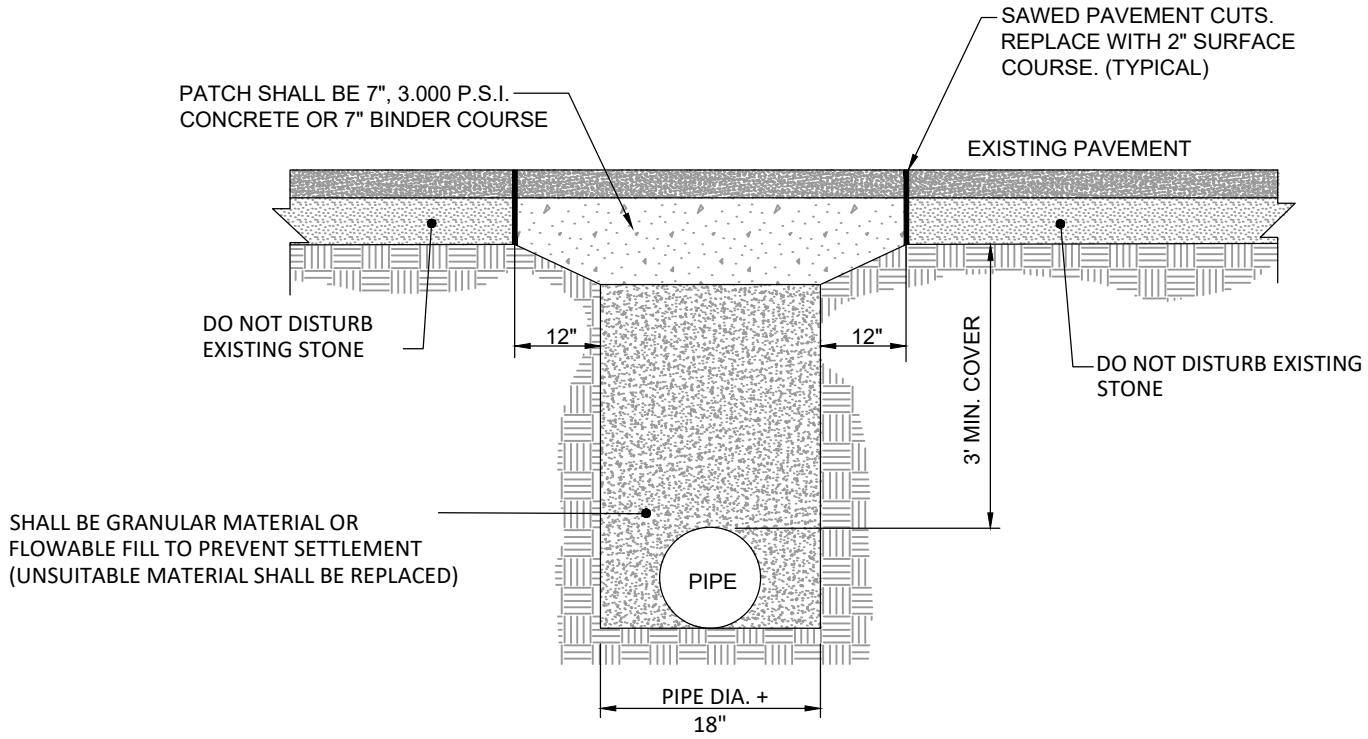
IREDELL WATER CORPORATION

TRENCH AND STONE REPAIR FOR PRIVATE DRIVES AND ROADS PART 2

NOT TO SCALE

DRAWN BY:	JGA
DATE:	05/20/2022
REVISION:	11/22/2024

W-4B



TRENCH AND PAVEMENT REPAIR - PRIVATE DRIVES AND ROADS

NOTES:

1. ALL TRAFIC CONTROL MUST CONFORM TO THE LATEST EDITION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES AND NCDOT STANDARDS.
2. ALL PAVEMENT CUTS SHALL BE REPAIRED ON THE SAME DAY. IF CONDITIONS DO NOT PERMIT A PERMANENT REPAIR WITHIN THE GIVEN TIME LIMIT, PERMISSION TO MAKE A TEMPPORARY REPAIR MUST BE OBTAINED FROM THE ENGINEER.
3. CONCRETE TRENCH CAP ON ASPHALT STREETS SHALL BE USED ONLY DURING INCLEMENT WEATHER WHEN ASPHALT PLANTS ARE NOT OPERATING.
4. IN ALL OPEN TRENCHES, BACKFILL SHALL BE COMPACTED TO 95% MAXIMUM DRY DENSITY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYNG COMPACTION REQUIREMENTS BY SOILS TESTING CERTIFIED BY A LICENSED PROFESSIONAL GEOTECHNICAL ENGINEER.
5. BACKFILL WITH A HIGH CLAY CONTENT, HIGH SHRINK-SWELL POTENTIAL, OR HIGH MOISTURE CONTENT THAT CANNOT MEET COMPACTION REQUIREMENTS SHALL BE DEEMED UNSUITABLE AND SHALL BE REPLACED WITH SUITABLE BACKFILL MATERIAL.
6. ALL PAVEMENT PATCHES SHALL PROVIDE A UNIFORM AND SMOOTH DRIVING SURFACE.

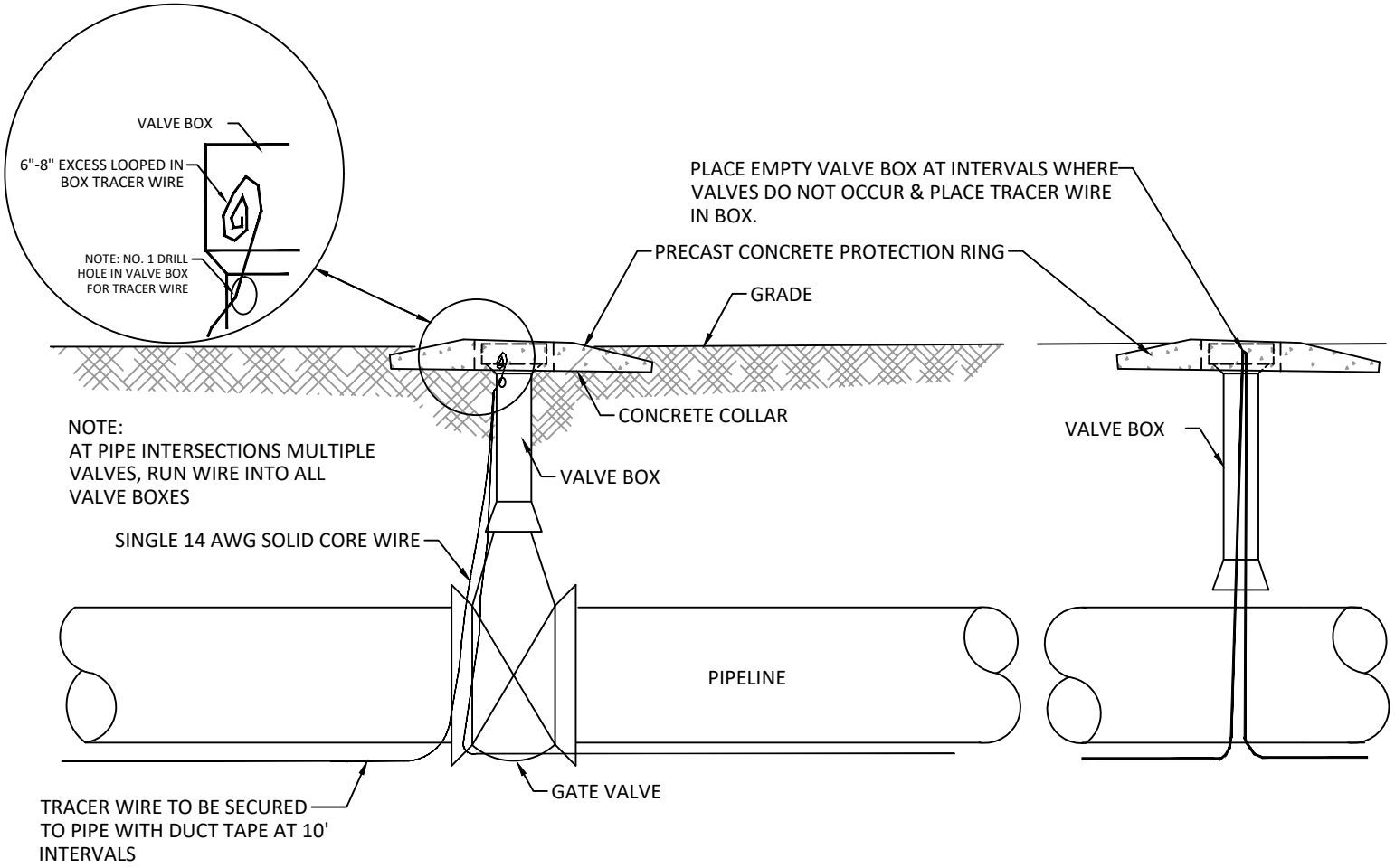
IREDELL WATER CORPORATION

TRENCH AND PAVEMENT REPAIR FOR PRIVATE DRIVES AND ROADS PART 3

NOT TO SCALE

DRAWN BY:	JGA
DATE:	05/20/2022
REVISION:	11/22/2024

W-4C



NOTES:
1. DRILL HOLE IN VALVE BOX TO INSERT TRACER WIRE, BRING UP TO INSIDE AND ROLL UP AT LEAST 6"-8" EXCESS
2. PLACE TRACER WIRE IN VALVE BOX AT 1,000" INTERVALS OR AS NOTED ON THE PLANS, TYPICAL
3. ALL NEW TRACER WIRE INSTALLATIONS SHALL BE TESTED UNDER THE DIRECTION OF THE ENGINEER AT PROJECT COMPLETION

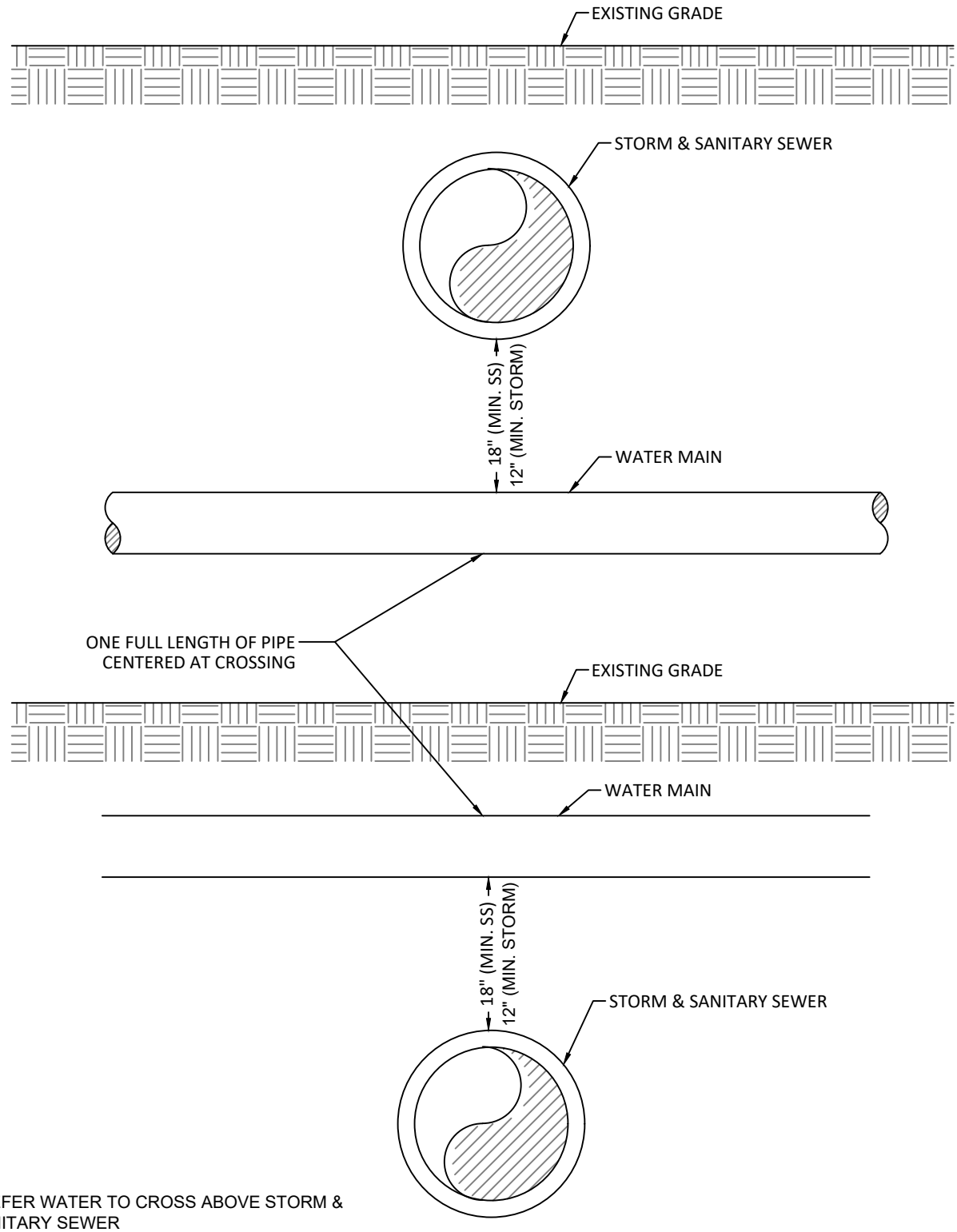
DRAWN BY:	JGA
DATE:	05/20/2022
REVISION:	11/22/2024

W-5

TRACER WIRE

NOT TO SCALE

REDELL WATER CORPORATION



NOTES:

1. PREFER WATER TO CROSS ABOVE STORM & SANITARY SEWER
2. SEPARATION PER NCDEQ PUBLIC WATER SUPPLY RULE, 15A:18C.0900

IREDELL WATER CORPORATION

STORM & SANITARY SEWER CROSSING

NOT TO SCALE

DRAWN BY:	JGA
DATE:	05/20/2022
REVISION:	11/22/2024

W–6

NO. DESCRIPTION

① WATER MAIN

② BALL CORPORATION STOP - CC (TAPER) THREAD x IPS INSTA-TITE (MUELLER H15005)

③ ENDOPURE PE ¾" TUBING (1" FOR DBL METER SERVICE)

④ METER BY IREDELL WATER CORPORATION

⑤ METER SETTER - SEE TABLE FOR SIZE NOTES

⑥ TRI - CAST 1118 METER BOX & LID (LID TO BE SOLID)

⑦ AWG #14 GAUGE COPPER TRACER WIRE (THWN) - WITH BLUE INSULATION - TERMINATE IN METER BOX WITH 24" EXCESS WIRE (COILED)

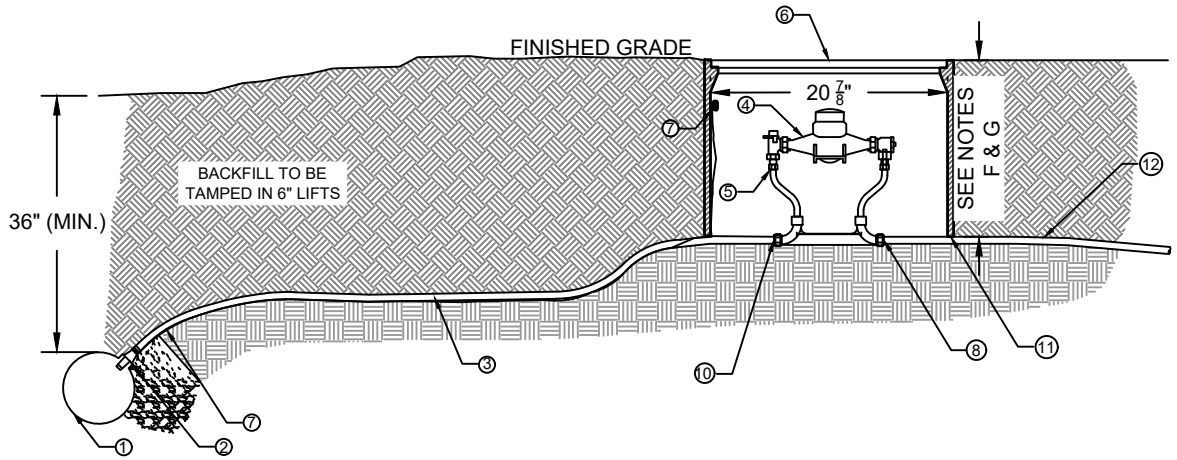
⑧ OUTLET SIDE OF SETTER MUELLER H14222N

⑨ HINGED BRONZE SADDLE CC THREADS (MUELLER S-13000 SERIES)

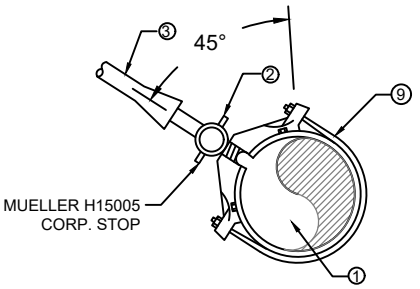
⑩ INLET SIDE OF SETTER MUELLER H14229N

⑪ SOLID CONCRETE BRICKS - DIAGONAL AT EACH CORNER

⑫ 18" - 24" BRASS NIPPLE TO CUSTOMER VALVE, PRV OR BACKFLOW DEVICE



SERVICE TAP



SERVICE SIZE	PART NAME	PART NUMBER
3 / 4"	METER SETTER	MUELLER B2404 R2 N (5 / 8" X 3 / 4" X 7")
1"	METER SETTER	MUELLER B2404 R2A N (1" X 10")

NOTE:

A. MINIMUM DISTANCE CENTER TO CENTER ON SERVICES OR TO BELLS OR SPIGOTS SHALL BE 3'-0'' AS MEASURED ALONG THE MAIN.
B. CENTER METER SETTER IN METER BOX.
C. SHOWN AS ¾'' SERVICE USE 1'' COMPONENTS FOR 1'' DOMESTIC WATER SERVICE.
D. METER BOX TO BE LOCATED AT BACK OF R/W OR UTILITY EASEMENT IF PROVIDED
E. NO TAPS OR SERVICES ALLOWED IN OR UNDER DRIVEWAYS. METER BOXES NOT ALLOWED IN CONCRETE DRIVES OR SIDEWALKS.
F. ¾" PIPE - 12" MIN TO 16" MAX DEPTH (GRADE TO TOP OF PIPE)
G. 1" PIPE - 18" MIN TO 22" MAX DEPTH (GRADE TO TOP OF PIPE)

DRAWN BY:	JGA
DATE:	05/20/2022
REVISION:	11/22/2024

W – 7

5/8'' X 3/4'' – 1'' SHORT SIDE WATER SERVICE CONNECTION

NOT TO SCALE

IREDELL WATER CORPORATION

NO. DESCRIPTION

① WATER MAIN

② HINGED BRONZE SADDLE CC THREADS (MUELLER S-13000 SERIES)

③ BALL CORPORATION STOP - CC (TAPER) THREAD x IPS INSTA-TITE (MUELLER H15005)

④ ENDOPURE PE $\frac{3}{4}$" TUBING

⑤ METER BY IREDELL WATER CORPORATION

⑥ METER SETTER- SEE TABLE FOR NOTES

⑦ SHELL

⑧ TRI - CAST 1118 METER BOX & LID, LID TO BE SOLID

⑨ AWG #14 GAUGE COPPER TRACER WIRE (THIN) - WITH BLUE INSULATION - TERMINATE IN METER BOX WITH 24" EXCESS WIRE (COILED)

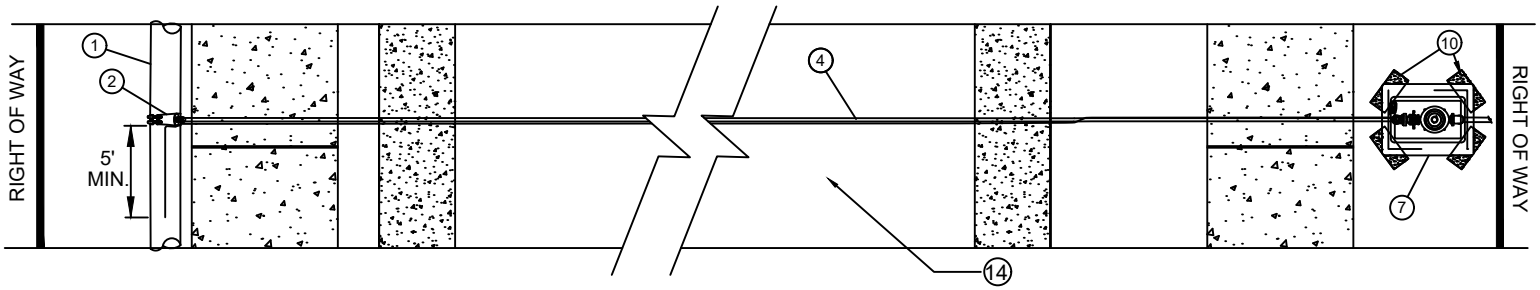
⑩ SOLID STANDARD CONCRETE BRICKS - DIAGONAL AT CORNERS - 4 EACH

⑪ OUTLET SIDE OF SETTER MUELLER H14222N

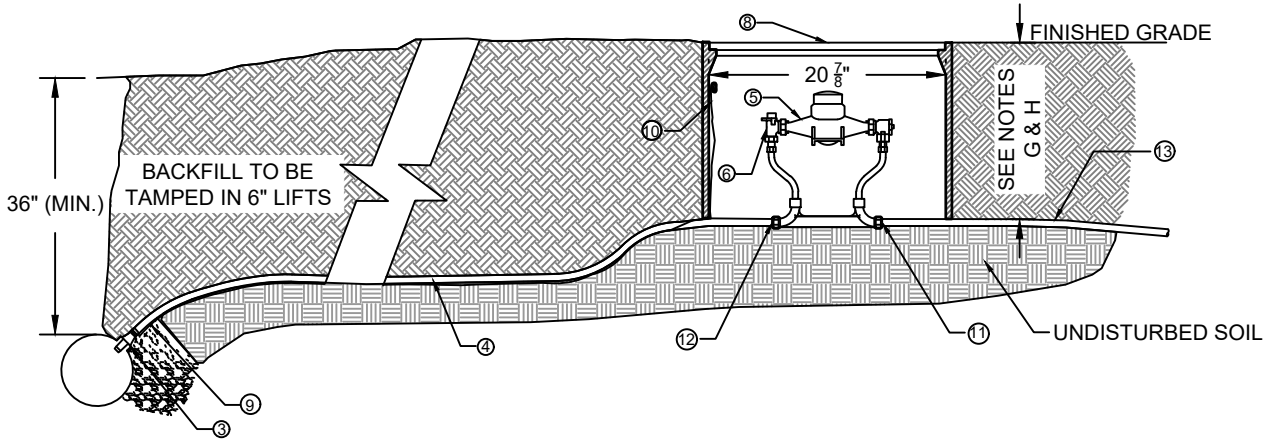
⑫ INLET SIDE OF SETTER MUELLER H14229N

⑬ 18" - 24" BRASS NIPPLE TO CUSTOMER VALVE, PRV OR BACKFLOW DEVICE

⑭ SLEEVE UNDER ROAD, BACK OF CURB TO BACK OF CURB



1'' OR $\frac{3}{4}$'' SERVICE CONNECTION
(LONG SIDE - PLAN VIEW)



NOTE:

A. MINIMUM DISTANCE CENTER TO CENTER ON SERVICES OR TO BELLS OR SPIGOTS SHALL BE 3'-0'' AS MEASURED ALONG THE MAIN.
B. NO TAPS OR SERVICES ALLOWED IN OR UNDER DRIVEWAYS. METER BOXES NOT ALLOWED IN CONCRETE DRIVES OR SIDEWALKS.
C. CENTER SETTER IN METER BOX.
D. SHOWN AS $\frac{3}{4}$'' SERVICE USE 1'' COMPONENTS FOR 1'' DOMESTIC WATER SERVICE.
E. IREDELL WATER CORPORATION MAINTENANCE ENDS AT DUAL PURPOSE NUT OUTLET SIDE OF SETTER
F. LONG SERVICE MUST BE SLEEVED WHEN OPEN CUT-MINIMUM SR 40 PIPE
G. $\frac{3}{4}$ '' PIPE - 14" MIN TO 18" MAX DEPTH (GRADE TO TOP OF PIPE)
H. 1" PIPE - 18" MIN TO 22" MAX DEPTH (GRADE TO TOP OF PIPE)

SERVICE SIZE	PART NAME	PART NUMBER
3 / 4"	METER SETTER	MUELLER N 2404N (5 / 8" X 3 / 4" X 7")
1"	METER SETTER	MUELLER B2404-2A10 (1" X 10")

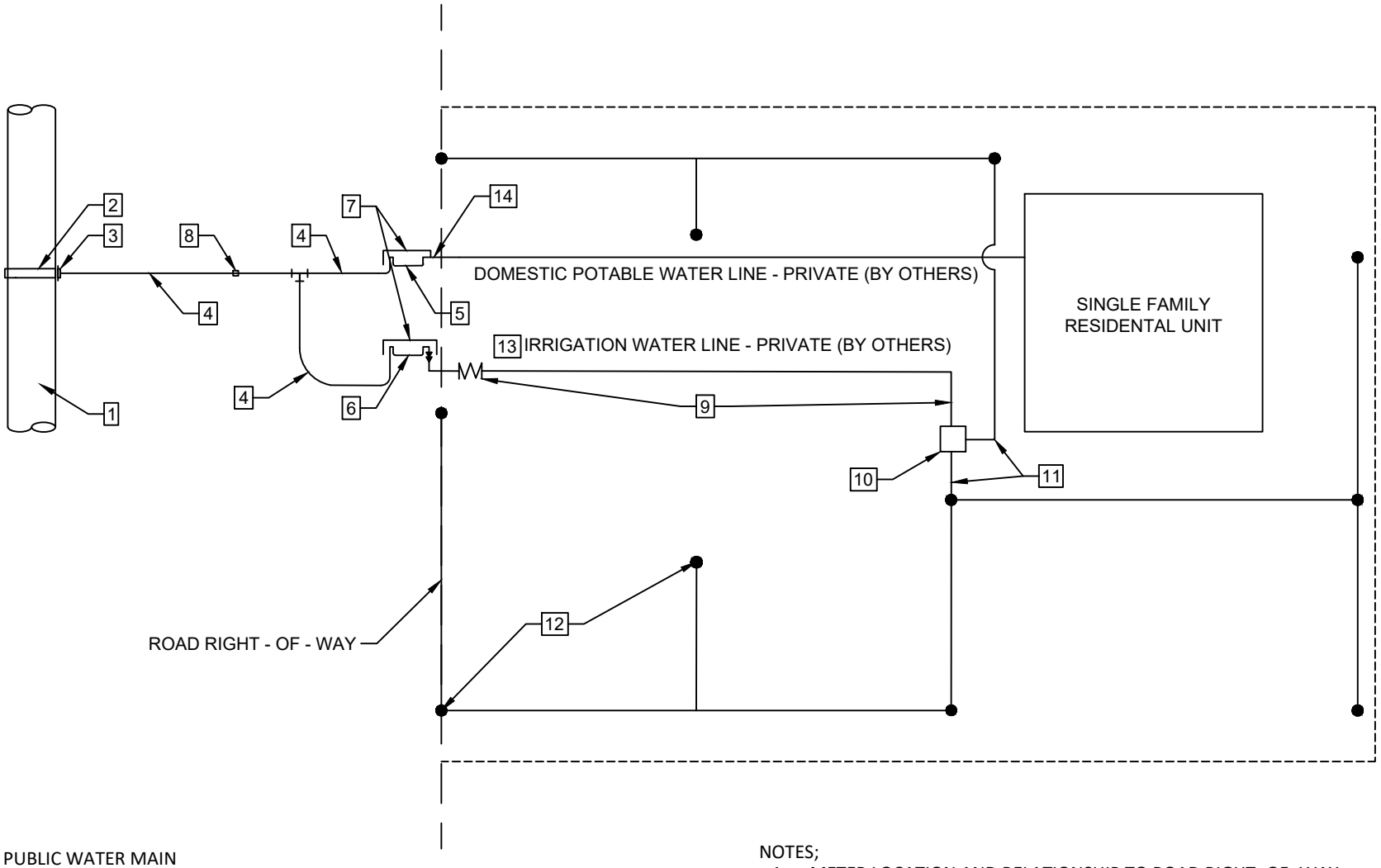
DRAWN BY:	AVT	
DATE:	05/13/2024	
REVISION:	11/22/2024	

W-8

5/8'' X 3/4'' – 1'' DOMESTIC WATER LONG SIDE SERVICE CONNECTION

NOT TO SCALE

IREDELL WATER CORPORATION



1. PUBLIC WATER MAIN
2. SERVICE SADDLE
3. CORPORATION STOP
4. IPS HDPE SERVICE TUBING
5. DOMESTIC METER
6. IRRIGATION METER
7. STD. METER BOX
8. PIPE CRIMPING ON HDPE TUBING (OMIT WITH NEW CONSTRUCTION) W/ FULL CIRCLE REPAIR CLAMP
9. REDUCED PRESSURE PRINCIPLE BACKFLOW ASSEMBLY (BY OTHERS) OR PLACED AT HOUSE
10. IRRIGATION CONTROL SYSTEM
11. IRRIGATION PIPE SYSTEM
12. IRRIGATION SPRINKLER HEAD
13. BRANCHES AND/OR IRRIGATION SPRINKLER HEADS ARE NOT PERMITTED BETWEEN IRRIGATION METER 6 AND BACKFLOW ASSEMBLY 9
14. 18" - 24" BRASS NIPPLE TO PRIVATE CUT-OFF VALVE

NOTES;

1. METER LOCATION AND RELATIONSHIP TO ROAD RIGHT- OF- WAY, CURB, SIDEWALK, AND DRIVEWAYS WILL VARY FROM SITE TO SITE BASED ON EXISTING CONDITIONS.
2. IREDELL WATER CORPORATION MAINTENANCE ENDS AT THE METER ASSEMBLY, AT THE LAST BRASS DUAL PURPOSE NUT.
3. DOMESTIC SERVICE SHALL BE ON THE RUN OF THE TEE AND IRRIGATION SERVICE SHALL BE ON THE BRANCH OF THE TEE AS SHOWN.
4. METER BOXES SHALL BE INSTALLED SIDE BY SIDE, WITH 2' MIN AND 3' MAX CLEARANCE
5. SERVICES SHALL BE ALL HDPE SERVICE TUBING. DO NOT MIX SERVICE TUBING MATERIALS.

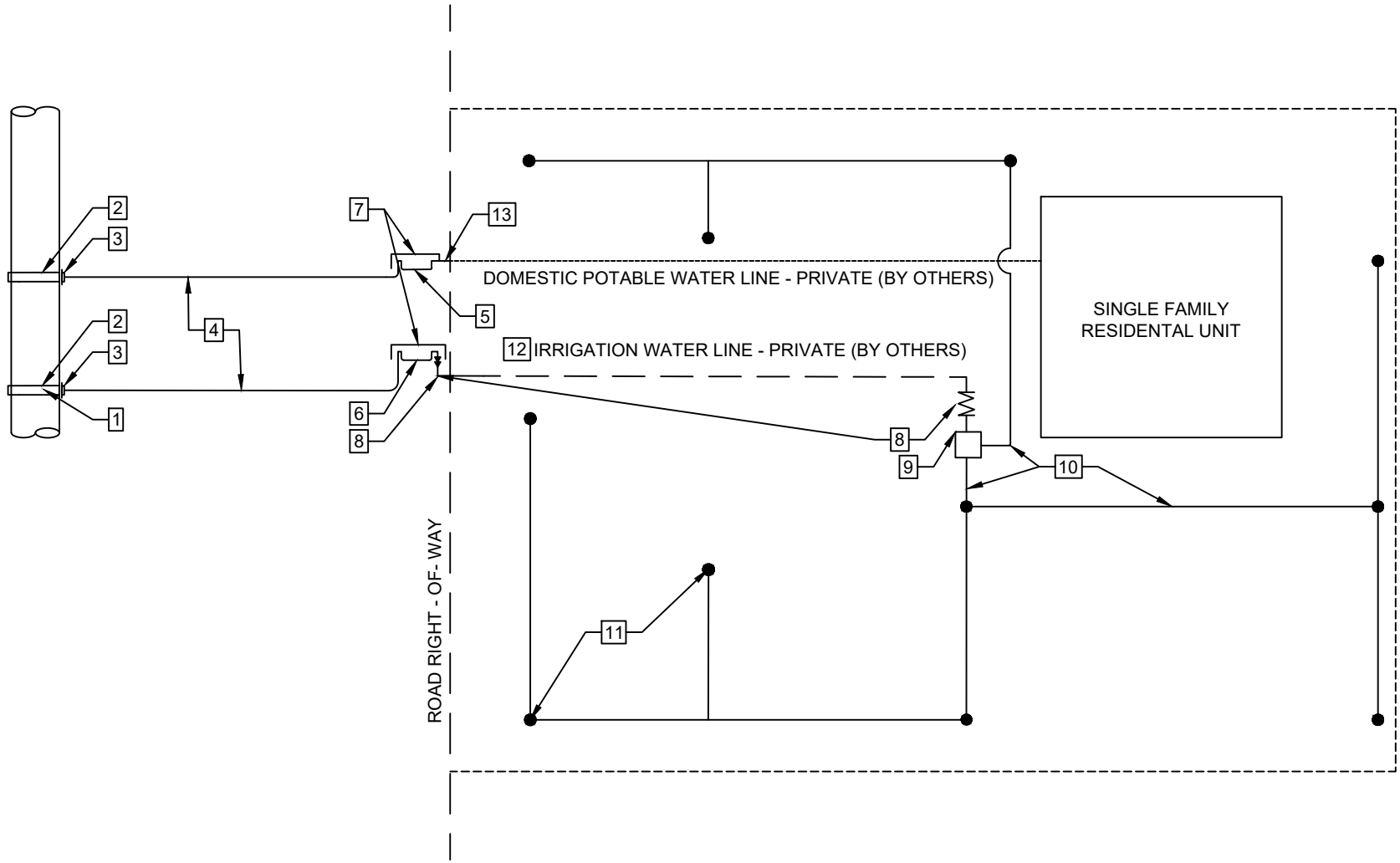
DRAWN BY:	AVT
DATE:	05/13/2024
REVISION:	11/22/2024

W—9

3/4'' OR 1'' DOMESTIC WATER METER SERVICE WITH SPLIT 3/4'' IRRIGATION SERVICE DUAL CHECK METER/BACKFLOW AT HOUSE

NOT TO SCALE

IREDELL WATER CORPORATION



1 PUBLIC WATER MAIN
2 SERVICE SADDLE
3 CORPORATION STOP
4 IPS HDPE SERVICE TUBING
5 METER
6 18" BRASS NIPPLE TO PRIVATE CUT-OFF VALVE
7 STD. METER BOX
8 REDUCED PRESSURE PRINCIPLE BACKFLOW ASSEMBLY (BY OTHERS) OR PLACED AT HOUSE
9 IRRIGATION CONTROL SYSTEM
10 IRRIGATION PIPE SYSTEM
11 IRRIGATION SPRINKLER HEAD
12 BRANCHES AND/OR IRRIGATION SPRINKLER HEADS ARE NOT PERMITTED BETWEEN IRRIGATION METER 6 AND BACKFLOW ASSEMBLY 8
13 18" - 24" BRASS NIPPLE TO PRIVATE CUT-OFF VALVE

NOTES:
1. METER LOCATION AND RELATIONSHIP TO ROAD RIGHT- OF- WAY, CURB, SIDEWALK, AND DRIVEWAYS WILL VARY FROM SITE TO SITE BASED ON EXISTING CONDITIONS.
2. IREDELL WATER CORPORATION MAINTENANCE ENDS AT THE METER ASSEMBLY, AT THE LAST DUAL PURPOSE BRASS FITTING.
3. METER BOXES SHALL BE INSTALLED SIDE BY SIDE, WITH 2' MIN AND 3' MAX CLEARANCE

DRAWN BY: AVT
DATE: 05/13/2024
REVISION:

W-10

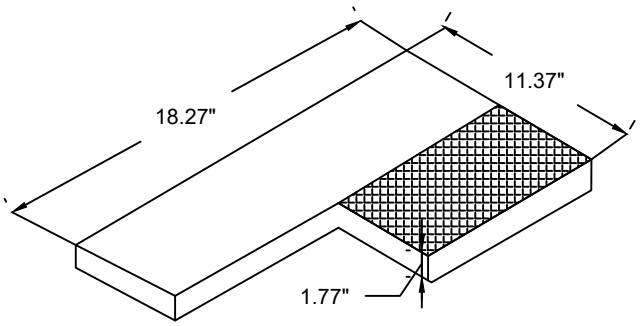
¾" OR 1' DOMESTIC WATER SERVICE WITH DEDICATED ¾" OR 1" IRRIGATION SERVICE WITH DUAL CHECK METER/BACKFLOW AT HOUSE

NOT TO SCALE

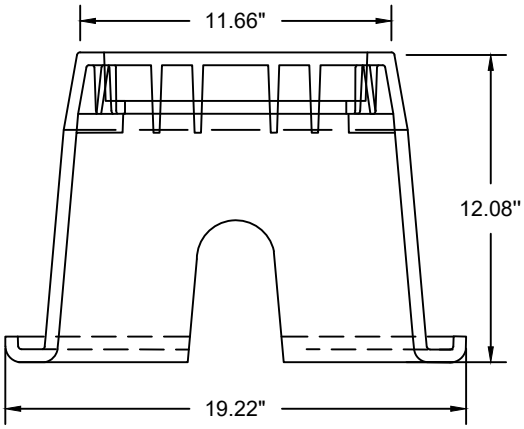
IREDELL WATER CORPORATION

NOTES:

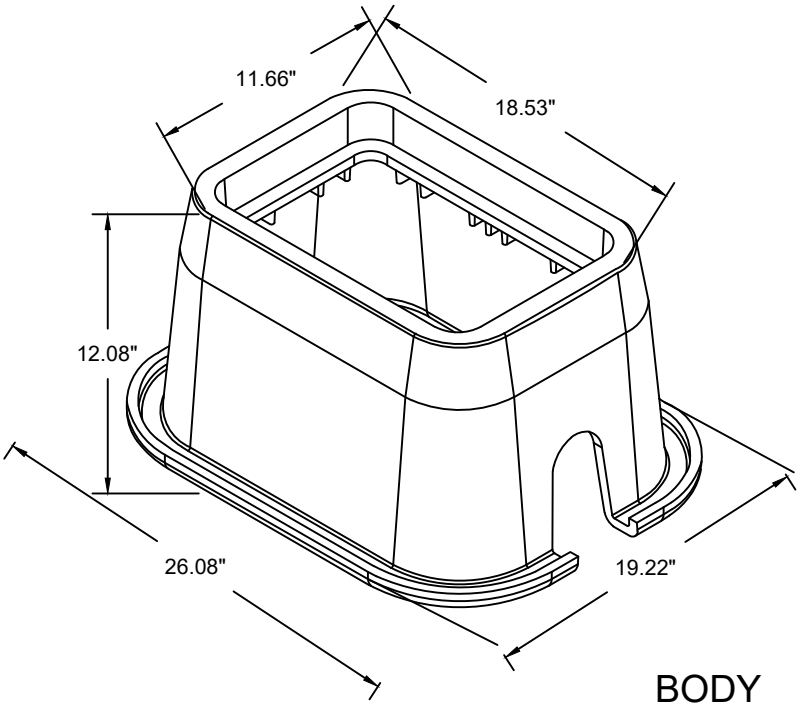
A. FOR USE IN NON-VEHICULAR TRAFFIC SITUATIONS ONLY.
B. WEIGHTS AND DIMENSIONS MAY VARY SLIGHTLY
C. ACTUAL LOAD RATING IS DETERMINED BY THE BOX AND COVER COMBINATION
D. LID & BOX MANUFACTURED BY TRICAST MASONRY SUPPLY ONLY MODEL 1118



SOLID POLYMER LID



SECTION VIEW



BODY

IREDELL WATER CORPORATION

¾" – 1" POLYMER METER BOX AND SOLID LID
TRI CAST 1118

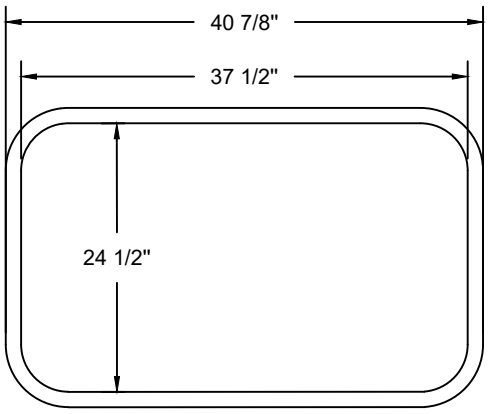
NOT TO SCALE

DRAWN BY:	AVT
DATE:	05/13/2024
REVISION:	11/22/2024

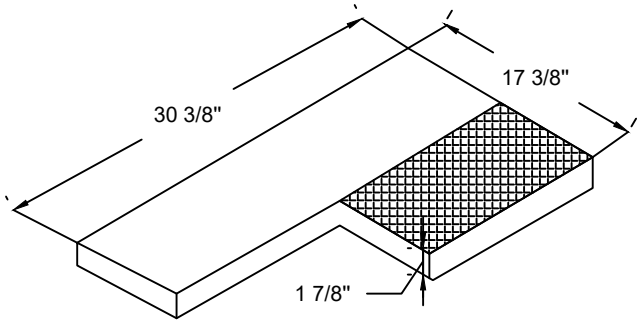
W–11

NOTES:

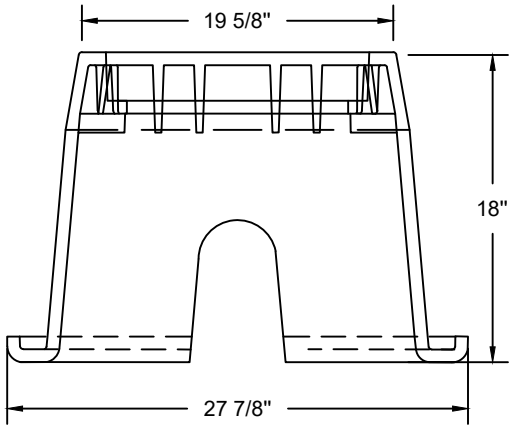
A. FOR USE IN NON-VEHICULAR TRAFFIC SITUATIONS ONLY.
B. WEIGHTS AND DIMENSIONS MAY VARY SLIGHTLY
C. ACTUAL LOAD RATING IS DETERMINED BY THE BOX AND COVER COMBINATION
D. STANDARD FASTENERS TO BE 3/8'' HEX BOLT
E. WEIGHT FOR 18'' DEPTH: 26 LBS
F. CARSON 1730 MODEL 17'' X 30'' OR OTHER EQUAL WITH PRIOR APPROVAL BY IREDELL WATER CORPORATION



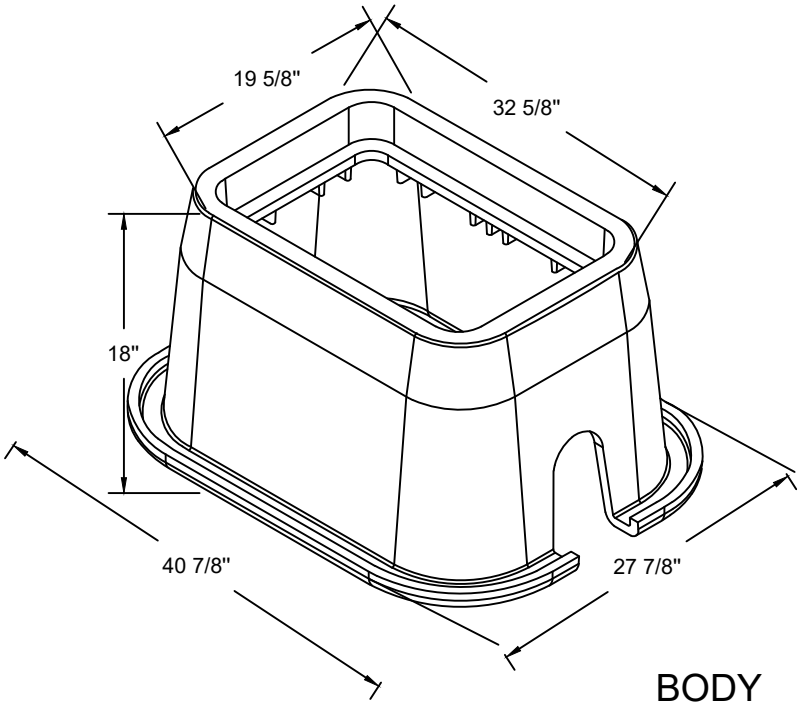
PLAN VIEW
BOTTOM DIMENSIONS SHOWN



SOLID POLYMER LID



SECTION VIEW



BODY

IREDELL WATER CORPORATION

POLYMER METER BOX AND LID
FOR 2'' WATER SERVICE

NOT TO SCALE

DRAWN BY:	AVT
DATE:	05/13/2024
REVISION:	11/22/2024

W–12

NO. DESCRIPTION

① WATER MAIN

② 2" BALL CORPORATION STOP MUELLER B25028N CORP STOP- MIP THREAD x CTS COMPRESSION

③ REHAU MUNICIPEX CTS 2"

④ 2" METER BY IREDELL WATER CORPORATION

⑤ MUELLER 105B2423-2N METER SETTER

⑥ METER BOX CARSON 1730-18 WITH SOLID POLYMER LID

⑦ AWG #14 GAUGE COPPER TRACER WIRE (THWN) - WITH BLUE INSULATION - TERMINATE IN METER BOX WITH 24" EXCESS WIRE (COILED)

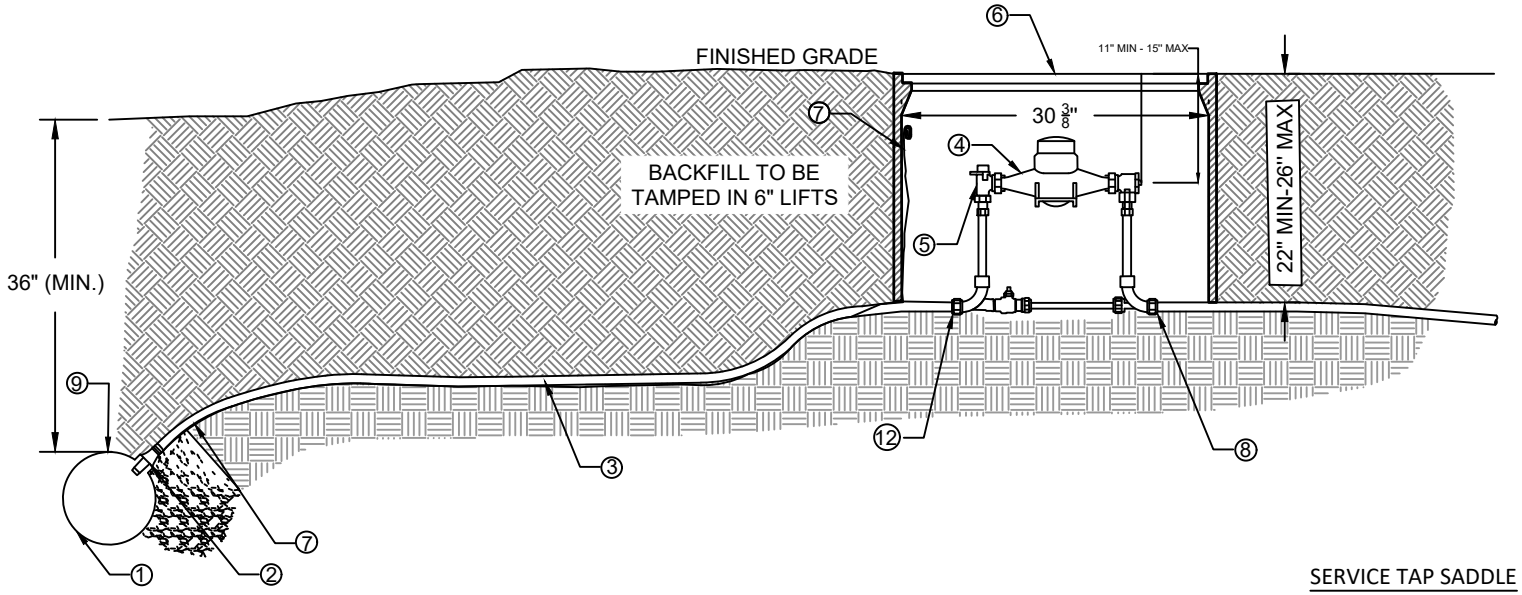
⑧ 24" TO 36" BRASS NIPPLE OR TYPE K OR L COPPER TO RPZ BACKFLOW ASSEMBLY

⑨ DOUBLE STRAP SADDLE

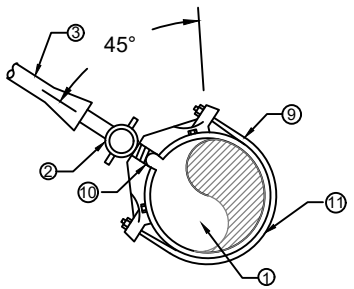
⑩ MUELLER DR2S SERVICE SADDLE FIP THREAD

⑪ STAINLESS STEEL STRAP & STUDS

⑫ 2" 110 CTS X MIP MUELLER



SERVICE TAP SADDLE



NOTE:
A. MINIMUM DISTANCE CENTER TO CENTER ON SERVICES OR TO BELLS OR SPIGOTS SHALL BE 3'-0" AS MEASURED ALONG THE MAIN.
B. SHOWN AS 2" SERVICE
C. NO TAPS OR METERS ALLOWED IN DRIVEWAYS. METERS ARE NOT TO BE PLACED IN CONCRETE, DRIVEWAYS, OR SIDEWALKS
D. METER BOX TO BE LOCATED AT BACK OF R/W OR UTILITY EASEMENT IF PROVIDED
E. USE STAINLESS STEEL INSERTS AT BOTH COMPRESSION CONNECTIONS

NOTE:
SINGLE SST STRAP SADDLE FOR WATER MAINS 1" & LESS
DOUBLE SST STRAP SADDLE FOR WATER MAINS LARGER THAN 1"

DRAWN BY:	JGA
DATE:	05/20/2022
REVISION:	11/22/2024

W-13

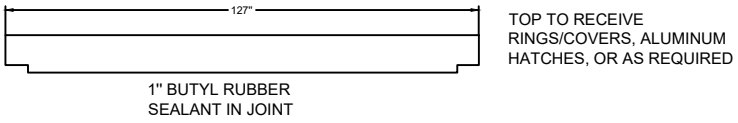
2" WATER SERVICE CONNECTION

NOT TO SCALE

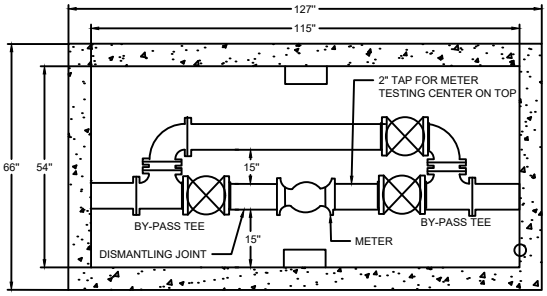
IREDELL WATER CORPORATION

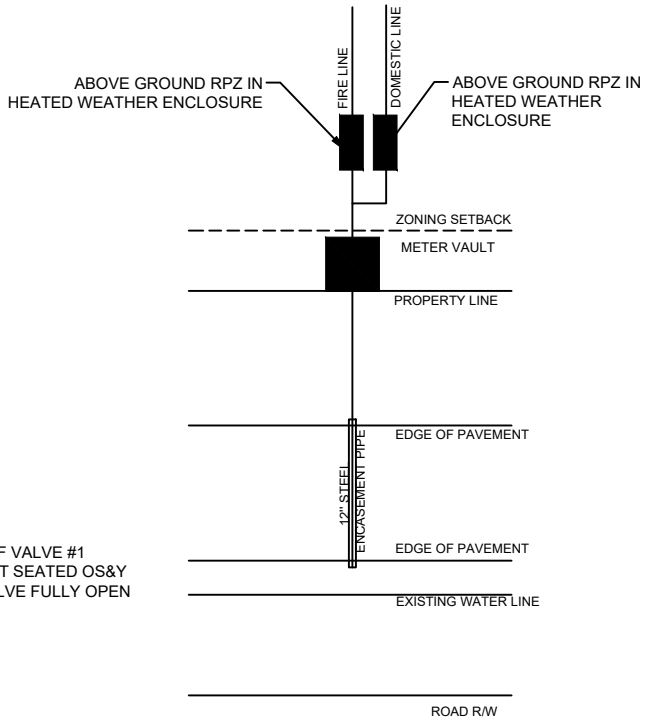
GENERAL NOTES:

1. PIPING AND FITTINGS SHALL BE DUCTILE IRON (AWWA C151) CLASS 350 AND SHALL BE RESTRAINED JOINT OR FLANGED AS INDICATED ON THE DETAIL. RESTRAINED JOINTS SHALL BE MEGA-LUG RESTRAINED OR APPROVED EQUAL.
2. ALL VAULTS SHALL BE 3800 PSI CONCRETE AND CAPABLE OF WITHSTANDING 150 PSF LOADING IN NON TRAFFIC AREAS.
3. ACCESS HATCHES SHALL BE ALUMINUM 150 PSF WITH LOCKABLE COVER DEVICE. MANUFACTURER SHALL BE BILCO, HALIDAY, OR APPROVED EQUAL.
4. INSTALL VAULT AT EDGE OF RIGHT OF WAY. DO NOT PLACE IN PAVEMENT.
5. PIPING TO BE A MINIMUM OF 18'' OFF OF FLOOR
6. DEVELOPER MUST CONTACT IREDELL WATER CORPORATION TO PAY FEES AND APPROVED MATERIAL AND METER TYPE PRIOR TO SCHEDULING CONTRACTOR TO TAP MAIN AND INSTALL VAULT AND METER
7. BYPASS PIPE EQUAL TO METER SIZE.
8. LAYING LENGTH BETWEEN VALVES SHALL BE 45'' TO ALLOW FOR DISMANTLING JOINT AND TESTING PORT
9. METER VAULT TO BE INSTALLED SLIGHTLY ABOVE GRADE
10. CONTACT IREDELL WATER FOR CURRENT METER MANUFACTURER AND MODEL
11. ALL VALVES SHOULD BE RESILIENT SEAT OS&Y GATE VALVES



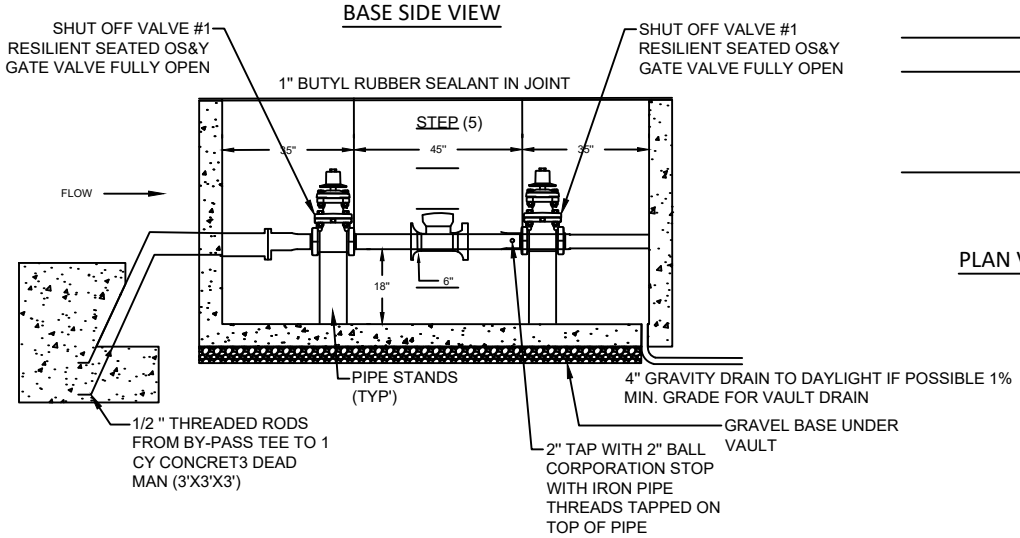
PLAN VIEW





PLAN VIEW SCHEMATIC

BASE SIDE VIEW



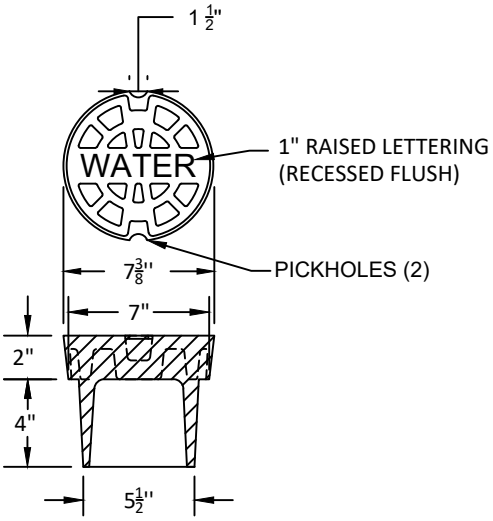
IREDELL WATER CORPORATION

WATER METER & VAULT 3'' OR LARGER

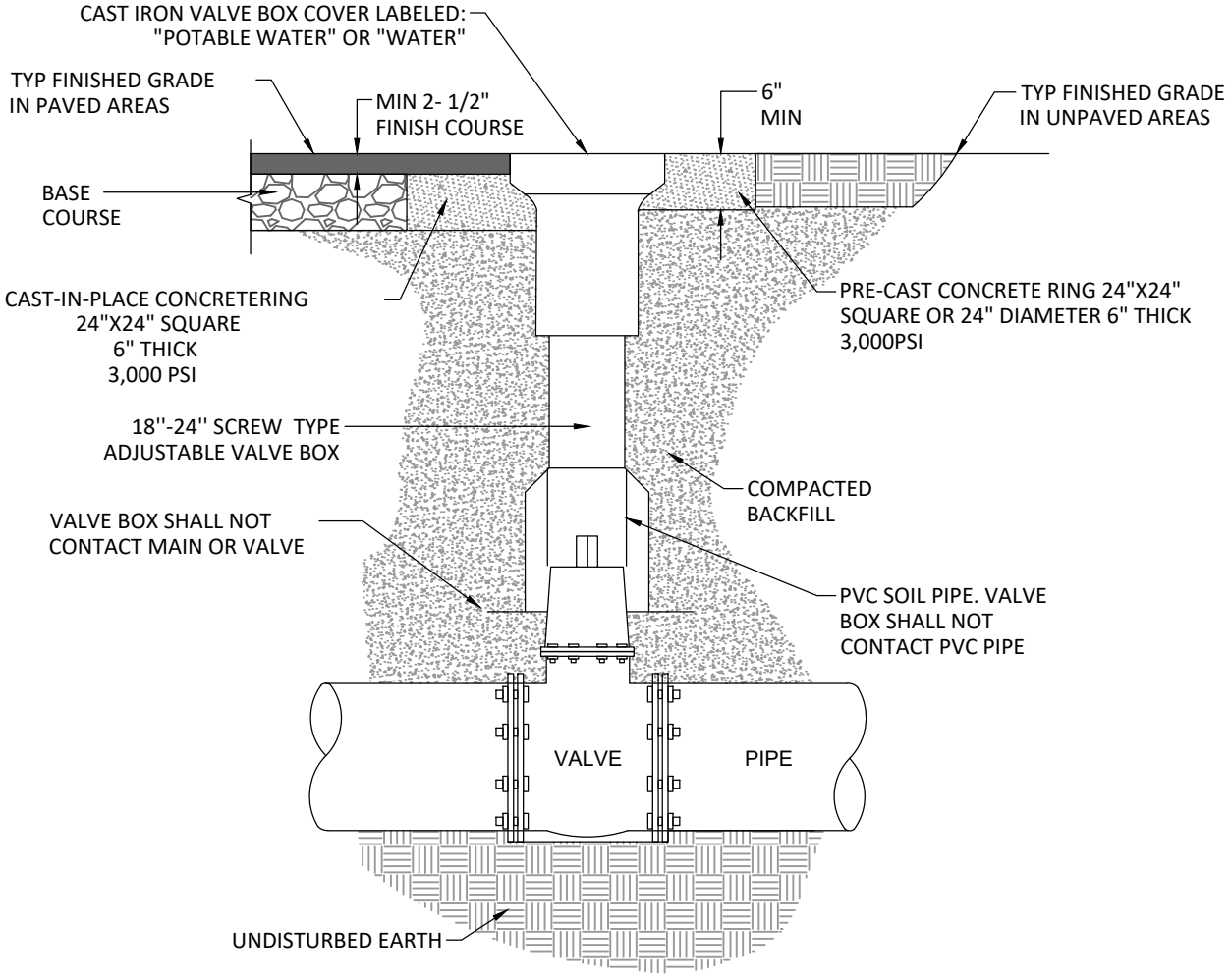
NOT TO SCALE

DRAWN BY:	AVT
DATE:	05/13/2024
REVISION:	11/22/2024

W–14



TOP - VIEW



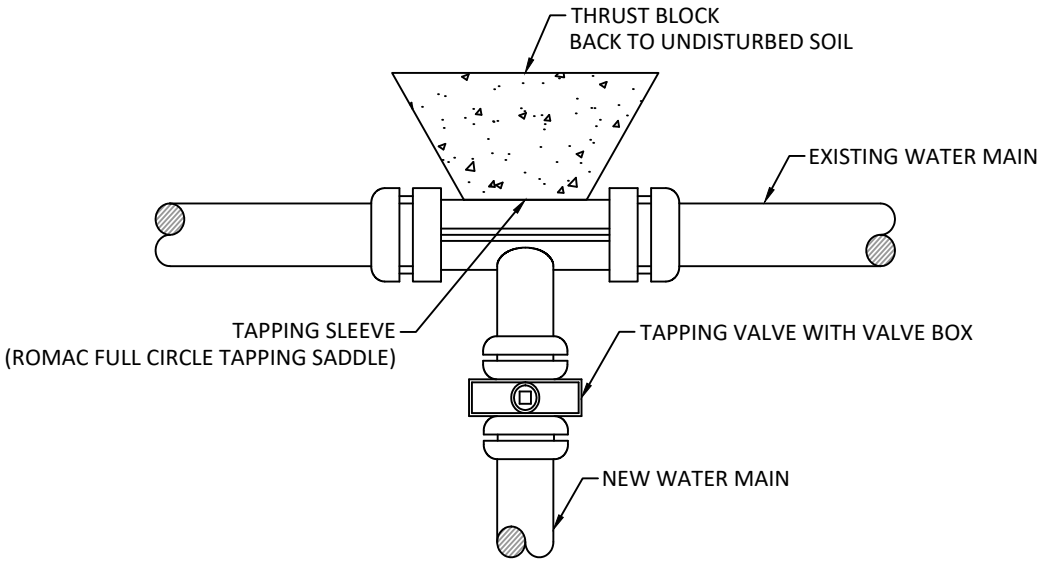
IREDELL WATER CORPORATION

VALVE & VALVE BOX

NOT TO SCALE

DRAWN BY:	JGA
DATE:	05/20/2022
REVISION:	11/22/2024

W–15A



NOTE:

1. TAPPING SLEEVE SHALL BE STAINLESS STEEL ONLY AND MANUFACTURED BY ROMAC INDUSTRIES STAINLESS STEEL OR STAINLESS STEEL III WITH DUCTILE IRON FLANGE

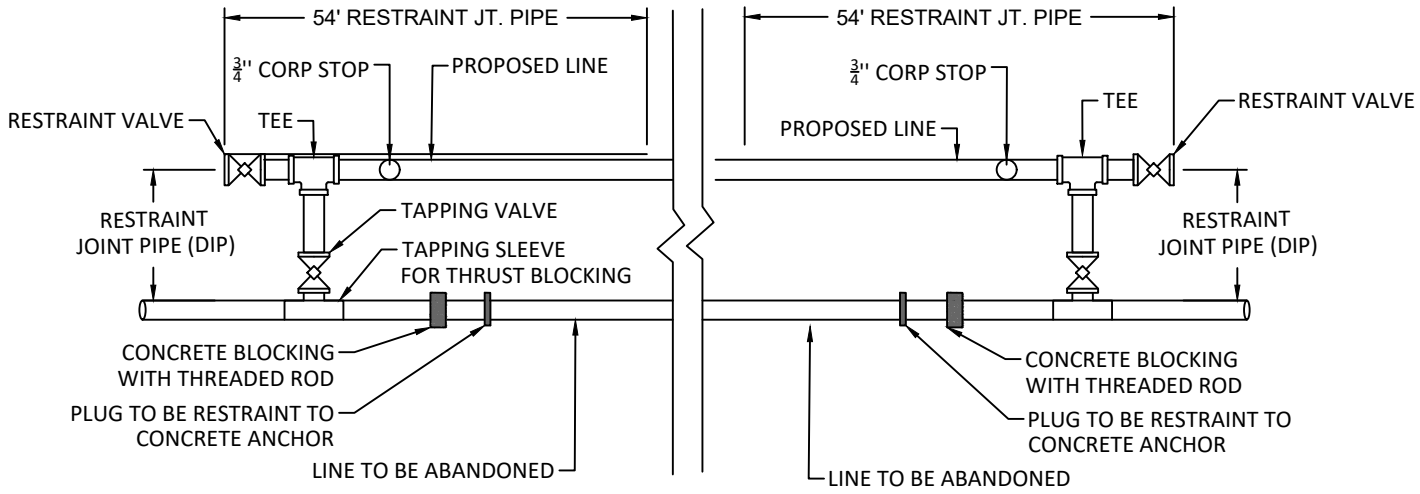
IREDELL WATER CORPORATION

TAPPING SLEEVE & VALVE ASSEMBLY

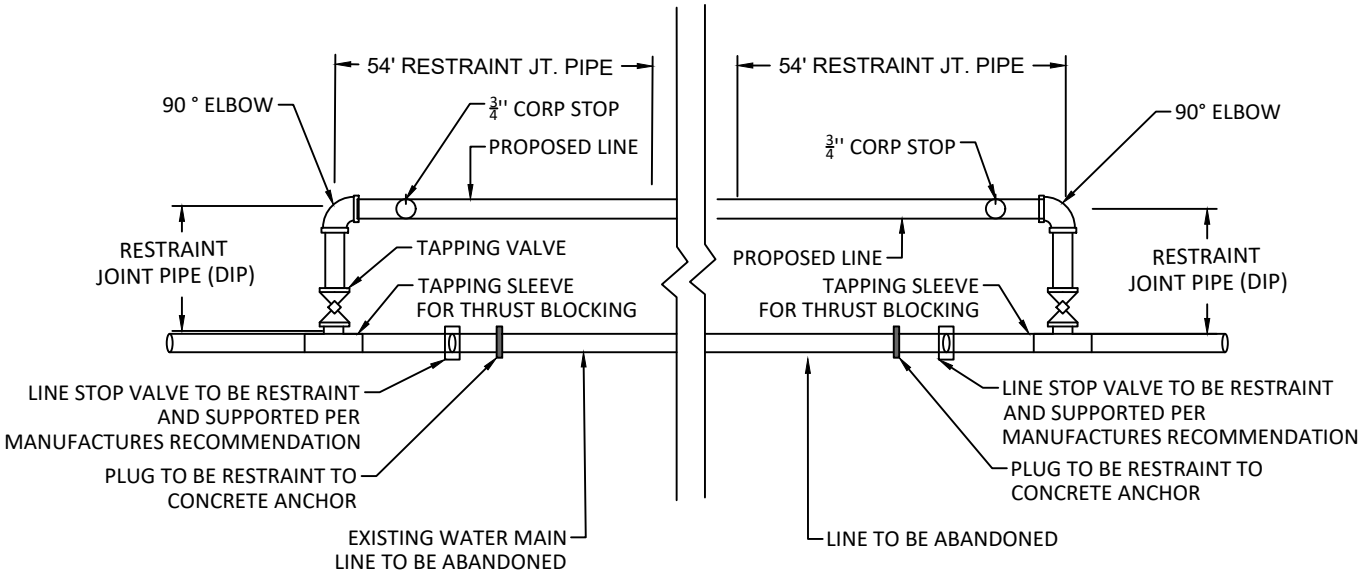
NOT TO SCALE

DRAWN BY:	JGA
DATE:	05/20/2022
REVISION:	11/22/2024

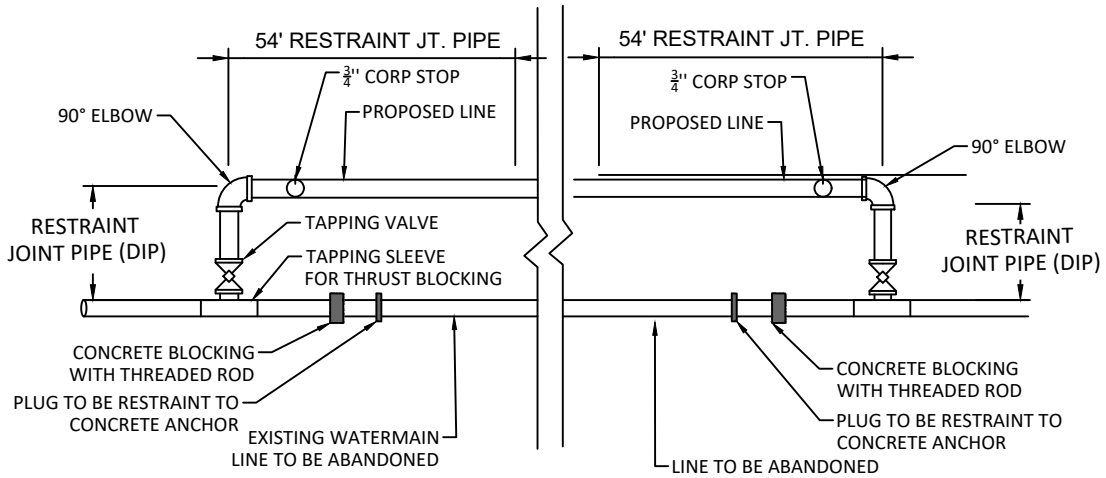
W-15B



WATERMAIN RELOCATION (WHERE NEW MAIN IS LARGER THAN EXISTING MAIN)



RELOCATION FOR LARGE WATERMAINS (6" OR GREATER)



RELOCATION FOR SMALL WATERMAINS (LESS THAN 6")

IREDELL WATER CORPORATION

WATERMAIN RELOCATION

NOT TO SCALE

DRAWN BY:	AVT
DATE:	05/13/2024
REVISION:	11/22/2024

W–16A

NO. DESCRIPTION

1. TAPPING SLEEVE WITH CONCRETE THRUST BLOCKING (REQUIRED) (A) SEE SPECIFICATIONS FOR APPROVED MODELS, (B) SIZE ON SIZE TAPPING SLEEVES SHALL BE ROMAC INDUSTRIES SST OR SST III W/DI FLANGE ONLY.
2. CUT-IN DIP TEE WITH PRIOR APPROVAL FROM IREDELL WATER CORPORATION
3. D.I.P. SHORT L 18''
4. R.M.J. DUCTILE IRON 90° BEND - ROTATE DOWN, AS APPROVED
5. DUCTILE IRON PIPE - RESTRAINED
6. R.M.J. DUCTILE IRON 90° BEND - ROTATE UP, AS APPROVED, CONCRETE THRUST BLOCKING IS REQUIRED. SEE NOTE IN CHART BELOW.
7. DUCTILE IRON PIPE - RESTRAINED - SEE CHART A
8. STEEL CASING - SEE CHART B
9. EXISTING WATER MAIN
10. EXISTING INFRASTRUCTURE THAT PREVENTS FRONT SIDE TAP - BACKSIDE TAP WILL BE PERMITTED ONLY WHERE EXISTING INFRASTRUCTURES PREVENTS FRONT SIDE TAP, AND REQUIRES APPROVAL OF THE ENGINEER.
11. STANDARD VALVE BOX ASSEMBLY
12. VALVE EXTENSION (WHEN OPERATING NUT IS GREATER THAN 4.5' DEEP)

CHART A - RESTRAINED LENGTH REQUIREMENTS

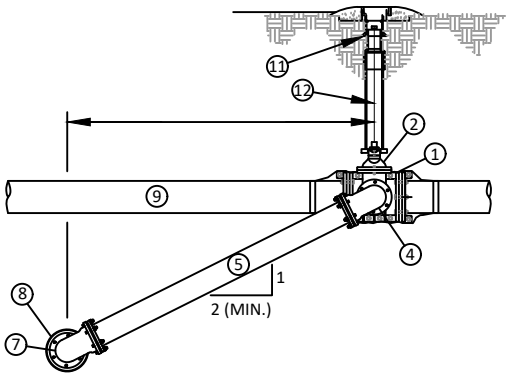
PIPE DIA. (INCHES)	TOTAL RESTRAINED LENGTH - R.L. - (FT)
3"	64' + CASING LENGTH (C.L.)
4"	77' + CASING LENGTH (C.L.)
6"	109' + CASING LENGTH (C.L.)
8"	140' + CASING LENGTH (C.L.)
10"	169' + CASING LENGTH (C.L.)
12"	196' + CASING LENGTH (C.L.)
16"	249' + CASING LENGTH (C.L.)

CHART B - ROADWAY CASING REQUIREMENTS

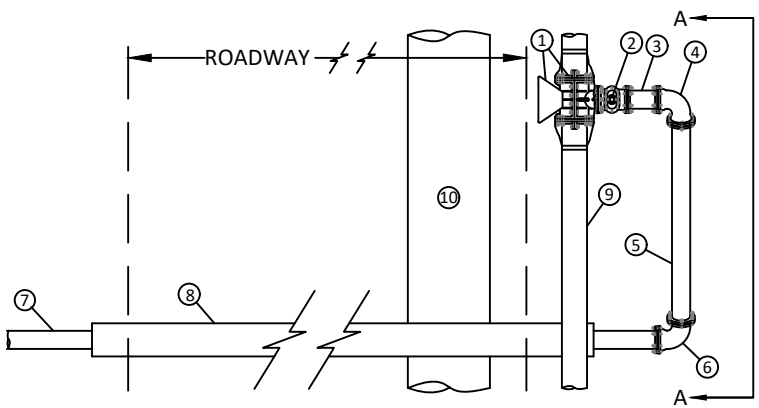
PIPE DIA. (INCHES)	CASING MIN. DIAMETER (INCHES)	CASING WALL THICKNESS - MIN. (INCHES)
3"	8"	0.250"
4"	8"	0.250"
6"	12.75"	0.250"
8"	16"	0.250"
10"	18"	0.250"
12"	20"	0.250"
16"	24"	0.250"

CONCRETE THRUST BLOCK (WRAP BEND PER 2) REQUIRED AT BOTTOM BEND 97) IF REQUIRED RESTRAINED LENGTH (R.L.) CAN NOT BE COMPLETELY INSTALLED

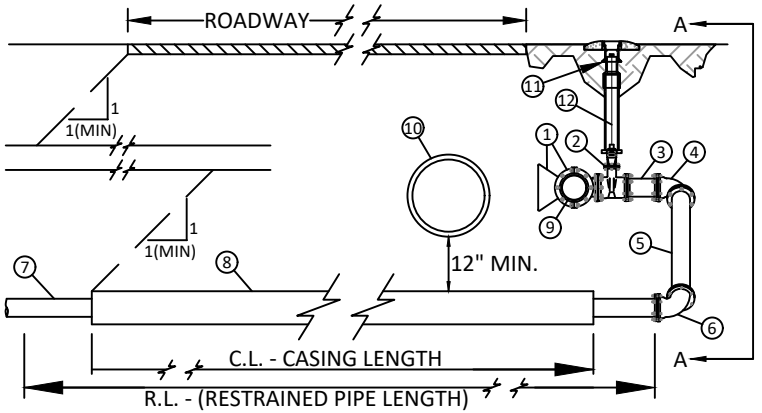
LARGER DIAMETER CASING MAY BE REQUIRED DUE TO LENGTH OF CROSSINGS AND RESTRAINED JOINT DIMENSIONS. SEE PLANS AND SPECIFICATIONS



A-A SECTION



PLAN



PROFILE

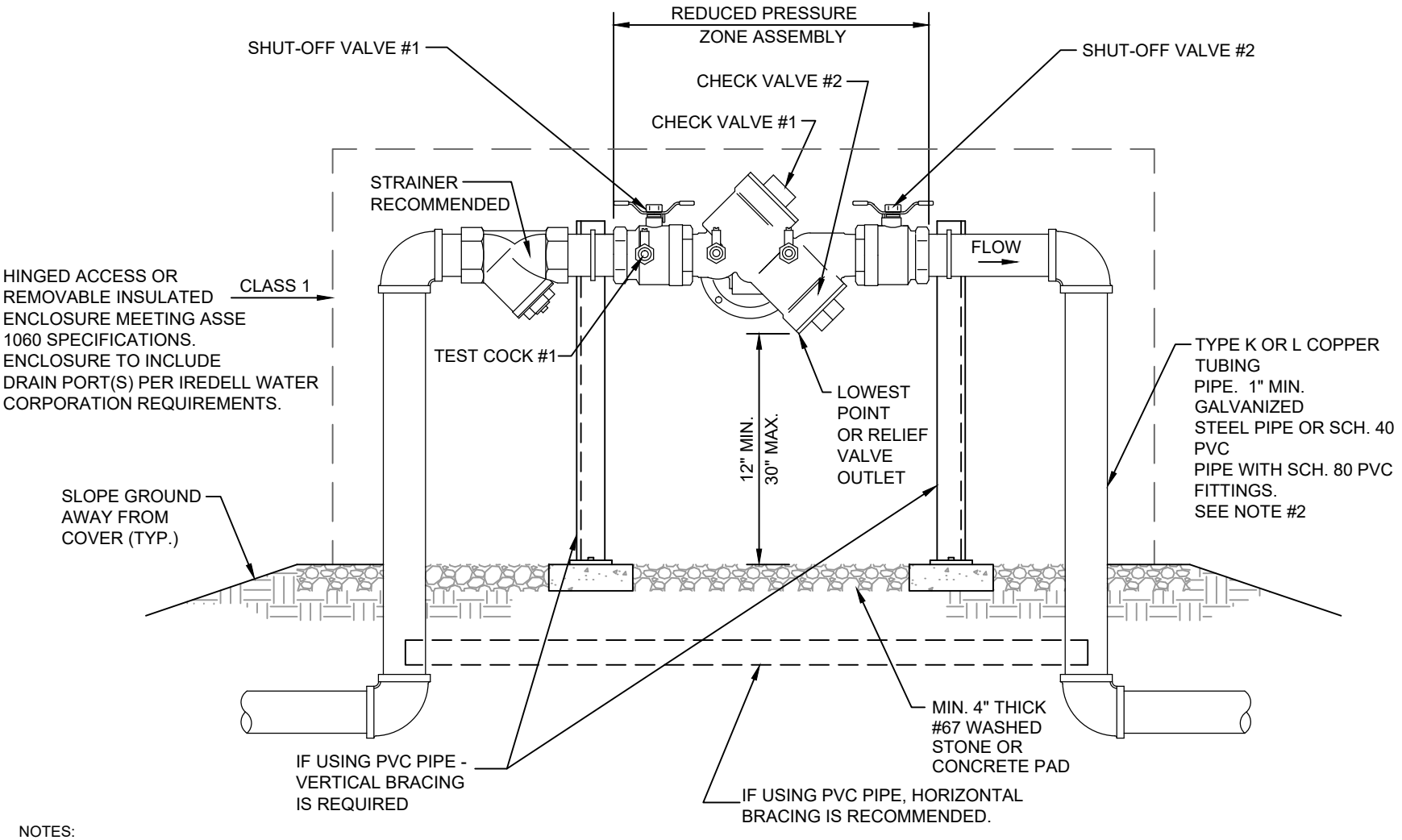
DRAWN BY:	AVT
DATE:	05/13/2024
REVISION:	11/22/2024

W-16B

BACKSIDE TAP 16'' AND SMALLER MAINS

NOT TO SCALE

IREDELL WATER CORPORATION



NOTES:

1. BACKFLOW PREVENTION ASSEMBLIES (BPA's) SHALL CONFORM TO ASSE & USC STANDARDS SPECIFICATIONS. SHUT-OFF VALVES ARE SPECIFIC TO EACH APPROVED BPA AND NO SUBSTITUTIONS OF SHUT-OFF VALVES ARE PERMITTED. REFER TO IREDELL WATER CORPORATION APPROVED LIST OF BPA's.
2. PIPE MATERIAL AND FITTINGS SHALL BE HARD COPPER OR SCHEDULE 80 OR AS RECOMMENDED BY MANUFACTURER. IF USING PVC PIPE / FITTINGS, VERTICAL SUPPORT IS REQUIRED AND HORIZONTAL BRACING IS RECOMMENDED
3. INSULATED ENCLOSURE SHALL BE ASE CLASS 1 INSULATED ENCLOSURE - HEATED INSULATED ENCLOSURE IS RECOMMENDED. NO INSULATION SHALL BE WRAPPED AROUND BPA.
4. ALL LOCATIONS FOR BPA'S REQUIRE IREDELL WATER CORPORATION APPROVAL AND MUST BE OUTSIDE OF ZONING SET-BACK DIRECTLY BEHIND METER.
5. THERE SHALL BE NO TAPS, PIPING BRANCHES, UNAPPROVED BYPASS PIPING, HYDRANTS, FIRE DEPT. CONNECTION POINTS, OR OTHER WATER-USING APPURTENANCES CONNECTED TO THE SUPPLY LINE BETWEEN ANY WATER METER AND ITS IREDELL WATER CORPORATION - REQUIRED BACKFLOW PREVENTER.
6. EACH IREDELL WATER CORPORATION -REQUIRED BPA IS REQUIRED TO BE TESTED BY AN APPROVED CERTIFIED TESTER PRIOR TO PLACING THE WATER SYSTEM IN SERVICE. TEST RESULTS SHALL BE SUBMITTED TO IREDELL WATER CORPORATION WITHIN 30 DAYS AND TESTED ANNUALLY THEREAFTER SUBMITTING RESULTS TO IREDELL WATER CORPORATION.
7. ALL INSTALLATIONS INTENDED FOR ADDRESSING IREDELL WATER CORPORATION REQUIREMENTS, REQUIRE PRIOR APPROVAL FROM THE APPROPRIATE IREDELL WATER CORPORATION BACKFLOW INSPECTOR.
8. CONSUMER IS RESPONSIBLE FOR PROTECTING BACKFLOW ASSEMBLY FROM FREEZING

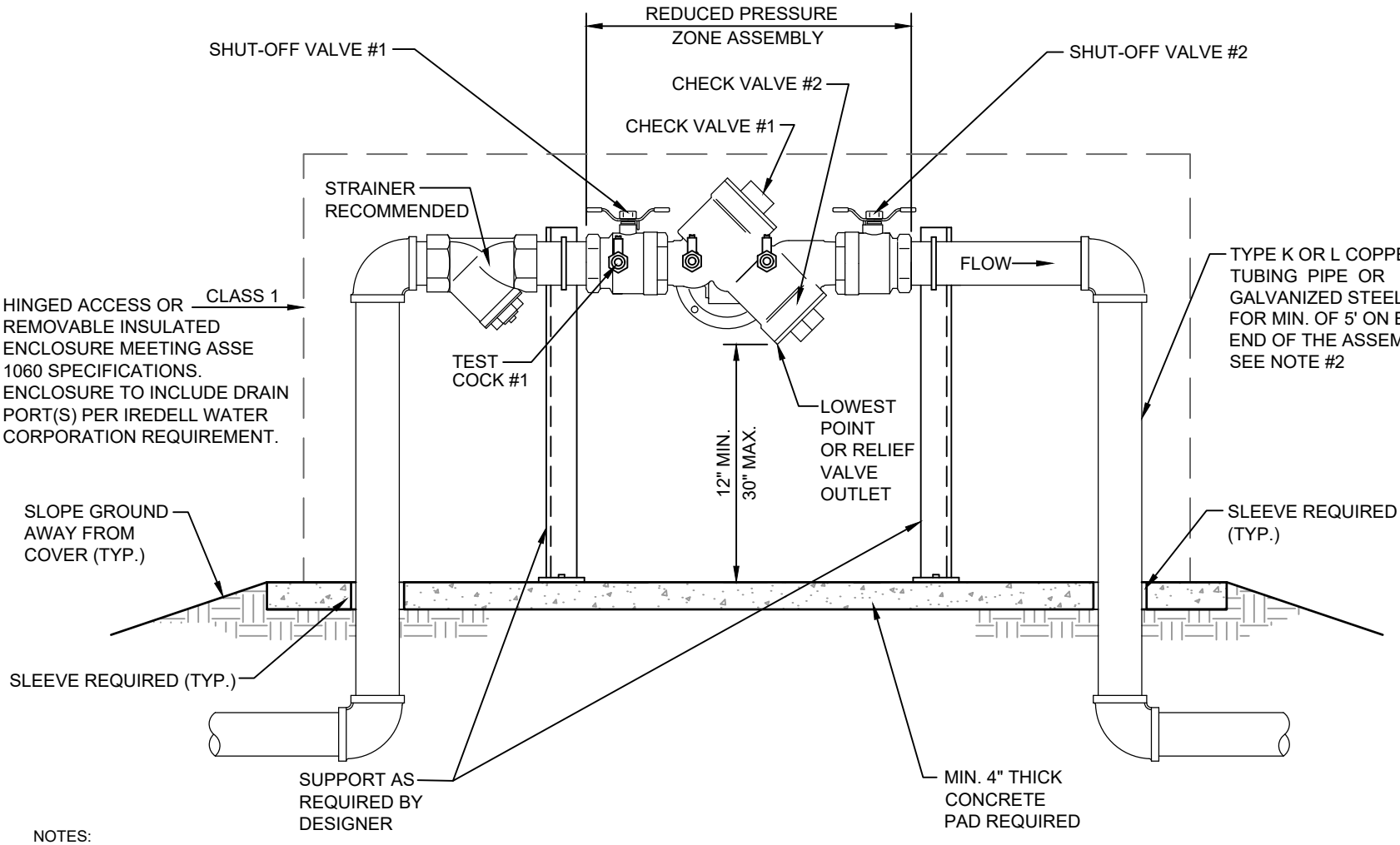
DRAWN BY:	JGA
DATE:	06/01/2022
REVISION:	11/22/2024

W-17A

REDUCED PRESSURE ZONE ASSEMBLY (RPZ) 3/4" – 1" ABOVE GROUND

NOT TO SCALE

IREDELL WATER CORPORATION



NOTES:

1. BACKFLOW PREVENTION ASSEMBLIES (BPA's) SHALL CONFORM TO ASSE & USC STANDARDS SPECIFICATIONS. SHUT-OFF VALVES ARE SPECIFIC TO EACH APPROVED BPA AND NO SUBSTITUTIONS OF SHUT-OFF VALVES ARE PERMITTED. REFER TO IREDELL WATER CORPORATION APPROVED LIST OF BPA's.
2. PIPE MATERIAL AND FITTINGS SHALL BE HARD COPPER OR SCHEDULE 80 OR AS RECOMMENDED BY MANUFACTURER. IF USING PVC PIPE / FITTINGS, VERTICAL SUPPORT IS REQUIRED AND HORIZONTAL BRACING IS RECOMMENDED
3. INSULATED ENCLOSURE SHALL BE ASE CLASS 1 INSULATED ENCLOSURE - HEATED INSULATED ENCLOSURE IS RECOMMENDED. NO INSULATION SHALL BE WRAPPED AROUND BPA.
4. ALL LOCATIONS FOR BPA'S REQUIRE IREDELL WATER CORPORATION APPROVAL AND MUST BE OUTSIDE OF ZONING SET-BACK DIRECTLY BEHIND METER.
5. THERE SHALL BE NO TAPS, PIPING BRANCHES, UNAPPROVED BYPASS PIPING, HYDRANTS, FIRE DEPT. CONNECTION POINTS, OR OTHER WATER-USING APPURTENANCES CONNECTED TO THE SUPPLY LINE BETWEEN ANY WATER METER AND ITS IREDELL WATER CORPORATION - REQUIRED BACKFLOW PREVENTER.
6. EACH IREDELL WATER CORPORATION -REQUIRED BPA IS REQUIRED TO BE TESTED BY AN APPROVED CERTIFIED TESTER PRIOR TO PLACING THE WATER SYSTEM IN SERVICE. TEST RESULTS SHALL BE SUBMITTED TO IREDELL WATER CORPORATION WITHIN 30 DAYS AND TESTED ANNUALLY THEREAFTER SUBMITTING RESULTS TO IREDELL WATER CORPORATION.
7. ALL INSTALLATIONS INTENDED FOR ADDRESSING IREDELL WATER CORPORATION REQUIREMENTS, REQUIRE PRIOR APPROVAL FROM THE APPROPRIATE IREDELL WATER CORPORATION BACKFLOW INSPECTOR.
8. CONSUMER IS RESPONSIBLE FOR PROTECTING BACKFLOW ASSEMBLY FROM FREEZING

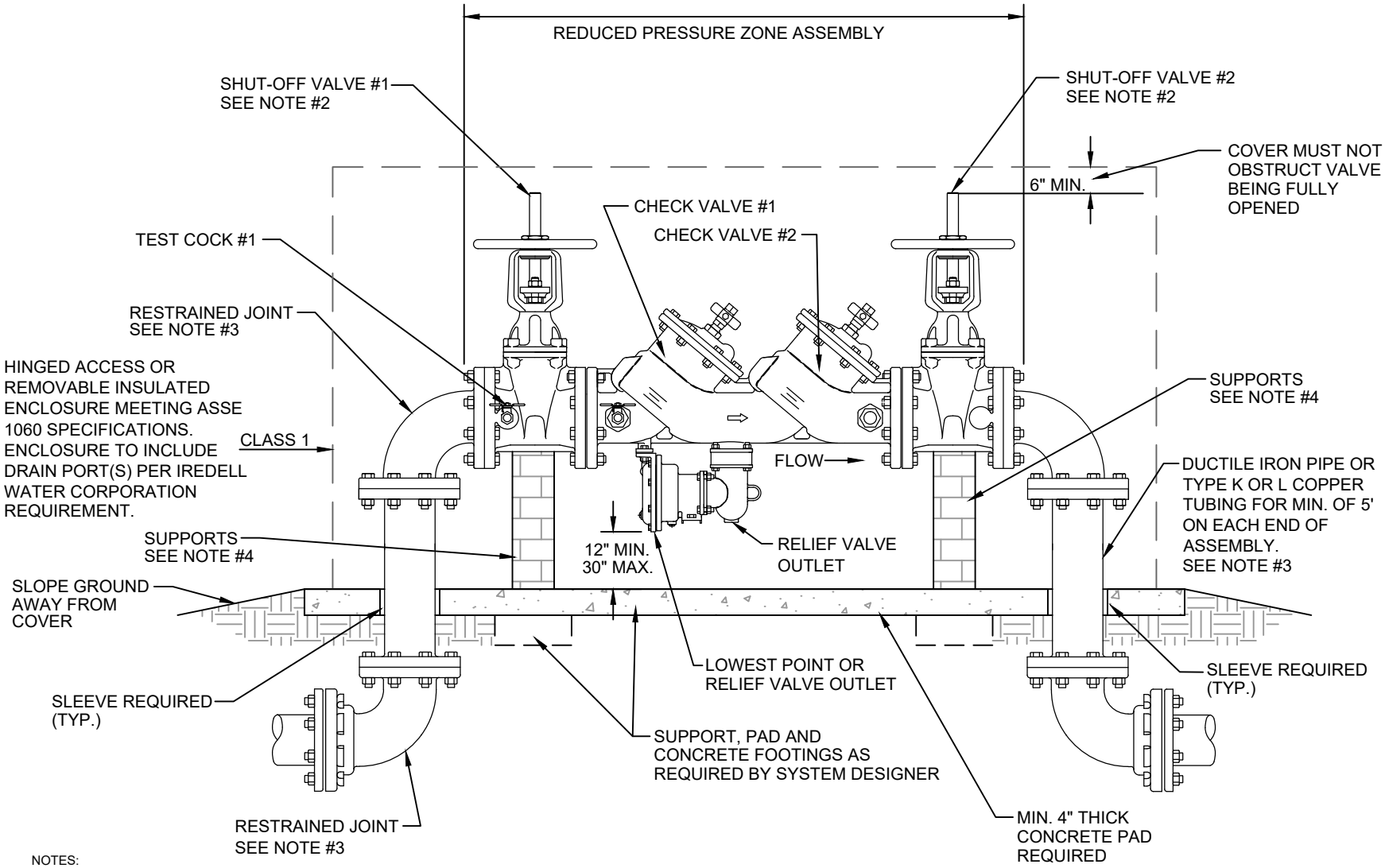
DRAWN BY:	JGA
DATE:	06/01/2022
REVISION:	11/22/2024

W-17B

REDUCED PRESSURE ZONE ASSEMBLY (RPZ) 1 1/2" – 2" ABOVE GROUND

NOT TO SCALE

IREDELL WATER CORPORATION



NOTES:

1. BACKFLOW PREVENTION ASSEMBLIES (BPA's) SHALL CONFORM TO ASSE & USC STANDARDS. SHUT-OFF VALVES ARE SPECIFIC TO EACH APPROVED BPA AND NO SUBSTITUTIONS OF SHUT-OFF VALVES ARE PERMITTED.
2. FIRE LINE SERVICES SHALL HAVE OUTSIDE STEM AND YOKE (OS & Y) HANDWHEEL OPERATORS OR BUTTERFLY VALVES, AND LISTED ON APPROVED LIST AS FIRE APPROVED. IF SERVING FIRE SPRINKLERS, TAMPER SWITCHES ARE REQUIRED.
3. PIPE MATERIAL AND FITTINGS SHALL BE DUCTILE IRON PIPE. ALL JOINTS SHALL BE RESTRAINED WITH MEGALUG RESTRAINTS OR APPROVED EQUAL.
4. SUPPORT OF ASSEMBLY SHALL BE DESIGNED BY OWNER, 8" - 12" SHALL BE SUPPORTED AT EACH VALVE AND SHALL NOT BLOCK RELIEF VALVE ON DRAIN PORT.
5. INSULATED ENCLOSURE SHALL BE ASSE CLASS 1 HEATED INSULATED ENCLOSURE ARE REQUIRED FOR FIRE LINE SERVICES. NO INSULATION SHALL BE WRAPPED AROUND BPA.
6. ALL LOCATIONS FOR BPA'S REQUIRE IREDELL WATER APPROVAL AND MUST BE OUTSIDE OF ZONING SET-BACK DIRECTLY BEHIND METER.
7. THERE SHALL BE NO TAPS, PIPING BRANCHES, UNAPPROVED BYPASS PIPING, HYDRANTS, FIRE DEPT. CONNECTION POINTS, OR OTHER WATER - USING APPURTENANCES CONNECTED TO THE SUPPLY LINE BETWEEN ANY WATER METER AND ITS IREDELL WATER CORPORATION - REQUIRED BACKFLOW PREVENTER.
8. EACH BACKFLOW ASSEMBLY - REQUIRED BPA IS REQUIRED TO BE TESTED BY AN APPROVED CERTIFIED TESTER PRIOR TO PLACING THE WATER SYSTEM IN SERVICE. TEST RESULTS SHALL BE SUBMITTED TO IREDELL WATER CORPORATION WITHIN 30 DAYS AND TESTED ANNUALLY THEREAFTER SUBMITTING RESULTS TO IREDELL WATER CORPORATION.
9. ALL INSTALLATIONS INTENDED FOR ADDRESSING IREDELL WATER CORPORATION REQUIREMENTS, REQUIRE PRIOR APPROVAL FROM THE APPROPRIATE IREDELL WATER CORPORATION BACKFLOW INSPECTOR.
10. CONSUMER IS RESPONSIBLE FOR PROTECTING BACKFLOW ASSEMBLY FROM FREEZING

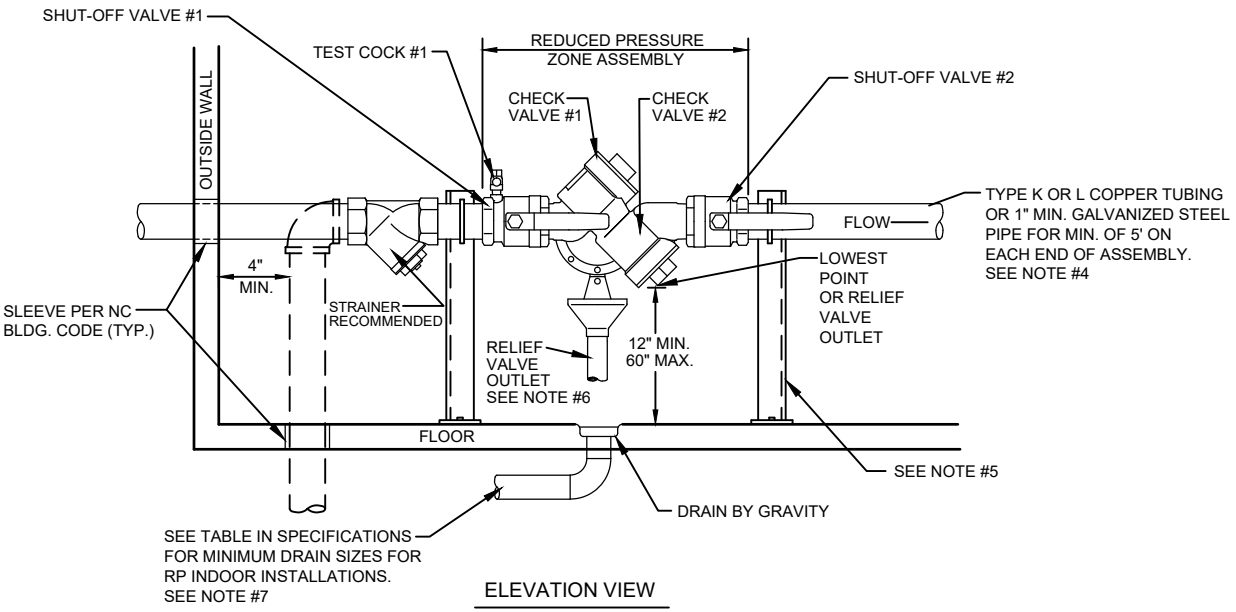
DRAWN BY:	JGA
DATE:	06/01/2022
REVISION:	11/22/2024

W-17C

REDUCED PRESSURE ZONE ASSEMBLY
(RPZ) 2 ½" – 12" ABOVE GROUND

NOT TO SCALE

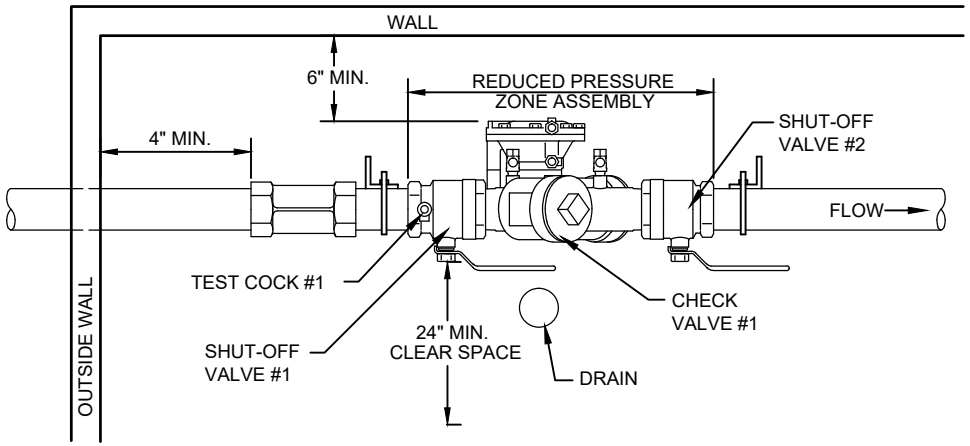
IREDELL WATER CORPORATION



ELEVATION VIEW

NOTES:

1. INDOOR INSTALLATION SHALL ONLY BE PERMITTED IN CASES WHERE ADEQUATE SPACE FOR THE BACKFLOW PREVENTION ASSEMBLY IS NOT AVAILABLE OUTSIDE. IREDELL WATER CORPORATION WILL REVIEW ON A CASE BY CASE BASIS.
2. BACKFLOW PREVENTION ASSEMBLIES (BPA's) SHALL CONFORM TO ASSE & USC STANDARDS. SHUT-OFF VALVES ARE SPECIFIC TO EACH APPROVED BPA AND NO SUBSTITUTIONS OF SHUT-OFF VALVES ARE PERMITTED. REFER TO IREDELL WATER CORPORATION APPROVED LIST OF BPA's.
3. ASSEMBLIES SHALL BE INSTALLED UPRIGHT AND IN THE HORIZONTAL POSITION.
4. PIPE MATERIAL AND FITTINGS SHALL BE DUCTILE IRON PIPE.
5. SUPPORT FOR ASSEMBLY SHALL BE DESIGNED BY OWNER AS REQUIRED.
6. AN AIR GAP DRAIN IS RECOMMENDED TO REDUCE SPLASHING OF MINOR DISCHARGES FROM THE RELIEF VALVE DRAIN PORT.
7. INDOOR INSTALLATION OF RPZ'S SHOULD PROVIDE FOR DRAINAGE CAPABLE OF HANDLING IN EXCESS OF THE MAXIMUM DISCHARGE RATE EXPECTED BY THE BACKFLOW ASSEMBLY MANUFACTURER.
8. ALL LOCATIONS FOR BPA'S REQUIRE IREDELL WATER CORPORATION APPROVAL.
9. THERE SHALL BE NO TAPS, PIPING BRANCHES, UNAPPROVED BYPASS PIPING, HYDRANTS, FIRE DEPT. CONNECTION POINTS, OR OTHER WATER - USING APPURTENANCES CONNECTED TO THE SUPPLY LINE BETWEEN ANY WATER METER AND ITS IREDELL WATER CORPORATION - REQUIRED BACKFLOW PREVENTER.
10. EACH BACKFLOW ASSEMBLY - REQUIRED BPA IS REQUIRED TO BE TESTED BY AN APPROVED CERTIFIED TESTER PRIOR TO PLACING THE WATER SYSTEM IN SERVICE. TEST RESULTS SHALL BE SUBMITTED TO IREDELL WATER CORPORATION WITHIN 30 DAYS AND TESTED ANNUALLY THEREAFTER SUBMITTING RESULTS TO IREDELL WATER CORPORATION.
11. ALL INSTALLATIONS INTENDED FOR ADDRESSING IREDELL WATER CORPORATION REQUIREMENTS, REQUIRE PRIOR APPROVAL FROM THE APPROPRIATE IREDELL WATER CORPORATION BACKFLOW INSPECTOR.



PLAN VIEW

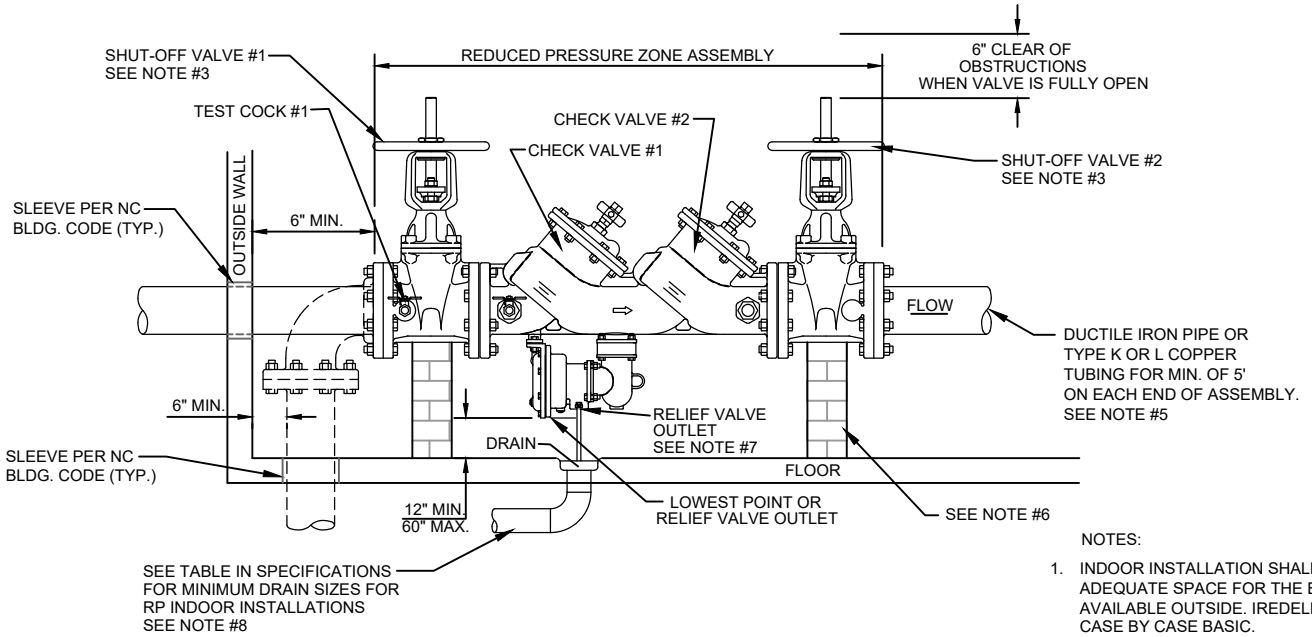
DRAWN BY:	JGA
DATE:	06/01/2022
REVISION:	11/22/2024

W-17D

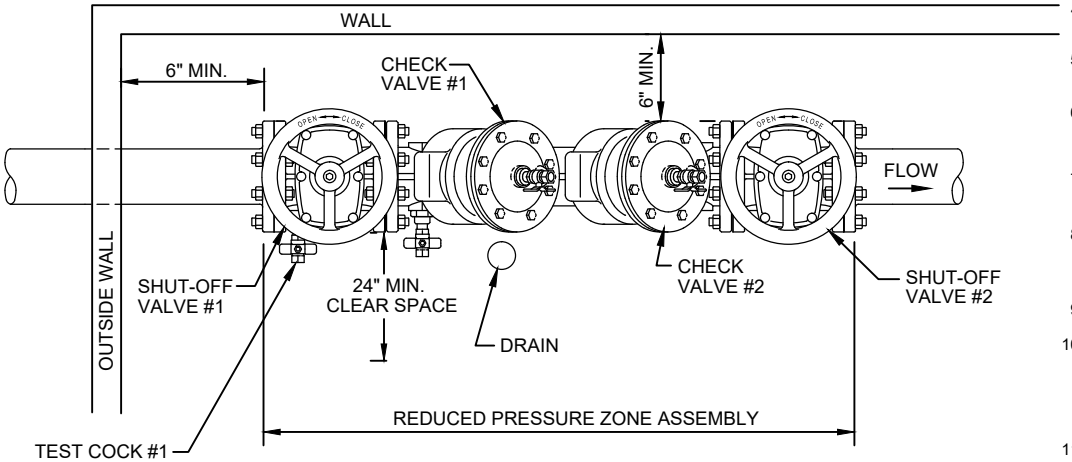
REDUCED PRESSURE ZONE ASSEMBLY (RPZ) 3/4" – 2" INDOOR

NOT TO SCALE

IREDELL WATER CORPORATION



ELEVATION VIEW



PLAN VIEW

NOTES:

1. INDOOR INSTALLATION SHALL ONLY BE PERMITTED IN CASES WHERE ADEQUATE SPACE FOR THE BACKFLOW PREVENTION ASSEMBLY IS NOT AVAILABLE OUTSIDE. IREDELL WATER CORPORATION WILL REVIEW ON A CASE BY CASE BASIC.
2. BACKFLOW PREVENTION ASSEMBLIES (BPA's) SHALL CONFORM TO ASSE & USC STANDARDS. SHUT-OFF VALVES ARE SPECIFIC TO EACH APPROVED BPA AND NO SUBSTITUTIONS OF SHUT-OFF VALVES ARE PERMITTED. REFER TO IREDELL WATER CORPORATION APPROVED LIST OF BPA's.
3. FIRE LINE INSTALLATIONS SHALL HAVE OUTSIDE STEM AND YOKE (OS&Y) HANDWHEEL OPERATORS OR BUTTERFLY VALVES, AND LISTED ON APPROVED LIST AS FIRE APPROVED. IF SERVING FIRE SPRINKLERS, TAMPER SWITCHES ARE REQUIRED.
4. ASSEMBLIES SHALL BE INSTALLED UPRIGHT AND IN THE HORIZONTAL POSITION.
5. PIPE MATERIAL AND FITTINGS SHALL BE AS SPECIFIED IN IREDELL WATER STANDARDS & SPECIFICATIONS.
6. SUPPORT FOR ASSEMBLY SHALL BE DESIGNED BY OWNER, 8" - 12" SHALL BE SUPPORTED AT EACH VALVE AND SHALL NOT BLOCK RELIEF VALVE ON DRAIN PORT.
7. AN AIR GAP DRAIN IS RECOMMENDED TO REDUCE SPLASHING OF MINOR DISCHARGES FROM THE RELIEF VALVE DRAIN PORT.
8. INDOOR INSTALLATION OF RPZ'S SHOULD PROVIDE FOR DRAINAGE CAPABLE OF HANDLING IN EXCESS OF THE MAXIMUM DISCHARGE RATE EXPECTED BY THE BACKFLOW ASSEMBLY MANUFACTURER.
9. ALL LOCATIONS FOR BPA'S REQUIRE IREDELL WATER CORPORATION APPROVAL.
10. THERE SHALL BE NO TAPS, PIPING BRANCHES, UNAPPROVED BYPASS PIPING, HYDRANTS, FIRE DEPT. CONNECTION POINTS, OR OTHER WATER - USING APPURTENANCES CONNECTED TO THE SUPPLY LINE BETWEEN ANY WATER METER AND ITS IREDELL WATER CORPORATION - REQUIRED BACKFLOW PREVENTER.
11. EACH BACKFLOW ASSEMBLY - REQUIRED BPA IS REQUIRED TO BE TESTED BY AN APPROVED CERTIFIED TESTER PRIOR TO PLACING THE WATER SYSTEM IN SERVICE. TEST RESULTS SHALL BE SUBMITTED TO IREDELL WATER CORPORATION WITHIN 30 DAYS AND TESTED ANNUALLY THEREAFTER SUBMITTING RESULTS TO IREDELL WATER CORPORATION.
12. ALL INSTALLATIONS INTENDED FOR ADDRESSING IREDELL WATER CORPORATION REQUIREMENTS, REQUIRE PRIOR APPROVAL FROM THE APPROPRIATE IREDELL WATER CORPORATION BACKFLOW INSPECTOR.

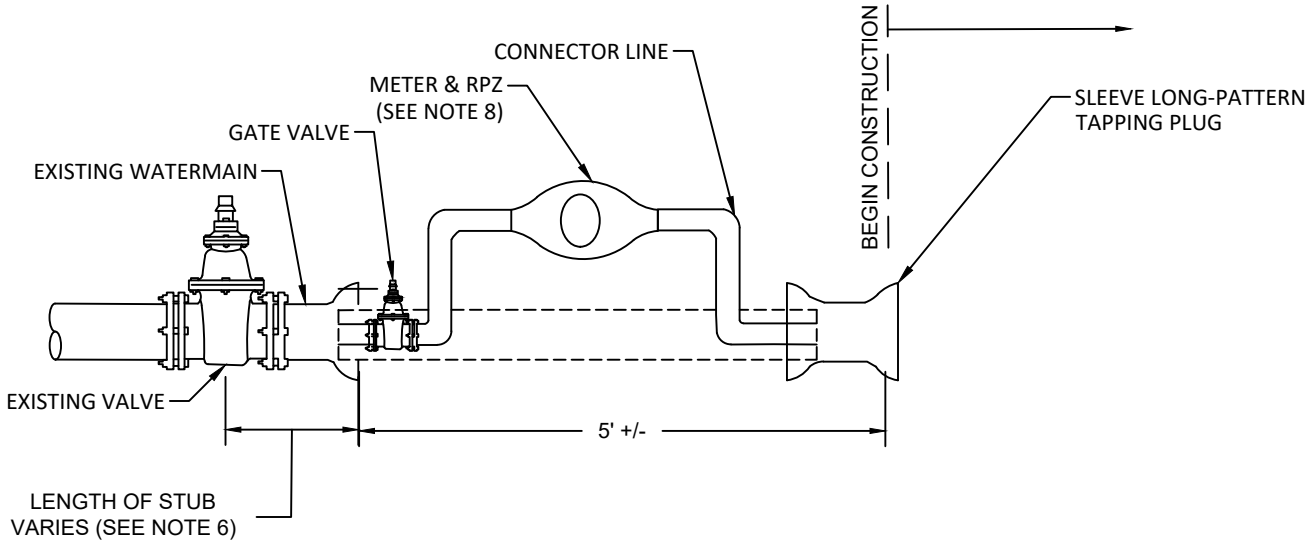
DRAWN BY:	JGA
DATE:	06/01/2022
REVISION:	11/22/2024

W-17E

REDUCED PRESSURE ZONE ASSEMBLY (RPZ)
2 1/2" - 2" INDOOR

NOT TO SCALE

IREDELL WATER CORPORATION



NOTES:

1. INSTALL CONNECTOR LINE FROM EXISTING BLOW OFF ASSEMBLY TO NEW MAIN FOR FILLING, TESTING AND STERILIZING NEW MAIN
2. CONNECTOR LINE TO BE ASSEMBLED WITH RPZ AND METER BY CONTRACTOR AND TO BE OPERATED AND INDEPENDENT OF EXISTING MAIN.
3. FINAL CONNECTION TO EXISTING MAIN TO BE MADE ONLY AFTER TOTAL PROJECT IS ACCEPTED BY IREDELL WATER CORPORATION
4. VALVES ON EXISTING SYSTEM TO BE OPERATED BY IREDELL WATER CORPORATION FORCES ONLY.
5. ONLY ONE CONNECTION WILL BE ALLOWED BETWEEN THE EXITING SYSTEM AND THE NEW CONSTRUCTION UNTIL TESTING AND DISINFECTION IS COMPLETE. UNLESS PRIOR APPROVAL IS OBTAINED FROM IREDELL WATER CORPORATION
6. MAXIMUM LENGTH OF PIPE NOT TO EXCEED 100'
7. RESPONSIBILITY OF CONTRACTOR TO PROVIDE AND TEST METER FOR ACCURACY. METER ACCURACY TEST MUST BE PROVIDED TO IREDELL WATER CORPORATION WITHIN LAST 12 MONTHS OR 100,000 GALLONS
8. METER AND RPZ TO BE PROPERLY SIZED FOR FILLING AND FLUSHING OF WATER MAINS

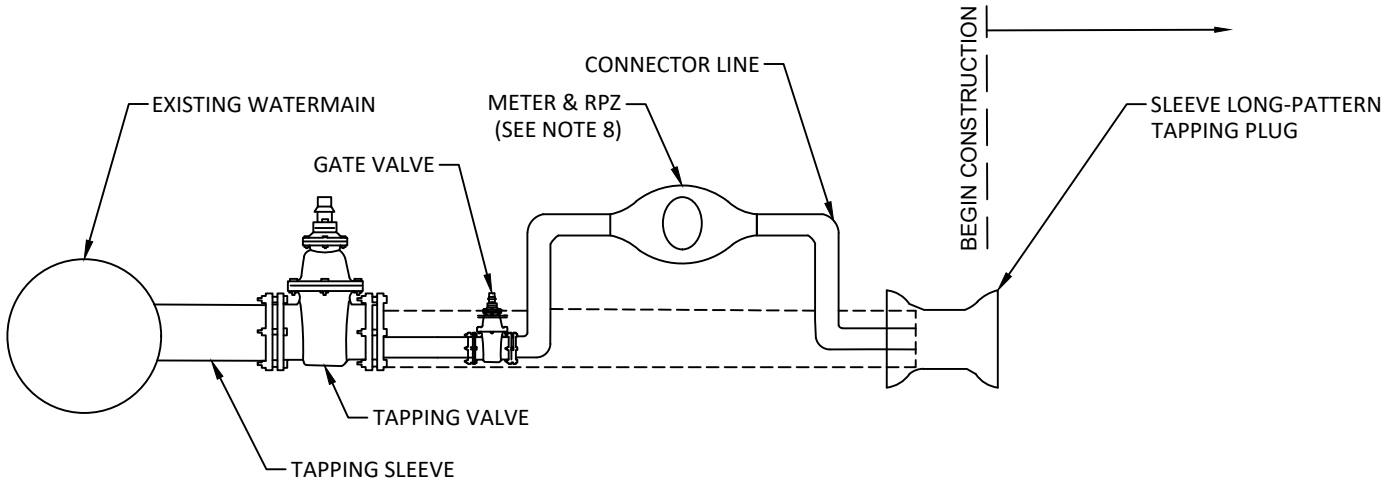
DRAWN BY:	AVT
DATE:	05/13/2024
REVISION:	11/22/2024

W-18

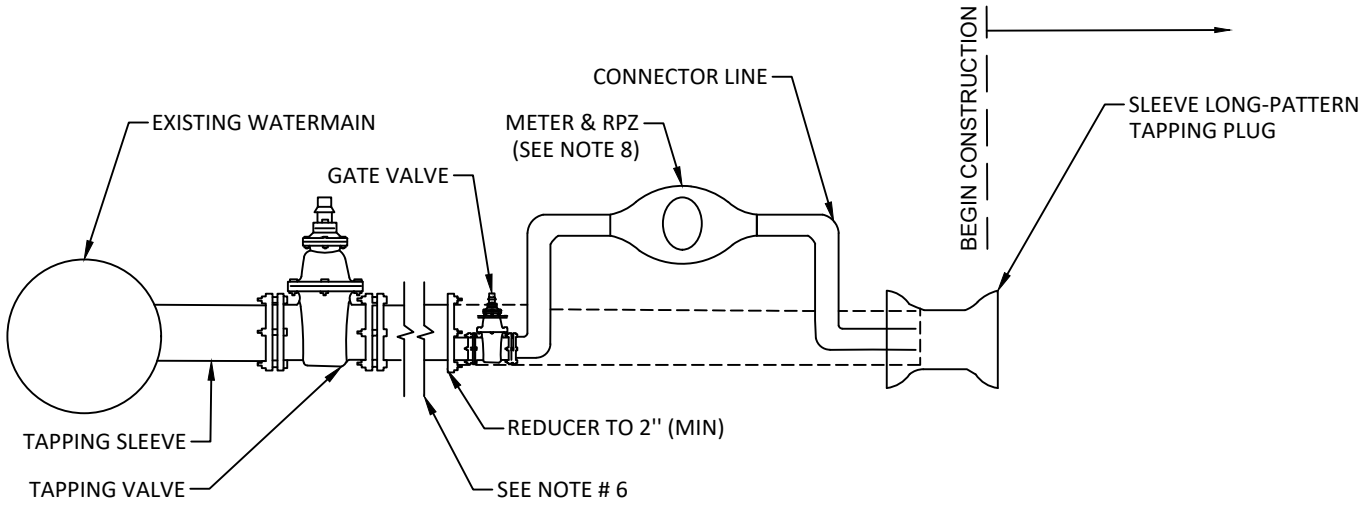
JUMPER CONNECTION FOR EXISTING WATERMAIN EXTENSION

NOT TO SCALE

IREDELL WATER CORPORATION



JUMPER CONNECTION - SHORT SIDE



JUMPER CONNECTION - LONG SIDE

NOTES:

1. INSTALL CONNECTOR LINE FROM EXISTING BLOW OFF ASSEMBLY TO NEW MAIN FOR FILLING, TESTING AND STERILIZING NEW MAIN
2. CONNECTOR LINE TO BE ASSEMBLED WITH RPZ AND METER BY CONTRACTOR AND TO BE OPERATED AND INDEPENDENT OF EXISTING MAIN.
3. FINAL CONNECTION TO EXISTING MAIN TO BE MADE ONLY AFTER TOTAL PROJECT IS ACCEPTED BY IREDELL WATER CORPORATION
4. VALVES ON EXISTING SYSTEM TO BE OPERATED BY IREDELL WATER CORPORATION FORCES ONLY.
5. ONLY ONE CONNECTION WILL BE ALLOWED BETWEEN THE EXITING SYSTEM AND THE NEW CONSTRUCTION UNTIL TESTING AND DISINFECTION IS COMPLETE. UNLESS PRIOR APPROVAL IS OBTAINED FROM IREDELL WATER CORPORATION
6. MAXIMUM LENGTH OF PIPE NOT TO EXCEED 100'
7. RESPONSIBILITY OF CONTRACTOR TO TEST METER FOR ACCURACY. METER ACCURACY TEST MUST BE PROVIDED TO IREDELL WATER CORPORATION WITHIN THE LAST 12 MONTHS OR 100,000 GALLONS
8. METER AND RPZ TO BE PROPERLY SIZED FOR FILLING AND FLUSHING OF WATER MAINS

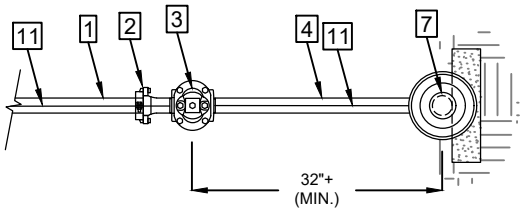
DRAWN BY:	AVT
DATE:	05/13/2024
REVISION:	11/22/2024

W-19A

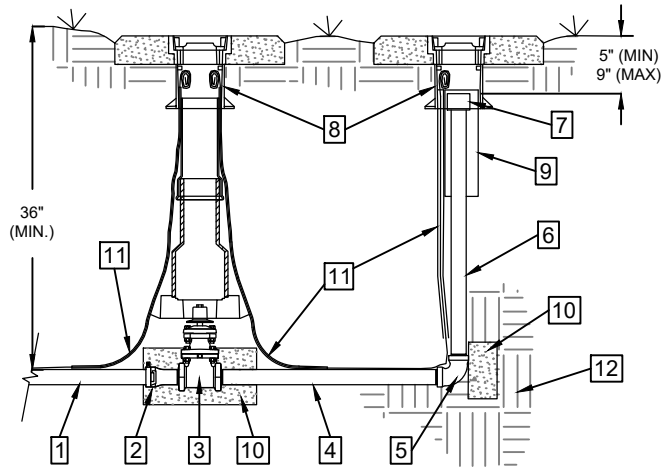
JUMPER CONNECTION - SHORT SIDE AND LONG SIDE

NOT TO SCALE

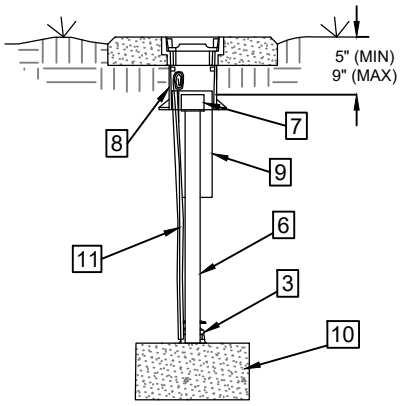
IREDELL WATER CORPORATION



PLAN VIEW



ELEVATION VIEW



END VIEW

NO. DESCRIPTION

1. 2" DR 13.5 PVC WATER MAIN (IPS)
2. 2" D.I. PC 350 ADAPTOR (BELL x MNPT) - FUSION BONDED EPOXY - HARCO OR APPROVED EQUAL WITH HARCO KNUCKLE JOINT RESTRAINT
3. 2" GATE VALVE (FNPT x FNPT)
4. 2" RED BRASS NIPPLE - SCH 40 - (MNPT x MNPT) - L=30" (MIN.)
5. 2" RED BRASS 90° BEND (FNPTxFNPT)
6. 2" RED BRASS NIPPLE - SCH 40 - (MNPT x MNPT) - LENGTH AS REQUIRED
7. 2" THREADED COUPLING (FNPT x FNPT) - PVC SCH 40 WITH 2" MNPT PLUG
8. STANDARD VALVE BOX ASSEMBLY - SEE DETAILS
9. 6" PVC PIPE, L=15", OR VALVE BOX BOTTOM SECTION
10. POURED THRUST BLOCKING
11. AWG #14 GAUGE COPPER TRACER WIRE WITH BLUE INSULATION (30MIL HDPE) - TERMINATE WITH 24" EXCESS WIRE (COILED) IN VALVE BOX (TYP.)
12. UNDISTURBED OR COMPACTED SOIL - 100% STANDARD PROCTOR

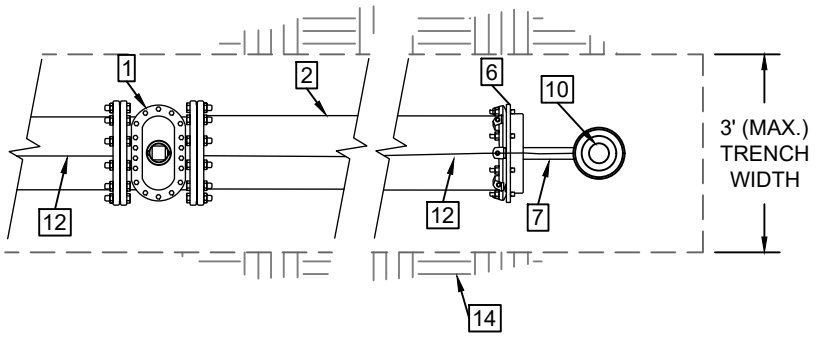
IREDELL WATER CORPORATION

2-INCH BLOWOFF ASSEMBLY

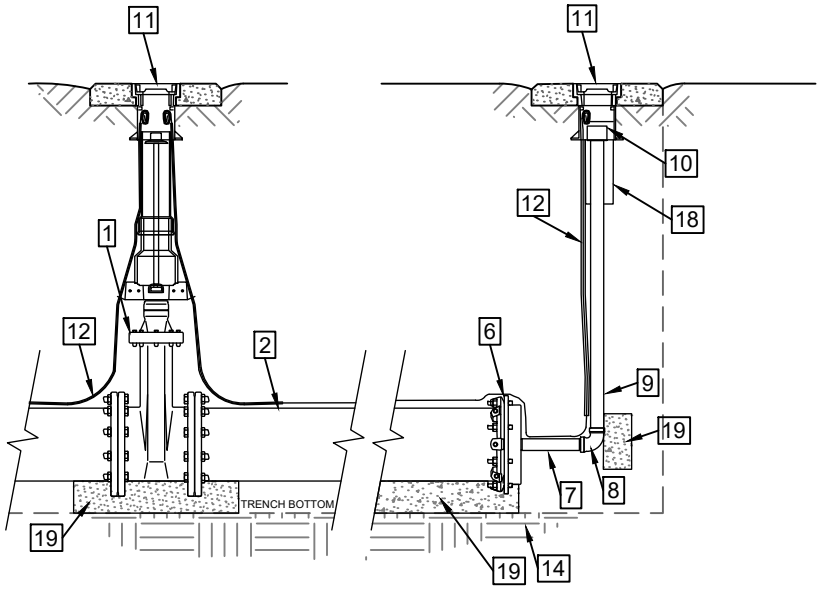
NOT TO SCALE

DRAWN BY:	JGA
DATE:	05/20/2022
REVISION:	11/22/2024

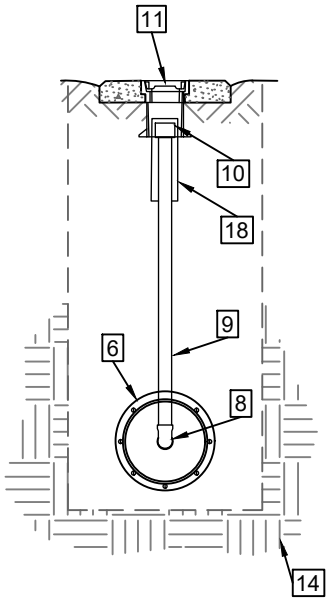
W-19B



PLAN VIEW



ELEVATION VIEW



END VIEW

NO. DESCRIPTION

1. END OF LINE GATE VALVE (MJ x MJ) RESTRAINED
2. DIP - (PE x PE) - REMOVAL BELL - LENGTH = 20FT
6. MJ CAP - WITH WEDGE ACTION RESTRAINT GLAND , TAP 2" THREADED OUTLET (FNPT)
7. 2" RED BRASS NIPPLES SCH 40 (MNPT x MNPT) - LENGTH = 12 INCH
8. 2" RED BRASS 90° BEND (FNPT x FNPT)
9. 2" RED BRASS NIPPLE SCH 40 (MNPT x MNPT) - LENGTH AS REQUIRED
10. 2" GALVANIZED MALLEABLE IRON COUPLING (FNPT x FNPT)
11. STANDARD VALVE BOX ASSEMBLY - SEE DETAILS
12. AWG #14 GAUGE COPPER TRACER WIRE - WITH BLUE INSULATION (30MIL HDPE) TERMINATE WITH 24-INCH EXCESS WIRE (COILED) IN VALVE BOX (TYP.)
14. UNDISTURBED SOIL
18. 6" PVC PIPE (L=15") VALVE BOX BOTTOM SECTION
19. POURED THRUST BLOCKING

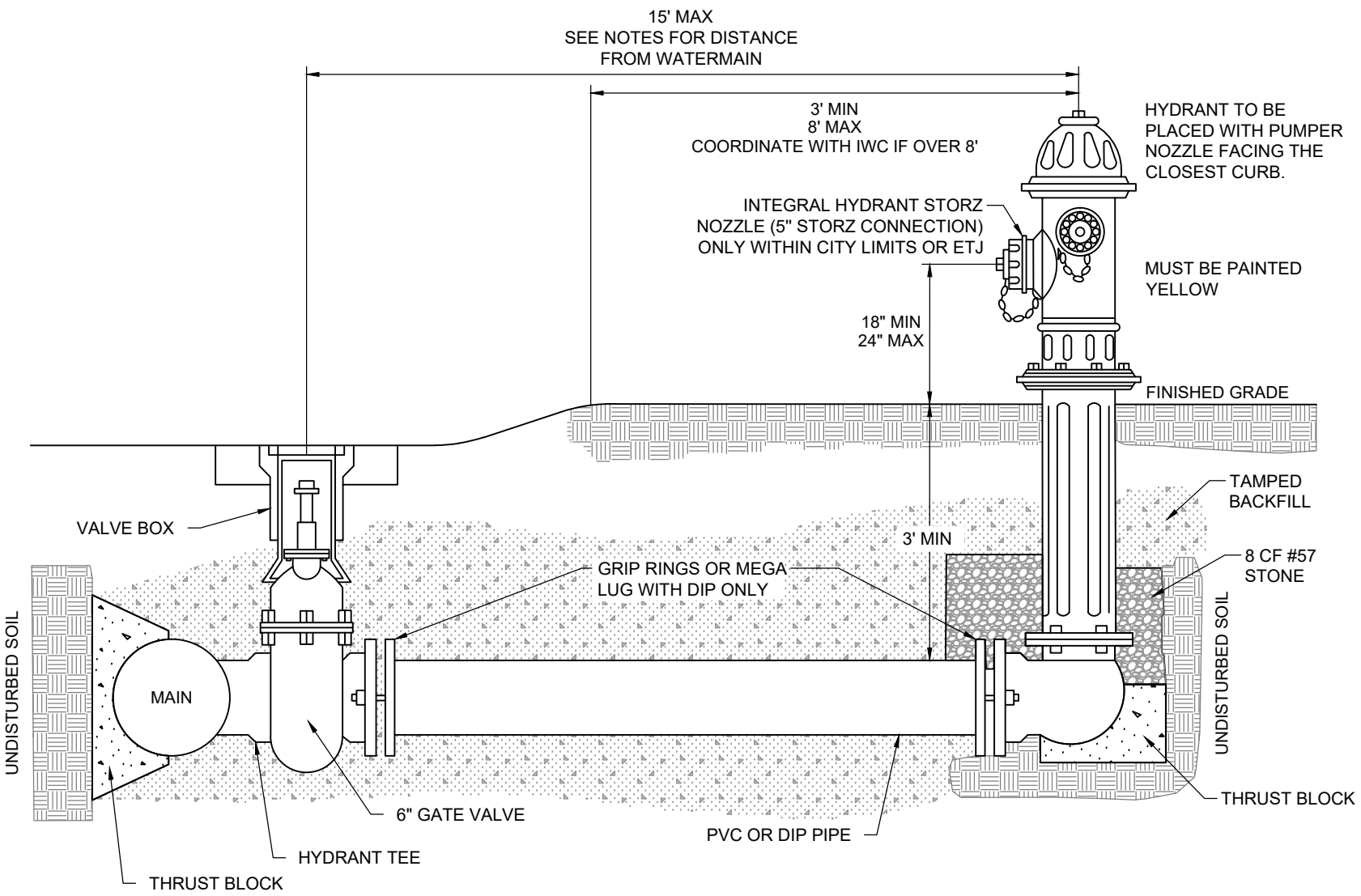
IREDELL WATER CORPORATION

3 & 4–INCH BLOWOFF ASSEMBLY

NOT TO SCALE

DRAWN BY:	JGA
DATE:	05/20/2022
REVISION:	11/22/2024

W–20A



NOTES:

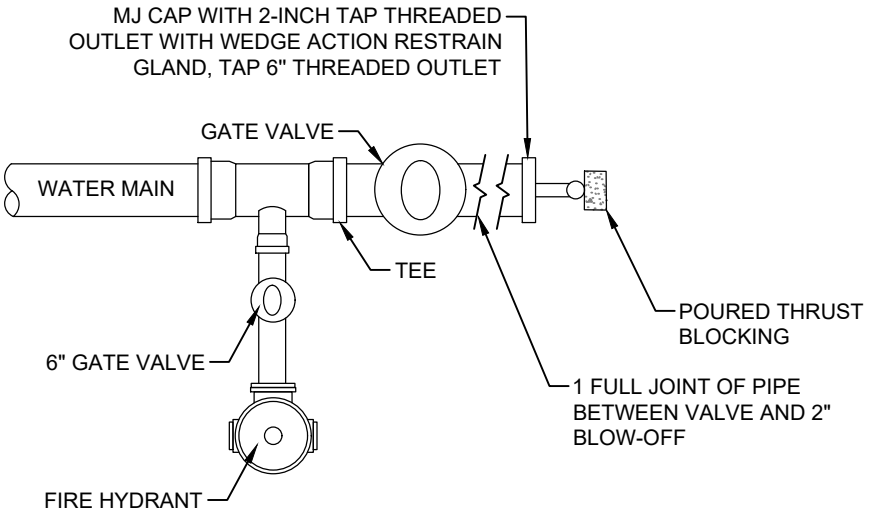
1. WATERMAIN TO BE 4.5 FT FROM THE BACK OF THE CURB IF THERE ARE NO TREES IN THE PLANTING STRIPS
2. WATERMAIN TO BE 4.5 FT FROM THE EDGE OF PAVEMENT IF THERE IS NO CURB OR SIDEWALK
3. WATERMAIN TO BE 1 FT UNDER SIDEWALK IF TREE IS PLANTED IN PLANTING STRIP
4. NO HYDRANTS TO BE LOCATED IN RADIUS OF INTERSECTIONS
5. HYDRANT MUST BE 18" MINIMUM OFF CURB OR 18" MINIMUM BEHIND SIDEWALK IF BETWEEN SIDEWALK AND R/W
6. MAINTAIN 3 FT CLEARANCE AROUND HYDRANT
7. LOCATION OF HYDRANTS INSIDE CITY LIMITS MUST BE APPROVED BY CITY FIRE MARSHALL

DRAWN BY:	JGA	
DATE:	05/20/2022	
REVISION:	11/22/2024	W-20B

FIRE HYDRANT ASSEMBLY

NOT TO SCALE

REDELL WATER CORPORATION



PLAN VIEW

NOTE:

1. WATER LINES 6" OR LARGER SHALL HAVE FIRE HYDRANT AS PERMANENT BLOW OFF.
2. 6-INCH AND ABOVE WATER MAIN WITH FIRE HYDRANT BLOWOFF ASSEMBLY WITH TEE AND TWO GATE VALVES STUBBED OUT WITH PLUG AND WITH 2" TAP TO BE REMOVED FOR FUTURE EXTENSION.

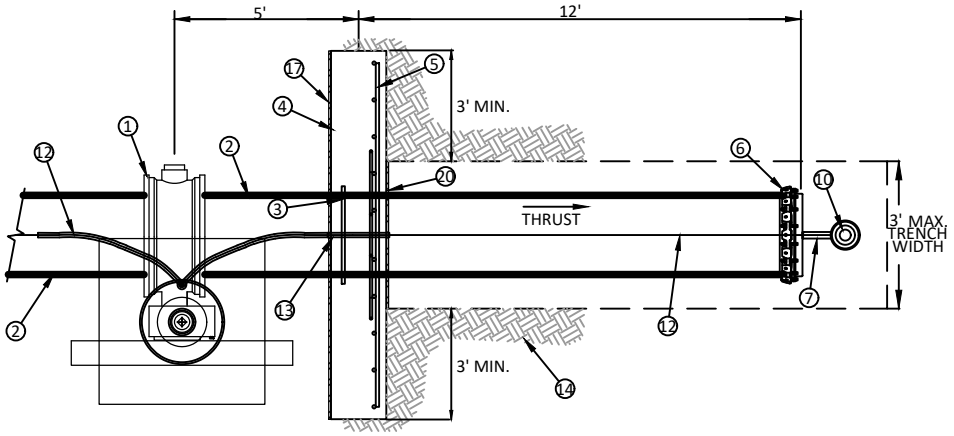
IREDELL WATER CORPORATION

FIRE HYDRANT BLOWOFF ASSEMBLY

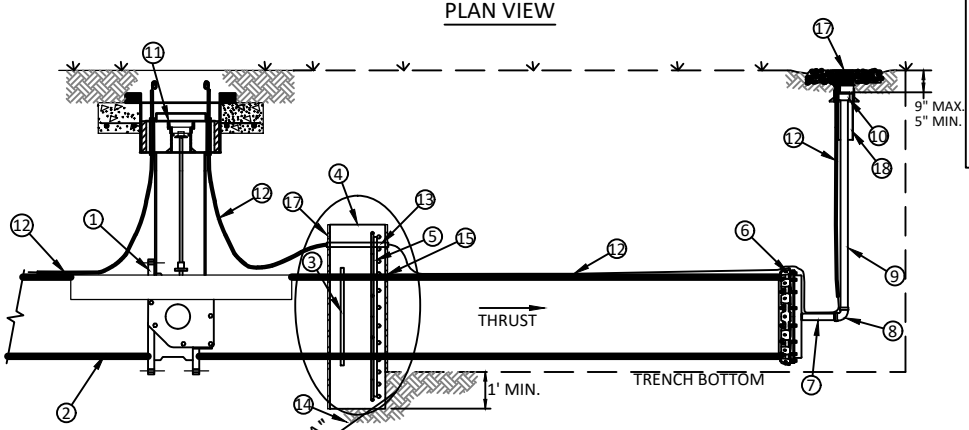
NOT TO SCALE

DRAWN BY:	JGA
DATE:	05/20/2022
REVISION:	11/22/2024

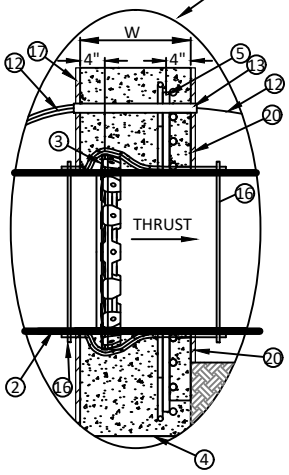
W-20C



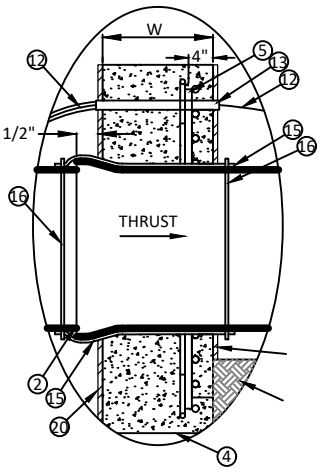
PLAN VIEW



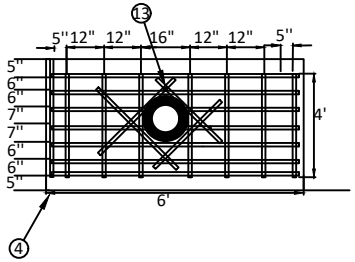
ELEVATION VIEW

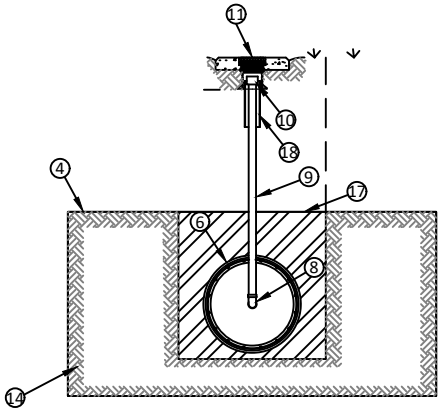


DETAIL "A"



DETAIL "A" (ALT)





NO.	DESCRIPTION
1.	END OF LINE VALVE - BUTTERFLY OR GATE VALVE (MJ X MJ)
2.	DIP - (PE X PE) - REMOVE BELL - LENGTH = 17' - 19'
3.	WEDGE ACTION THRUST RESTRAINT GLAND
4.	CONCRETE WALL BLOCK (f'c = 3600 PSI MIN) 10' x 5' x WIDTH (W)
5.	REBARS - GRADE 60 PER ASTM A615 - SEE REBAR SHCEDULES, CUT WHEN REQUIRED
6.	MJ CAP - WITH WEDGE ACTION RESTRAINT GLAND, TAP 2'' THREADED OUTLET (FNPT)
7.	2'' RED BRASS NIPPLE SCH 40 *MNPT X MNPT) - LENGTH = 12''
8.	2'' RED BRASS 90° BEND (FNPT X FNPT)
9.	2'' RED BRASS NIPPLE SCH 40 (MNPT X MNPT) - LENGTH AS REQUIRED
10.	2'' BRASS COUPLING (FNPT X FNPT) WITH PVC MIP PLUG
11.	STANDARD VALVE BOX ASSEMBLY (16'' + VALVES) - SEE DETAIL
12.	AWG #14 GAUGE COPPER TRACER WIRE - WITH BLUE INSULATION (30 MIL HDPE) TERMINATE WITH 24'' EXCESS WIRE (COILED) IN VALVE BOX (TYP)
13.	1'' SCH 40 PVC ELECTRICAL CONDUIT - LENGTH AS REQUIRED
14.	UNDISTURBED SOIL
15.	HIGH DENSITY CROSS LAMINATED POLYTHEYLENE FILM TUBE (HDCLPE) AWWA C105 - 4 MILS EACH X 2 LAYER - 8 MILES TOTAL
16.	HDPE ADHESIVE TAPE OR HDPE ZIP LOCK TIES
17.	PLYWOOD FORM
18.	6" PVC PIPE - L = 15'' OR VALVE BOX BOTTOM SECTION

DRAWN BY:	AVT
DATE:	05/13/2024
REVISION:	11/22/2024

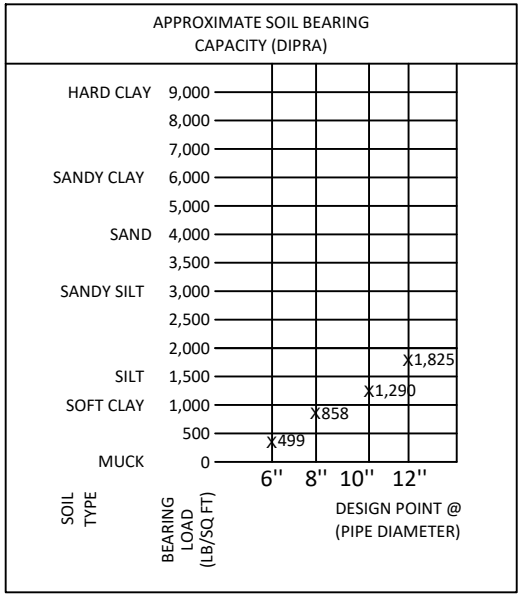
W-21A

DEAD END THRUST – WALL BLOCKING AND 2'' BLOW-OFF ASSEMBLY 6'' THROUGH 12'' MAINS PART 1

NOT TO SCALE

REDELL WATER CORPORATION

APPROX. DEAD END THRUST (DIPRA) AT 200 PSI WATER PRESSURE		UNDISTURBED SOIL BEARING AREA	APPROX. SOIL PRESSURE	W (WIDTH) (MINIMUM)	CONCRETE VOLUME (APPROXIMATE)	
PIPE DIAMETER (INCHES)	TOTAL THRUST (POUNDS)	SQUARE FEET	BEARING LOAD (LB/SQ FT)	INCHES	FT^3	CY
6	7,478	15	499	10	20	0.74
8	12,866	15	858	12	24	0.89
10	19,354	15	1,290	12	24	0.89
12	27,370	15	1,825	14	28	1.04



REBAR SCHEDULE		
TYPE	LENGTH (INCHES)	NUMBER REQUIRED
VERTICAL	38	6
HORIZONTAL	62	6
HORIZONTAL	24	2
DIAGONAL	30	4

REBAR DIAMETER SCHEDULE			
PIPE DIAMETER	BAR SIZE	TOTAL REBAR LENGTH (FT)	TOTAL REBAR WEIGHT (LB)
6''	#6	64	96
8''	#7	64	131
10''	#8	64	171
12''	#9	64	218

NOTES:

A. 12 - INCH MAINS REQUIRE THIS INSTALLATION.
B. 6 - INCH MAINS THROUGH 10 - INCH MAINS REQUIRE THIS INSTALLATION WHEN SOFT SOILS ARE ENCOUNTERED, OR WHEN REQUIRED BY THE ENGINEER
C. WHEN DIRECTED BY THE ENGINEER, THE CONCRETE WALL BLOCK SIZE MY BE ADJUSTED, BASED ON THE ACTUAL SOIL CLASSIFICATION
D. FULLY RESTRAINED JOINT PIPE MAY BE USED IN LIEU OF THIS DETAIL - SEE RESTRAINED PIPE JOINT DETAIL
E. ENGINEER OF RECORD SHALL SUBMIT CALCULATIONS FOR EACH JOINT REQUIRING RESTRAINT

DRAWN BY: AVT
DATE: 05/13/2024
REVISION: 11/22/2024

W-21B

DEAD END THRUST - WALL BLOCKING AND 2'' BLOW-OFF ASSEMBLY 6'' THROUGH 12'' MAINS PART 2

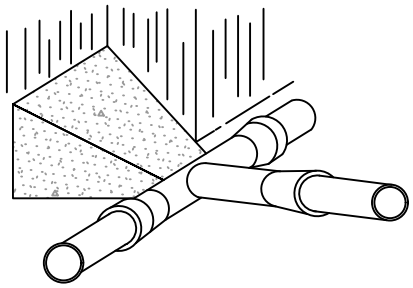
NOT TO SCALE

REDELL WATER CORPORATION

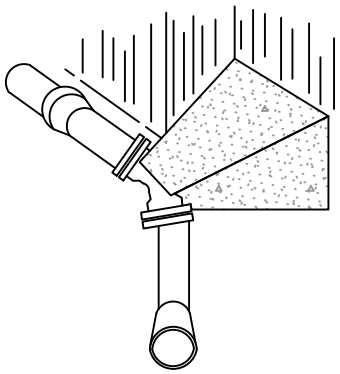
REACTION BEARING AREAS FOR HORIZONTAL WATER PIPE BENDS
BASED ON TEST PRESSURE OF 150 PSI

ALL AREAS GIVEN IN SQUARE FEET

SIZE AND DEGREE OF BEND	STATIC THRUST IN POUNDS	QUICKSAND-VERY POOR SOIL 1,000 LBS/FT²	GRAVEL/COARSE SAND 1,600 LBS/FT²	SOFT CLAY 2,000 LBS/FT²	SAND-CLEAN DRY 4,000 LBS/FT²	MODERATELY DRY CLAY 4,000 LBS/FT²	DRY CLAY-ALWAYS DRY 8,000 LBS/FT²	SAND, COMPACT FIRM 8,000 LBS/FT²	ROCK-POOR 10,000 LBS/FT²
2"									
11 1/4°	93	0.14	0.09	0.07	0.03	0.03	0.02	0.02	0.01
22 1/2°	184	0.28	0.17	0.14	0.07	0.07	0.03	0.03	0.03
45°	360	0.54	0.34	0.27	0.14	0.14	0.07	0.07	0.05
90°	666	1.00	0.62	0.50	0.25	0.25	0.12	0.12	0.10
PLUG	471	0.71	0.44	0.35	0.18	0.18	0.09	0.09	0.07
4"									
11 1/4°	369	0.55	0.35	0.28	0.14	0.14	0.07	0.07	0.06
22 1/2°	735	1.10	0.69	0.55	0.28	0.28	0.14	0.14	0.11
45°	1,442	2.16	1.35	1.08	0.54	0.54	0.27	0.27	0.22
90°	2,665	4.00	2.50	2.00	1.00	1.00	0.50	0.50	0.40
PLUG	1,884	2.83	1.77	1.41	0.71	0.71	0.35	0.35	0.28
6"									
11 1/4°	831	1.25	0.78	0.62	0.31	0.31	0.16	0.16	0.12
22 1/2°	1,654	2.48	1.55	1.24	0.62	0.62	0.31	0.31	0.25
45°	3,244	4.87	3.04	2.43	1.22	1.22	0.61	0.61	0.49
90°	5,995	9.00	5.62	4.50	2.25	2.25	1.12	1.12	0.90
PLUG	4,239	6.36	3.97	3.18	1.59	1.59	0.79	0.79	0.64
8"									
11 1/4°	1,477	2.22	1.39	1.11	0.55	0.55	0.28	0.28	0.22
22 1/2°	2,940	4.41	2.76	2.21	1.10	1.10	0.55	0.55	0.44
45°	5,768	8.66	5.41	4.33	2.16	2.16	1.08	1.08	0.87
90°	10,658	16.00	9.99	7.99	4.00	4.00	2.00	2.00	1.60
PLUG	7,536	11.31	7.07	5.65	2.83	2.83	1.41	1.41	1.13
10"									
11 1/4°	2,308	3.46	2.16	1.73	0.87	0.87	0.43	0.43	0.35
22 1/2°	4,595	6.90	4.31	3.45	1.72	1.72	0.86	0.86	0.69
45°	9,012	13.53	8.45	6.76	3.38	3.38	1.69	1.69	1.35
90°	16,653	24.99	15.61	12.49	6.25	6.25	3.12	3.12	2.50
PLUG	11,776	17.67	11.04	8.83	4.42	4.42	2.21	2.21	1.77
12"									
11 1/4°	3,016	4.52	2.82	2.63	1.14	1.14	0.56	0.56	0.46
22 1/2°	6,004	9.02	5.63	4.51	2.25	2.25	1.12	1.12	0.90
45°	11,776	17.68	11.04	8.84	4.41	4.41	2.21	2.21	1.76
90°	21,760	32.65	20.40	16.32	8.17	8.17	4.08	4.08	3.27
PLUG	15,386	23.09	14.43	11.54	5.78	5.78	2.89	2.89	2.31



TEE INTERSECTION



BEND

NOTES:
1. CONCRETE SHALL BE 3,000 PSI.
2. CONCRETE SHALL NOT CONTACT BOLTS OR ENDS OF MECHANICAL JOINT FITTINGS.
3. ALL BENDS AND INTERSECTIONS SHALL HAVE CONCRETE THRUST BLOCKING.
4. TRENCH SIDE TO BE AT AN ANGLE OF 90° TO THE THRUST VECTOR.

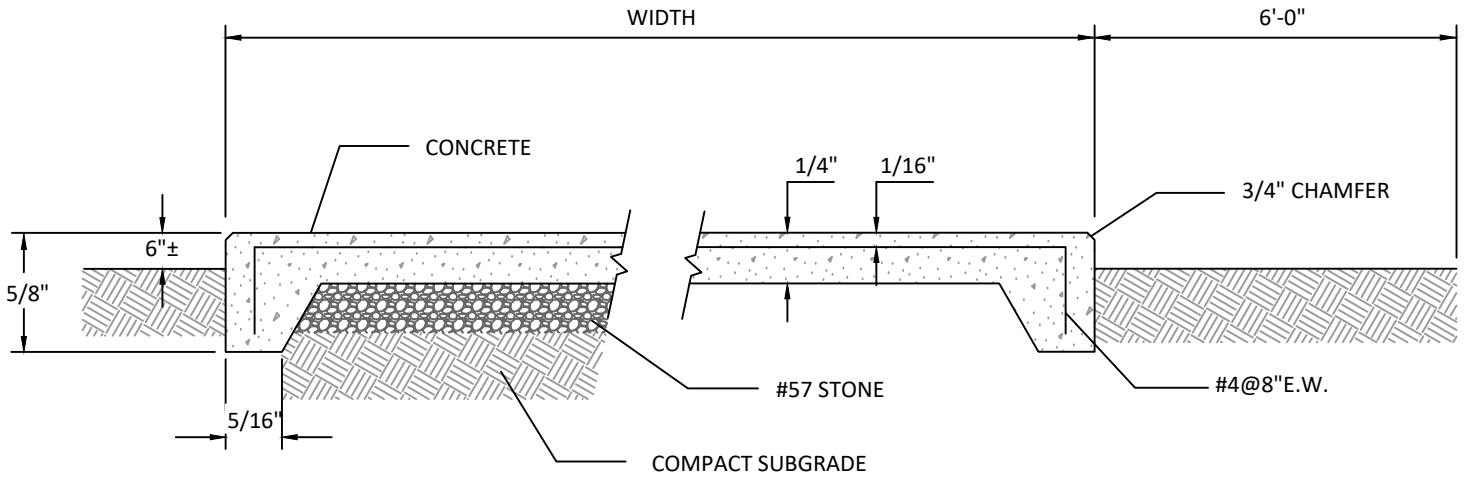
IREDELL WATER CORPORATION

CONCRETE THRUST BLOCKING

NOT TO SCALE

DRAWN BY:	JGA
DATE:	05/20/2022
REVISION:	11/22/2024

W–22



NOTE:

1. PROPANE TANK TO SIT ON CONCRETE BLOCKS

	LENGTH	WIDTH
EMERGENCY GENERATOR PAD	5'-0"	8'-0"
TRANSFORMER PAD	3'-0"	3'-0"
PROPANE TANK PAD	SEE NOTE 1	SEE NOTE 1

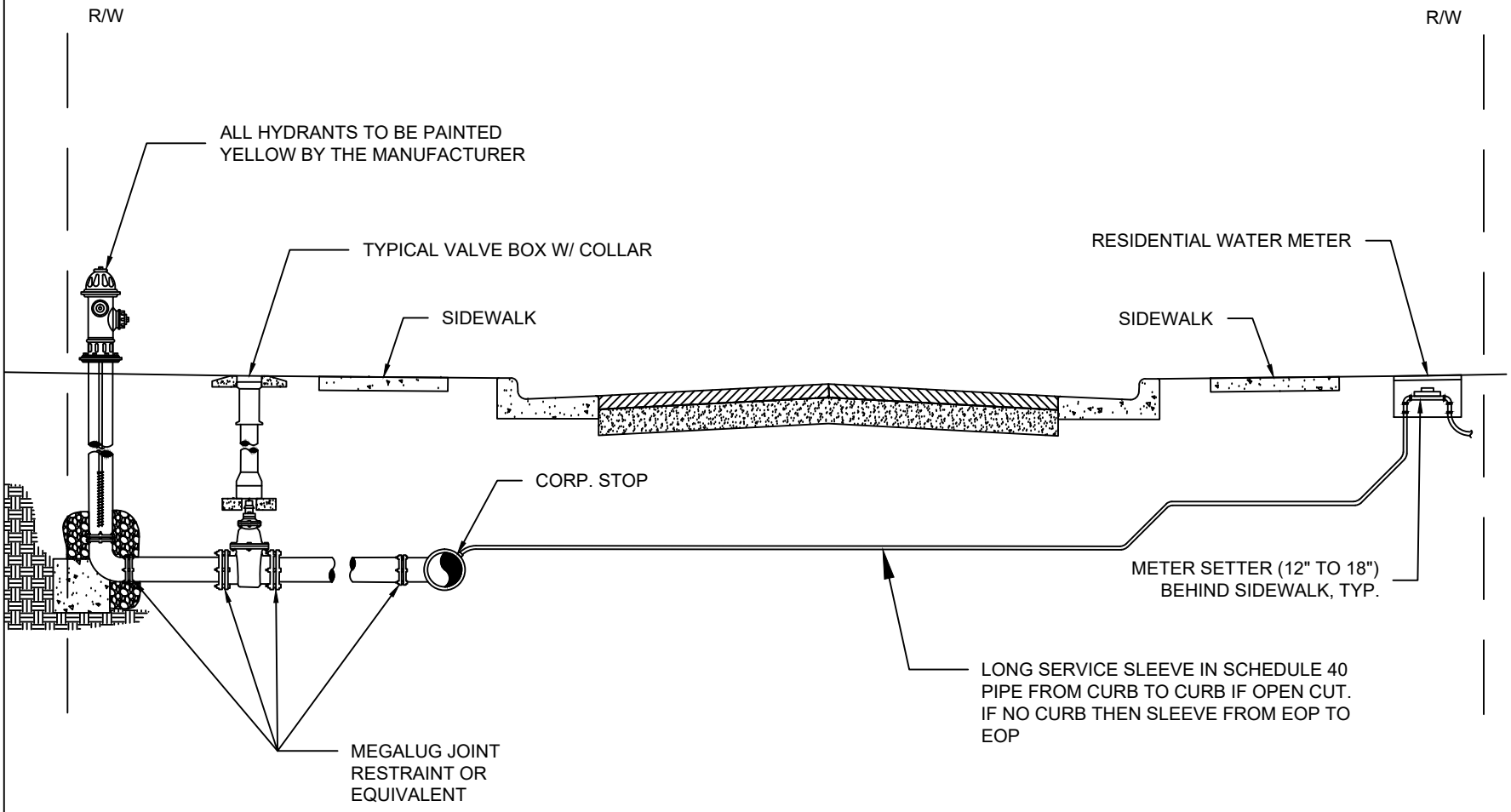
DRAWN BY:	JGA	
DATE:	05/20/2022	
REVISION:	11/22/2024	

W-23

CONCRETE EQUIPMENT PAD

NOT TO SCALE

REDELL WATER CORPORATION



NOTES:

1. WATERMAIN TO BE 4.5 FT FROM THE BACK OF THE CURB IF THERE ARE NO TREES IN THE PLANTING STRIPS
2. WATERMAIN TO BE 4.5 FT FROM THE EDGE OF PAVEMENT IF THERE IS NO CURB OR SIDEWALK
3. WATERMAIN TO BE 1 FT UNDER SIDEWALK IF TREE IS PLANTED IN PLANTING STRIP
4. NO HYDRANTS TO BE LOCATED IN RADIUS OF INTERSECTIONS
5. HYDRANT MUST BE 18" MINIMUM OFF CURB OR 18" MINIMUM BEHIND SIDEWALK IF BETWEEN SIDEWALK AND R/W
6. MAINTAIN 3 FT CLEARANCE AROUND HYDRANT
7. LOCATION OF HYDRANTS INSIDE CITY LIMITS MUST BE APPROVED BY CITY FIRE MARSHALL

DRAWN BY:	CSW
DATE:	11/22/2024
REVISION:	

W-24

UTILITIES IN R/W

NOT TO SCALE

REDELL WATER CORPORATION