

# PROJECT MANUAL

## WOOSTER WATER SYSTEM



**MAY, 2026**

ADH # 143926 Wooster  
Standard Specifications and  
Details (2026-05-20)

Craig Corder

Digitally signed by  
Craig Corder  
Date: 2026.06.22  
10:33:26-05'00'

ccorder

06/22/2026



**MCE PROJECT NO. 26-5716**

**FOR REVIEW ONLY**

**MCE** McCLELLAND  
CONSULTING  
ENGINEERS, INC.  
DESIGNED TO SERVE



# Arkansas Department of Health

4815 West Markham Street • Little Rock, Arkansas 72205-3867 • Telephone (501) 661-2000

**Governor Sarah Huckabee Sanders**  
**Renee Mallory, RN, BSN Secretary of Health**  
**Jennifer Dillaha, MD, Director**

Public Health Engineering Branch, Slot 37  
www.healthy.arkansas.gov/eng

Ph (501) 661-2623 Fax (501) 661-2032  
After Hours Emergency (501) 661-2136

June 22, 2026

Stephen Youngblood, P.E.  
McClelland Consulting Engineers, Inc.  
7302 Kanis Rd  
Little Rock, AR 72204



RE: MISCELLANEOUS REPORTS WATER/SEWER  
Wooster Standard Specifications and Details 2026  
Wooster Waterworks – Faulkner County  
Project 143926

Dear Mr. Youngblood:

The above-referenced project, received on May 29, 2026, has been reviewed and is hereby approved with the following conditions:

1. The Engineering Branch relied upon the statements and representations made in the specifications. In case any statement or representation in the aforementioned document is found to be incorrect, this Approval may be revoked.
2. There shall be no deviation from the specifications unless revised specifications have been first submitted for review and written consent given.
3. Additional specifications for items not included in these specifications will be required on future projects when the project includes items not in the standard specifications.
4. Please provide the ADH Engineering Branch with amendments for approval when they are made to the specifications. We strongly recommend that the specifications are thoroughly reviewed at least every 5 years to ensure conformance with current industry standards, regulations, etc.
5. The ADH Engineering Branch reserves the right to revoke this approval or require revisions to be made in the event of changes in current industry standards, rules, regulations, or laws which conflict with these standard specifications.
6. Flowable fill concrete shall only be used in contact with metal piping such as ductile iron or steel.

One set of the plans is being retained for our files. When submitting correspondence pertaining to this project, please include our reference number 143926.

Sincerely,

Craig S. Corder, P.E.  
Chief Engineer  
Engineering Branch - ADH

CSC:JTC:SF:sf

cc: Wooster Waterworks — PWS 196

# **PROJECT MANUAL**

## **WOOSTER WATER SYSTEM**

**MAY, 2026**

**MCE PROJECT NO. 26-5716**

**Prepared By:**

McClelland Consulting Engineers, Inc.

7302 Kanis Road

Little Rock, Arkansas 72204

Phone 501/371-0272

Fax 501/371-9932

## Wooster Water System Material Specifications (Summary)

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| Water System Material                 | Wooster Water System Specification                                                           |
|---------------------------------------|----------------------------------------------------------------------------------------------|
| PVC Pipe – 2” through 8”              | Class 200 SDR 21                                                                             |
| Ductile Iron Pipe – 6” through 12”    | Min. 250 PSI Pressure Class                                                                  |
| Joint Restraint                       | Megalug Series 1100 by EBAA                                                                  |
| Tracer Wire Splice Caps               | Carsonite Model LCTSI508                                                                     |
| Tracer Wire Splice Poles              | Carsonite Model CTP307201                                                                    |
| Marking Tape                          | Terra Tape "Extra Stretch"<br>Rhino Marking and Protection Systems<br>Harris Industries Inc. |
| Water Line Marker Signs               | Carsonite International                                                                      |
| Gate Valves                           | Clow 2368<br>Mueller Series 2361                                                             |
| Valve Boxes                           | Mueller H-10364<br>Clow F-2452                                                               |
| Tapping Sleeves                       | Smith-Blair 662 / Romac SST / M&H Style 129                                                  |
| Fire Hydrants<br>(including iHydrant) | Clow Medallion<br>Mueller Super Centurion 250                                                |
| Blow-Off Hydrants                     | Kupferle Foundry Company, #77<br>Mainguard                                                   |
| Combination Air Valve (1/2"-2")       | A.R.I. D-040                                                                                 |
| Meter Box                             | DFW Plastics Polymer Body-1200TT                                                             |
| Meter Box Lid                         | Nicor #B9XB1UHDTHB-848                                                                       |
| Meter Setter                          | A.Y. McDonald 726-207WC2F44<br>(3/4"x5/8")<br>A.Y. McDonald 726-410WC2D44 (1")               |
| Tapping Saddle                        | Smith Blair Model #662                                                                       |
| Corp Stop                             | A.Y. McDonald NL 74701B-22 (1")<br>A.Y. McDonald 73122B-2 (2")                               |
| Service Tubing                        | SDR 9 HDPE Tubing (Drisco or Municipex)                                                      |

**WOOSTER WATER SYSTEM  
26-5716**

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## **SECTION 01 00 00**

### **GENERAL REQUIREMENTS AND PROCEDURES**

#### **PART 1. GENERAL**

##### **1.1 WORK INCLUDED**

- A. These Specifications for water system design and construction are provided to outline Wooster Water System's procedures and minimum criteria for the design and construction of water lines.
- B. All construction projects shall conform to these Specifications for acceptance by Wooster Water System. All construction drawings and specifications must be approved by Wooster Water System before construction begins. Construction observation services shall be provided by the Engineer of record. Final acceptance testing will be coordinated with Wooster Water System. Wooster Water System shall be given a minimum of forty-eight (48) hours' notice prior to the commencement of construction projects for observation purposes.
- C. A preconstruction meeting shall be held before initializing work. Two (2) full sets of construction drawings shall be provided to Wooster Water System at the preconstruction meeting.
- D. These Specifications set forth the minimum criteria for the design and all work in connection with the construction of water lines within the jurisdiction of Wooster Water System, including the entire system and its appurtenances from the water distribution system to the point of connection at the water meter. All drawings, profiles, cut sheets, easement documents, and specifications shall conform to the standards and requirements herein established. Addenda and/or revisions to these Specifications by Wooster Water System may be issued periodically and will be distributed to contractors upon request for Specifications. Users of this text are urged to review the latest revisions or editions to these Specifications to apprise themselves of any changes/revisions.
- E. Where the requirements of another jurisdictional authority having influence on work outside the purview of the Wooster Water System are greater than that provided by these Specifications, the work shall conform to the greater requirement of that respective jurisdictional authority.
- F. All water system design and construction shall be in accordance with the Faulkner County Code of Ordinances. All work within any city municipal boundary shall conform to the city codes and ordinances.
- G. The Contractor shall be responsible for procuring all necessary permits and licenses, paying all charges and fees, and giving all notices necessary and incidental to the work.
- H. These Specifications are provided with the intent of reducing project document assembly and agency review, and to provide for the highest quality construction methods and materials.



- I. These Specifications are written in imperative and abbreviated form. The imperative language is directed at the Contractor, unless specifically noted otherwise. Incomplete sentences shall be completed by inserting “shall”, “the Contractor shall”, “shall be”, and similar mandatory phrases by inference in the same manner as they are applied to notes on the Drawings. The words “shall be:” shall be supplied by inference where a colon (:) is used within sentences or phrases. Except as worded to the contrary, all indicated requirements shall be performed whether stated imperatively or otherwise.
- J. Questions and comments concerning these Specifications should be directed to Wooster Water System, 7 Reed Road, Wooster, AR 72181(501) 679-2048.

## **1.2 DEFINITIONS**

- A. Owner – Wooster Water System
- B. Engineer – The Engineer of record for Wooster Water System
- C. Contractor – Any individual, partnership, firm, corporation or other entity who is initiating the work as well as any and all contractors representing or working for that entity. This will also include contractors working directly for Wooster Water System
- D. Provide – Furnish and install, complete in place, fully operational, tested and approved.
- E. Products – The materials, systems, and equipment provided by the Contractor.

## **1.3 SUBMITTALS**

- A. Initial submittal for review shall be in PDF format.
- B. One (1) hard copies and one (1) PDF copy of submittal documents must be sent to the Owner.
- C. The Owner reserves the right to make corrections as necessary to ensure compliance with these specifications.
- D. Construction procedures other than those outlined in these specifications shall be submitted to the Owner for approval.
- E. Complete specifications covering any unusual or special construction procedures shall be submitted for approval, and approval must be received prior to beginning any construction operations.
- F. The Owner’s review time shall be expected to be a minimum of two (2) weeks for all submittals.

## **1.4 PROTECTION OF WATER SUPPLIES**

- A. There shall be no physical connections between a public or private water supply

system and a sanitary sewer or appurtenances thereto which would permit the passage of any polluted water into the potable supply. Water mains shall be installed at least ten (10) feet horizontally from any sewer manhole edge and/or sewer main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten (10) foot separation, the Arkansas Department of Health may allow deviation on a case-by-case basis if supported by data from the design engineer. Such deviation may allow installation of the water main closer to a sewer main provided that the water main is in a separate trench, and at an elevation so the bottom of the water main is at least 18-inches above the top of the sewer main.

- B. For locations where a new water main crosses a sewer main, the water main must be installed on top with a clear distance between pipes of at least eighteen (18) inches.
- C. If 18-inches of clearance cannot be provided or when the water main must pass below the sewer main, the water main shall be encased in watertight pipe centered on the crossing with sealed watertight ends extending at least ten (10) feet either side of the crossing. If the water main must pass below the sewer main, the water main encasement must be installed with a clearance of at least eighteen (18) inches from the sewer main in addition to the preceding encasement requirement. Exceptions to this must be approved in writing by the Arkansas Department of Health.
- D. Encasement pipe and associated materials shall be provided and installed in accordance with Section 31 23 16.15 of these Specifications.

## **1.5 CONNECTION TO EXISTING DISTRIBUTION SYSTEM**

- A. In cases where completing the connection will disrupt service to customers, the Contractor shall notify the Owner and Engineer at least two days in advance of the work. The customers whose service will be disrupted shall be notified by the Owner with the assistance of the Contractor. The Contractor shall plan the work so that disruption of service is held to a minimum. The plan must be satisfactory to the Owner/Engineer.
- B. After connections have been completed, the valves shall remain tightly closed until all testing and sterilization is complete.
- C. Connections to existing lines will be made as directed by the Engineer and in accordance with the standard details by tapping sleeves and valves or installation of fittings on existing lines.
- D. The Contractor will notify the Owner prior to operating any valves. An Owner's representative must be present before any valves are opened or closed on the water system.

## **1.6 WARRANTY**

- A. The Contractor shall warrant all work against defective materials or workmanship for a period of one (1) year after the date of final acceptance by the Owner. The

Contractor assumes responsibility for the same warranty for all work and materials provided by subcontractors or manufacturers of packaged equipment components.

- B. During the warranty period, the Contractor shall make, at his own expense, all repairs or replacements necessitated by defects in materials or workmanship and shall pay for any damages that result from such defects. The Contractor shall hold the Owner and the Engineer harmless from liability of any kind arising from damages due to said defects.
- C. The Contractor shall make all repairs and replacements promptly upon receipt of written order from the Owner. If the Contractor fails to make the repairs and replacements promptly, the Owner may do the work, and the Contractor and his Surety shall be liable for the cost thereof.

**END OF SECTION**

## **SECTION 01 11 00**

### **GENERAL DESIGN STANDARDS - WATER**

#### **PART 1. GENERAL**

##### **1.1 GENERAL**

- A. Approval shall be obtained from Wooster Water System prior to the installation of all water facilities connecting to Wooster Water System. Water lines shall be designed and installed in accordance with the Standard Specifications and Details.

##### **1.2 REQUIREMENTS TO EXTEND WATER SERVICE**

- A. All new development of any kind shall be required to extend water services to that development at the Contractor's expense. Water lines shall be extended to each property to be served by Wooster Water System. This includes all new developments, infill projects, and lot splits. Water service shall include providing adequate domestic water flows as well as fire protection as necessary with hydrants spaced in accordance with the local and state fire codes.
- B. Water service lines shall extend perpendicular to the water main and extend to the property being served where an appropriately sized water meter will be installed.
- C. On subdivision or large scale development water systems, water lines shall be extended through all the development to the property line so that future development(s) can tie on without disrupting the service to or property of any existing customers or owners. Dead end lines shall be avoided whenever possible.
- D. A blow-off assembly shall be installed on all dead end water lines.
- E. Developments shall tie to the existing water system at a minimum of two locations whenever possible to maintain water quality and maintain water service in the event of a water line break in the immediate vicinity. An inline valve shall be installed on the existing water line between the two points of connection if one is not currently installed. Water line extensions shall be required off the development to loop with the existing water distribution system. Construction of such extensions shall be at the expense of the Contractor.
- F. At some locations, easements may be required to facilitate future extensions of lines to adjacent properties.
- G. The requirements to extend water service and provide lines adequate for both domestic and fire demands as necessary shall apply to all subdivisions.

### **1.3 WATER SERVICE LINES**

- A. Service lines serving single meter sets and double meter sets shall be 1-inch HDPE tubing in accordance with these specifications.
- B. Service lines serving 1-1/2 inch and 2-inch meter sets shall be 2-inch HDPE tubing in accordance with these specifications.
- C. Water services lines installed across city streets shall be encased from back of curb to back of curb or back of sidewalk to back of sidewalk (if applicable). Water service lines installed across state highways shall be encased from right-of-way line to right-of-way line. 1-inch lines shall be encased in 2 inch HDPE SDR9 tubing. 2-inch lines shall be encased in 3-inch HDPE SDR9 tubing.
- D. Service lines serving 3-inch and large meter sets shall be PVC in accordance with these specifications.

### **1.4 BACKFLOW PREVENTION**

- A. Wooster Water System's distribution system shall be protected from the possibility of backflow as necessary by the use of a reduced-pressure principal backflow prevention assembly (RPZ), a double check valve assembly (DC), or an air gap in accordance with the Arkansas State Plumbing Code (ASPC), latest edition.
- B. Wooster Water System shall review and sign off on all proposed backflow prevention installations.
- C. The following is a partial list of facilities which ordinarily will require a reduced-pressure principal backflow prevention assembly (RP) or an air gap in accordance with the ASPC, latest edition. Requirements are based upon the degree of hazard afforded the public potable water system.
  - 1. Automatic car washes.
  - 2. Auxiliary water systems (interconnected with the public water system).
  - 3. Exterminators and veterinary clinics.
  - 4. Facilities with boilers, condenser water or chilled water systems.
  - 5. Fire systems containing chemical additives.
  - 6. Hospitals, medical clinics, dental clinics, health clinics, sanitariums, morgues, mortuaries, autopsy facilities, nursing and convalescent homes.
  - 7. Irrigation systems and lawn sprinkler systems.
  - 8. Laboratories (industrial, commercial, photography, medical and school).
  - 9. Commercial laundries.
  - 10. Radiator and battery shops.
  - 11. Restricted, classified or other facilities closed to inspection.
  - 12. Sand, gravel and concrete plants.
  - 13. Wastewater treatment plants, pump stations, and storm water pumping facilities.
  - 14. Commercial swimming pools.
  - 15. Commercial farms using pesticides and herbicides.

16. Establishments holding livestock for sale or slaughter including cattle, horses, hogs, poultry, emus, ostriches, llamas, rabbits, etc.
  17. Others (with suspected high hazards).
- D. The following is a partial list of facilities which ordinarily will require a minimum of DC or an air gap in accordance with the ASPC, latest edition:
1. Tall buildings (over four stories) or any buildings with water booster pumps.
  2. Beauty parlors and barber shops.
  3. Hotels and motels.
  4. Restaurants, cafeterias, fast-food marts and other food handling facilities.
  5. Fire sprinkler systems (without chemicals).
  6. Others (with suspected medium hazards).

## **1.5 EASEMENTS**

- A. For water lines that are up to 10 feet deep, permanent utility easements shall be at least 15 feet in width with the water line in the center of the easement. For water lines that are greater than 10 feet deep, easements shall be 1 foot per foot of depth to the bottom of the pipe on each side of the water line. The easement may be designated specifically for water line purposes or it may be a general utility easement.
- B. New developments that contain existing water lines must modify the existing easements as necessary to meet the above requirements for widths in relation to pipe location and size, including increasing the size of the easement if proposed fill will cause the depth of bury to exceed ten feet.
- C. Easements of a lesser width will be considered when adjacent to another easement or under other special circumstances.

## **1.6 PERMITS**

- A. For new developments, all permits required to accomplish the work shall be the responsibility of the Contractor/Developer. Such permits may include but are not limited to permits for work within Highway Department Right-of-Way, railroad crossing permits, "Notice of Intent" for Erosion Control (Arkansas Department of Environmental Quality) Stormwater Permits, Short Term Activity Authorizations, US Army Corps of Engineers Permits, etc. Work shall not be started without the appropriate permit(s) in place.

## **1.7 APPROVAL OF WATER EXTENSION PLANS**

- A. Detailed plans and specifications shall be required for all extensions and shall be prepared by a professional engineer registered to do business in the State of Arkansas.
- B. The plans and specifications shall be first approved by Wooster Water System and then shall be forwarded to the Arkansas Department of Health by the Engineer of Record for their approval. In no case shall any water line construction be allowed before the Contractor has written approval from the Arkansas Department of Health.

- C. Private lines constructed for fire prevention purposes which have no metering device or backflow prevention device at the point of tie-in to the main shall be treated as a public line and be subject to these specifications as far as engineering, construction techniques, materials, testing, and inspections are concerned. After a final inspection and acceptance of the work, the line shall be owned and maintained by the owner of the property it serves.
- D. No construction of any kind may begin without an erosion control plan on file with the Owner. The erosion control measures must be in place in the field prior to construction. For projects that require a permit, it is the responsibility of the contractor to have on file with the Arkansas Department of Environmental Quality a "Notice of Intent".
- E. Written notice of the intent to begin construction must be given to the Owner no less than three (3) days nor more than ten (10) days prior to the construction start date. A pre-construction conference involving the Engineer of Record, Contractor, and the Owner is required prior to beginning construction.

#### **1.8 LOCATION OF WATER LINES**

- A. Water lines shall be placed along public roadways either in the public right of way or in an easement adjacent to the road right of way. Water lines can be placed in easements between lots when there is no other reasonable way to access a line or provide for future service. In no case shall lines intended for individual services be placed in the rear of lots or along back property lines.
- B. Water lines shall be located a minimum of 36-inches from any other parallel utilities or structures.

#### **1.9 LOCATION OF WATER METERS**

- A. Water meters shall be located in non-paved areas and readily accessible to the Owner without going through fences or gates.
- B. Water meters shall be free of obstructions for a minimum of a 3-foot radius from the center of the water meter box.
- C. Water meters shall be located on the Owner's side of the property line (edge of easement or right-of-way).
- D. Double meter sets shall be located on the common property line between the two properties being served.

#### **1.10 VALVE MARKERS**

- A. In all rural settings except those in cleaned yards, when valves, air release valves, blow-offs, and other similar hardware are installed in an easement location, water system marker signs shall be installed so that the items may be easily found.

### **1.11 WATER LINE DEPTH**

- A. Minimum depth to the top of pipe for all water main lines shall be 3.0 feet.
- B. Maximum water line cover shall be 5.0 feet under normal conditions. Cover greater than 5.0 feet shall be allowed for short distances where required by field conditions and approved by the Owner. Water line depth shall be shown on the as-built drawings.
- C. Minimum depth of all water service lines from the main to the water meter shall be 30-inches.

### **1.12 WATER PRESSURE**

- A. The water distribution system shall be designed to maintain a minimum working water pressure of 40 psi at the water meter during a fire flow of 1600 gpm for one (1) story building, 1,500 gpm for two (2) story building will be required.
- B. Design of new construction that results in less than 40 psi working pressure at the water meter shall be approved by the Wooster Water System representative on a case by case basis. A fire flow of 1600 gpm for one (1) story building, 1,500 gpm for two (2) story building will be required.
- C. Under no circumstances shall the working pressure of the water distribution system be below 20 psi during fire flow of 500 gpm for one (1) story building, 1,000 gpm for two (2) story building will be required.
- D. Multiple story building above two (2) stories will need to be reviewed by Owner.

### **1.13 VELOCITIES**

- A. Velocities in the water distribution system shall be sized such that velocities will be no greater than five (5) feet per second during normal operation conditions.
- B. Velocities during fire flow conditions shall not exceed ten (10) feet per second.

### **1.14 VALVES**

- A. Isolation valves for water distribution lines shall be resilient seat gate valves.
- B. Valve spacing for development in the water distribution system shall not exceed 500 feet in commercial developments, or more than one block or 800 feet in residential developments.
- C. Valves shall be located on each side of a major stream crossing along with leak detection.

### **1.15 FIRE HYDRANT SPACING AND PLACEMENT**

- A. For developments where fire protection is required, fire hydrants for single family dwellings and duplexes shall be installed so that (1) the distance between two



consecutive fire hydrants does not exceed 600 feet, and (2) no lot is more than 300 feet from a fire hydrant.

- B. For developments where fire protection is required, fire hydrants in areas for apartment complexes, commercial structures, and industrial structures shall be installed so that the distance between two consecutive fire hydrants does not exceed 400 feet. The local Fire Chief shall have the authority to require additional fire hydrants upon a determination that such additional fire hydrants are necessary to provide adequate fire protection as outlined in the International Fire Code, latest edition.
- C. Fire hydrants shall be free of obstructions for a minimum of a 3-foot radius from the center of the fire hydrant. Fire hydrants shall be placed outside of all fences.

#### **1.16 FIRE LINES**

- A. Fire lines, backflow prevention, and FDC shall be installed and inspected the same as waterlines.
- B. Fire lines shall be constructed of ductile iron pipe and shall be poly wrapped.
- C. All valves for fire lines shall have the word "FIRE" on the valve box lid, this includes the valve on the water main. Post indicator valves shall be installed on all fire lines to demarcate ownership. Post indicator valves shall match the valve manufacturer.

#### **1.17 AIR VALVES**

- A. Air valves shall be required at high points in water lines or on other specific applications to protect the water distribution system at the discretion of the Wooster Water System representative.

#### **1.18 STEEL ENCASEMENTS**

- A. Water lines under roadways, culverts, creeks, concrete channels, retaining walls, or other difficult and/or dangerous to maintain areas shall be encased in a smooth steel encasement pipe. The steel encasement shall extend 5 feet either side of the area.
- B. HDPE carrier and/or encasement pipe installed via directional bores may be used in lieu of steel encasement when approved by the Owner.

#### **1.19 PLANNED WATER OUTAGES**

- A. Under no circumstances shall water be shut off to any active service in the course of new construction without written permission from Wooster Water System. If water pressure needs to be reduced to facilitate construction, a preconstruction meeting shall be held. The work shall be performed as described in the Water Line Pressure Reduction Procedures Section.

## **1.20 PROTECTION OF WATER SUPPLIES**

- A. There shall be no physical connections between a public or private water supply system and a sanitary sewer or appurtenances thereto which would permit the passage of any polluted water into the potable supply. Water mains shall be installed at least ten (10) feet horizontally from any existing sewer manhole edge and/or existing sewer main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten (10) foot separation, the Arkansas Department of Health may allow deviation on a case-by-case basis if supported by data from the design engineer. Such deviation may allow installation of the water main closer to a sewer main provided that the water main is in a separate trench, and at an elevation so the bottom of the water main is at least 18-inches above the top of the sewer main.
- B. For locations where a new water main crosses a sewer main, the water main must be installed on top with a clear distance between pipes of at least eighteen (18) inches.
- C. If 18-inches of clearance cannot be provided or when the water main must pass below the sewer main, the water main shall be encased in watertight pipe centered on the crossing with sealed watertight ends extending at least ten (10) feet either side of the crossing. If the water main must pass below the sewer main, the water main encasement must be installed with a clearance of at least eighteen (18) inches from the sewer main in addition to the preceding encasement requirement. Exceptions to this must be approved in writing by the Arkansas Department of Health.

## **1.21 EXISTING UTILITY STRUCTURES AND FACILITIES**

- A. The drawings shall show the location of overhead and underground utility lines and existing water and sewer lines according to the best information presented and available.

## **1.22 RECORD DRAWINGS**

- A. DATUM REQUIREMENTS
  - 1. Horizontal Datum: NAD83 (2011) Arkansas State Plane, North Zone, US foot (Grid System).
  - 2. Vertical Datum: NAVD88 (feet)
- B. Water drawings submitted as record ("as-built") drawings shall indicate the location where the water line was installed and have the following items surveyed during/after construction and shown on the drawings:
  - 1. Fire hydrant, location and top operating nut elevation
  - 2. Water valves, location
  - 3. Water fittings, location
  - 4. Water service saddle, location
  - 5. Water service saddles used for testing, location
  - 6. Water meters, location
  - 7. Tapping sleeves, location
  - 8. Any other pipe penetrations, location

9. Steel encasements, location
  10. Details shall be provided for all vertical offset water lines, profile drawing
- C. Manufacturing data shall be collected for pipe, valves, and hydrants as follows:
1. Pipe
    - a. Manufacturer
    - b. Material (DI or PVC)
    - c. Diameter
    - d. Production run code or lot code
  2. Valves
    - a. Manufacturer
    - b. Model number
    - c. Year manufactured
    - d. Type (gate, ball)
    - e. Diameter
  3. Hydrants
    - a. Manufacturer
    - b. Model number
    - c. Year manufactured
    - d. Depth of bury, including extensions
- D. All sheets shall have the phrase "as-built" or "record drawing" boldly printed on them with the as constructed date. Record drawings shall be submitted in hard copy, .dwg electronic format, and .pdf electronic format.

### **1.23 INSPECTIONS AND TESTING PROCEDURES**

- A. All field tests required for a project shall be witnessed by the Owner or the Owner's authorized representative.
- B. The City requires a 24-hour working day notice on all tests. Calls to the Owner for the purpose of setting test times shall be made by no later than 10:00 AM for test on the following work day.
- C. Tests delayed by weather or other factors will be rescheduled on the same basis.
- D. In no case shall a test be made without the presence of the Owner or the Owner's authorized representative. It is the responsibility of the Contractor to coordinate the scheduling of tests with the Owner and with the other parties involved.
- E. The tests generally associated with water line construction are:
1. Pressure testing of tapping sleeve installations
  2. Pressure testing of lines after installation
  3. Disinfection
  4. Bacteriological (Bac-T) testing
  5. Fire hydrant flow testing
  6. Trace wire continuity testing
- F. Generally, no Contractor or Engineer of Record involvement is required in the taking of samples for the Bac-T test except that the Contractor is responsible for the proper flushing of the line prior to samples being taken by the Owner.

However, the Owner may require the presence of the Contractor or Engineer of Record when questions have been raised as to the methodology or techniques used in the sampling process. Samples are to be at the expense of the contractor and labeled as "Construction Samples" and not submitted under the Owner's PWS number.

- G. Bac-T samples are sent to the Arkansas Department of Health for testing. Results obtained by the Owner shall be forwarded to the Engineer of Record either by email, fax, or mail upon receipt by the Owner.
- H. Lines failing the Bac-T tests shall be re-sampled as soon as practicable. If a line fails two (2) consecutive Bac-T tests, the line must be re-chlorinated before Bac-T samples can be taken again. The Owner shall not be responsible for rescheduling Bac-T tests.
- I. The fire hydrant test shall consist of checking the operation of the fire hydrant valve and flow testing the fire hydrant. This shall be done after the pressure test has been completed. The fire hydrant valve shall be left in the open position during the test and after the test is completed.
- J. All equipment, materials, and labor required for testing shall be furnished by the Contractor at his expense.

#### **1.24 FINAL ACCEPTANCE BY THE OWNER**

- A. The Owner will be deemed to have accepted water lines and appurtenances for ownership upon completion of the following.
  - 1. Acceptable Final Walk-through by the following:
    - a. A representative of Wooster Water System
    - b. The Engineer of Record
    - c. The Contractor
    - d. A representative of the City Engineer's Office (if inside city limits)
  - 2. Acceptable walk-through by the Owner for location, grade, and condition of water meter settings.
  - 3. Record Drawings are received by the Owner:
    - a. Two (2) full-size sets of paper drawings
    - b. One (1) flash drive with electronic versions of the drawings, in both .pdf and AutoCAD versions.
  - 4. Engineer of Record Certification is received by the Owner.
- B. No water meter shall be set until all final acceptance requirements are met and the line is accepted in writing by the Owner.

#### **1.25 APPLICABILITY**

- A. The regulations and requirements contained in these Standard Specifications shall be applicable to all land or parcels of land being developed for commercial, industrial, or residential use. The material and construction specifications shall be applicable to all water line construction under the control of Wooster Water System.

#### **END OF SECTION**

## **SECTION 01 40 00**

### **WATER LINE PRESSURE REDUCTION PROCEDURES**

#### **PART 1. GENERAL**

##### **1.1 WORK INCLUDED**

- A. This section covers the procedures associated with reducing water line pressure for construction.

##### **1.2 PROCEDURES**

- A. Water lines may need to have the pressure significantly reduced to facilitate construction in a project area, i.e. tie-ins or cut and caps.
- B. Water pressure reductions shall be approved and coordinated with Wooster Water System.
- C. The maximum amount of time that the line is permitted to be shut down shall be determined by Wooster Water System
- D. The Contractor shall have sufficient materials, labor, and necessary backup provisions in place prior to initiating water line pressure reduction to ensure that construction activities can be completed within the time determined by Wooster Water System.
- E. A minimum of 72-hour notice shall be provided to each customer that will be affected by the pressure reduction procedures.
- F. The Contractor shall provide the notices and generate a list of each address that received a notice. The list shall be given to Wooster Water System for their files.

##### **1.3 CONSTRUCTION REQUIREMENTS**

- A. The excavation in the project area shall be dewatered prior to pressure in the water main being reduced.
- B. All water pipe, fittings, and materials shall be disinfected per AWWA C651, latest revision.
- C. Immediately after construction is complete, the existing water lines shall be flushed thoroughly and background chlorine levels re-established.

**END OF SECTION**

## **SECTION 01 55 26**

### **TRAFFIC CONTROL**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. The Contractor shall conduct construction work in a manner that will ensure the least obstruction to traffic and shall provide for the safety and convenience of the general public.
- B. This item shall include the erection of signs and barricades, and the maintenance of, or non-interference with traffic in accordance with MUTCD and accepted practices as required for the work.

#### **PART 2. PROCEDURES**

##### **2.1 NOTIFICATION**

- A. In the event that traffic will be restricted on public roadways, the Contractor shall contact local authorities to get necessary permissions and permits to obstruct traffic flow.
- B. The Contractor is to notify the Owner as well as local fire departments, law enforcement, and Emergency Medical Services 48-hours before any roadway is cut or barricaded and provide the times the roadway is expected to be closed.
- C. After a roadway closure and barricade plan has been approved by local governing authorities, the Contractor must notify the Owner again one (1) hour prior to the closing of the public roadway. This notification shall not apply where only one lane of traffic is blocked or where there is an emergency situation. In emergencies, such notice shall be given to Emergency Services as soon as reasonably possible.

##### **2.2 TRAFFIC CONTROL DEVICES**

- A. The Contractor shall work in cooperation with local governing authorities to establish, install, maintain, and operate complete and adequate traffic control devices, including signage, in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) and the requirements of local governing authorities.

##### **2.3 FLAGMAN**

- A. If traffic congestion warrants, the Contractor may be required to hire a Flagman to direct traffic and to maintain traffic control. The Contractor will be required to pay all costs for such traffic control as may be required.

## **2.4 DRIVEWAYS**

- A. It shall be the Contractor's responsibility to maintain adequate access to private and commercial property at all times, except as approved by the Owner or Engineer. During the construction of driveways or at any time that the property Owner cannot use his driveway, the Contractor shall notify the property owner when the driveway will be closed and the approximate length of time that it will be closed.
- B. It shall be the Contractor's intent to cause as little inconvenience as possible to private property owners.

## **PART 3. EXECUTION**

Not Used

**END OF SECTION**

## **SECTION 02 41 13**

### **SELECTIVE SITE DEMOLITION**

#### **PART 1. GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Labor and material that is necessary for the work associated with the removal of the existing facilities as shown on the Drawings.

##### **1.2 RELATED SECTION**

- A. Section 31 10 00 - Site Clearing.
- B. Section 31 23 33 – Trenching & Backfilling

##### **1.3 SAFETY REQUIREMENTS**

- A. Work shall be done in conformance with federal, state, and local rules and regulations pertaining to safety and as specified elsewhere in these Specifications.

##### **1.4 SALVAGE**

- A. Salvageable piping, valves, hydrants and materials removed during demolition are the property of the Owner if the Owner so desires. Contractor shall coordinate with Owner for which items are to be returned and which items to be disposed of. Place salvageable materials on the site in an area designated by the Owner.

#### **PART 2. PRODUCTS**

Not Used.

#### **PART 3. EXECUTION**

##### **3.1 PREPARATION**

- A. Make provisions to prevent the entrance of surface runoff from entering the area of excavation.
- B. Coordinate any disconnect and capping of services with Owner before starting demolition.
- C. Protect existing structures and underground utilities within the Work area from being damaged during demolition.



### **3.2 DEMOLITION AND REMOVAL**

- A. Excavate to the minimum extent necessary.
- B. Dispose of demolition debris at a site approved by the Owner or to the nearest state approved landfill permitted to receive the waste.

### **3.3 BACKFILLING**

- A. Begin backfilling excavated areas after receiving approval from Engineer.
- B. Backfill in accordance with Section 31 00 00 and Section 31 23 33.
- C. Import backfill as required.

**END OF SECTION**

## **SECTION 03 20 00**

### **CONCRETE REINFORCING**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. Provide reinforcing steel or welded wire fabric/mesh, as specified.
- B. Conform to "Placing Reinforcing Bars", An Extensive Field Reference for the Proper Placement of Steel Reinforcing Bars, Joint Effort of CRSI-WCRSI, prepared under the direction of the CRSI Committee on Engineering Practice.
- C. Notify Engineer when reinforcing steel is ready for inspection and allow sufficient time for this inspection prior to placing concrete.
- D. Related sections:
  - 1. Section 03 30 00 – CAST-IN-PLACE CONCRETE

##### **1.2 REFERENCE STANDARDS**

- A. American Concrete Institute (ACI), 38800 Country Club Drive, Farmington Hills, Michigan 48331 (latest revision).
  - 1. ACI CODE-318 Building Code Requirements for Structural Concrete and Commentary
  - 2. ACI PRC-315 Guide to Presenting Reinforcing Steel Design Details
- B. American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428, (latest revision).
  - 1. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
  - 2. ASTM A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

##### **1.3 SUBMITTALS**

- A. Submit the following to the Engineer prior to the start of concrete work:
  - 1. Bending lists,
  - 2. Placing drawings,
  - 3. Shop drawings.
- B. Shop Drawings:
  - 1. Bars for footings, including dowels, shall not be fabricated and shipped without prior review of Shop Drawings by the Engineer.
  - 2. Shop and Placing Drawings shall include reinforcing placing plans and details indicating size, location, arrangement, placing sequence, etc., and shall conform to ACI PRC-315.

## **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver Reinforcing Steel:
  - 1. Deliver with suitable hauling and handling equipment.
  - 2. Tag for easy identification.
  - 3. Store to prevent contact with the ground.
- B. Unloading, storing, and handling of bars shall conform to CRSI publication "Placing Reinforcing Bars".

## **PART 2. PRODUCTS**

### **2.1 DEFORMED REINFORCING BARS**

- A. Deformed carbon-steel bars shall conform to ASTM A615, Grade 60.

### **2.2 WELDED WIRE FABRIC/MESH**

- A. Welded wire fabric shall conform to ASTM A1064.

### **2.3 ACCESSORIES:**

- A. Tie wire: 16-gage, black, soft-annealed wire.
- B. Bar supports: proper type for intended use.
- C. Bar supports in beams, columns, walls, and slabs exposed to view after stripping: Small rectangular concrete blocks of same color and strength of concrete that is being placed around them.
- D. Concrete supports: for reinforcing concrete placed on grade.
- E. Conform to requirements of CRSI publication "Placing Reinforcing Bars".

## **PART 3. EXECUTION**

### **3.1 CONCRETE REINFORCEMENT**

- A. Clean metal reinforcement of loose mill scale, oil, earth and other contaminants.
- B. Straightening and rebending reinforcing steel:
  - 1. Do not straighten or rebend concrete reinforcement.
  - 2. Where construction access through reinforcing is a problem, bundle or space bars instead of bending.
  - 3. Submit details and obtain Engineer's review prior to placing.

- C. Protection, spacing, and positioning of reinforcing steel: Conform to the current edition of ACI CODE-318, reviewed placing drawings and design drawings.
- D. Location Tolerance: Conform to the current edition of CRSI publication "Placing Reinforcing Bars" and to the Details and Notes on the Drawings.
- E. Splicing:
  - 1. Conform to Drawings and current edition of ACI CODE-318.
  - 2. Stagger splices in adjacent horizontal reinforcing bars.
- F. Tying deformed reinforcing bars: Conform to current edition of CRSI publication "Placing Reinforcing Bars" and to details and notes on Drawings. Reinforcement steel shall be tied a minimum of every third intersection (33%).
- G. Field Bending:
  - 1. Field bending of reinforcing steel bars is not permitted when rebending will later be required to straighten bars.
  - 2. Consult with Engineer prior to pouring if there is a need to work out a solution to prevent field bending.

### **3.2 REINFORCEMENT AROUND OPENINGS**

- A. Place an equivalent area of steel around pipe or opening and extend on each side sufficiently to develop bond in each bar.
- B. See Drawings for bar extension length each side of opening.
- C. Where welded wire fabric is used, provide extra reinforcement using fabric or deformed bars.

### **3.3 WELDING REINFORCEMENT**

- A. Welding shall not be permitted unless Contractor submits detailed Shop Drawings, qualifications, and radiographic nondestructive testing procedures for review by Engineer.
  - 1. Obtain results of this review prior to proceeding.
  - 2. Basis for submittals: Structural Welding Code, Reinforcing Steel, AWS D1.4, published by American Welding Society, and applicable portions of ACI CODE-318, current edition.
  - 3. Test 10% of welds using radiographic, nondestructive testing procedures in accordance to the above referenced codes.

### **3.4 PLACING WELDED WIRE FABRIC/MESH**

- A. Conform to ACI 318, latest edition, and to the current Manual of Standard Practice for Welded Wire Reinforcement, by the Wire Reinforcement Institute regarding placement, bends, laps, and other requirements.

B. Placing:

1. Extend fabric to within 2 inches of edges of slab.
2. Lap splices at least 1-1/2 courses of fabric and a minimum of 6 inches.
3. Tie laps and splices securely at ends and at least every 24 inches with 16-gage black annealed steel wire.
4. Place welded wire fabric at the proper distance above bottom of slab.

**END OF SECTION**

## **SECTION 03 30 00**

### **CAST-IN-PLACE CONCRETE**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. Furnish all labor, materials, equipment, and incidentals for cast-in-place concrete required to complete the Work as indicated on the Drawings and as specified herein.
- B. Related sections:
  - 1. Section 03 20 00 – CONCRETE REINFORCING

##### **1.2 REFERENCE STANDARDS**

- A. American Concrete Institute (ACI), 38800 Country Club Drive, Farmington Hills, Michigan 48331 (latest revision).
  - 1. ACI SPEC-117 – Specification for Tolerances for Concrete Construction and Materials
  - 2. ACI PRC-211.1 – Selecting Proportions for Normal-Density and High-Density Concrete - Guide
  - 3. ACI SPEC-301 – Specifications for Concrete Construction
  - 4. ACI PRC-304 – Guide for Measuring, Mixing, Transporting, and Placing Concrete
  - 5. ACI PRC-304.2 – Guide to Placing Concrete by Pumping Methods
  - 6. ACI PRC-304.4 – Placing Concrete with Belt Conveyors
  - 7. ACI PRC-305 – Guide to Hot Weather Concreting
  - 8. ACI PRC-306 – Guide to Cold Weather Concreting
  - 9. ACI PRC-308 – Guide to External Curing of Concrete
  - 10. ACI PRC-309 – Guide for Consolidation of Concrete
  - 11. ACI CODE-318 Building Code Requirements for Structural Concrete and Commentary
  - 12. ACI PRC-347 – Guide to Formwork for Concrete
  - 13. ACI CODE-350 – Code Requirements for Environmental Engineering Concrete Structures and Commentary
- B. American Society of Testing for Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428, (latest revision).
  - 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 C94 – Standard Specification for Ready-Mixed Concrete
  - 5. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete
  - 6. ASTM C150 – Standard Specification for Portland Cement
  - 7. ASTM C171 – Standard Specification for Sheet Materials for Curing Concrete

8. ASTM C173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
9. ASTM C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
10. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete
11. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
12. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete
13. ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
14. ASTM C685 – Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
15. ASTM C881 – Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
16. ASTM C1064 – Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
17. ASTM C1602 – Standard Specification for Mixing Water Used in the Production of Hydraulic-Cement Concrete
18. ASTM E329 – Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

### **1.3 SUBMITTALS**

- A. Submit the following to the Engineer prior to the start of concrete work:
  1. All chemical admixtures, including certifications. Chloride ion content must be included.
  2. Concrete mix design,
  3. Certification for aggregate quality,
  4. Mill tests and chemical analysis for cement and fly ash,
  5. Method of adding admixtures,
  6. Materials and methods for curing,
  7. Indicate the name of the independent testing agency to perform the services required in ACI SPEC-301, Section 167,
  8. Laboratory tests on concrete.

### **1.4 QUALITY ASSURANCE**

- A. Reinforced concrete shall comply with the requirements of ACI SPEC-301, ACI CODE-318, and ACI CODE-350.
- B. The recommendations of ACI PRC-305 shall be followed during hot weather concreting. The recommendations of ACI PRC-306 shall be followed during cold weather concreting.
- C. Inspection: Engineer shall have access and rights to inspect batch plants, cement mills, and facilities of suppliers, manufacturers, and subcontractors providing products specified.

- D. Batch Plant:
  - 1. Certification: Current certification that weighing scales have been tested and are within tolerances as set forth in National Institute of Standards and Technology Handbook No. 44.
  - 2. Equipment: Semi-automatic or fully automatic.
- E. Obtain materials from the same source throughout the Work.
- F. A concrete pre-placement conference shall be held prior to the placement of structural concrete. Representatives from the Contractor, Engineer, independent testing laboratory, concrete ready-mix supplier, and concrete pumping subcontractor shall be in attendance.

## **PART 2. PRODUCTS**

### **2.1 CEMENT**

- A. Cement shall be Portland Type I or Type II complying with the requirements of ASTM C150. One brand of cement shall be used throughout the project. Cement brand shall be subject to review and approval by the Engineer.

### **2.2 WATER**

- A. Potable water for cement shall be clean and free from oil, acid, alkali, organic matter, or other deleterious substances. Water shall meet the requirements of ASTM C1602.

### **2.3 FLY ASH**

- A. Fly ash shall comply with the requirements of ASTM C618, Type C.

### **2.4 CONCRETE AGGREGATES**

- A. General:
  - 1. Natural aggregates, well graded, free from deleterious coatings and organic materials conforming to ASTM C33.
  - 2. Import non-reactive aggregates if local aggregates are reactive. (Appendix XI-ASTM C33).
  - 3. Wash aggregates uniformly before use.
  - 4. Other aggregate gradations may be approved by Engineer.
- B. Fine Aggregates:
  - 1. Clean, sharp, natural sand conforming to ASTM C33.
  - 2. Less than 2% passing the No. 200 sieve.
- C. Coarse Aggregates:
  - 1. Natural gravel, crushed gravel, crushed stone, or combination of these materials.



2. Less than 15% float or elongated particles (long dimension >5 times short dimension).
3. Less than 0.5% passing the No. 200 sieve.

D. Grading Requirements for Coarse Aggregates:

| Sieve Size or<br>Size in<br>Inches | 1-1/2"<br>Aggregate<br>(ASTM #5) | 1"<br>Aggregate<br>(ASTM #57) | 3/4"<br>Aggregate<br>(ASTM #67) |
|------------------------------------|----------------------------------|-------------------------------|---------------------------------|
| 1-1/2"                             | 100                              | 100                           | ---                             |
| 1"                                 | 90 - 100                         | 95 - 100                      | 100                             |
| 3/4"                               | 20 - 55                          | ---                           | 90 - 100                        |
| 1/2"                               | 0 - 10                           | 25 - 60                       | ---                             |
| 3/8"                               | 0 - 5                            | ---                           | 20 - 55                         |
| No. 4                              |                                  | 0 - 10                        | 0 - 10                          |
| No. 5                              |                                  | 0 - 5                         | 0 - 5                           |

E. Grading Requirements for Fine Aggregates:

| Sieve Size | Minimum | Maximum |
|------------|---------|---------|
| 3/8"       | 100     | ---     |
| No. 4      | 95      | 100     |
| No. 8      | 80      | 100     |
| No. 16     | 50      | 85      |
| No. 30     | 25      | 60      |
| No. 50     | 10      | 30      |
| No. 100    | 2       | 10      |

## 2.5 CONCRETE AIR-ENTRAINING ADMIXTURES

- A. Air entraining admixtures shall comply with ASTM C260. Admixture shall be certified to be compatible with other required concrete admixtures. Air entraining admixtures shall not contain calcium chlorides
- B. Acceptable manufacturers:
  1. Daravair by GCP Applied Technologies.
  2. MasterAir AE by Master Builders Solutions.
  3. Eucon AEA by Euclid Chemical Co.
  4. SikaAir by Sika Corporation.
  5. Or approved equal.
- C. Air entrainment shall be provided for concrete exposed to freezing and thawing or required to be watertight.

## **2.6 WATER REDUCING ADMIXTURES**

- A. Water-Reducing Admixture: Conforming to ASTM C494, Type A:
  - 1. Mira or Zyla by GCP Applied Technologies.
  - 2. Eucon WRor MR by Euclid Chemical Company.
  - 3. MasterPozzolith or MasterPolyheed by Master Builders Solutions.
  - 4. Plastocrete by Sika Corporation.
  - 5. Or approved equal.
- B. Water-Reducing Retarding Admixture: Conforming to ASTM C494, Type D:
  - 1. Recover, by GCP Applied Technologies.
  - 2. Eucon Retarder-75 by Euclid Chemical Company.
  - 3. MasterSet Delvo by Master Builders Solutions.
  - 4. Plastiment by Sika Corporation.
  - 5. Or approved equal.
- C. High-Range Water-Reducing Admixture (Superplasticizer): Conforming to ASTM C494, Type F or G:
  - 1. Adva by GCP Applied Technologies.
  - 2. Eucom 37 by Euclid Chemical Company.
  - 3. Rheobuild 1000 by Master Builders Solutions.
  - 4. Sikament by Sika Corporation.
  - 5. Or approved equal.
- D. Non-Corrosive Non-Chloride Accelerator Admixture: Conforming to ASTM C494 Type C or E:
  - 1. Daraset by GCP Applied Technologies.
  - 2. Accelguard 80 by Euclid Chemical Company.
  - 3. MasterSet AC by Master Builders Solutions.
  - 4. SikaSet by Sika Corporation.
  - 5. Or approved equal.
  - 6. Manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least 1 year's duration) using an acceptable accelerated corrosion test method using electrical potential measures.
- E. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions.
- F. Certification: Submit written conformance to the requirements and chloride ion content of the admixture to Engineer prior to mix design review.

## **2.7 CURING AND SEALING COMPOUND**

- A. Curing and sealing compound shall be liquid type membrane-forming and shall comply with the requirements of ASTM C309, Type 1-D. Liquid curing compound shall be water based.

## **2.8 SHEET CURING MATERIAL**

- A. Sheet curing material shall comply with ASTM C171 and shall be one of the following types: curing paper which can be regular or white, polyethylene film which can be clear or white opaque, or white burlap-polyethylene sheet.

## **2.9 VAPOR RETARDER**

- A. Vapor retarder shall be Stego 10 mil Class A vapor retarder, or approved equal.

## **2.10 CONCRETE MIX DESIGN**

- A. Submit mix design on each class of concrete for review; include standard deviation analysis or trial mixture test data.
- B. Proportion mix design in accordance with ACI CODE-318-19, Section 26.4, "Concrete Materials and Mixture Requirements".
- C. If trial batches are used:
  - 1. Prepare mix design by independent testing laboratory.
  - 2. Achieve an average compressive strength 1,200 PSI higher than the specified strength, or 1,400 PSI for specified concrete strengths over 5,000 PSI.
  - 3. Certified copies of laboratory trial mix reports and cylinder tests shall be submitted to the Engineer by the testing laboratory for approval.
- D. Do not place concrete prior to receipt of Engineer's written approval of mixes and cylinder test results.
- E. Fly ash may be substituted for cement to a maximum of 20% of the total cementitious material by weight.
- F. Design mix and perform tests to meet the requirements as specified.

| Concrete Class | Minimum 28-Day Compressive Strength (psi) | Maximum Water Cement Ratio | Air Content (Percent) | Slump Range (in.) |
|----------------|-------------------------------------------|----------------------------|-----------------------|-------------------|
| Class A        | 3,000                                     | 0.54                       | 4 – 7                 | 1 - 4             |
| Class C        | 4,000                                     | 0.44                       | 4 – 7                 | 1 - 4             |

- G. Class A concrete per the table above shall be used for thrust blocking, sidewalks, and anchor collars.
- H. Class C concrete per the table above shall be used for pavement, pavement repair areas, equipment pads, slabs, and all other structural concrete.

I. Minimum Cement Content (based on aggregate size):

|           |            |
|-----------|------------|
| 517 lb/cy | 1-1/2-inch |
| 540 lb/cy | 1-inch     |
| 564 lb/cy | 3/4-inch   |

J. Combined Aggregate Gradings:

1. Aggregates for concrete shall be combined in proportions that will provide a mixture within the grading limits in accordance with this Section, unless otherwise approved in writing by Engineer.
2. Maximum aggregate size depends on rebar clearances.
3. Recommended Admixture Usage:

| Location or Condition                         | Recommended Admixture                                    | Additional Requirements                                 |
|-----------------------------------------------|----------------------------------------------------------|---------------------------------------------------------|
| Air-entrained concrete                        | Air-entraining admixture                                 | Non-toxic; non-corrosive                                |
| Pumped concrete                               | High-range, water reducing (Superplasticizer)            | Initial slump:                                          |
|                                               |                                                          | 2-4-inch Slump with Superplasticizer:<br>9 inch maximum |
| Concrete with a water-cement ratio below 0.50 | High-range, water-reducing admixture (Superplasticizer). | Initial slump:                                          |
|                                               |                                                          | 2-4-inch Slump with Superplasticizer:<br>9 inch maximum |

4. Admixtures:
  - a. Concrete shall contain the specified water-reducing admixture or the specified high-range water-reducing admixture (superplasticizer).
  - b. Concrete required to be air-entrained shall contain an approved air entraining admixture.
  - c. Pumped concrete, concrete for industrial slabs, architectural concrete, concrete required to be watertight, or concrete with a water/cement ratio below 0.50 shall contain the specified high-range water-reducing admixture (superplasticizer).

## PART 3. EXECUTION

### 3.1 MEASUREMENT OF MATERIALS AND MIXING

- A. Conform to ACI PRC-304 current edition; ASTM C94; specified requirements for mix design, testing, and quality control; and to other requirements of these Specifications.

### **3.2 RETEMPERING**

- A. Retempering of concrete or mortar in which the cement has partially hydrated will not be permitted. Redosage with the specified high-range water-reducing admixture (superplasticizer) may be done with the prior approval of the Engineer regarding dosage and time periods.

### **3.3 PLACING CONCRETE - GENERAL**

- A. All concrete shall be placed in the presence of the Owner or Engineer.
- B. Allow other trades reasonable time to complete portions of work which must be completed before concrete is placed.
- C. Notify Owner and Engineer at least 1 full working day in advance before starting to place concrete to permit inspection of forms, reinforcing, sleeves, conduits, boxes, inserts, or other work required to be installed in concrete.
- D. Review curing methods with Engineer and verify curing materials and equipment are at the project site prior to the concrete placement.
- E. Concrete placement shall conform to requirements and recommendations of ACI PRC-304 and ACI CODE-318, except as modified in these Specifications.
- F. Place concrete as soon as possible after leaving mixer in horizontal layers not over 24 inches deep. Deposit concrete continuously so as to avoid cold joints. Concrete shall be deposited as close as possible to its final location without segregation or loss of ingredients, and without splashing forms or reinforcement steel above.
- G. Vertical Free Fall Drop to Final Placement:
  - 1. Concrete shall not be dropped freely where reinforcing steel will cause segregation. Concrete free fall shall not exceed 15 feet for concrete containing high-range water-reducing admixture (superplasticizer), and shall not exceed 5 feet for other concrete.
- H. Do not use concrete pump truck pipes, tremies, finishing tools, etc., constructed of aluminum.
- I. Before depositing concrete:
  - 1. Remove debris from space to be occupied by concrete.
  - 2. Dampen:
    - a. Gravel fill beneath slabs on ground.
    - b. Sand where vapor barrier is specified.
    - c. Wood forms.
  - 3. Verify reinforcement is secured in position.

### **3.4 ADDITION OF WATER AT PROJECT SITE**

- A. Do not add water to concrete at Project site if slump is within specified range.

- B. With the Engineer's approval, add water to concrete arriving at Project site with a slump less than the specified range, provided it can be demonstrated that the specified water-cement ratio will not be exceeded.

### **3.5 CONVEYING**

- A. Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent the separation or loss of materials.
- B. Conveying equipment shall be capable of providing a supply of concrete at the site of placement without interruptions sufficient to permit loss of plasticity between successive increments.

### **3.6 CONSOLIDATION AND VISUAL OBSERVATION**

- A. Concrete shall be consolidated with internal vibrators having a frequency of at least 8,000 vibrations per minute, with amplitude required to consolidate concrete in the section being placed.
- B. At least 1 standby vibrator in operable condition shall be at the placement site prior to and during placing concrete.
- C. Consolidation equipment and methods shall conform to ACI PRC-309 Guide for Consolidation of Concrete.
- D. Vibrator operator is required to see the concrete being consolidated to ensure good quality workmanship; or Contractor shall have a person actually observe the vibration of the concrete and will advise the vibrator operator of changes needed to assure complete consolidation.
- E. Vibrators shall not be used to transport concrete in forms.

### **3.7 HOT WEATHER CONCRETING**

- A. Follow the recommendations in ACI PRC-305 Guide to Hot Weather Concreting.
- B. Do not place concrete at times when temperature is forecast to exceed 100 degrees F. within 12 hours after the concrete is placed.
- C. Verify preparations are complete before ordering concrete so that concrete may be placed upon arrival.
- D. Fog spray forms, reinforcing steel, and subgrade immediately prior to placing concrete.
- E. Minimize size of concrete placements and thickness of layers of concrete.
- F. Make every effort to maintain concrete temperature:
  - 1. Below 95 degrees F. at time of placement: cool the ingredients before mixing by use of chilled water.

2. Uniform:
  - a. Minimize the time of placement.
  - b. Begin each operation in concrete finishing promptly when the concrete is ready for it.
- G. Place concrete promptly upon arrival at Project and vibrate immediately after placement.
- H. Do not add water to retemper.
- I. Consider placing concrete in late afternoon as opposed to early morning.
- J. Provide windbreaks, shading, and fog spraying on days when temperature is forecast to exceed 90 degrees F.
- K. Protect and cure exposed surfaces by one of the following:
  1. Continuous water curing.
  2. Moisture-cover curing.

### 3.8 COLD WEATHER CONCRETING

- A. Preparation:
  1. Follow recommendations in ACI PRC-306 Guide to Cold Weather Concreting.
  2. Additives for the sole purpose of providing freeze protection shall not be used.
  3. Arrangements for covering, insulating, housing, or steam heating newly-placed concrete shall be made in advance of placement and shall be adequate to maintain temperature and moisture conditions recommended.
  4. Temperatures of concrete mix shall be as shown for various stages of mixing and placing of concrete mix:

|                                                                                      | Section Size, Minimum Dimension                              |                   |                |                |
|--------------------------------------------------------------------------------------|--------------------------------------------------------------|-------------------|----------------|----------------|
|                                                                                      | < 12<br>Inches                                               | 12 - 36<br>Inches | 36 - 72 Inches | > 72<br>Inches |
| Air Temperature                                                                      | Minimum concrete temperature as mixed for indicated weather: |                   |                |                |
| Above 30° F                                                                          | 60° F                                                        | 55° F             | 50° F          | 45° F          |
| 0° F to 30° F                                                                        | 65° F                                                        | 60° F             | 55° F          | 50° F          |
| Below 0° F                                                                           | 70° F                                                        | 65° F             | 60° F          | 55° F          |
| Maximum allowable gradual temperature drop in first 24 hours after end of protection | 50° F                                                        | 40° F             | 30° F          | 20° F          |

- B. Placement:
  1. Surfaces to be in contact with concrete shall be free of snow, ice, and frost and shall be above 35 degrees F.
  2. Do not place concrete on frozen subgrade.

3. Placement of insulating material, tarpaulins, or other movable coverings shall follow closely the placing of concrete so that only a few feet of concrete are exposed to outside air at any time.

C. Curing and Protection:

1. Keep concrete continuously moist and maintain concrete temperature at a minimum of 50 degrees F. for 7 days; temperature shall be uniform throughout concrete. If high-early strength concrete is used, this temperature requirement may be reduced to 3 days.
2. It is recommended to leave forms in place for the entire period of protection; use insulated blankets or other approved method on slab surfaces.
3. Limit rapid temperature changes at end of protection period to avoid thermal cracking.

### **3.9 BONDING TO CONCRETE SURFACES**

A. New Concrete Surfaces:

1. New concrete is defined as less than 60 days old.
2. Roughen surface to hardened concrete.
3. Thoroughly clean and saturate with water.
4. Immediately place concrete.
5. Horizontal surfaces:
  - a. Cover surface with 2 inches of grout.
  - b. Limit first lift on top of grout to 12 inches.
  - c. Thoroughly vibrate to mix and consolidate grout and concrete.

B. Old Concrete Surfaces:

1. Use bonding agent.
2. Prepare surface in strict accordance with manufacturers printed instructions and recommendations for specific application for this Project.
3. Follow manufacturer's recommendations.

### **3.10 EVALUATION AND ACCEPTANCE OF CONCRETE**

- A. The Contractor shall retain an independent testing laboratory, acceptable to the Owner, to determine compliance with these Specifications.
- B. Conform to ACI CODE-318 Building Code Requirements for Structural Concrete and Commentary requirements for reinforced concrete, Section 26.12, "Concrete Evaluation and Acceptance", and to the following specifications:
- C. Field Testing Responsibilities:
1. Contractor:
    - a. Collect, label, and handle test specimens at Project site in accordance with ASTM C31.



- b. Provide adequate facilities for safe storage, curing, and protection for first 24 hours and for additional time as may be required before transporting to test lab by lab representative.
  - c. Pay for testing.
- D. Number of Test Cylinders:
  - 1. Set of Cylinders: 5
    - a. One 7-day and three 28-day compressive strength samples in addition to 1 spare cylinder
  - 2. Sample Frequency:
    - a. 1 set/class of concrete/50 cubic yards.
    - b. 1 set/class of concrete/day.
    - c. Whichever is greater.
  - 3. Cylinders shall be tested in accordance with ASTM C39.
- E. Laboratory shall test 1 cylinder at 7 days, and 3 cylinders at 28-days. The test results should be the average strength of the 3 cylinders. If 1 cylinder shows obvious evidence of improper sampling, molding, or testing, it may be discarded and the strengths of the other 2 cylinders averaged. Should the average 28-day compressive strength be less than the design strength of the sampled concrete, a 56-day compressive strength test shall be conducted using the spare cylinder.
- F. Slump Tests shall be made in the field in accordance with ASTM C143. Slump tests shall be performed off the back of the truck. Any water or plasticizer added after the initial slump test will require retesting.
- G. Air Content tests shall be performed in accordance with either ASTM C231 or ASTM C173.
- H. Temperature tests shall be performed in accordance with ASTM C1064.

### **3.11 PATCHING – GENERAL**

- A. Prior to starting patching work, except as specified, obtain Engineer's approval of proposed patching techniques and mixes.

### **3.12 REPAIR OF DEFECTIVE AREAS**

- A. Definition: Concrete in place that does not conform to specified design strength, shapes, alignments, and elevations as shown on Drawings or contains surface defects.
- B. Evaluation and acceptance of concrete shall conform to ACI CODE-318.
- C. With prior approval of the Engineer, as to method and procedure, repair defective areas in conformance with ACI SPEC-301, Chapter 5, except that the specified bonding compound shall be used.

- D. The specified patching mortar may be used in lieu of the above-mentioned method when color match of adjacent concrete is not required. Prior approval of the Engineer is required.
- E. Defective Areas:
1. Concrete not conforming to the specified concrete strength shall be considered defective.
  2. Cut out and replace with fresh concrete of same type and class as original concrete.
  3. Finish repaired areas to blend into adjacent concrete.
- F. Surface Repairs:
1. Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Owner.
  2. Honey-combed areas and rock pockets:
    - a. Repair immediately after removal of forms.
    - b. Prepare no-slump concrete mortar and test so that, when dry, patching mortar will match surrounding color and strength.
    - c. Cut out to solid concrete or minimum of 1-inch depth.
    - d. Make edges for cuts perpendicular to the concrete surface.
    - e. Thoroughly clean and dampen with water.
    - f. Apply bonding compound.
    - g. Compact no-slump concrete into patch, and finish to blend with adjacent finished concrete.
    - h. Cure in same manner as adjacent concrete.
  3. High Areas:
    - a. Grind after concrete has cured at least 14 days or achieved the design strength based on laboratory testing.
  4. Low Areas:
    - a. Repair during or immediately after completion of surface finishing operations.
    - b. Cut out low areas and replace with fresh concrete of same type and class as original concrete.
    - c. Finish repaired areas to blend into adjacent concrete.
  5. Make structural repairs with prior approval of Engineer, as to method and procedure, using the specified epoxy adhesive or epoxy mortar. Where epoxy injection procedures must be used, use an approved low viscosity epoxy made by the manufacturers previously specified.
  6. Level floors for subsequent finishes by use of specified underlayment material.
  7. Where required, level exposed floors by use of the specified self-leveling repair topping.
  8. Repair methods not specified above may be used, subject to approval of Engineer.

### **3.13 BLOCKOUTS AT PIPES OR OTHER PENETRATIONS**

- A. Submit proposed blockouts for review prior to concrete work.

#### **END OF SECTION**

## **SECTION 09 90 00**

### **PAINTING**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. Prepare surfaces and furnish and apply paint and protective coatings.
- B. Paint new exposed ferrous surfaces, whether specifically mentioned or not, except as modified herein.
- C. Paint all ferrous metal if not made of stainless steel or already furnished with a finish coat of paint by the manufacturer.
- D. Paint exposed piping, both existing and new, including pipe within vaults throughout the project site.

##### **1.2 ABBREVIATIONS**

|        |                                       |
|--------|---------------------------------------|
| ANSI   | American National Standards Institute |
| AWWA   | American Water Works Association      |
| FRP    | Fiberglass Reinforced Plastic         |
| HCl    | Hydrochloric Acid                     |
| MDFT   | Minimum Dry Film Thickness            |
| MDFTPC | Minimum Dry Film Thickness Per Coat   |
| mil    | Thousandths of an Inch                |
| MIL-P  | Military Specification - Paint        |
| OSHA   | Occupational Safety and Health Act    |
| PSDS   | Paint System Data Sheet               |
| SFPG   | Square Feet Per Gallon                |
| SFPGPC | Square Feet Per Gallon Per Coat       |
| SP     | Surface Preparation                   |
| SSPC   | Steel Structures Painting Council     |

##### **1.3 REFERENCES**

- A. Steel Structures Painting Council (SSPC).

##### **1.4 SURFACES NOT REQUIRING PAINTING**

- A. Unless specified or shown on the Drawings, the following areas or items will not require painting:
  - 1. Nonferrous and corrosion-resistant ferrous alloys such as copper, bronze, monel, aluminum, chromium plate, weathering steel, and stainless steel except where required for electrical insulation between dissimilar metals.
  - 2. Aluminum and stainless steel embedded in concrete or masonry, or aluminum in contact with concrete or masonry.
  - 3. Fiberglass reinforced plastic (FRP) equipment with an integral colored gel coat does not require painting, provided the color is as specified.

4. Prefinished electrical and architectural items such as motor control centers, switchboards, switchgear, panelboards, transformers, disconnect switches, etc.
5. Items specified to be galvanized after fabrication unless specifically required elsewhere in these Specifications or subject to immersion.

## **1.5 SUBMITTALS**

- A. Provide the following in accordance with Specifications:
  1. Obtain from each paint manufacturer for submittal to Engineer:
    - a. Paint System Data Sheet (PSDS) for each paint system used.
    - b. Material Safety Data Sheets (MSDS) for each product used in the paint system.
    - c. Technical Data Sheets for each product used in the paint system.
  2. Submit the required information on a system-by-system basis.
  3. Provide copies of the paint system submittals to the coating applicator.
  4. A sample PSDS form is appended at the end of this Section.
- B. Paint Color Sample: Submit samples of colors that Owner has chosen.

## **1.6 COLOR SELECTION CONFERENCE**

- A. Prepare color samples displaying full color selection available for each item to be painted by each manufacturer listed for use during the Conference.
- B. Samples for the above referenced Conference are designated as manufacturers' actual product and color chips; photographs and color reproductions in brochures are not acceptable.

## **1.7 QUALITY ASSURANCE**

- A. Provide mock-ups using the selected colors and specified products per the Painting Schedule located at the end of this Section. The Owner or Engineer shall approve colors and application process prior to starting Work of this Section.
- B. A representative of the paint manufacturer, familiar with the products specified shall be available at jobsite at initial starting of coating work and at intervals during surface preparation and painting required for product application quality assurance, to determine compliance with manufacturer's instructions and these Specifications, and to resolve necessary field problems attributable to, or associated with, manufacturer's products furnished under this Contract.
- C. Inform Engineer a minimum of 3 days in advance of the start of surface preparation work or coating application work. Work shall be performed only in the presence of Engineer, unless Engineer has granted prior approval to perform work in his absence.
- D. For coatings subject to immersion, full cure must be obtained for the completed system. Consult coating manufacturer's written instructions for these requirements. Coating shall not be immersed until completion of the curing cycle.

- E. Inspection by Engineer, or waiver of inspection of any particular portion of the Work, shall not be construed to relieve Contractor of his responsibility to perform the Work in accordance with these Specifications.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver new materials to the Project site in unopened containers that show time of use, designated name, date of manufacture, color, and name of manufacturer.
- B. Store paints in a protected area that is heated or cooled to maintain temperatures within the range recommended by paint manufacturer.

## **1.9 WARRANTY**

- A. Warrant to Owner and guarantee work under this Section against defective workmanship and materials for a period of 1 year commencing on the date of final acceptance of the Work.

## **PART 2. PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Specified products are those manufactured by Tnemec Co., Inc., Kansas City, MO and are specified as the standard of quality required for use on this project.
- B. Products of a different manufacturer can be considered for approval as equal.
- C. Products for each specified function and system shall be of a single manufacturer.

### **2.2 PAINT MATERIALS**

- A. Product: Refer to Painting Schedule at the end of this Section.

### **2.3 EPOXY FILLER**

- A. Manufacturer: Tnemec, epoxy filler and surfacer for spot welds and other areas that require fill and smoothing, or approved equal.

### **2.4 COLOR SELECTION**

- A. Colors shall be formulated with colorants free of lead, lead compounds, or other materials which might be affected by the presence of hydrogen sulfide or other gas likely to be present at the Project.

### **2.5 EQUIPMENT COLORS**

- A. Equipment shall be meant to include the machinery or vessel itself plus the structural supports and fasteners and attached electrical conduits. Non-submerged portions of equipment shall be painted the same color as the process piping it serves, except as itemized below.

| <u>Equipment</u>                                           | <u>Color</u> |
|------------------------------------------------------------|--------------|
| Dangerous parts of equipment and machinery .....           | OSHA Orange  |
| Fire protection equipment and apparatus .....              | OSHA Red     |
| Physical hazards in normal operating area; handrails ..... | OSHA Yellow  |

## **PART 3. EXECUTION**

### **3.1 GENERAL**

- A. Materials of a paint system, including primer and finish coats, shall be produced by the same paint manufacturer. Thinners, cleaners, driers, and other additives shall be as recommended by the paint manufacturer of the particular coating.
- B. Primers, finish coats, additives, or any other component of the coatings used shall not alter the NSF 61 Certification of the object being painted.
- C. Aluminum and Dissimilar Metal Insulation coatings shall be used where specified and on the following items or areas:
  - 1. Aluminum in contact with concrete and masonry.
  - 2. Contacting dissimilar metals.

### **3.2 INTENT**

- A. Leave surfaces of work in such condition that only minor cleaning and sanding is required prior to surface preparation and painting.
- B. Inspect and provide substrate surfaces that are prepared in accordance with these Specifications and the printed directions and recommendations of the paint manufacturer whose product is to be applied.

### **3.3 PROTECTION OF MATERIALS NOT TO BE PAINTED**

- A. Remove, mask, or otherwise protect hardware, lighting fixtures, switchplates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted.
- B. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.
- C. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting processes.
- D. Mask openings in motors to prevent paint and other materials from entering the motors.

### **3.4 ENVIRONMENTAL CONDITIONS**

- A. Paint shall not be applied in temperatures beyond the manufacturer's recommended maximum and minimum allowable, nor in dust, smoke-laden atmosphere, damp or humid weather.

- B. Abrasive blast cleaning shall not be performed whenever the relative humidity exceeds 85 percent or when surface temperature is less than 5 degrees F above the dew point of the ambient air.
- C. Use fans to provide adequate continuous ventilation during cure and sufficient heat to facilities to maintain temperatures above the minimum shown on the manufacturer's product data sheets.
- D. Provide minimum 25 foot candles (270 lx.) of lighting on surfaces to be finished.
- E. Containment and Disposal of Debris:
  - 1. Take precautions necessary to avoid adversely affecting the surrounding environment with blast media or paint particle drift or overspray. Contractor's activities shall comply with federal, state and local requirements for environmental pollution control.
  - 2. Prevent the migration of abrasive blast media, dust, and paint residue onto or from the property of the Owner. Containment structure shall be utilized as necessary in accordance with applicable Federal, State, and local regulations and shall meet SSPC requirements for the appropriate class of containment structure (refer to SSPC-Guide 6 (CON) Guide for Containing Debris Generated During Paint Removal Operations).
- F. The Contractor shall be responsible for all costs associated with containment and waste disposal that may result from the execution of the work.

### **3.5 SAFETY**

- A. Painting shall be performed in strict accordance with the safety recommendations of the paint manufacturer and with the safety recommendations of the National Association of Corrosion Engineers contained in the publication, Manual for Painter Safety; federal, state, and local agencies having jurisdiction.

### **3.6 PAINT MIXING**

- A. Multiple-component coatings shall be prepared using contents of the container for each component as packaged by the paint manufacturer.
- B. No partial batches permitted.
- C. Multiple-component coatings that have been mixed shall not be used beyond their pot life.
- D. Provide small quantity kits for touch-up painting and for painting other small areas.
- E. Only the components specified and provided by the paint manufacturer shall be mixed.
- F. No intermixing of additional components permitted.
- G. Keep materials sealed when not in use.

- H. Where more than one coat of a material is applied within a given system, color will be alternated to provide a visual reference that the required number of coats has been applied.

### **3.7 PREPARATION OF SURFACES – METAL**

- A. No surface preparation blasting will be permitted prior to submission of samples.
- B. Workmanship for metal surface preparation as specified shall be in strict conformance with the current Steel Structures Painting Council (SSPC) Specifications as follows:
  - 1. Solvent Cleaning: SSPC-SP-1
  - 2. Hand Tool Cleaning: SSPC-SP-2
  - 3. Power Tool Cleaning: SSPC-SP-3
  - 4. White Metal Blast Cleaning: NACE No. 1/SSPC-SP-5
  - 5. Commercial Blast Cleaning: NACE No. 3/SSPC-SP-6
  - 6. Brush-off Blast Cleaning: NACE No. 4/SSPC-SP-7
  - 7. Near-White Blast Cleaning: NACE No. 2/SSPC-SP-10
  - 8. Power Tool Cleaning to Bare Metal: SSP-SP-11
  - 9. Industrial Blast Cleaning: NACE No. 8/SSPC-SP-14
  - 10. Commercial Grade Power Tool Cleaning: SSPC-SP-15
  - 11. Brush-off Blast Cleaning of Non-Ferrous Metals: SSPC-SP-16
- C. Wherever the words "solvent cleaning," "hand tool cleaning," "wire brushing," or "blast cleaning," or similar words of equal intent are used in these Specifications or in paint manufacturer's specifications, they shall be understood to refer to the applicable SSPC Specifications listed above.
- D. Hand-tool clean areas that cannot be cleaned by power tool cleaning.
- E. Surface Preparation for Existing Ductile Iron Pipe:
  - 1. Remove all paint, loose annealing oxides, loose rust, dirt and other foreign matter with the use of hand or power tools.
  - 2. Do not use cleaning tools that burnish or smooth the natural roughness (profile) of the cast iron surface.
  - 3. Any dust or other contaminants remaining after hand or power tool cleaning shall be removed.
- F. Surface Preparation for New Ductile Iron Pipe:
  - 1. Order pipe with Series N140 Pota-Pox Plus primed from the shop.
  - 2. In the field, de-gloss and create a profile by sanding the shop primer.
  - 3. Surface shall be clean and dry prior to topcoat.

### **3.8 PRE-BLAST CLEANING REQUIREMENTS**

- A. Oil, grease, welding fluxes, and other surface contaminants shall be removed prior to blast cleaning.
- B. Pre-blast cleaning methods shall use steam, open flame, hot water, or cold water with appropriate detergent additives followed with clean water rinsing.



- C. Small isolated areas shall be cleaned as above or solvent cleaned with suitable solvents and clean cloths.
- D. Sharp edges shall be rounded or chamfered and burrs, jagged edges, and surface defects shall be ground smooth.
- E. Welds and adjacent areas shall be prepared so that there is:
  - 1. No undercutting or reverse ridges on the weld bead.
  - 2. No weld spatter on or adjacent to the weld or any other area to be painted.
  - 3. No sharp peaks or ridges along the weld bead.
  - 4. Embedded pieces of electrode or wire shall be ground flush with the adjacent surface of the weld bead.

### **3.9 BLAST CLEANING REQUIREMENTS**

- A. The type of equipment and speed of travel shall be such that the specified degree of cleanliness is obtained.
- B. The type and size of abrasive shall be selected to produce a surface profile that meets the coating manufacturer's recommendations for the particular primer to be used.
- C. Only dry blast cleaning methods will be permitted.
- D. The abrasive shall not be reused.
- E. Comply with the applicable federal, state, and local air pollution control regulations for blast cleaning.
- F. All paint particles and used blast media containing paint particles shall be collected by the Contractor. Non-hazardous and hazardous waste shall be disposed of by the Contractor. Disposal shall be in accordance with federal, state, and local requirements.
- G. The compressed air used for dry blast cleaning methods shall be free of water and oil. Adequate traps and separators shall be used to ensure elimination of all contaminants.
- H. Blasting shall not be performed when the surface temperature is less than 5 degrees F. above the dew point to prevent the formation of rust bloom. Dew point and surface temperature readings shall be taken prior to blasting to ensure this condition. Care should be exercised to avoid hand or clothing contamination of freshly blasted surface.
- I. Blasting of exterior surfaces shall not be performed when wind velocities cause residue to drift and be deposited on adjacent property.
- J. Interior or exterior welds, burning or repairs on/or affecting previously blast cleaned areas shall be re-blasted to duplicate the surrounding area. If immediate repair is not feasible, the affected area shall be masked off (a minimum of 6 inches in any direction from a weld) and repaired following application of the primer.

### **3.10 POST-BLAST CLEANING AND OTHER CLEANING REQUIREMENTS**

- A. Surfaces shall be cleaned of dust and residual particles caused by the cleaning operations by dry (no oil or water vapor) air blast cleaning or other method prior to painting.
- B. Enclosed areas and other areas where dust settling is a problem shall be vacuum cleaned and wiped with a tack cloth.
- C. Surfaces shall be coated within 6 hours after they are blasted.
- D. Surfaces that have started to rust before they are painted shall be re-blasted.

### **3.11 SOLVENT CLEANING**

- A. Solvent cleaning shall consist of removal of foreign matter such as oil, grease, soil, drawing and cutting compounds, and other surface contaminants by the use of solvents, emulsions, cleaning compounds, steam cleaning, or similar materials and methods that involve a solvent or cleaning action. This method shall be used in conformance with Steel Structures Painting Council SP 1.

### **3.12 APPLICATION OF PAINT - GENERAL**

- A. Furnish the Engineer with manufacturer's written instructions for applying each type of paint or protective coating prior to application.
  - 1. Cleaned surfaces and coats shall be inspected prior to the succeeding coat.
  - 2. Schedule inspections with the Engineer in advance.
  - 3. Apply coatings in strict accordance with the paint manufacturer's recommendations, as reviewed by the Engineer.
  - 4. Allow sufficient time between coats to assure thorough drying of previously applied paint.
  - 5. Paint new units that are to be bolted together and to structures prior to assembly or installation.

### **3.13 SHOP PRIMED SURFACES**

- A. Shop primed items shall be inspected at the jobsite for compliance with these Specifications.
  - 1. Schedule inspections with Engineer in advance.
  - 2. Areas of chipped, peeled, or abraded primer shall be hand or power sanded feathering the edges.
  - 3. Areas shall then be spot primed with the specified primer.
- B. Prior to application of finish coats, shop primed surfaces shall be cleaned to be free of dirt, oil, and grease, and a mist coat, 3.0 mil dry film thickness, of the specified primer applied, complete.
- C. Holdback areas for welding shall be prepared and primed after welding, as required for the specified paint system.
- D. Application of primer shall be in accordance with manufacturer's instructions.

### **3.14 MANUFACTURER APPLIED PAINT SYSTEMS**

- A. Abraded areas on factory finished items: Repair in strict accordance with the equipment manufacturer's directions.
- B. Repaired areas shall be carefully blended into the original finish.

### **3.15 FILM THICKNESS**

- A. Coverage is listed as either total minimum dry film thickness in mils (MDFT) or the spreading rate in square feet per gallon (SFPG). Per coat determinations are listed as MDFTPC or SFPGPC. The number of coats is the minimum required irrespective of the coating thickness.
  - 1. Additional coats may be required to obtain the minimum required paint thickness, depending on method of application and atmospheric conditions.
  - 2. Maximum film build per coat shall not exceed the coating manufacturer's recommendations.
  - 3. Perform electrical inspection and film thickness measurements on coated surfaces with properly calibrated instruments.
  - 4. Recoat and repair as necessary for compliance with the Specifications.
  - 5. Coatings will be subject to inspection by Engineer and coating manufacturer's representative.
  - 6. Particular attention shall be given to edges, angles, flanges, and all areas where insufficient film thicknesses are likely to be present. Ensure proper millage in these areas.
  - 7. After repaired and recoated areas have dried sufficiently, final tests will be conducted by the Engineer.
  - 8. Coating thickness specified in mils will be measured with a non-destructive magnetic type dry film thickness gage with digital electronic readout.
  - 9. Finish coat (except zinc primer and galvanizing) will be tested for holidays and discontinuities with an electrical holiday detector, low voltage, wet sponge type; Model M-1, manufactured by Tinker and Rasor, San Gabriel, CA, or approved equal.
  - 10. Each coat will be checked for the correct millage.
  - 11. No measurement will be made under a minimum of 8 hours after application of coating.

### **3.16 DAMAGED COATINGS**

- A. Damaged coatings, pinholes, and holidays shall have the edges feathered and repaired in accordance with the recommendations of the paint manufacturer, as reviewed by the Engineer.
  - 1. Repair of fusion bonded coatings to be as recommended by the original applicator.
  - 2. Liquid repair kits to be provided for this purpose by the applicator, as recommended by the coating manufacturer.
- B. Finish coats, including touch-ups, and damage-repair coats shall be applied in a manner which will present a uniform texture and color-matched appearance.

### **3.17 UNSATISFACTORY APPLICATION**

- A. For coatings found to have improper finish color or insufficient film thickness, the surface shall be cleaned and top coated with the specified paint material to obtain the specified color and coverage. Specific surface preparation information to be secured from the coating manufacturer and the Engineer.
- B. Visible areas of chipped, peeled, or abraded paint shall be hand or power-sanded, feathering the edges.
  - 1. The areas shall then be primed and finish coated in accordance with the Specifications.
  - 2. Depending on the extent of repair and its appearance, a finish sanding and topcoat may be required by the Engineer.
- C. Work shall be free of runs, bridges, shiners, laps, or other imperfections. Evidence of these conditions shall be cause for rejection.
- D. Defects in the coating system shall be repaired per written recommendations of the coating manufacturer.
- E. Leave staging up until the Engineer has inspected the surface or coating. Staging removed prior to approval by Engineer shall be replaced.

### **3.18 SHIPPING**

- A. Protect precoated items shipped to the jobsite from damage.
- B. Coated items shall be battened to prevent abrasion.
- C. Use nonmetallic or padded slings and straps in handling.
- D. Items will be rejected for excessive damage, in the opinion of the Engineer.

### **3.19 CLEANUP**

- A. Cloths and waste that might constitute a fire hazard shall be placed in closed metal containers or destroyed at the end of each day.
- B. Upon completion of the Work, staging, scaffolding, and containers shall be removed from the site or destroyed in a legal manner.
- C. Paint spots, oil, or stains upon adjacent surfaces and floors shall be completely removed, and the entire job left clean.

### **3.20 APPLICATION SCHEDULE**

- A. Unless otherwise indicated in the Specifications or on the Drawings, Work shall be painted or coated in accordance with the following application schedule.
- B. In the event of discrepancies or omissions in the following, request clarification from the Engineer before starting the work in question.

- C. Submerged Metal: Metal surfaces below a plane of 1 foot above the maximum liquid surface, metal surfaces above the maximum liquid surface which are a part of the immersed equipment, concrete embedded surfaces of metallic items under submerged conditions; wall pipes, pipes, pipe sleeves, weirs, baffles, access manholes, gate guides and thimbles, interior of solids contact clarifier, and structural steel.
- D. Surfaces which have been factory prepared and primed need only have finish coats field applied, unless primer coating is damaged. Coatings manufacturer shall provide appropriate solvent coatings as required for adhesion of finish coats.

#### PAINT SCHEDULE

| AREA                                                                      | NUMBER AND COLOR               | MANUFACTURER | NO. OF COATS | MIL THICKNESS |
|---------------------------------------------------------------------------|--------------------------------|--------------|--------------|---------------|
| <b>Exterior Non-submerged Ferrous Metals, Including Ductile Iron Pipe</b> |                                |              |              |               |
| First Coat                                                                | Series N69/N69F HB Epoxoline   | Tnemec       | 1 Coat       | 4.0 – 6.0     |
| Second Coat                                                               | Series 1094/1095 Endura-Shield | Tnemec       | 1 Coat       | 3.0 – 5.0     |
|                                                                           |                                |              | Total Mils   | 7.0 – 11.0    |
| <b>Interior Non-submerged Ferrous Metals, Including Ductile Iron Pipe</b> |                                |              |              |               |
| First Coat                                                                | Series N69/N69F HB Epoxoline   | Tnemec       | 1 Coat       | 4.0 – 6.0     |
| Second Coat                                                               | Series N69/N69F HB Epoxoline   | Tnemec       | 1 Coat       | 4.0 – 6.0     |
|                                                                           |                                |              | Total Mils   | 8.0 – 12.0    |

**IF THERE IS A CONFLICT OR UNAVAILABILITY WITH PAINT PRODUCT OR COLOR, CONTACT ENGINEER PRIOR TO ORDERING PAINT. OWNER WILL CONSIDER COLOR CHANGE IF REASONABLE ALTERNATE COLORS ARE AVAILABLE.**

**PAINT SYSTEM DATA SHEET**

Attach Technical Data Sheet (if applicable) to this sheet for each paint system submittal.

Paint System Number (from Spec.)\_\_\_\_\_

Paint System Title (from Spec.)\_\_\_\_\_

Coatings Supplier\_\_\_\_\_

Representative\_\_\_\_\_

Surface Preparation\_\_\_\_\_

| Paint Material<br>(Generic) | Product Name/Number<br>(Proprietary) | Min. Coats<br>Coverage |
|-----------------------------|--------------------------------------|------------------------|
| _____                       | _____                                | _____                  |
| _____                       | _____                                | _____                  |
| _____                       | _____                                | _____                  |
| _____                       | _____                                | _____                  |
| _____                       | _____                                | _____                  |
| _____                       | _____                                | _____                  |
| _____                       | _____                                | _____                  |
| _____                       | _____                                | _____                  |
| _____                       | _____                                | _____                  |
| _____                       | _____                                | _____                  |
| _____                       | _____                                | _____                  |
| _____                       | _____                                | _____                  |
| _____                       | _____                                | _____                  |
| _____                       | _____                                | _____                  |
| _____                       | _____                                | _____                  |

**END OF SECTION**

## **SECTION 31 10 00**

### **SITE CLEARING**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. Remove interfering or objectionable material from designated areas of Work.
- B. Preserve vegetation and existing objects designated to remain from injury or defacement.
- C. Cut trees only at direction of Engineer.

##### **1.2 DEFINITIONS**

- A. Clearing:
  - 1. Cutting, removing, and disposing of trees, snags, stumps, shrubs, brush, limbs, and other vegetative growth.
  - 2. Removing evidence of their presence from the surface, inclusive of sticks and branches greater than 2 inches in diameter or thickness.
  - 3. Removing and disposing of trash piles, rubbish, and fencing.
- B. Grubbing:
  - 1. Removing and disposing of wood or root matter below the ground surface remaining after clearing.
  - 2. Includes stumps, trunks, roots, or root systems greater than 2 inches in diameter or thickness to a depth of 18 inches below the ground surface.
- C. Stripping: Removing and disposing of organic sod, topsoil, grass and grass roots, and other objectionable material from the areas designated to be stripped that remain after clearing and grubbing.

#### **PART 2. MATERIALS**

##### **2.1 GENERAL**

- A. Provide materials, suitable and in adequate quantity, required to accomplish Work of this Section.

#### **PART 3. EXECUTION**

##### **3.1 PREPARATION**

- A. Review with Engineer's representative the location, limits, and methods to be used prior to commencing Work under this Section.

### **3.2 CUTTING TIMBER**

- A. Exercise care when clearing near the clearing limits to avoid damage to existing trees, vegetation, structures, or utilities which are outside of the clearing limits.
- B. Trees shall be leveled into the area to be cleared.
- C. Flush cut stumps not designated for grubbing by cutting flush with or below the ground surface.
- D. Timber is the property of the Contractor.
- E. Dispose of stumps, limbs, brush, snags, non-marketable timber, and other vegetative growth off-site.
- F. Holes remaining after removal of trees, stumps, etc. shall be backfilled and compacted per the requirements of Section 31 23 33. The Contractor shall complete the clearing operations so that the site is free of holes, ditches, or other abrupt changes in elevations that resulted from clearing and grubbing operations.

### **3.3 PRESERVATION OF TREES, SHRUBS, AND OTHER VEGETATION**

- A. Trees, shrubbery, and other vegetation not designated for removal shall be protected from damage.
- B. Movement and operation of the equipment shall be such that roots, branches, and trunks of trees and shrubs selected to be preserved will not be scarred, broken, or otherwise damaged to the extent that the life of the plant is endangered.
- C. Cut and remove tree branches only where, in the opinion of the Engineer, cutting is necessary to not affect construction operations.
- D. Remove branches other than those which are expected to affect the Work to provide a balanced appearance of any tree, as approved prior to removal.
- E. Treat scars resulting from the removal of branches with an approved tree sealant.

### **3.4 CLEARING AND GRUBBING LIMITS**

- A. Clear and grub areas within the limits of construction.
- B. Clear and grub in stages as the construction area is increased to avoid unnecessary clearing and grubbing.

### **3.5 DISPOSAL OF CLEARING AND GRUBBING DEBRIS**

- A. Haul the material from the Work site and dispose of in accordance with state, federal, and local laws. Off-site disposal shall be at the Contractor's sole expense.



### **3.6 AREAS TO BE STRIPPED**

- A. Strip areas that are cleared and grubbed, including all areas where excavation is to be made.
- B. The exact depth of stripping shall be determined by the Engineer.
- C. Topsoil requirements are specified in Section 31 23 33.
- D. Strip areas in stages to avoid unnecessary stripping.

### **3.7 DISPOSAL OF STRIPPINGS**

- A. Do not mix strippings with borrow excavation.
- B. Stockpile topsoil from the strippings for use in landscape grading.
- C. Dispose of excess topsoil.
- D. Strippings not suitable for use as topsoil shall become the property of the Contractor and shall be removed from the site.
- E. Contractor shall comply with all Federal, State, County, and City laws, regulations, and ordinances applicable to the disposal of clearing and grubbing material.

**END OF SECTION**

## **SECTION 31 23 16.15**

### **RIGHT-OF-WAY UNDERCROSSINGS**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. The Owner will obtain the necessary undercrossing permit from the permitting authority for work within public or private right-of-ways. The permit shall be approved by the permitting authority and be in place prior to commencement of work on the undercrossing.
- B. Street crossings shall be made by open cutting the road surface, except where shown otherwise. State highway crossings shall be made by boring and installing an encasement pipe.
- C. Railroad crossing shall be made by boring and installing a steel encasement pipe.
- D. Contractor shall comply with all requirements of the permitting authority. If the permitting authority has more stringent construction requirements, then those shall apply.
- E. Prior to starting construction, required labor, materials, and equipment shall be on the site.
- F. Contractor shall field verify highways, county roads, streets, and right-of-ways prior to excavation or pipe installation.
- G. Contractor shall provide casing spacers and end seals as part of encasement pipe installation.

##### **1.2 RELATED SECTIONS**

- A. Section 31 23 33 – Trenching & Backfilling
- B. Section 33 05 19 – Ductile Iron Utility Water Pipe & Fittings
- C. Section 33 05 24.13 – Steel Encasement Pipe
- D. Section 33 05 31.15 – Polyvinyl Chloride Pressure Pipe and Fittings
- E. Section 33 05 33.14 - High Density Polyethylene (HDPE) Pipe, Fittings and Joining/Fusion

##### **1.3 REFERENCES**

- A. American Association of State Highway and Transportation Officials, 444 North Capitol Street, North West, Suite 225, Washington, D.C.
  - 1. AASHTO T99 - Moisture-Density Relations of Soils Using a 5.5-lb (2.5-kg) Rammer and a 12-inch (305-mm) Drop.

- B. American Society for Testing and Material, 1916 Race Street, Philadelphia, Pennsylvania 19103.
  - 1. ASTM C900 - Test Method for Pullout Strength of Hardened Concrete.
  - 2. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 10-lb. (4.54-kg) Rammer and 18-inch (457-mm) Drop.

## **PART 2. MATERIALS**

### **2.1 EXCAVATION**

- A. Excavation shall conform to Section 31 23 33.

### **2.2 PIPE EMBEDMENT MATERIAL**

- A. Conform to Section 31 23 33.

### **2.3 TRENCH BACKFILL**

- A. Rock or foundation stabilization and backfill materials shall conform to Section 31 23 33.

### **2.4 ENCASEMENT PIPE**

- A. Provide encasement pipe of size to permit proper construction to required lines and grades.
- B. Encasement pipe shall be type indicated on drawings.
- C. Steel encasement pipe shall be fabricated in sections for welded field joints.
- D. Refer to Section 31 23 33, Section 33 05 31.15, and Section 33 05 24.13 for materials for encasement and carrier pipe.

### **2.5 MINIMUM DIAMETER**

- A. The minimum diameter for encasement pipe shall be such that the carrier pipe, along with casing spacers and joint restraints, will not bind against the inside of the encasement pipe during installation. The minimum diameter of encasement pipe shall be as follows:

| <u>Diameter of Carrier Pipe</u> | <u>Diameter of Encasement</u> |
|---------------------------------|-------------------------------|
| 2"                              | 5"                            |
| 3"                              | 6"                            |
| 4"                              | 8"                            |
| 6"                              | 12"                           |
| 8"                              | 16"                           |
| 10"                             | 20"                           |
| 12"                             | 24"                           |

- B. Encasement for larger diameter's of Carrier Pipe(s) should be discussed with the Owner to ensure proper installation and future extraction for repairs.

## **2.6 CASING SPACERS**

- A. Casing spacers shall be bolt on style with a two-piece shell and risers from 304 stainless steel with minimum 14 gage thickness.
- B. Shell shall be lined with a ribbed PVC extrusion.
- C. Bearing surfaces of runners shall be made from UHMW polymer, attached to support structures at appropriate positions to properly support the carrier pipe within the casing.
- D. Casing spacers shall be model CCS as manufactured by Cascade Waterworks Manufacturing Company, or approved equal.

## **2.7 CASING AND END SEALS**

- A. Casing end seals shall be made of neoprene with 304 stainless steel bands.
- B. Seals shall be Cascade model CCES, or approved equal.

# **PART 3. EXECUTION**

## **2.1 GENERAL**

- A. Prior to the start of the work, submit satisfactory evidence to the Engineer that insurance coverage requirements called for by the Permittee have been met.
- B. Proposed construction methods and materials for the undercrossings shall be approved by the Engineer and the Permittee prior to the crossing operation.

## **2.2 TRENCH EXCAVATION AND BACKFILL**

- A. Conform to the applicable portions of Section 31 23 33.

## **2.3 ENCASEMENT PIPE**

- A. Size of encasement pipe shall be large enough to provide sufficient working space to properly install the water pipe to lines and grades shown.
- B. Steel encasement shall be continuously welded at joints for a rigid, watertight encasement.

## **2.4 CARRIER PIPE**

- A. Install casing spacers and casing end seals on carrier pipe as recommended by the spacer manufacturer and slide into encasement pipe. Casing spacers shall be utilized for installation of the carrier pipe in the encasement pipe.

- B. Pipe installation to conform to applicable portions of Sections 33 05 19, 33 05 31.15, and 33 05 33.14.

## **2.5 INSTALLATION OF ENCASEMENT PIPE BY BORING**

- A. Boring for steel encasement pipe shall be done by the dry bore and jack method and should be installed as shown in the Design Drawings. Steel encasement pipe shall be required and for all Railroad Crossings.
- B. Boring HDPE encasement pipe for roadway or highway crossings may be done by the directional bore method in accordance with Section 33 05 33.14 with the approval of the Owner or Engineer.
- C. Highway Bore: Do not set up equipment or begin excavating pit near state highway property without permission from an authorized representative of the Arkansas Department of Transportation.
- D. Railroad Bore: Do not set up equipment or begin excavating pit on or near railroad property without permission of the respective railroad company.
- E. Boring Pit: The boring pit shall be solid sheeted, braced, and shored as necessary to provide a safe operation. The contractor shall take all precautions, and comply with all requirements as may be necessary to protect private or public property. Excavate pits and trenches required at each side of crossing to minimum width and length necessary for boring and jacking operation and carrier pipe installation. Keep pit pumped free of standing water. Maintain pit bottom to provide a stable base for guide rails and equipment and firm footing for workman.
- F. Line and Grade: The Contractor shall set the guide rails and boring rig so that after the encasement is complete, and the water pipe is installed, the invert of the pipe shall conform to grade and alignment as shown on the Design Drawings. As the encasement pipe is installed, the Contractor shall check the horizontal and vertical alignment frequently. Contractor shall install the boring to a 90-degree angle to the crossing unless the Owner approves a different crossing angle.
- G. Boring and jacking: Boring and jacking of the encasement pipe shall be accomplished by the dry auger boring method without jetting, sluicing, or wet boring. The hole shall be bored and cased through the soil by cutting head on a continuous auger mounted inside the casing pipe. The boring of the hole and installation of the casing pipe shall be simultaneous. Lengths of the casing pipe shall be fully welded to the preceding section in accordance with AWS recommended procedure. Connect sections by full penetration butt welding preformed in accordance with AWS D1.
- H. The contractor shall plan to use a casing lubricant in the event excessive frictional forces jeopardize the successful completion of the encasement installation.

## **2.6 INSTALLATION OF CARRIER PIPE**

- A. Pull or jack carrier pipe through encasement pipe. Do not allow cables or jacks to be in direct contact with carrier pipe while pulling or jacking pipe. Use casing spacers to aid in the carrier pipe installation.
- B. A minimum of three casing spacers shall be installed on carrier pipe sections up to 20 feet in length. Distance between casing spacers on the carrier pipe shall never be more than six feet.
- C. All carrier pipe joints installed in encasements that exceed 25 feet in length shall be provided with fully restrained joints. Over-belling of the carrier pipe shall be prevented.

## **2.7 CONTRACTOR'S RESPONSIBILITY**

- A. The Contractor shall be fully responsible for settlement or deterioration of the finished undercrossing pavement and facilities during the warranty period.
- B. The Owner will withhold final payment for the Work until the right-of-way crossing has been completed to the satisfaction of the permitting authority.

**END OF SECTION**

## **SECTION 31 23 33**

### **TRENCHING AND BACKFILLING**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. Work of this Section includes:
  - 1. Replacing topsoil that contains regenerative material.
  - 2. Imported topsoil.
  - 3. Crush rock backfill required by over-excavation.
  - 4. Imported pipe zone material.
  - 5. Trench settlement repair, including replacing roadway surfacing, sidewalk, or other structures.
  - 6. Replacing damaged culverts.
- B. Trench excavation is classified as common excavation and includes removal of material of whatever types encountered including rock to depths shown or as directed by Engineer.
- C. Pipe zone includes full width of excavated trench from bottom of pipe to a point 6 inches above top outside surface of pipe barrel.
- D. Conform to federal, state, and local codes governing safe loading of trenches with excavated material.
- E. The right is reserved to modify the use, location, and quantities of the various types of backfill during construction as Engineer considers to be in the best interest of Owner.
- F. There shall be no extra compensation for dewatering and rock excavation.
- G. Pipe shall be installed according to the latest version of applicable AWWA Standards.

##### **1.2 REFERENCES**

- A. Arkansas Department of Transportation, P.O. Box 2261, Little Rock, Arkansas 72203, latest edition.
  - 1. ARDOT 303 - Aggregate Base Course.
- B. ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428-2959 (latest edition).
  - 1. ASTM D448 - Classifications for Standard Sizes of Aggregate and Bridge Construction.
  - 2. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb. (2.49-kg.) Rammer and 12-inch (304.8-mm) Drop.

3. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 10-lb. (4.54-kg.) Rammer and 18-inch (457-mm) Drop.
  4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes.
  5. ASTM D2922 - Test Methods for Density of Soils and Soil-Aggregates in Place by Nuclear Method.
- C. Occupational Safety and Health Administration (OSHA) Standard for Excavation and Trenches Safety System, 29 CFR 1926, Subpart P: Excavations.
  - D. The Contractor shall be solely responsible for trench and excavation safety systems in accordance with Act 291 of 1993.
  - E. American Water Works Association, 6666 West Quincy Avenue, Denver, Colorado 80235 (latest edition).
  - F. Arkansas Department of Health (ADH), 4815 W. Markham Street, Little Rock, Arkansas 72205.

### **1.3 DEFINITIONS**

- A. Relative Compaction:
  1. The ratio, in percent, of the as-compacted field dry density to the laboratory maximum dry density as determined by the Standard Proctor Test, ASTM D698, or as determined by the Modified Proctor Test, ASTM D1557, as applicable.
  2. Corrections for oversize material may be applied to either the as-compacted field dry density or the maximum dry density, as determined by the Engineer.
- B. Optimum Moisture Content:
  1. Moisture content of the material for which the maximum dry density is obtained as determined by ASTM D698 or D1557.
  2. Field moisture contents shall be determined on the basis of the fraction passing the 3/4-inch sieve.
- C. Completed Course: A course or layer that is ready for the next layer or the next phase of construction.

### **1.4 PROTECTION**

- A. The work may require excavation and related activities in close proximity to existing utility lines and facilities, such as water lines, telephone cables, and TV cables. Where their presence is known, the approximate location of all utilities should be shown on the Drawings, but all such utilities and individual service lines are not known. The Contractor shall be aware of the potential for such utility lines to conflict with intended construction efforts, and the Contractor shall use appropriate precautionary measures to locate and protect such utility lines and services so as to avoid damage and interruptions to service.
- B. The Contractor shall contact the owners of the various existing utility lines and services as may be affected by the construction and solicit their assistance in



identifying, locating, marking, protecting, bracing, or relocating these facilities prior to the beginning of any excavation or other work which might endanger the existing utilities. If such utilities are damaged or impaired because of the Contractor's actions or omissions, the contractor shall be responsible for the cost of repairs or replacements of the affected or damaged utility or service line.

- C. The Contractor shall comply with the Arkansas One-Call System and shall alert potentially conflicting utility systems accordingly.
- D. In all cases, the Contractor is responsible for protecting public and private property; and, protecting any person or persons who might be injured as a result of the Contractor's work.

## **1.5 REPAIRS**

- A. All streets, driveways, walks, drainage structures, fences, mailboxes, etc. that are disturbed during construction activities shall be restored to their original or better condition using like materials. The costs of such repairs shall be borne by the Contractor.
- B. The Contractor shall coordinate with landowners prior to the disturbance of private driveways, structures, fences, or mailboxes.

## **PART 2. PRODUCTS**

### **2.1 FOUNDATION STABILIZATION**

- A. Crushed gravel or crushed rock, free from dirt, clay balls, or organic material, well graded from coarse to fine, containing sufficient finer material for proper compaction, and meeting ASTM D448 Size No. 67 (Concrete Aggregate).

### **2.2 PIPE EMBEDMENT MATERIAL (INCLUDES BEDDING MATERIAL)**

- A. Select material consisting of fine loose earth or sand free from clods or rocks larger than 3/4-inch in any dimension.
- B. Crushed stone conforming to ASTM C33, Size No. 67.
- C. Washed stone or gravel size 1/4-inch to 3/4-inch.
- D. For thermal plastic pipe [Polyvinyl Chloride (PVC), High Density Poly-Ethylene (HDPE), etc.] pipe, the maximum embedment particle size shall not exceed 3/4-inch (20 mm) for angular rock.
- E. Native trench material can only be used for pipe embedment for non-paved areas above the groundwater table and when written approval is obtained from the Owner or Engineer.

## **2.3 NATIVE MATERIAL USED FOR BACKFILL**

- A. Material shall not contain pieces larger than 3 inches diameter, and shall be free of roots, debris, or organic matter. Never use materials of frozen, perishable, spongy, wet, or otherwise unsuitable nature.

## **2.4 SELECT FILL MATERIALS**

- A. Class 7 as established by Section 303 of Arkansas Department of Transportation Standard Specifications for Highway Construction.

## **2.5 FLOWABLE FILL MATERIAL**

- A. Flowable fill material for select backfill shall have a maximum compressive strength of 200 psi.
- B. Flowable fill material components shall conform to the requirements in Section 03 47 00.

## **2.6 COMPACTION EQUIPMENT**

- A. Suitable type and adequate to obtain the amount of compaction specified.
- B. Operate in strict accordance with manufacturer's instructions and recommendations and maintain in such condition so that it will deliver manufacturer's rated compactive effort.
- C. Hand-operated equipment shall be capable of achieving the specified densities.

## **2.7 TOPSOIL**

- A. Selected topsoil at the site, properly stored and protected, free from roots, sticks, hard clay, and stones which will not pass through a 2-inch square opening.
- B. Provide imported topsoil if required to accomplish the work.

## **2.8 IMPORTED TOPSOIL**

- A. Suitable sandy loam from an approved source.
- B. Must possess friability and a high degree of fertility.
- C. Free of clods, roots, gravel, and other inert material.
- D. Free of quackgrass, horsetail, and other noxious vegetation and seed.

## **2.9 IMPORTED MATERIAL ACCEPTANCE**

- A. Import only if sufficient material is not available on-site.

- B. Locate and arrange use of a site near the construction area for obtaining borrow material.
- C. Additional tests required at the borrow area:
  - 1. Standard Proctor.
  - 2. Remolded permeability.
  - 3. Atterberg limits.
- D. Upon completion of removal of borrow material, grade the site to drain, place topsoil on disturbed areas, and establish grass.
- E. Cost for testing and imported material shall be the responsibility of the Contractor.

## **2.10 WATER REMOVAL EQUIPMENT**

- A. Provide and operate equipment adequate to keep excavation and trenches free of water.

## **PART 3. EXECUTION**

### **3.1 PREPARATION**

- A. Where clearing or partial clearing of right-of-way is necessary, complete prior to start of trenching.
- B. Do not permit excavated materials to cover brush or trees prior to disposal.
- C. Sections of pipe to be inspected upon arrival to the site and all foreign material removed prior to installation.

### **3.2 PREVENT TRENCH WATER AND ANIMALS FROM ENTERING PIPE**

- A. When pipe laying is not in progress, including noon hours, open ends of pipe shall be closed; and no trench water, animals, or foreign material shall be permitted to enter the pipe.
- B. Installed pipes to be inspected and all foreign material shall be removed prior to installing the next section of pipe.

### **3.3 DISPOSAL OF CLEARED MATERIAL**

- A. Dispose of material in such a manner to meet requirements of state, county, and local regulations regarding health, safety, and public welfare.
- B. Dispose of nonflammable and flammable material off the construction site in an approved location.
- C. Do not leave material on the project site, shove onto abutting private properties, or bury in embankments or trenches.

### **3.4 REMOVAL OF OBSTRUCTIONS**

- A. Remove obstructions within trench area or adjacent thereto such as tree roots, stumps, abandoned piling, logs, and debris.
- B. Engineer may, if requested, make changes in the trench alignment to avoid major obstructions, if such alignment changes can be made within the easement or right-of-way without adversely affecting the intended function of the facility.
- C. Dispose of obstructions in accordance with Section 31 10 00.

### **3.5 REMOVAL AND REPLACEMENT OF TOPSOIL**

- A. Where trenches cross lawns, garden areas, pasturelands, cultivated fields, or other areas on which reasonable topsoil conditions exist, remove topsoil for a depth of 6 inches for full width of trench to be excavated.
- B. Use equipment capable of removing a uniform depth of material.
- C. Stockpile removed topsoil at regular intervals, and do not mix with other excavated material.
- D. Locate stockpiles so that material of one ownership is not transported and stockpiled on property of another ownership.
- E. Minimum finished depth of topsoil over trenches: 6 inches.
- F. Imported topsoil may be substituted for stockpiling and replacing topsoil.
- G. Maintain finished grade of topsoil level with area adjacent to trench until final acceptance by Engineer.
- H. Repair damage to adjacent topsoil caused by work operations.
  - 1. Remove rock, gravel, clay, and other foreign materials from the surface.
  - 2. Regrade.
  - 3. Add topsoil as required.

### **3.6 TRENCH WIDTH**

- A. Minimum width of unsheeted trenches where pipe is to be laid shall be 18 inches greater than the outside diameter of the pipe, or as approved.
- B. Maximum width at top of trench will not be limited, except where excess width of excavation would cause damage to adjacent structures or property or cause undue stresses on the pipe.
- C. Confine trench widths to dedicated rights-of-way or construction easements, unless special written agreements have been made with affected property owners.

### **3.7 EXCAVATION**

- A. Excavate trench to lines and grades shown or as established by Engineer with proper allowance for pipe thickness and for pipe base or special bedding when required.
- B. If trench is excavated below required grade, correct with foundation stabilization material.
- C. Place material over full width of trench in compacted layers not exceeding 6 inches deep to established grade with allowance for pipe base or special bedding.

### **3.8 PREPARATION OF TRENCH - LINE AND GRADE**

- A. Do not deviate more than 1/2 inch from line or 1/2 inch from grade. Measure for grade at the pipe invert, not at the top of the pipe, because of permissible variation in pipe wall thickness.
- B. Grade the bottom of the trench by hand to the line and grade where the pipe is to be laid, with proper allowance for pipe thickness and for pipe base when specified or indicated.
- C. Remove hard spots that would prevent a uniform thickness of bedding.
- D. Check the grade with a straightedge and correct irregularities found.
- E. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between bell holes, except that the grade may be disturbed for the removal of lifting tackle.

### **3.9 SHORING, SHEETING, AND BRACING OF TRENCHES**

- A. Sheet and brace trench when necessary to prevent caving during excavation in unstable material or to protect adjacent structures, property, workers, and the public.
- B. Increase trench widths accordingly by the thickness of the sheeting.
- C. Maintain sheeting in place until pipe has been placed and backfilled at pipe zone.
- D. Remove shoring and sheeting as backfilling is done in a manner that will not damage pipe or permit voids in backfill.
- E. Conform to safety requirements of OSHA and federal, state, or local public agency having jurisdiction for sheeting, shoring, and bracing of trenches; the most stringent of these requirements shall apply.

### **3.10 LOCATION OF EXCAVATED MATERIALS**

- A. Place excavated material only within construction easement, right-of-way, or approved working area.

- B. Do not obstruct private or public traveled roadways or streets.

### **3.11 REMOVAL OF WATER**

- A. Provide and maintain ample means and devices to promptly remove and dispose of water entering trench during time trench is being prepared for pipe laying, during laying of pipe, and until backfill at pipe zone is completed.
  - 1. These provisions apply during the noon hour as well as overnight.
  - 2. Provide necessary means and devices, as approved, to positively prevent under water from entering the construction area of another contractor.
- B. Dispose of water in a manner to prevent damage to adjacent property.
- C. Drainage of trench water through the pipeline under construction is prohibited.

### **3.12 FOUNDATION STABILIZATION**

- A. When existing material in bottom of trench is unsuitable for supporting pipe, excavate unsuitable material.
- B. Backfill trench to subgrade of pipe base with foundation stabilization material specified.
- C. Place foundation stabilization material over the full width of trench and compact in layers not exceeding 6 inches deep to required grade by making passes with a vibratory compactor (or equivalent).
- D. Material shall be considered unsuitable when it contains more than 5 percent organic material by volumetric sampling or when it will not support a reading of 1.5 on a hand penetrometer.

### **3.13 PIPE BEDDING**

- A. When one of the following conditions exists, support pipe on bedding material:
  - 1. Rock is encountered in the trench.
  - 2. Paved areas including roadways, driveway, parking areas, etc.
  - 3. Creek crossings to be open cut.
  - 4. Existing foundation/soils contain particles larger than the allowable size or consist expansive clays or collapsing material.
- B. Minimum Bedding Thickness: Minimum of 6 inches.

### **3.14 PIPE EMBEDMENT BACKFILL**

- A. Particular attention must be given to area of pipe embedment from flow line to centerline of pipe to ensure firm support is obtained to prevent lateral movement of pipe during final backfilling of pipe zone.
- B. Backfill area of pipe embedment from bottom of pipe to horizontal centerline of pipe by hand-placing material around pipe in 4-inch layers.

- C. Achieve continuous support beneath pipe haunches by "walking in" and slicing with shovel.
- D. Backfill area of pipe embedment from horizontal centerline to top of pipe zone with pipe zone material as specified above.
- E. If the Owner or Engineer determines that the existing material is insufficient or unsuitable at trench side for selected material for pipe embedment, provide suitable material from other trench excavation along pipeline or imported pipe embedment material.
- F. Pipe embedment material shall be compacted to 95% Standard Proctor density.

### **3.15 TRENCH BACKFILL ABOVE PIPE EMBEDMENT**

- A. When backfill is placed mechanically, push backfill material onto slope of backfill previously placed and allow to slide down into trench.
- B. Do not push backfill into trench in such a way as to permit free fall of material until at least 2 feet of cover is provided over top of pipe.
- C. Under no circumstances allow sharp, heavy pieces of material to drop directly onto pipe or tamped material around pipe.
- D. Do not use backfill material of consolidated masses larger than 1/2 cubic foot.
- E. Native trench backfill shall be provided in 12" maximum lifts and compacted to 80% Standard Proctor density.
- F. Select fill material shall be provided in 8" maximum lifts and compacted to 95% Standard Proctor density for gravel driveways, gravel surfaced areas, and sidewalks.
- G. Select fill material shall be provided in 8" maximum lifts and compacted to 95% Modified Proctor density for paved areas.

### **3.16 EXCESS EXCAVATED MATERIAL**

- A. Dispose of excess excavated material off the project site in an area approved by the Owner.

### **3.17 DRAINAGE CULVERTS**

- A. Replace drainage culverts which are removed on near right angles to pipe centerline.
- B. If pipe cannot be reused or is damaged during removal, dispose of it and provide new pipe.
- C. Protect culverts from damage or restore to equivalent condition.

- D. Replace culverts to existing lines and grades.
- E. Do not replace culverts until proposed pipeline is installed and backfill of trench has been completed to subgrade of culvert.

### **3.19 DRAINAGE DITCH RESTORATION**

- A. Undercrossings of minor drainage ditches not covered in another Specification Section shall be backfilled so that upper 1 foot of material in ditch between ditch banks is clay.
- B. Compact material for full ditch width by 6 passes of vibratory compactor (or equivalent).
- C. Where indicated on Drawings, provide concrete arch, and/or riprap on ditch banks.

### **3.20 SITE GRADING**

- A. Perform grading of backfilled trench to match the preconstruction surface or to the new lines and grades as shown on Drawings with proper allowance for topsoil or paved surfacing.
- B. Slopes shall be free of loose exposed roots and stones exceeding 3-inch diameter.
- C. Neatly and smoothly trim rounded surfaces; over-excavating and backfilling to the proper grade are not acceptable.
- D. Finished site grading shall be reviewed by the Engineer.

### **3.20 SETTLEMENT**

- A. Correct settlement noted in backfill, fill, or in structures built over backfill or fill within warranty period.

### **3.21 IMPORTED TOPSOIL**

- A. Should regenerative material be present in soil, remove both surface and root which appears in within 1 year following acceptance of the work in a manner satisfactory to Owner.

**END OF SECTION**



## **SECTION 31 25 00**

### **EROSION AND SEDIMENTATION CONTROL**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. Install slope protection and erosion control.
- B. Complete Work to present a continuous appearance.
- C. Temporary storm water pollution prevention measures shall be performed promptly when problem conditions exist or when storm water pollution problems are anticipated in certain areas to minimize soil erosion and siltation. Temporary measures shall be properly maintained until permanent control measures are functioning properly.
- D. The Contractor shall comply with all Federal, State, and local laws and regulations concerning controlling pollution of the environment. He shall take all necessary precautions to prevent pollution of streams, lakes, ponds, and reservoirs with fuel, oils, bitumens, chemicals, soil sedimentation, or other harmful materials, and to prevent pollution of the atmosphere from particulate gaseous matter.
- E. Contractor shall be responsible for implementing and following a Storm Water Pollution Prevention Plan as required by the Arkansas Department of Environmental Quality and in accordance with NPDES ARR150000. The successful Contractor shall develop a Storm Water Pollution Prevention Plan to meet all State and Federal regulations and submit to the Engineer for review and approval prior to commencing work.

##### **1.2 RELATED SECTIONS**

- A. Section 31 10 00 - Site Clearing.
- B. Section 31 23 33 - Trenching and Backfilling.

##### **1.3 SAFETY REQUIREMENTS**

- A. Conform with OSHA requirements, federal, state, and local rules and regulations pertaining to safety and as specified elsewhere in these Specifications.

#### **PART 2. PRODUCTS**

##### **2.1 STRAW BALES**

- A. Straw shall be threshed plant residue of oats, wheat, barley, rye, or rice from which the grain has been removed.

## **2.2 FENCE OR WIRE FABRIC**

- A. The fence fabric shall be a commercial grade of woven wire fence fabric. The wire fabric shall be a welded wire fabric.

## **2.3 FILTER FABRIC FOR SILT FENCING**

- A. Nonwoven polypropylene or polyester fabric.
- B. Manufacturer: Typar 3401, Trevira S1115, or equal.

## **2.4 ACCESSORIES**

- A. Wood or steel stakes. If using steel stakes (rebar), stakes shall have safety caps that meet OSHA requirements.
- B. Rectangular hay bales secured with twine or nylon rope.
- C. Filter fabric shall be supported by steel or wooden post.
- D. Filter fabric shall be backed with a woven wire fabric for support if post spacing farther than 6 feet is desired (10 foot maximum).

# **PART 3. EXECUTION**

## **3.1 PERMITTING**

- A. A Storm Water Pollution Prevention Plan (SWPPP) is required if the area to be disturbed is greater than or equal to 1 acre.
- B. A Notice of Automatic Coverage shall be provided along with the SWPPP if the area disturbed is greater than or equal to 1 acre and less than 5 acres.
- C. A Notice of Intent is necessary along with the SWPPP if the area disturbed is greater than or equal to 5 acres. After the site is deemed stabilized, the Contractor shall file a required Notice of Termination.
- D. The SWPPP and permitting documentation shall be posted at the job site prior to the start of construction and shall be maintained on site throughout the duration of construction activities.

## **3.2 GENERAL**

- A. Work shall consist of temporary and permanent storm water pollution prevention measures through the use of berms, sediment basins, sediment dams, fiberglass roving, filter fabric, silt fences, brush barriers, baled straw erosion checks, temporary flexible pipe slope drains and temporary seeding as necessary.
- B. If a SWPPP is required and the Contractor fails to properly maintain, install, or construct erosion and sedimentation control items, the Owner may take the

following actions: cessation of the Work, withholding of the Contractor's payment, suspension of the project, or default of the Contractor.

- C. Once the site has been fully stabilized against erosion, remove sediment control devices and all accumulated silt. Dispose of silt and waste materials in proper manner. Regrade all areas disturbed during this process and stabilize against erosion.
- D. All wash water shall be detained and properly treated or properly discarded.
- E. Sufficient oil and grease absorbing materials and flotation booms shall be maintained on-site or readily available to contain and clean up fuel or chemical spills and leaks.
- F. Dust on the site shall be controlled. The use of motor oils and other petroleum based or toxic liquids for dust suppression operations is prohibited.
- G. Trash, litter, and other such materials shall be deposited into sealed containers. These materials shall be prevented from leaving the site through the action of wind or storm water discharge into drainage ditches or waters of the State.
- H. All dewatering activities shall conform to all federal, state, and local requirements. Discharged water must be properly treated before releasing from the site.

### **3.3 INSTALLATION**

- A. Stake hay bales with wooden or steel stakes to prevent movement and to provide erosion control.
- B. Install silt fencing to control dust movement and to prevent erosion.
- C. Hay bales and silt fencing support shall be set in shallow trench and anchored a minimum of a 1-1/2 inch in ground surface.

### **3.4 MAINTENANCE**

- A. The Contractor shall have all erosion and sedimentation control measures inspected by qualified personnel at least once every 7 calendar days or every 14 calendar days and within 24 hours of the end of a rainfall event that exceeds 0.25".
- B. All measures shall be repaired to original condition or cleaned promptly after damage or a deficiency is observed.
- C. Sediment shall be removed from along the silt fence when sediment reaches no more than half the height of the silt fence.
- D. Seeded areas shall be checked regularly to see that a good stand is maintained. Contractor shall fertilize and reseed those areas in accordance with Section 32 92 19 as necessary.

### **END OF SECTION**

## **SECTION 32 12 16.01**

### **ASPHALT CONCRETE PAVEMENT REPAIR**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. Repair asphaltic concrete pavement in accordance with this Section and where indicated on the Drawings.
- B. Construct Work of this Section that is adjacent to or connected to city streets in accordance with requirements of the City for city streets.
- C. Secure permits and inspections, post necessary bonds, and pay necessary fees.

##### **1.2 REFERENCES**

- A. American Association of State Highway and Transportation Officials, 444 North Capitol Street, North West, Suite 249, Washington, DC 20001.
  - 1. AASHTO M140 - Anionic Emulsified Asphalt.
  - 2. AASHTO M81 - Cut-Back Asphalt Concrete (Rapid-Curing Type).
  - 3. AASHTO M82 - Cut-Back Asphalt Concrete (Medium-Curing Type).
  - 4. AASHTO M208 - Cationic Emulsified Asphalt.
- B. ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428-2959 USA Phone: (610) 832-9585 Fax: (610) 832-9555.
  - 1. ASTM C207 - Specification for Hydrated Lime for Masonry Purposes.
  - 2. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb. Rammer and 12-in. Drop.
  - 3. ASTM D946 - Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
  - 4. ASTM D977 - Specification for Emulsified Asphalt.
- C. Arkansas Department of Transportation, P.O. Box 2261, Little Rock, Arkansas 72203.
  - 1. ARDOT - Standard Specifications for Highway Construction, latest Edition.
  - 2. ARDOT 303 - Aggregate Base Course.
  - 3. ARDOT 304 - Aggregate Surface Course.
  - 4. ARDOT 305 - Asphaltic Concrete Hot Mix Stabilized Base Course.

#### **PART 2. PRODUCTS**

##### **2.1 ASPHALTIC PAVING MATERIALS**

- A. Base Course: Crushed stone conforming to ARDOT Standard Specifications for Highway Construction Section 303, Class 7.

- B. Tack/Prime Coat: Medium curing cut-back asphalt; MC-30 or MC-70; AASHTO M82; heated and applied within the temperature range 80 degrees F. - 150 degrees F.
- C. Hot-mix surfacing material shall meet the following requirements: Asphaltic Cement, Type II in accordance with Arkansas Department of Transportation, Edition, latest edition.

## **PART 3. EXECUTION**

### **3.1 SUBGRADE PREPARATION**

- A. Subgrade for asphalt paving improvements shall have organic silty and clayey topsoils and other unsuitable material removed and replaced with approved material.
- B. Fill and tamp traces of utility trenches.
- C. Replace soft spots as needed.

### **3.2 BASE COURSE FOR ASPHALTIC PAVING**

- A. Place and compact Class 7 fill material per Section 31 23 33.
- B. Tack/prime coat shall not be put down until base course is compacted and concrete cap cured.

### **3.3 TACK/PRIME COAT**

- A. After acceptance of completed base course, a prime coat shall be uniformly distributed over the prepared base at the rate of 0.3 gallon per square yard.
- B. Remove surplus asphalt material.

### **3.4 HOT-MIX SURFACING FOR ASPHALTIC PAVING**

- A. Plant Mixing and Transporting: Mixing, transportation, and temperature limitations for hot-mix surface course materials shall be in accordance with the requirements of Division 400, Asphalt Pavements of the ARDOT Standard Specifications for Highway Construction, Edition, latest edition.
- B. Placing, compacting, and acceptance shall be in accordance with Division 400, Asphalt Pavements of the ARDOT Standard Specifications for Highway Construction, Edition, latest edition.

**END OF SECTION**

## **SECTION 32 13 13**

### **CONCRETE PAVING**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. Construction of concrete curbs, gutters, sidewalks, and streets.

##### **1.2 RELATED SECTIONS**

- A. Section 03 20 00 - Concrete Reinforcing.
- B. Section 03 30 00 – Cast-in-Place Concrete.
- C. Section 31 10 00 - Site Clearing.
- D. Section 31 23 33 - Trenching and Backfilling.

##### **1.3 REFERENCES**

- A. American Concrete Institute, 22400 W. Seven Mile Road, Detroit, Michigan 48219.
  - 1. ACI 614.
- B. American Society for Testing and Materials, 1961 Race Street, Philadelphia, Pennsylvania 19103.
  - 1. ASTM C94 - Specification for Ready-Mixed Concrete.
  - 2. ASTM C309 - Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - 3. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb (2.49-kg) Rammer and 12-in (304.8-mm) Drop.
  - 4. ASTM D994 - Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

##### **1.4 SUBMITTALS**

- A. Submit complete information regarding concrete mix to Engineer for review in accordance with the requirements of ASTM C94, Alternate 2.

#### **PART 2. PRODUCTS**

##### **2.1 CURB FORMS**

- A. 2-inch dressed dimension lumber or metal of equal strength, free from defects that would impair appearance or structural quality of completed curb.
  - 1. Metal forms: Subject to approval of Engineer.
- B. Short-Radius Forms: 1-inch dressed lumber or plywood.

- C. Curb Face: No horizontal joints in form material closer than 7 inches from top of curb.
- D. Stakes and Bracing Materials: Provide as required to hold forms securely in place.

## **2.2 SIDEWALK FORMS**

- A. 2-inch dressed lumber, straight and free from defects, or standard metal forms.
- B. Short-Radius Forms: 1-inch dressed lumber or plywood.
- C. Stakes and Bracing Materials: Provide as required to hold forms securely in place.

## **2.3 CRUSHED ROCK BASE**

- A. Class 7 base conforming to the requirements for select fill as specified in Section 31 23 33.

## **2.4 EXPANSION JOINT FILLER**

- A. 1/2-inch thick preformed asphalt-impregnated expansion joint material conforming to ASTM D994.

## **2.5 CONCRETE**

- A. Ready mixed conforming to ASTM C94, Alternate 2 and in accordance with Section 03 30 00.

## **2.6 CURING COMPOUND**

- A. Liquid membrane-forming, clear or translucent, suitable for spray application.
- B. Conform to ASTM C309, Type 1.

## **2.7 ACCEPTANCE OF MATERIALS**

- A. Materials shall be subject to inspection for suitability by the Engineer prior to or during incorporation into the work.

# **PART 3. EXECUTION**

## **3.1 EXCAVATION AND BACKFILL**

- A. Excavate and backfill in accordance with Section 31 23 33.

### **3.2 PREPARATION OF SUBGRADE**

- A. Bring the areas where curbs and sidewalks are to be constructed to required grade on undisturbed ground and compact by sprinkling and rolling or mechanical tamping.
- B. As depressions occur, refill with suitable material and recompact until the surface is at the proper grade.
- C. In areas outside of utility trench, compact subgrade to 95 percent of maximum density at optimum moisture content as determined by ASTM D698.

### **3.3 PLACING CRUSHED ROCK BASE**

- A. After subgrade for sidewalks and curbs is compacted and at proper grade, spread at least 4 inches Class 7 fill and compact to at least 95 percent of maximum density as determined by ASTM D698.
- B. Sprinkle with water as necessary and compact by rolling or other method.
- C. Top of compact granular fill shall be at proper level to receive concrete.

### **3.4 SETTING FORMS**

- A. Construct forms to the shape, lines, grades, and dimensions called for on the Drawings.
- B. Stake wood or metal forms securely in place, true to line and grade.
- C. Brace forms to prevent change of shape or movement in any direction resulting from the weight of the concrete during placement.
- D. Construct short-radius curved forms to exact radius.
- E. Tops of forms shall not depart from grade line more than 1/8 inch when checked with a 10 foot straightedge.
- F. Alignment of straight sections shall not vary more than 1/8 inch in 10 feet.
- G. Forms shall be cleaned and oiled thoroughly after each use and before concrete is placed.

### **3.5 CURB CONSTRUCTION**

- A. Construct curbs to line and grade shown or established by the Engineer, and conform to the details shown on Drawings.
- B. Place, process, finish, and cure concrete in conformance with this Section and the applicable requirements of ACI 614. Wherever requirements differ, the more stringent shall govern.



- C. Cast in uniform lengths of approximately 10 to 20 feet, except at closures where lengths may not be less than 6 feet.
- D. Placement of Preformed Asphalt-Impregnated Expansion Joints:
  - 1. At intervals not exceeding 40 feet.
  - 2. Beginning and end of curved portions of the curb.
  - 3. Connections to existing curbs.
- E. Contraction Joints:
  - 1. Place at intervals not exceeding 10 feet.
  - 2. Open type joint.
  - 3. Provide by inserting thin, oiled steel sheet vertically in fresh concrete to force coarse aggregate away from joint.
  - 4. Steel sheet shall be inserted the full depth of the curb.
  - 5. After initial set has occurred in the concrete and prior to removing the front curb form, steel sheet shall be removed with a sawing motion.
- F. As soon as concrete has set sufficiently to support its own weight, remove the front form and finish all exposed surfaces.
  - 1. Finish top of curb with a steel trowel.
  - 2. Finish edges with a steel edging tool.
  - 3. Rub formed faces with burlap sack or similar device to produce a uniformly textured surface, free from form marks, honeycomb, and other defects.
- G. Curing:
  - 1. Upon completion of finishing, apply approved curing compound to exposed surfaces of curb.
  - 2. Curing shall continue for a minimum of 5 days.
- H. Backfilling Curb: Upon completion of curing period, but not before 7 days has elapsed since pouring the concrete, backfill the curb as specified in Section 31 23 33.
- I. Adjusting:
  - 1. Finished curb shall present a uniform appearance for both grade and alignment
  - 2. Remove curb sections showing abrupt changes in alignment or grade or that are more than 1/4 inch away from location as staked or that are defective for any reason.
  - 3. Construct new curb at Contractor's expense.

### **3.6 SIDEWALK CONSTRUCTION**

- A. Thickness of sidewalks shall a minimum of 4 inches or as shown on the Drawings, with a turned down edge. Concrete shall be placed true to grade to ensure that ponding of water will not occur.
- B. Place, process, finish, and cure concrete in conformance with this Section and the applicable requirements of ACI 614. Where the requirements differ, the more stringent shall govern.

- C. Placement of Preformed Asphalt Expansion Joints:
  - 1. Where sidewalk ends.
  - 2. Around posts, poles, or other objects protruding through the sidewalk.
  - 3. At intervals to match existing sidewalk, not to exceed 25 feet.
- D. Control Joints:
  - 1. Provide transversely to the sidewalks.
  - 2. Saw cut weakened plane joints shall be straight and at right angles to the surface of the walk. Saw cuts shall be constructed at intervals between expansion joints that match the existing sidewalk. Saw cut to a depth of 25 percent of slab thickness. Saw cuts shall be performed within 24 hours of placement.
- E. Reinforcing: 6 by 6 inch, No. 6 mesh shall be installed.
- F. Finish:
  - 1. Broom surface with fine hair broom at right angles to length of walk and tool at edges, joints, and markings.
  - 2. Walks shall be scored at no less than 5-foot intervals and within 24 hours of concrete placement.
- G. Curing:
  - 1. Upon completion of finishing, apply an approved curing compound to exposed surfaces.
  - 2. Protect sidewalks from damage for period of 7 days.

### **3.7 CONCRETE STREET PAVING**

- A. In areas shown to receive concrete paving on the Drawings, concrete shall be placed in accordance with Division 3 of these Specifications.

**END OF SECTION**

## **SECTION 32 13 73**

### **PAVEMENT JOINT SEALANTS**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Expansion and contraction joints within portland cement concrete surfaces.
  - 2. Joints between cement concrete and asphalt pavement.

##### **1.2 SUBMITTALS**

- A. Product Data: For each joint-sealant product indicated.
- B. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- C. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
  - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
  - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

##### **1.3 QUALITY ASSURANCE**

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

##### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

##### **1.5 PROJECT CONDITIONS**

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (4.4 deg C).

2. When joint substrates are wet or covered with frost.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## **PART 2. PRODUCTS**

### **2.1 MATERIALS, GENERAL**

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Engineer from manufacturer's full range between the color black and dark grey.
- C. Finish of Joint: Sand joint filler.

### **2.2 COLD-APPLIED JOINT SEALANTS**

- A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.
  1. Acceptable products:
    - a. Crafco Inc.; RoadSaver Silicone.
    - b. Dow Corning Corporation; 888.
    - c. Approved equal.

### **2.3 JOINT-SEALANT BACKER MATERIALS**

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.
- D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

## **2.4 PRIMERS**

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

## **PART 3. EXECUTION**

### **3.1 EXAMINATION**

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

### **3.3 INSTALLATION OF JOINT SEALANTS**

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of backer materials.
  - 2. Do not stretch, twist, puncture, or tear backer materials.
  - 3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.
- D. Install sealants using proven techniques that comply with the following at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses provided for each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealants from surfaces adjacent to joint.
  - 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.
- G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

### **3.4 CLEANING**

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

### **3.5 PROTECTION**

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so that installations with repaired areas are indistinguishable from the original work.

### **END OF SECTION**

## **SECTION 32 14 41**

### **GRAVEL SURFACING**

#### **PART 1. GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Gravel paving course, compacted.

##### **1.2 REFERENCES**

- A. American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.
  - 1. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- B. Arkansas Department of Transportation, P.O. Box 2262, Little Rock, Arkansas 72203.
  - 1. ARDOT 303 - Aggregate Base Course.

#### **PART 2. PRODUCTS**

##### **2.1 MATERIALS**

- A. Class 7 as established by Section 303 of Arkansas Department of Transportation Standard Specifications for Highway Construction.

#### **PART 3. EXECUTION**

##### **3.1 INSPECTION**

- A. Verify compacted subgrade is dry and ready to receive Work of this Section.
- B. Verify gradients and elevations of subgrade are correct.
- C. Beginning of installation means acceptance of existing conditions.

##### **3.2 PLACING GRAVEL PAVING**

- A. Spread gravel material over prepared base to a minimum total compacted thickness of 6 inches or as shown on the Drawings.
- B. Level surfaces to elevations and gradients indicated.
- C. Compact placed gravel materials to achieve 95 Percent Standard Proctor density.

- D. Moisture Content:
  - 1. Add water, if necessary, to assist compaction.
  - 2. With an excess water condition, rework topping and aerate to reduce moisture content.
- E. Perform hand tamping in areas inaccessible to compaction equipment.

### **3.3 REPAIRING GRAVEL SURFACING**

- A. Gravel surfacing shall be replaced to at least the compacted thickness of the original surface. All excavated material shall be removed from excavated surfaces affected by construction and sufficient new gravel material shall be placed to restore the original surfaced area.

**END OF SECTION**



## **SECTION 32 92 19**

### **SEEDING**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. This item shall consist of furnishing and applying lime, fertilizer, seed, mulch cover, and water according to these specifications at locations shown on the plans or as directed for permanent and temporary seeding.
- B. The work under this item shall be accomplished as soon as practicable after the grading in an area has been completed in order to deter erosion.

##### **1.2 REFERENCES**

- A. Arkansas Department of Transportation (ARDOT), Standard Specifications for Highway Construction, latest edition.

#### **PART 2. MATERIALS**

##### **2.1 TOPSOIL**

- A. Existing topsoil shall be reused where practical.
- B. Imported topsoil shall be furnished at the sole expense of the Contractor.

##### **2.2 LIME**

- A. Lime shall be agricultural grade ground limestone or equivalent as approved by the Engineer.

##### **2.3 FERTILIZER**

- A. Fertilizer shall be a commercial grade, uniform in composition, free flowing, and suitable for application with mechanical equipment.
- B. Fertilizer shall be delivered to the site in labeled containers that conform to current Arkansas fertilizer laws and bearing the name, trademark, and warranty of the producer.

##### **2.4 SEED**

- A. Seed shall have a minimum of 98% pure seed and 85% germination by weight, and shall contain no more than 1% weed seeds.
- B. A combined total of 110 noxious weed seeds shall be the maximum amount per 50 pounds of seed with the following exceptions: Johnson grass seed, wild onion seed, wild garlic seed, field bindweed seed, nut grass seed, sickle pod seed,

sesbania seed, indigo seed, morning-glory seed, and cocklebur seed will not be allowed in any amount.

- C. Seed shall be furnished in sealed, standard containers. Seed that has become wet, moldy, or otherwise damaged in transit or in storage will not be acceptable.
- D. Legumes shall be inoculated with an approved culture as recommended by the manufacturer, just prior to seeding.
- E. Seeds shall be composed of the varieties and amounts by weight as shown below.

## 2.5 SEED MIX

- A. Seed for permanent seeding shall be Common Bermuda Grass, applied at the following rates or as recommended by the County Cooperative Extension Service:

|                                                | lbs./acre |
|------------------------------------------------|-----------|
| <b>March 1 - August 31</b>                     |           |
| Bermuda Grass (Common) unhulled - husk in tact | 75        |
| Bermuda Grass (Common) hulled - husk removed   | 25        |
| <b>September 1 - February 28/29</b>            |           |
| Winter Barley or Annual Ryegrass               | 50        |
| Bermuda Grass (Common) unhulled - husk in tact | 75        |

- B. Bermuda grass seed shall be used for temporary seeding between March 1 and September 1 at the rate listed for permanent seeding or as recommended by the County Cooperative Extension Service.
- C. Winter barley or annual rye grass shall be used for temporary seeding between September 1 and March 1 applied at a rate of 120 pounds/acre or as recommended by the County Cooperative Extension Service.

## 2.6 MULCH COVER

- A. Mulch cover shall consist of straw from threshed rice, oats, wheat, barley, or rye; of wood excelsior; or of hay obtained from various legumes or grasses, such as lespedeza, clover, vetch, soybeans, bermuda, carpet sledge, bahia, fescue, or other legumes or grasses; or a combination thereof. Mulch shall be dry and reasonably free from Johnson grass or other noxious weeds, and shall not be excessively brittle or in an advanced state of decomposition. All material will be inspected and approved prior to use.

## 2.7 TACKIFIERS

- A. Tackifiers used in mulch anchoring shall be of such quality that the mulch cover will be bound together to form a cover mat that will stay intact under normal climatic conditions.

## **2.8 WATER**

- A. Water shall be of irrigation quality and free of impurities that would be detrimental to plant growth.

## **PART 3. EXECUTION**

### **3.1 TEMPORARY SEEDING AND REVEGETATION**

- A. Soil that is stockpiled for more than 30 days or disturbed areas where there will be no construction for 12 months shall be stabilized to prevent erosion.
- B. If natural vegetation does not occur, area shall be temporarily seeded.
- C. Temporary revegetation shall occur during the spring and summer period.
- D. Provide temporary revegetation to control erosion. The use of a broadcast seeder after the last frost through July is acceptable.
- E. Alternative to Temporary Seeding: Mulching using the methods and rates given in this Section.

### **3.2 PROJECT SCHEDULE**

- A. Project Schedule shall show an anticipated time for grading and seeding to take place, so that seasonal consideration can be given attention.

### **3.3 SITE GRADING**

- A. Shape, trim, and finish slopes to conform with lines and grades shown.
- B. Make slopes free of loose exposed roots and stones exceeding 2 inches in diameter.
- C. Ensure that site drains properly and there are no areas where water may pond.
- D. Finished site grading will be reviewed by Engineer.

### **3.4 PREPARATION OF SEEDBED**

- A. Areas to be seeded shall be dressed to the shape and section shown on the plans.
- B. If the plans call for replacing topsoil, this shall be done before any preparations for seeding.
- C. Before beginning the seedbed preparation, soil samples shall be obtained from each major soil area for lime requirement analysis.
- D. Lime shall be uniformly spread at the rate determined by the lime requirement test on areas to be seeded prior to their being roughened or scarified. The seedbed

shall be thoroughly pulverized by means of disk harrows or other approved methods, thoroughly mixing lime and soil to a depth of not less than 4 inches (2 inches for slopes 4:1 or steeper) below finish slope elevations. Regardless of the pulverizing method used, the soil shall be broken with the contour of the slope.

- E. Apply fertilizer and mix with topsoil.
- F. Objectionable foreign matter shall be removed and the soil left in a suitable horticultural condition to receive fertilizer and seed. Water may be applied before, during, and after seedbed preparation in order to maintain the desired moisture content in the soil.
- G. When no lime is required, seedbed preparation shall be accomplished as specified above, regardless of the method used in the distribution of fertilizer, seed, and mulch cover.
- H. Rake the area to a uniform grade so that areas drain in the same manner as at the start of the Project.
- I. Lightly compact before planting grass.
- J. Remove trash and stones exceeding 2 inches in diameter from area to a depth of 2 inches prior to preparation and planting grass.

### **3.5 FERTILIZATION**

- A. Apply commercial fertilizer of the type and at the rate recommended by the County Cooperative Extension Service. Fertilizer shall be uniformly incorporated into the soil alone, or in conjunction with the required lime. If the Contractor so elects, the fertilizer may be drilled into the soil or combined with the seed in the hydro-seeding operation.

### **3.6 TIME OF SEEDING**

- A. Conduct seeding under favorable weather conditions during seasons which are normal for work as determined by accepted practice in locality of Project.

### **3.7 MECHANICAL SEEDING**

- A. Sow grassed areas evenly with a mechanical spreader, or as otherwise instructed by the Engineer. Roll with cultipacker to cover seed. Method of seeding may be varied at discretion of Contractor on his own responsibility to establish a smooth, uniformly grassed area.

### **3.8 HYDRO-SEEDING**

- A. If hydro-seeder is used for seeding, fertilizer and seed may be incorporated into one operation but a maximum of 800 pounds of fertilizer shall be permitted for each 1500 gallons of water. If the Contractor so elects, the fertilizer may be applied during preparation of the seedbed. The area shall be lightly firmed with a cultipacker immediately before hydro-seeding.

### **3.9 WINTER PROTECTIVE SEEDING**

- A. Areas receiving temporary winter protective seeding shall be re-seeded when weather conditions become favorable.

### **3.10 MULCH COVER**

- A. Mulch cover shall be applied at the rate of 4,000 pounds per acre immediately after seeding and shall be spread uniformly over the entire area by approved power mulching equipment. When approved by the Engineer, the Contractor may use hand methods to apply mulch cover to small or inaccessible areas.

### **3.10 MULCH ANCHORING**

- A. The mulch shall be effectively pressed into the soil using steel cleated track or cleated roller equipment. The anchoring shall be performed so that the grooves formed are perpendicular to the flow of water down backslopes and foreslopes. The equipment and method used shall produce acceptable results.

### **3.11 WATER**

- A. After application of the mulch cover, water shall be applied in sufficient quantity, as Directed by the Engineer, to thoroughly moisten the soil to the depth of pulverization and then as necessary to germinate the seed.
- B. When directed by the Engineer, the Contractor shall apply water in an amount such that, in conjunction with any rainfall, the seeded and mulched area will receive an amount equivalent to a minimum of 1 inch of water each week beginning the week after seeding and continuing for a minimum of 3 weeks.

### **3.12 MAINTENANCE**

- A. Begin maintenance immediately after each portion of grass is planted and continue until a reasonable stand of grass has been obtained. Repair washed out areas by filling with topsoil, fertilizing, and seeding.

### **3.13 GUARANTEE**

- A. If, at the end of a 180-day period, a satisfactory stand of grass has not been produced, the Contractor shall renovate and reseed the grass or unsatisfactory portions thereof immediately, or, if after the usual planting season, during the next planting season. If a satisfactory stand of grass develops by July 1 of the following year, it will be accepted. If it is not accepted, a complete replanting will be required during the planting season.
- B. A satisfactory stand is defined as grass or section of grass that has:
  - 1. No bare spots larger than 1 square foot.
  - 2. Not more than 15 percent of total area with bare spots larger than 6 inches square.

### **END OF SECTION**

## **SECTION 32 92 23**

### **SODDING**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. Provide slab sod, fertilizer, and water to establish and maintain grass.
- B. Planting Period: As recommended by sod producer for time of year, subject to Owner's approval.

##### **1.2 REFERENCES**

- A. Federal Specifications.
  - 1. FS O-F-241 - Fertilizers, Mixed, Commercial.

##### **1.3 DEFINITIONS**

- A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

##### **1.4 REGULATORY REQUIREMENTS**

- A. Comply with regulatory agencies for herbicide composition.

##### **1.5 QUALITY CONTROL**

- A. Grass that has been cut more than 48 hours before placing shall not be used.
- B. Sod shall not be loaded in bulk on vehicles and dumped in bulk on planting site.
- C. Soil Analysis: For each un-amended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory prior to setting Sod. Cooperative Extension Service is an acceptable soil testing lab.
  - 1. The soil-testing laboratory shall oversee soil sampling.
  - 2. Report suitability of tested soil for turf growth.
    - a. State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
    - b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver to site, store, and protect products at site.
- B. Sod:
  - 1. Cut sod with approved sod cutters to minimum depth of 2-1/2 inches in satisfactory and uniform widths and convenient lengths for handling.
  - 2. Place cut sod flat, grass side up, on boards and haul to site with soil intact.
  - 3. Sod shall not hang over the edges of the boards.
- C. Fertilizer: Deliver in waterproof bags showing weight, chemical analysis, and name of manufacturer.

## **PART 2. MATERIALS**

### **2.1 TOPSOIL**

- A. Existing topsoil shall be reused where practical.
- B. Imported Topsoil shall be furnished at the sole expense of the Contractor.

### **2.2 SLAB SODDING**

- A. Type: As indicated on Drawings, to match existing, or Common Bermuda.
- B. Certified nursery grade cultivated grass sod, 95 percent weed free.
- C. Sod shall be live, fresh, and uninjured at time of placing.

### **2.3 FERTILIZER**

- A. FS O-F-241, Type and Grade as recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil to the proportions of nitrogen, phosphoric acid, and soluble potash as recommended by the County Cooperative Extension Service and/or sod producer, subject to Engineer's approval.

### **2.4 WATER**

- A. Clean, fresh, and free of substances or matter which could inhibit vigorous growth of grass.

### **2.5 HERBICIDES**

- A. As recommended by sod producer and as approved by Engineer.

## **PART 3. EXECUTION**

### **3.1 PREPARATION**

- A. Fine grade to eliminate uneven areas and low spots. Allow for thickness of topsoil and sod.
- B. Spread topsoil and thoroughly till to a depth of at least 4 inches by harrowing.

### **3.2 FERTILIZING**

- A. Apply approximately 90 percent over entire area to receive slab sodding.
- B. Apply remaining 10 percent over sod after placing and rolling.

### **3.3 SODDING**

- A. Upon delivery to site, transfer sod from boards to soil surface.
- B. Place slabs closely, leaving a minimum amount of space between slabs.
- C. Use appropriate tools to pull together slabs that do not fit closely.
- D. Do not handle sod by hand except when filling small cracks or at locations where it would be impractical to use boards.

### **3.4 ROLLING**

- A. Roll slab sod as soon after planting as practicable with plain rollers or cultipackers.
- B. Tamp sod with approved hand methods where rolling is impractical.

### **3.5 MAINTENANCE**

- A. Water to prevent grass and soil from drying out.
- B. Control growth of weeds.
- C. Apply herbicides in accordance with the instructions from the County Cooperative Extension Service or the sod producer.
- D. Remedy damage resulting from improper use of herbicides.
- E. Immediately re-sod areas which show bare spots.
- F. Protect sodded areas with warning signs during maintenance period.

**END OF SECTION**



## **SECTION 33 01 10.58**

### **DISINFECTION OF WATER UTILITY PIPING**

#### **PART 1. GENERAL**

##### **1.1 WORK INCLUDED**

- A. Disinfection of potable water distribution system.
- B. Test and report results.

##### **1.2 REFERENCES**

- A. American Water Works Association.
  - 1. AWWA C651- Standard for Disinfecting Water Mains (latest edition).
- B. The Ten States Standards for Water (latest edition).
- C. Arkansas Department of Health (ADH), 4815 W. Markham Street, Little Rock, Arkansas 72205.

##### **1.3 QUALITY ASSURANCE**

- A. Testing Laboratory: Arkansas Department of Health.

##### **1.4 REGULATORY REQUIREMENTS**

- A. Conform to Arkansas Department of Health regulations for Work of this Section.

##### **1.5 PROJECT RECORD DOCUMENTS**

- A. Submit 3 copies of reports in accordance with Specifications.
- B. Disinfection report; accurately record:
  - 1. Type and quantity of disinfectant used.
  - 2. Date and time of start and completion of disinfectant injection.
  - 3. Test locations.
  - 4. Initial, 24-hour, and 48-hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
  - 5. Date and time of start and completion of flushing.
  - 6. Disinfectant residual after flushing in ppm for each outlet tested.
- C. Bacteriological report; accurately record:
  - 1. Date issued, project name, and testing laboratory name, address, and telephone number.
  - 2. Time and date of water sample collection.
  - 3. Name of person collecting samples.
  - 4. Test locations.
  - 5. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
  - 6. Coliform bacteria test results for each outlet tested.

7. Certification that water conforms, or fails to conform, to bacterial standards of the Arkansas Department of Health.
8. Bacteriologist's signature.
9. Wooster Water System's PWS ID Number is 196.
10. Samples are to be at the expense of the Contractor and labeled as "Construction Samples" and not submitted as a normal bacti sample under the Owner's PWS number.

## **1.6 STORAGE AND HANDLING**

- A. The Contractor is reminded that chlorine is a powerful oxidant and reacts readily with foreign substances.
- B. Chlorine compounds shall be handled and stored in accordance with manufacturer's recommendations.

## **PART 2. PRODUCTS**

### **2.1 CALCIUM HYPOCHLORITE**

- A. Granular form or tablets containing 65 percent available chlorine by weight.
- B. Calcium hypochlorite intended for swimming pool disinfection is **not allowed**.

### **2.2 SODIUM HYPOCHLORITE**

- A. Liquid form containing approximately 5 to 15 percent available chlorine.

## **PART 3. EXECUTION**

### **3.1 PREPARATION**

- A. Verify that piping system has been cleaned, inspected, and pressure tested.
- B. Perform scheduling and disinfection activity with startup, testing, adjusting, balancing, and demonstration procedures, including coordination with related systems.

### **3.2 EXECUTION**

- A. Provide and attach equipment required to execute Work of this Section.
- B. Utilize fire hydrants as blow-off points when possible.
- C. Fire hydrants shall not be used for sample points.
- D. Sample points constructed shall be a 3/4 inch or 1 inch copper riser pipe that shall extend adequately above the ground surface.

- E. During application of chlorine solution, prevent solution from flowing back into the distribution system.
- F. Disinfect piping system by one of the three following methods in accordance with ANSI/AWWA C651 (latest version):
  1. Tablet Method.
  2. Continuous Feed Method.
  3. Slug Method.
- G. Tablet Method:
  1. This method may only be used if pipes and appurtenances are kept clean and dry during construction.
  2. This procedure must not be used on solvent welded plastic or on screw joint steel pipe.
  3. If using granules:
    - a. Placement of calcium hypochlorite granules during construction: Calcium hypochlorite granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500-ft (150-m) intervals. The quantity of granules at each location shall be as shown in Table 1.

**Weight of calcium hypochlorite granules to be placed at beginning of main and at each 500-ft (150-m) interval**

| Pipe Diameter ( <i>d</i> ) |                  |                       | Calcium Hypochlorite Granules |
|----------------------------|------------------|-----------------------|-------------------------------|
| <i>in</i>                  | <i>(mm)</i>      | <i>oz</i>             | <i>(g)</i>                    |
| 4                          | (100)            | 1.7                   | (48)                          |
| 6                          | (150)            | 3.8                   | (108)                         |
| 8                          | (200)            | 6.7                   | (190)                         |
| 10                         | (250)            | 10.5                  | (298)                         |
| 12                         | (300)            | 15.1                  | (428)                         |
| 14 and larger              | (350 and larger) | D <sup>2</sup> x 15.1 | D <sup>2</sup> x 428          |

Where D is the inside pipe diameter, in feet  $D = d/12$

4. If using tablets:
  - a. Placement of calcium hypochlorite tablets during construction: Calcium hypochlorite tablets (5-grams) shall be placed in the upstream end of each section of pipe to be disinfected, including branch lines. Also, at least one tablet shall be placed in each hydrant branch and in other appurtenances. The number of 5-g tablets required for each pipe section shall be  $0.0012 d^2 L$  rounded to the next higher integer, where  $d$  is the inside pipe diameter, in inches, and  $L$  is the length of the pipe section, in feet. Table 2 shows the number of tablets required for commonly used sizes of pipe. Calcium hypochlorite tablets shall be attached by an adhesive meeting the requirements of NSF/ANSI 61. There shall be adhesive only on the broadside of the tablet attached to the surface of the pipe. Attach tablets inside and at the top of the main. If the tablets are attached before the pipe section is placed in the

trench, their positions shall be marked on the pipe exterior to indicate that the pipe has been installed with the tablets at the top.

**Number of 5-g calcium hypochlorite tablets required for dose of 25 mg/L\***

|               |       | Length of Pipe Section, ft (m)             |          |          |          |           |
|---------------|-------|--------------------------------------------|----------|----------|----------|-----------|
| Pipe Diameter |       | 13 (4.0) or less                           | 18 (5.5) | 20 (6.1) | 30 (9.1) | 40 (12.2) |
| in            | (mm)  | Number of 5-g Calcium Hypochlorite Tablets |          |          |          |           |
| 4             | (100) | 1                                          | 1        | 1        | 1        | 1         |
| 6             | (150) | 1                                          | 1        | 1        | 2        | 2         |
| 8             | (200) | 1                                          | 2        | 2        | 3        | 4         |
| 10            | (250) | 2                                          | 3        | 3        | 4        | 5         |
| 12            | (300) | 3                                          | 4        | 4        | 6        | 7         |
| 16            | (400) | 4                                          | 6        | 7        | 10       | 13        |

\*Based on 3.25-g available chlorine per tablet

5. Filling and contact time: When installation has been completed, the main shall be filled with water such that the full pipe velocity is no greater than 1 ft/sec (0.3 m/sec). Fill rate must be carefully controlled to ensure tablets do not come loose from pipe. Precautions shall be taken to ensure that air pockets are eliminated. As an optional procedure, if required by the purchaser, water used to fill the new main shall be supplied through a temporary connection that shall include an appropriate cross-connection control device, consistent with the degree of hazard, for backflow protection of the active distribution system.  
The chlorinated water shall remain in the pipe for at least 24 hr. If the water temperature is less than 41°F (5°C), the water shall remain in the pipe for at least 48 hr. A detectable free chlorine residual ( $\geq 0.2$  mg/L) shall be found at each sampling point after the 24- or 48-hr period.

6. Refer to ANSI/AWWA C651 (latest version) for additional detail.

**H. Continuous Feed Method:**

1. After installation flush water line to remove particulates. Velocity in the water line shall not be less than 3 ft./sec.
2. Fill water line with water dosed with chlorine. Chlorine concentration shall not be less than 25 mg/l free chlorine.
3. Retain chlorinated water in water line for 24 hours. Operate valves and hydrants during this time to disinfect.
4. Chlorine residual in water shall not be less than 10 mg/l at the end of the 24-hour period.
5. Refer to ANSI/AWWA C651 (latest version) for additional detail.

**I. Slug Method:**

1. After flushing water line to remove particulates, slowly fill water line with water dosed with a 100 mg/l concentration of chlorine.
2. Retain chlorinated water in water line for not less than 3 hours.

3. Measure the free chlorine residual in the water line as it is filled. If dosage drops below 50 mg/l during this time, stop flow and relocate chlorination equipment to the reduced level of where chlorine was detected. As flow is resumed, apply chlorine to restore the free chlorine in the water to not less than 100 mg/l.
  4. Operate valves and hydrants during this time to disinfect.
  5. Refer to ANSI/AWWA C651 (latest version) for additional detail.
- J. Final Flushing:
1. Flush water from water line until chlorine measurements are no higher than the chlorine residual that are found in the existing distribution system.
  2. Inspect environment where the chlorinated water is to be discharged. Add a neutralizing chemical as the chlorinated water is being discharged if area is in threat of environmental damage from the chlorinated water.
- K. Bacteriological Tests:
1. For new mains, sets of samples shall be collected every 1,200 ft of the new water main, plus one set from the end of the line and at least one from each branch greater than one pipe length.
  2. After final flushing and prior to the new water line being connected to the existing distribution system, two consecutive sets of acceptable water samples collected from the new water line and taken on consecutive days at least 24 hours apart shall be submitted by the Contractor to the bacteriological laboratory at the Arkansas Department of Health in Little Rock, Arkansas.
  3. Samples shall be tested for bacteriological quality in accordance with Standard Methods for the Examination of Water and Wastewater per the American Public Health Association, AWWA, and Water Environment Association (latest edition) and shall show the absence of coliform organisms.
  4. If samples collected are positive, the disinfecting procedures and samples shall be repeated until two consecutive sets of acceptable water samples taken at least 24 hours apart are tested safe.

## **END OF SECTION**

**SECTION 33 05 05.31**  
**HYDROSTATIC TESTING**

**PART 1. GENERAL**

**1.1 SUMMARY**

- A. This Section covers test for water appurtenances and piping.

**1.2 RELATED SECTIONS**

- A. Section 33 05 19 – Ductile Iron Utility Water Pipe and Fittings.  
B. Section 33 05 31.15 - Polyvinyl Chloride Pressure Pipe and Fittings.

**1.3 SUBMITTALS**

- A. Submit testing procedures in accordance with Specifications.

**PART 2. MATERIALS**

**2.1 WATER FOR HYDROSTATIC TESTING OF PRESSURE LINES**

- A. Furnish water from the nearest hydrant or other suitable source for testing purposes.

**PART 3. EXECUTION**

**3.1 HYDROSTATIC AND LEAK TESTING OF PRESSURE LINES**

- A. Upon completion of installation, thoroughly clean new pipe:
1. Lines shall be filled slowly with potable water at a maximum velocity of 1 ft/sec while venting air.
  2. Flush with water to remove dirt, stones, pieces of wood, or other obstructions that may have entered pipe during construction.
  3. Flush pipelines at a minimum rate of 3 feet per second for a duration suitable to Engineer.
  4. A minimum of three changes of treated water shall be used in flushing operations.
- B. Upon completion of installation, pressure test water pipelines:
1. Conduct test in presence of Engineer and Owner.
  2. Minimum Pressure: 25 percent above normal operating pressure at the highest elevation along the test section or 50 percent above normal operating pressure at the lowest elevation along the test section, whichever is greater.
  3. Duration: 2 hours.
  4. Repair visible leaks regardless of the amount of leakage.

- C. Provide water into pipeline for testing and flushing, including necessary:
  - 1. Pumps, gages (increment at 10 psi or less), and meters.
  - 2. Plugs and caps.
  - 3. Temporary blowoff piping to discharge water.
  - 4. Reaction blocking to prevent pipe movement during testing.
- D. Water source for the pump suction shall be potable water from the Owner's distribution system; vessel used shall be approved by the Engineer.
- E. Prevent contamination of the Owner's water distribution system.
- F. After pipelines or isolated sections of pipelines have been filled with water, increase the pressure to test pressure by means of a pump.
- G. Test pressure shall be 25 percent above normal operating pressure at the highest elevation along the test section or 50 percent above normal operating pressure at the lowest elevation along the test section, whichever is greater.
- H. Duration of hydrostatic leakage test shall be 2 hours.
- I. Open interior valves and other appurtenances, during tests.
- J. After the specified test pressure has been applied, the entire pipeline shall be checked in the presence of the Engineer giving particular attention to parts of the pipeline and the appurtenances that are exposed.
- K. If leaks are apparent, perform corrective work and replace material that is required to remedy the defect and stop the leaks at no extra cost to the Owner.
- L. If no leaks were apparent or after corrective work has been completed, the pipelines shall be subjected to a leakage test at the pressure specified with a meter inserted in the test pump discharge line.
- M. AWWA C600 (Latest Edition) leak test for Ductile Iron.
  - 1. Hydrostatic Testing shall comply with Section 5.2 of AWWA C600.
  - 2. Leakage Criteria to follow allowable criteria found in the "Testing Allowance" section in AWWA C600.

$$L = \frac{S \times D \times (P^{0.5})}{148,000}$$

L = Quantity of makeup water in gallons per hour

S = Length of pipe section being tested, in feet

D = Nominal diameter of the pipe, in inches

P = Average test pressure during the hydrostatic test, in pounds per square inch (gauge)

- N. AWWA C605 (Latest Edition) leak test for PVC.
1. Hydrostatic Testing shall comply with Section 9.3 of AWWA C605.
  2. Leakage Criteria to follow allowable criteria found in the "Test Allowance" section of AWWA C605.

$$Q = \frac{L \times D \times (P^{0.5})}{148,000}$$

Q = Quantity of makeup water in gallons per hour

L = Length of pipe section being tested, in feet

D = Nominal diameter of the pipe, in inches

P = Average test pressure during the hydrostatic test, in pounds per square inch (gauge)

This formula is based on a testing allowance of 10.5 GPD/mile/inch of nominal pipe diameter at a test pressure of 150 psi.

- O. If test of pipe laid discloses leakage greater than the allowable leakage as calculated from the above formula, locate the leak or leaks and perform corrective work and replace material that is required in order to remedy the defect and stop the leak.
- P. Corrective work shall be approved by Engineer.
- Q. Hydrostatic testing procedures for HDPE pipe shall be as specified in Section 33 05 33.14 of these Specifications.

**END OF SECTION**



## **SECTION 33 05 19**

### **DUCTILE IRON UTILITY WATER PIPE & FITTINGS**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. Provide cement-lined ductile iron pipe and gray cast iron or ductile iron fittings as specified.
- B. Service shall include potable water lines.

##### **1.2 RELATED SECTIONS**

- A. Section 31 23 33 – Trenching & Backfilling.
- B. Section 33 05 05.31 – Hydrostatic Testing.

##### **1.3 REFERENCES**

- A. American National Standards Institute.
  - 1. ANSI/AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
  - 2. ANSI/AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings, 3 in Through 48 in, for Water and other Liquids.
  - 3. ANSI/AWWA C111/A21.11 - Rubber Gasket Joints for Ductile-Iron and Gray-Iron Fittings Pressure Pipe and Fittings.
  - 4. ANSI/AWWA C115/A21.15 - Flanged Ductile-Iron Pipe with Threaded Flanges.
  - 5. ANSI/AWWA C150/A21.50 - Thickness Design of Ductile-Iron Pipe.
  - 6. NSF/ANSI 61 - Drinking Water System Components - Health Effects.
- B. ASTM International.
  - 1. ASTM A307 - Specifications for Carbon Steel Externally Threaded Standard Fasteners.
  - 2. ASTM A563 - Specification for Carbon and Alloy Steel Nuts.
  - 3. ASTM D1248 - Specification for Polyethylene Plastic Molding and Extrusion Materials.
- C. American Water Works Association.
  - 1. AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in., for Water and Other Liquids.
  - 2. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
  - 3. AWWA C115 - Standard for Flanged Ductile-Iron Pipe with Threaded Flanges.
  - 4. AWWA C207 - Standard for Steel Pipe Flanges for Waterworks Service, Sizes 4 in. Through 144 in.

## **PART 2. PRODUCTS**

### **2.1 PIPE**

- A. Pressure Class 250 psi minimum, as shown on Drawings and in compliance with applicable requirements of ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51. Flanged pipe shall meet or exceed ANSI/AWWA C115/A21.15.
- B. Pipe shall be jointed with push-on, mechanical, flanged, restrained, or flexible joints meeting applicable requirements of ANSI/AWWA C 111/A21.11 and ANSI/AWWA C115/A21.15.
- C. Ductile iron pipe shall receive standard thickness cement lining and bituminous seal coat in conformance with ANSI/AWWA C104/A21.4.
- D. Buried ductile iron pipe shall receive an exterior coating of 1 mil thick bituminous material in accordance with ANSI/AWWA C104/A21.4.
- E. Exposed ductile iron pipe shall be shop primed with Tnemec Series N140 Pota-Pox Plus per manufacturer recommendations.
- F. Flexible Joint (Ball and Socket) Pipe: Class 58.

### **2.2 FITTINGS**

- A. Ductile iron, Pressure Class 250 psi minimum as shown on Drawings, cement-lined and seal-coated. Where taps are shown on fittings, tapping bosses shall be provided.
  - 1. Flanged Joint: ANSI/AWWA C115/A21.15. and ANSI/AWWA C110/A21.10, faced and drilled. 125-pound ANSI standard.
  - 2. Mechanical Joint: ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53.
  - 3. Flexible Joint: American Flex-Lox pipe or equal.
- B. Cement Linings:
  - 1. In accordance with ANSI/AWWA C104/A21.4
  - 2. Certified to be in compliance with NSF/ANSI 61.
- C. Buried fittings shall receive an exterior coating of 1 mil thick bituminous material in accordance with ANSI/AWWA C104/A21.4.
- D. Exposed fittings shall be shop primed with Tnemec Series N140 Pota-Pox Plus per manufacturer recommendations.
- E. Fittings shall have distinctly cast on them the manufacturer's identification, pressure rating, nominal diameter of openings, and the number of degrees or fraction of the circle on bends.

## **2.3 FLANGES**

- A. ANSI/AWWA C115/A21.15, threaded, 250 psi working pressure, 125-pound drilling in accordance with ANSI B16.1.

## **2.4 BOLTS**

- A. For Class 125 FF flanges use carbon steel, ASTM A307, Grade A hex head bolts and ASTM A563, Grade A hex head nuts.
- B. For Class 250 RF flanges use carbon steel, ASTM A307, Grade B hex head bolts and ASTM A563, Grade A heavy hex head nuts.
- C. For bolts for fittings and valves in buried applications, use stainless steel bolts and fasteners.

## **2.5 GASKETS**

- A. Gaskets for mechanical joints shall be rubber, conforming to ANSI/AWWA C111/A21.11.
- B. Gaskets for flanged joints shall be 1/8-inch thick, cloth-inserted rubber conforming to applicable parts of ANSI/AWWA C115/A21.15 and AWWA C207.
- C. Gasket Material: Free from corrosive alkali or acid ingredients and suitable for use in potable water lines.
- D. Gaskets shall be full-face type for 125-pound FF flanges.
- E. Gaskets to be NSF 61 certified.

## **2.6 LUBRICANT**

- A. Lubricant for push-on or mechanical joint end piping shall be manufacturer's standard.

## **2.7 MECHANICAL JOINT RETAINER GLANDS**

- A. Acceptable Manufacturers:
  - 1. EBAA Iron, Inc.
- B. Restraint devices for mechanical joint fittings and appurtenances shall consist of multiple gripping wedges incorporated into a follower gland.
- C. Retainer glands shall have the MEGA-BOND® coating system, or equal, for corrosion resistance.

## **2.8 TRACER WIRE**

- A. Tracer wire shall be 12-gauge insulated copper-clad steel tracer wire.
- B. Insulated jacket color shall be blue for potable water lines.
- C. Terra Tape or equal.
- D. Color: Blue for water and Green for sewer.
- E. Tracer wire shall be wet rated.

## **PART 3. EXECUTION**

### **3.1 GENERAL**

- A. Installation of Ductile Iron Pipe shall conform to the latest edition of AWWA C600.

### **3.2 HANDLING PIPE**

- A. Do not damage the cement lining when handling the pipe.

### **3.3 CUTTING PIPE**

- A. Cut pipe with milling type cutter, rolling pipe cutter, or abrasive saw cutter. Do not flame cut.

### **3.4 DRESSING CUT ENDS**

- A. Dress cut ends of pipe in accordance with the type of joint to be made.
- B. Dress cut ends of mechanical joint pipe to remove sharp edges or projections which may damage the rubber gasket.
- C. Dress cut ends of pipe for flexible couplings and flanged coupling adapters as recommended by the coupling or adapter manufacturer.

### **3.5 MECHANICAL JOINT**

- A. Join pipe with mechanical joints in accordance with the manufacturer's recommendations. Provide special tools and devices, special jacks, chokers, and similar items required for proper installation. Pipe manufacturer shall provide lubricant for the pipe gaskets, no substitute lubricants shall be permitted.

### **3.6 MECHANICAL JOINT CONNECTIONS**

- A. All mechanical joint water line fittings and appurtenances shall be restrained with mechanical joint retainer glands and thrust blocking.

- B. Where multiple mechanical joint fittings and/or appurtenances are to be connected, the connection shall be made with a foster adapter or anchor coupling.

### **3.7 FABRICATION OF FLANGED PIPE AND FITTINGS**

- A. Flanged pipe and fittings shall be fabricated in the shop, not in the field, and delivered to the job site with flanges in place and properly faced.
- B. Threaded flanges shall be individually fitted and machine tightened on the threaded pipe by the manufacturer.
- C. Flanges shall be faced after fabrication in accordance with ANSI/AWWA C115/A21.15.

### **3.8 JOINTING FLANGED PIPE**

- A. Prior to connecting flanged pipe, the faces of the flanges shall be thoroughly cleaned of oil, grease, and foreign material.
- B. The rubber gaskets shall be checked for proper fit and thoroughly cleaned.
- C. Care shall be taken to assure proper seating of the flanged gasket.
- D. Bolts shall be tightened so that the pressure on the gasket is uniform.
- E. Torque-limiting wrenches shall be used to ensure uniform bearing insofar.
- F. If joints leak when the hydrostatic test is applied, the gaskets shall be removed and reset and bolts retightened.

### **3.9 TRACER WIRE**

- A. Trace wire shall be installed for the entire length of pipe.
- B. Run wire continuous from valve box to valve box, meter box, air release vault, cleanout, or other access points.
- C. Bring wire up inside boxes and vaults in an accessible method.
- D. Testing of the work shall include following tracer wire.
- E. Wire breaks shall be repaired at no additional expense to the Owner.

### **3.10 THRUST BLOCKING**

- A. Install 2,500 psi concrete thrust blocks at bends, wyes, or other thrust points on pressure piping.
- B. Block to bear against undisturbed soil and shall be of size and with bearing area as shown on Standard Details.

### **3.11 TESTING**

- A. Water lines shall be hydrostatically or pneumatically tested. Test procedures shall be as specified in Section 33 05 05.31.

### **3.11 POLYETHYLENE MATERIAL FOR DUCTILE IRON PIPE PROTECTION**

- A. Polyethylene material, either in tubing form or flat sheets or rolls, as specified herein, shall be placed around all Ductile Iron pipe and fitting joints and all valves and fire hydrants with mechanical joint ends, and all saddles, sleeves, couplings, tapping saddles and any other appurtenances with exposed bolts, as directed by the Owner. Ductile iron pipe and appurtenances shall be completely encased in polyethylene tubing material. Tube size or sheet width for each pipe diameter shall be as listed in the latest edition of the DIPRA Handbook.

Specific requirements for the polyethylene material are:

The material shall conform to ANSI A21.5 (AWWA C-105). The tubing material shall be made from virgin polyethylene extended in the form of a tube and shall have the following characteristics:

|                                      |                            |
|--------------------------------------|----------------------------|
| Minimum thickness                    | 8 mils                     |
| ASTM D1248, Type I, Class C (black)  | Grade E-1                  |
| Maximum flow index                   | 0.4                        |
| Minimum tensile strength             | 1,200 p.s.i.               |
| Minimum elongation                   | 300%                       |
| Dielectric strength (raw material)   | Volume resistivity minimum |
| Dielectric strength (sheet material) | 800 V/mil                  |

Tape for field application shall be Polyken #900 or Scotchwrap #50 or equal, at least two (2) inches wide.

**END OF SECTION**

## **SECTION 33 05 24.13**

### **STEEL ENCASEMENT PIPE**

#### **PART 1. GENERAL**

##### **1.1 WORK INCLUDED**

- A. Provide encasement pipe jacked through bored tunnel for crossing of water lines under right-of-ways where shown on the Drawings.
- B. Provide encasement pipe by open cut construction where shown on the Drawings.
- C. Pulling or jacking carrier pipe through encasement pipe.

##### **1.2 RELATED SECTIONS**

- A. Section 31 23 16.15 – Right-of-Way Undercrossings
- B. Section 31 23 33 – Trenching & Backfilling
- C. Section 33 05 19 – Ductile Iron Utility Water Pipe & Fittings

##### **1.3 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A139 Specification for Electric-Fusion (Arc) - Welded Steel Pipe (sizes 4" and over).
  - 2. ASTM A211 Specifications for Spiral-welded Steel or Iron Pipe.
- B. American Welding Society (AWS):
  - 1. AWS D1.1 Structural Welding Code.
- C. Arkansas Department of Health (ADH), 4815 W. Markham Street, Little Rock, Arkansas 72205

#### **PART 2. PRODUCTS**

##### **2.1 MATERIALS**

- A. Encasement pipe: Smooth wall steel pipe conforming to ASTM A53 / ASTM A135 / ASTM A139, Grade B, physical tests only (no hydrostatic test required). The pipe shall have beveled ends prepared for welded joints. The pipe steel shall have a minimum yield strength of 35,000 psi.
- B. Welding materials: Type required for materials being welded and conforming to applicable AWS Specifications.
- C. Grout: Cementitious grout shall consist of a preblend of lightweight aggregate, cement, fly ash and admix to prevent segregation and promote expansion upon

setting. Loose bulk density for the dry mix materials shall be 30 to 35 pounds per cubic foot. Grout shall equal or exceed Strong-Seal Grout 250 - Product Code 2133 and shall be packaged in 2 cubic foot bags.

- D. Polyethylene Encasement: Polyethylene encasement shall be in conformance to ANSI/AWWA C105/A21.5, latest revision.

## **2.2 MINIMUM THICKNESS**

- A. The encasement pipe shall be capable of supporting all traffic and earth loads. The Contractor shall submit design calculations supporting the selection of the encasement pipe thickness used.
- B. Minimum wall thickness for encasement shall be as follows:

| <u>Diameter of Encasement Pipe</u> | <u>Minimum Wall Thickness</u> |
|------------------------------------|-------------------------------|
| 16" or less                        | 0.250" (1/4")                 |
| 20"                                | 0.3750" (3/8")                |
| 24"                                | 0.3750" (3/8")                |

Sizes not listed above shall be determined on an as-needed basis by the Owner.

- D. When boring under railroad right-of-way, minimum thickness shall be determined by railroad standards or these Specifications. The more stringent requirements shall apply.

## **PART 3. EXECUTION**

### **3.1 EXCAVATION**

- A. Excavation and preparation for the bore shall be done in accordance with Section 31 23 16.15 of these Specifications.

### **3.2 INSTALLATION, STEEL ENCASEMENT PIPE**

- A. General: Install encasement pipe at grade and alignment shown on Drawings. Allow for height of casement spacers when establishing grade for gravity line encasement pipe. Refer to Standard Details.
- B. Bores:
  - 1. Installation of steel encasement pipe by boring and jacking shall comply with the requirements of Section 31 23 16.15. Bore tunnel and simultaneously jack encasement pipe forward one section at a time. Connect sections by full penetration butt welding performed in accordance with AWS D1.1.
  - 2. Remove excavated soil from boring operation as it enters pit and dispose of it in an approved location.
  - 3. End seal shall be installed after the carrier pipe has been installed.



- C. Open Cut:
  - 1. Excavate trench as required.
  - 2. Steel encasement pipe shall be installed, bedded, and backfilled the same as ductile iron pipe by the requirements listed in Section 33 05 19.
  - 3. Steel encasement pipe shall be poly wrapped.
  - 4. End seal shall be installed after the carrier pipe has been installed.

### **3.3 INSTALLATION, CARRIER PIPE**

- A. Installation of carrier pipe through steel encasement pipe shall conform to the requirements of Section 31 23 16.15.

### **3.4 BACKFILL**

- A. Prior to backfill, seal ends of encasement pipe with and end seal as shown in the Standard Details.
- B. Use material excavated from pit if it is considered an acceptable backfill material per Section 31 23 33.
- C. Backfill against ends of encasement pipe.
- D. Backfill pit and carrier pipe in same manner as specified in Section 31 23 33.

### **3.5 CLEANUP**

- A. Clean up ground surface around work area in same manner as specified for line work in Section 31 23 33.

**END OF SECTION**

## **SECTION 33 05 31.15**

### **POLYVINYL CHLORIDE PRESSURE PIPE AND FITTINGS**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. Provide polyvinyl chloride (PVC) pipe and fittings.

##### **1.2 RELATED SECTIONS**

- A. Section 31 23 33 - Trenching and Backfilling.
- B. Section 33 05 05.31 - Hydrostatic Testing.

##### **1.3 REFERENCES**

- A. Arkansas Department of Health.
  - 1. ADH: *"Rules and Regulations Pertaining to Public Water Systems, latest Edition."*
- B. ASTM International.
  - 1. ASTM D1784 - Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
  - 2. ASTM D2241 - Specifications for Poly (Vinyl Chloride) (PVC) Pressure - Rated Pipe (SDR Series).
  - 3. ASTM D3139 - Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
  - 4. ASTM F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- C. American Water Works Association (latest edition).
  - 1. AWWA C605 - Underground installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
  - 2. AWWA: *"The Ten States Standards for Water, 2007 Edition or latest version."*

#### **PART 2. PRODUCTS**

##### **2.1 PIPE**

- A. PVC pressure pipe, SDR-21, Class 200 psi that meets or exceeds the requirements of ASTM D2241.
- B. PVC pressure pipe, DR 18, Class 235 psi that meets or exceeds the requirements of AWWA C900.
- C. PVC pressure pipe shall comply with ASTM D1784 and be manufactured from virgin PVC compound with a cell classification of 12454-B with gasket joints and integral bell for buried water piping.

- D. Pipe shall be permanently marked at 5-foot intervals with the following information:
  - 1. Nominal size.
  - 2. Material code designation.
  - 3. Manufacturer's name or trademark and production record code.
  - 4. ASTM or AWWA certification.
  - 5. SDR designation.
- E. Warranty:
  - 1. Manufacturer of the pipe shall warrant product for a period of not less than one (1) year.
  - 2. Forward copies of warranty to the Owner.
  - 3. Replace defective materials at no extra cost to the Owner.

## **2.2 JOINTS**

- A. Buried Pipe: Gasketed slip joint.
- B. Comply with ASTM D3139.

## **2.3 FITTINGS**

- A. Fittings 3 Inches and Larger: Ductile iron per Section 33 05 19
- B. Fittings shall have distinctly cast on them the manufacturer's identification, pressure rating, nominal diameter of openings, and the number of degrees or fraction of the circle on bends.
- C. Fittings Smaller Than 3 Inches: PVC.

## **2.4 GASKETS**

- A. As recommended by pipe manufacturer to conform to pipe.
- B. Comply with ASTM F477.

## **2.5 MECHANICAL JOINT RETAINER GLANDS**

- A. Acceptable Manufacturers:
  - 1. EBAA Iron, Inc.
- B. Restraint devices for mechanical joint fittings and appurtenances shall consist of multiple gripping wedges incorporated into a follower gland.
- C. Retainer glands shall have the MEGA-BOND® coating system, or equal, for corrosion resistance.

## **2.6 TRACER WIRE**

- A. Tracer wire shall be 12-gauge insulated copper-clad steel tracer wire.
- B. Insulated jacket color shall be blue for potable water lines.

- C. Terra Tape or equal.
- D. Color: Blue for Water and Green for Sewer.
- E. Tracer wire shall be wet rated.

## **PART 3. EXECUTION**

### **3.1 GENERAL**

- A. Rigid PVC pipe shall be cut, made up, and installed in accordance with the pipe manufacturer's recommendations.
- B. Offset shall be as recommended by the manufacturer for the maximum temperature variation between time of installation and final use.

### **3.2 HANDLING PIPELINE MATERIALS**

- A. The Contractor shall handle the material with the utmost care and in a manner to prevent damage to the materials, material coating and lining during loading, hauling, unloading, and installation operations. Material damaged shall be replaced or repaired at the Contractor's expense.
- B. Hooks shall not be in contact with the pipe interior.
- C. The interior of the pipeline materials shall be kept free from dirt and foreign matter at all times. Any pipe or appurtenances contaminated by sanitary sewer and/or hazardous liquid or debris shall be removed from the project area and not used for potable water facility construction; decontamination is not an alternative for the use of pipe or appurtenance for potable water facility construction.
- D. Pipe line materials, especially valves, hydrants, and fittings shall be drained and stored in a manner to protect them from damage by freezing.

### **3.3 MECHANICAL JOINT CONNECTIONS**

- A. All mechanical joint water line fittings and appurtenances shall be restrained with mechanical joint retainer glands and thrust blocking.

### **3.4 TRACER WIRE**

- A. Trace wire shall be installed for the entire length of pipe.
- B. Run wire continuous from valve box to valve box, meter box, air release vault, cleanout, or other access points.
- C. Bring wire up inside boxes and vaults in an accessible method.

- D. Testing of the work shall include following tracer wire.
- E. Wire breaks shall be repaired at no additional expense to the Owner.

### **3.5 THRUST BLOCKING**

- A. Install 2,500 psi concrete thrust blocks at bends, wyes, or other thrust points on pressure piping.
- B. Block to bear against undisturbed soil and shall be of size and with bearing area as shown on Standard Details.

### **3.6 PIPE INSTALLATION**

- A. Installation of Polyvinyl Chloride Pipe shall conform to the latest edition of AWWA C605.
- B. Inspect each joint of pipe carefully before it is placed in the trench. Plainly mark and separate from the remaining pipe any joint that is found to be cracked, warped, or otherwise damaged. Remove these damaged joints from the project site as soon as possible. All water pipe shall be installed manually, without the use of machines to push pipe into bell.
- C. Cut pipe in a neat and workmanlike manner without damage to pipe or pipe lining when trimming joint length. All pipe shall be cut at 90-degrees to pipe centerline.
- D. All foreign matter or dirt shall be removed from the inside of the pipe and appurtenances before lowering into the trench, and the pipe interior shall be kept clean during and after laying. At all times when pipe laying is not actively progressing, the open ends of the pipe shall be closed and made watertight by installing a plug or cap of sufficient design to prevent trench water, mud, foreign matter, and dirt from entering the pipeline. Plastic sheeting, wood sheeting, tape, steel plate, etc. shall not be used to attempt plugging or capping of the pipe. Plugs and caps shall be true fittings of ductile iron or PVC construction, with gaskets, and they shall be securely fastened to or inserted into the pipe.
- E. Pipe shall not be deflected more than manufacturer's recommendation at any time during installation process.

### **3.7 TESTING**

- A. Pressure lines shall be hydrostatically tested at the pressures listed in Section 33 05 05.31.
- B. Use pipe-locating equipment to test continuity of tracer wire.
- C. Owner or Engineer shall observe and document tracer wire test.

### **END OF SECTION**

## **SECTION 33 05 33.14**

### **HIGH DENSITY POLYETHYLENE (HDPE) PIPE, FITTINGS AND JOINING/FUSION**

#### **PART 1. GENERAL**

##### **1.1 SCOPE OF WORK**

- A. This specification covers the material (pipe and fittings), joining methods and general installation practice for high density polyethylene pipe (HDPE) for piping systems for water utility use as indicated on the Drawings.

##### **1.2 SUBMITTALS**

- A. Submit product data for all pipe, fittings, and appurtenances to the Engineer for review.
- B. Furnish in duplicate to the Engineer confirmation that product shipped meets or exceeds the standards set forth in this specification. This shall be in the form of a written document from the manufacturer attesting to the manufacturing process meeting the standards.
- C. Provide a statement in writing from the HDPE pipe manufacturer that it is listed with the Plastic Pipe Institute as a qualified extruder for the polyethylene resin being used to manufacture the pipe for this project.
- D. Provide a statement that personnel responsible for fusing the pipe have been trained and qualified.
- E. Contractor shall also submit the following to the Engineer for approval:
  - 1. Certified dimensional as-built drawings/profile of all installed pipe, specials and fittings.
  - 2. Details of fittings and specials such as elbows, wyes, tees, outlets, connections, test bulkheads, bosses and nozzles or other specials where shown on the Construction Drawings, which indicate amount and position of reinforcement. All fittings and specials shall be properly reinforced to withstand the internal pressure both circumferential and longitudinal, and the external loading conditions as indicated in the Contract Documents. Shop Drawings shall clearly detail special castings indicating all pertinent dimensions.
  - 3. The Supplier of the material shall submit, through the Contractor, a Certificate of Compliance that the pipe, fittings and other products or materials furnished for this project have been inspected at the plant and comply with all applicable provisions of these Specifications. The Contractor shall submit these certificates to the Engineer prior to installation of the pipe materials.

### 1.3 REFERENCES

- A. Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document in effect at the bid date of the project.
- B. American Water Works Association (latest edition).
  - 1. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm) for Water Service.
  - 2. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission.
  - 3. AWWA C651 - Standard for Disinfecting Water Mains.
  - 4. AWWA M55 - Manual of Water Supply Practices, PE Pipe—Design and Installation.
- C. Plastics Pipe Institute.
  - 1. PPI Handbook of Polyethylene Pipe – 2009 (2nd Edition)
  - 2. PPI Municipal Advisory Board (MAB) - Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe.
  - 3. PPI Material Handling Guide for HDPE Pipe and Fittings.
  - 4. PPI TR-33 - Generic Butt Fusion Joining Procedure for Polyethylene Gas Pipe.
  - 5. PPI TR-34 - Disinfection of Newly Constructed Polyethylene Water Mains.
  - 6. PPI TR-38 - Bolt Torque for Polyethylene Flanged Joints.
  - 7. PPI TR-41 - Generic Saddle Fusion Joining Procedure for Polyethylene Gas Piping.
  - 8. PPI TN-42 - Recommended Minimum Training Guidelines for PE Pipe Butt Fusion Joining Operators for Municipal and Industrial Projects.
  - 9. PPI TR-46 - Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of High Density Polyethylene Pipe.
- D. ASTM International.
  - 1. ASTM F 585 - Standard Guide for Insertion of Flexible Polyethylene Pipe Into Existing Sewers.
  - 2. ASTM F 714 - Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
  - 3. ASTM F 905 - Standard Practice for Qualification of Polyethylene Saddle-Fused Joints.
  - 4. ASTM F 1055 - Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Fittings.
  - 5. ASTM F 1290 - Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings.
  - 6. ASTM F1417 - Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.
  - 7. ASTM F 1962 - Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacles, Including River Crossings.
  - 8. ASTM F 2164 - Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure.

9. ASTM F2206 - Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock, or Block Stock.
  10. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
  11. ASTM F 2620 - Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.
  12. ASTM D 2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
  13. ASTM D 2737 - Standard Specification for Polyethylene (PE) Plastic Tubing.
  14. ASTM D 2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
  15. ASTM F 2880 - Standard Specification for Lap-Joint Type Flange Adapters for Polyethylene Pressure Pipe in Nominal Pipe Sizes 3/4 in. to 65 in.
  16. ASTM F 3124 - Standard Practice for Data Recording the Procedure Used to Produce Heat Butt Fusion Joints.
  17. ASTM D 3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
  18. ASTM D 3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
  19. ASTM D 3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- E. Arkansas Department of Health (ADH), 4815 W. Markham, Little Rock, Arkansas 72205.

## **PART 2. PRODUCTS**

### **2.1 HIGH DENSITY POLYETHYLENE MATERIALS**

- A. Resin and Material Requirements:
1. All material shall be manufactured from a PE 4710 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D 3350 with a minimum cell classification of 445474. HDPE pipe and fittings shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. HDPE products shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.
- B. HDPE Pipe:
1. Pipe shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification as noted in 2.1.A. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black of not less than 2 percent. The manufacture of the HDPE resin shall certify the cell classification indicated.
  2. Pipe sizes 3" and larger shall have a manufacturing standard of ASTM F 714, while pipe smaller than 3" shall be manufactured to the dimensional requirements listed in ASTM D 3035. Dimension Ratio (DR) and Outside Diameter (IPS/DIPS) shall be as specified on plans.



3. Pipe shall meet AWWA C901 (1/2" to 3") or AWWA C906 (4" to 63"), and shall be listed as meeting NSF-61.
4. Pipe shall be manufactured by an ISO 9001 certified manufacturer. The pipe manufacturer shall have an ongoing Quality Control program for incoming and outgoing materials, and shall assure that the pipe will meet the material requirements of this specification. HDPE resins for manufacturing of pipe shall be checked for density, melt flow rate, and contamination. The facility shall have the necessary testing equipment to verify that the pipe meets the AWWA and NSF standards. Pipe shall be checked for outside diameter, wall thickness, length, and surface finish on the inside and outside. The Manufacturer's production facilities shall be open for inspection by the Owner or Engineer if they so desire.
5. All pipe shall be color coded for the intended service. The color coding shall be permanently co-extruded stripes on the pipe outside surface as part of the pipe's manufacturing process. Painting HDPE pipe to accomplish color coding is not permitted. Color coding shall be as follows:
  - a. Water – blue

C. HDPE Fittings:

1. Butt Fusion Fittings- Fittings shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification as noted in 2.1.A. Fittings shall have a minimum pressure rating equal to or greater than the pipe to which they are joined unless otherwise specified on the plans or accepted by owner/engineer. All fittings shall meet the requirements of AWWA C901 or C906.
  - a. Molded fittings shall comply with the requirements of ASTM D 3261.
  - b. All fabricated elbows, tees, reducing tees and end caps shall be produced and meet the requirements of ASTM F 2206, as manufactured by a manufacturer holding an ISO 9001 quality system certificate. Each fitting will be marked per ASTM F 2206 including the nominal size and fitting EDR, which will meet or exceed the pipe DR identified for the project. Test results to validate ASTM F 2206 section 7.3 and 9 shall be provided to owner or owner's representative upon request.
  - c. Socket fittings shall meet ASTM D 2683.
2. Electrofusion Fittings - Fittings shall be made of HDPE material with a minimum material designation code of PE 4710 and with a minimum Cell Classification as noted in 2.1.A. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a minimum pressure rating equal to or greater than the pipe to which they are joined unless otherwise specified on the plans. For potable water systems, all electrofusion fittings shall have AWWA approval
3. Bolted Connections – Flanged and Mechanical Joint Adapters can be made to ASTM D 3261 or if machined, must meet the requirements of ASTM F 2206. Flanges and MJ Adapters shall be fused onto the pipe and have a minimum pressure rating equal to or greater than the pipe unless otherwise specified on the plans.
  - a. Flange Adapters shall meet the dimensional and material requirements of ASTM F 2880.
  - b. Metallic back-up rings (Van-Stone style lap joint flanges), shall have a radius on the inside diameter of the bore so as to be compatible with

HDPE Flanges. Back up rings shall have bolt pattern that will mate with AWWA C207 Class B, D, or E, ASME/ANSI B 16.5 Class 150, ASME/ANSI B 16.1 Class 125, or ASME/ANSI B16.47 Series A.

- c. Flange assemblies shall be assembled and torqued according to PPI TN-38, "Bolt Torque for Polyethylene Flanged Joints."
  - d. Where shown on the drawings, 4" and larger transitions to mechanical joint fittings and valves shall be accomplished using a MJ Adapter with kit. The D.I./HDPE mechanical joint adaptor shall consist of:
    - i. A molded or fabricated HDPE mechanical joint transition fitting.
    - ii. A rubber gasket.
    - iii. A mechanical joint backup drive ring.
    - iv. Corten mechanical joint tee bolts.
4. Mechanical Fittings: The use of mechanical coupling and saddles shall be approved by the owner or engineer prior to installation. Mechanical Fittings shall be designed for use and compatible with HDPE pipe. Mechanical fittings shall have a pressure rating equal to or greater than the pipe.
- a. Couplings without self-restraining capabilities (integrated serrated teeth or grippers) shall include a plan for external restraint or isolation from pipeline generated forces.
  - b. Mechanical Saddles shall have wide straps for distribution of clamping loads. No U-bolts shall be allowed.
  - c. When required by mechanical coupling manufacturer, pipe stiffeners shall be employed to support the interior wall of the HDPE. The stiffeners shall support the pipe's end and control the "necking down" reaction to the pressure applied during normal installation. The pipe stiffeners shall be formed of 304 or 316 stainless steel, with a wedged style design to fit the HDPE manufacturers published average inside diameter of the specific size and DR of the HDPE
- D. Fusion Unit Requirements:
- 1. All Fusion Equipment, whether new or used, rented or owned, shall comply with the requirements of ISO 12176-1 "Equipment for Fusion Jointing Polyethylene Systems".
  - 2. The butt fusion equipment must be serviced prior to use for this project. The machine must be environmentally friendly and in satisfactory working order. The hydraulic system must be leak free. The pressure gage and thermometer must be checked for accuracy.

## **2.2 PIPELINE LOCATING MATERIALS**

- A. Tracer Wire - All HDPE pipe 4" and greater shall be installed with an extra high-strength, copper clad steel tracer wire. The jacket shall be colored based on pipe service, with blue for potable water. Tracer wire gauge shall be 12 AWG, 10 AWG, or 8 AWG depending upon application and installation procedure. The larger tracer wire (lower gauge) shall be used for directional boring installations. This wire shall to be continuous and brought up in the valve boxes at the ends of each line segment with splices made only by methods per the equipment manufacturer's recommendation. All miscellaneous splicing components shall be furnished and installed by the Contractor.

- B. Tracer tape shall be layed on top of pipe bedding. Terra tape or equal. Blue for water and green for sewer.
- C. Tracer wire shall be wet rated.

## **PART 3. EXECUTION**

### **3.1 GENERAL**

- A. All HDPE pipe and fittings shall be cut, joined, and installed in accordance with the manufacturer's recommendations. Joining, laying, and pulling of polyethylene pipe shall be accomplished by personnel experienced in working with polyethylene pipe systems.

### **3.2 TRANSPORTATION, UNLOADING, AND STORAGE**

- A. The manufacturer shall package product in a manner designed to deliver the pipe and fittings to the project neatly, intact and without physical damage. During transportation each pipe shall rest on suitable pads, strips skids, or blocks securely wedged or tied in place. The transportation carriers shall use appropriate methods and intermittent checks to ensure the pipe is properly supported, stacked and restrained during transportation such that the pipe is not nicked, gouged, or physically damaged. The transportation carrier shall provide tarpaulins to cover any potable water pipe subject to exposure to diesel exhaust or smoke.
- B. During loading, transportation, and unloading, every precaution should be taken to prevent damage to the pipe. Cuts or gouges that reduce the wall thickness by more than 10% is not acceptable and must be cut out and discarded.
- C. Handle the pipe in accordance with the PPI Handbook of Polyethylene Pipe (2nd Edition), Chapter 2. All pipe and accessories shall be loaded and unloaded by lifting with hoists or by skidding in order to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be rolled or skidded against pipe on the ground. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or interior of the pipe. All pipe and fittings shall be subjected to visual inspection at time of delivery and before they are lowered into the trench to be laid. Joints or fittings that do not conform to these specifications will be rejected and must be removed immediately by the Contractor.
- D. Materials, if stored, shall be kept safe from damage. The contractor shall be responsible for all security, damage and loss of pipe. The interior of the pipe as well as all sealing surfaces of mating components (i.e. flange faces) shall be kept free from dirt or foreign matter at all times.
- E. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tiers shall be kept off the ground on timbers, rails, or concrete. Pipe shall not be stored close to heat sources.

- F. The open ends of all sections of joined and/or installed pipe (not in service) shall be plugged to prevent animals or foreign material from entering the pipe line or pipe section. The practice of stuffing cloth or paper in the open ends of the pipe will not be permitted. Waterproof nightcaps of approved design may be used but they shall be so constructed that they will prevent the entrance of any type of natural precipitation into the pipe and will be secured to the pipe in such a manner that the wind cannot blow them loose.
- G. Where possible, the pipe shall be raised and supported at a suitable distance from the open end such that the open end will be below the level of the pipe at the point of support.

### **3.3 PIPE INSPECTION**

- A. All pipe and fittings shall be subjected to visual inspection at time of delivery and before they are installed or lowered into the trench to be laid. Defective, damaged, or unsound pipe will be rejected. Cuts, punctures, or gouges that penetrate or reduce the wall thickness by 10% or more are not acceptable and must be removed and discarded. Joints or fittings that do not conform to these specifications will be rejected and must be removed immediately by the Contractor.

### **3.4 HANDLING PIPE**

- A. The handling of the pipeline shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Sections of the pipes with cuts and gouges exceeding 10 percent of the pipe wall thickness or kinked sections shall be removed and the ends rejoined.
- B. Refer to the PPI Material Handling Guide for HDPE Pipe and Fittings for recommendations, guidelines and instructions regarding the handling, lifting, loading, storing and installing polyethylene pipe and fittings.

### **3.5 PIPE JOINING AND INSTALLATION**

- A. Installation of HDPE Pipe shall conform to the latest edition of AWWA M55.
- B. Direct Burial:
  - 1. Buried HDPE pipe and fittings shall be installed in accordance with ASTM D 2774 for pressure systems and AWWA Manual of Practice M55. The Design Window identified in AWWA M55 Chapter 5 shall be considered acceptable design and installation conditions.
  - 2. Pipe embedment – Embedment and backfill material should conform to Section 31 23 33.
- C. Installation of HDPE pipe by Directional Boring shall follow the guidelines in ASTM F1962 or PPI TR-46.
- D. Fusion Joining Requirements:
  - 1. All HDPE pipe shall be joined to itself by the heat fusion process which produces homogeneous, sealed, leak tight joints. Tie-ins between sections of HDPE pipe shall be made by butt fusion whenever possible.

2. Butt Fusion: The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. All fusion joints shall be made in compliance with the pipe or fitting manufacturer's recommendations. Fusion joints shall be made by qualified fusion technicians per ASTM F3190. A record or certificate of training for the fusion operator must be provided that documents training to the fundamentals of ASTM F 2620. Considerations should be given to and provisions made for adverse weather conditions, such as temperatures below freezing, precipitation, or wind, which is accepted by the owner/engineer.
3. Electrofusion: Electrofusion joining shall be done in accordance with the manufacturers recommended procedure. Other sources of electrofusion joining information are ASTM F 1290, PPI TN 34, and PPI Municipal Advisory Board (MAB) Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe. The process of electrofusion requires an electric source, commonly called an electrofusion processor that has wire leads and a method to read electronically (by laser) or otherwise input the barcode of the fitting. The electrofusion processor must be capable of reading and storing the input parameters and the fusion results for later download to a record file. Qualification of the fusion technician shall be demonstrated by evidence electrofusion training within the past year on the equipment to be utilized for this project.

E. Fusion Operators:

1. The employer of the fusion machine operator is responsible for the fusion joint quality of the fusion weld made by that individual. The employer is responsible for documenting all qualification and training records of that individual.
2. All HDPE fusion equipment operators shall be qualified to the procedure used to perform pipe joining. Fusion equipment operators shall have current, formal training on all fusion equipment employed on the project. Training received more than two years prior to operation with no evidence of activity within the past 6 months shall not be considered current.
3. When the fusion machine operator is employed by the HDPE pipe and fusion machine supplier, the supplier shall maintain an ISO 9001 Certified Quality Management System.

F. Butt Fusion Equipment:

1. For 6" and larger pipe sizes, the pipe butt fusion machine shall be a self-contained hydraulic fusion machine capable of butt fusing HDPE pipe. The carriage must be removable from the chassis for in-ditch use. The machine must be compatible with an electronic data recording device. Accessories will include all butt fusion inserts for the specified range of pipe sizes, a pyrometer kit for checking the surface temperature of the heater, extension cord (25' minimum), and hydraulic extension hoses (minimum of four).
2. In areas where there may be insufficient space to layout the entire length of fused pipe to be pulled-back, the Contractor shall utilize a continuous HDPE pipe fusion equipment or other means in order to fuse the length of pipe necessary for the installation. The Contractor shall be responsible for securing and obtaining permission/permits from adjacent property if necessary, for staging and/or fusing of the pipe and HDD equipment at no additional cost to the Owner.

G. Fusion Data Recording:

1. For 6" and larger pipe sizes, fusion data recorder shall be used to record all fusion welds on hydraulically operated fusion machines. The device shall be capable of meeting the requirements of ASTM F 3124, "Standard Practice for Data Recording the Procedure used to Produce Heat Butt Fusion Joints in Plastic Piping Systems or Fittings". The device, or combination of devices, shall record the following variables of each fused joint:
  - a. Heater surface temperature immediately before inserting the heater plate. Alternatively, the heater plate may be measured with a pyrometer and entered into the weld record.
  - b. Gauge pressure during the initial heat cycle
  - c. Gauge pressure and elapsed time during the heat-soak cycle
  - d. Heater removal (dwell) time
  - e. Gauge pressure and elapsed time during the fusing/cool cycle
  - f. Drag pressure
  - g. Pipe diameter and wall thickness
  - h. Type of HDPE material (Specification and Classification) and manufacturer
  - i. Fusion Machine Identification
2. The device shall record the operator, a unique operator ID number, the date and time of each weld.
3. Records showing the device is up to date on all required calibration should be available for presentation when requested.
4. All fusion welds should be traceable to the report (via operator and weld ID) with an indentation weld stamp or by permanent paint marker/pen next to fusion weld.
5. When requested prior to commencement of work, a weld location map may be requested by the owner or owner's representative.

H. Butt Fusion Examination and Testing:

1. Examinations:
  - a. Visual: For pipe sections, examine the full exterior circumference for bead uniformity before cutting. After cutting the pipe section, review the interior bead. All beads should have visually acceptable bead formation as shown in Fig 4 and Appendix X2 of ASTM F 2620. In addition, the following characteristics are expected:
    - i. There shall be no evidence of cracks or incomplete fusing
    - ii. There shall be no evidence of captured objects (e.g., pipe shavings, facer ribbons) between bonded surfaces.
    - iii. Variations in upset bead heights on opposite sides of the cleavage and around the circumference of fused pipe joints are acceptable.
    - iv. The apex of the cleavage between the upset beads of the fused joint shall remain above the base material surface
    - v. Fused joints shall not display visible angular misalignment, and outside diameter mismatch shall be less than 10% of the nominal wall thickness

- vi. Fusion data record review that meet criteria of section 6-2.1 can be used as additional verification of visual indicators.
  - b. Fusion Data Record Review:
 

The fusion data record for each fused joint shall be compared to the approved fusion procedure. The reviewer shall verify the following:

    - i. That all required data was recorded
    - ii. Interfacial pressure was within the acceptable range
    - iii. Heater surface temperature was within the acceptable range
    - iv. Butt fusion pressure applied during the fusing/cool cycle was correctly calculated to include drag pressure, fell within the acceptable range for the applicable size and agrees with the recorded hydraulic fusing pressure.
    - v. Butt fusing pressure was reduced to a value less than or equal to drag pressure at the beginning of the heat soak cycle.
    - vi. Fusing machine was opened at the end of the heat soak cycle, the heater was removed, and the end were brought together at the fusion pressure with the acceptable time range.
    - vii. Cooling time at butt fusing pressure met the minimum time specified.
  - c. If the recorded data in section 3.5.G.1.b is outside the limits of the acceptable range, the joint is unacceptable.
  - d. Records for test fusion joints should be reviewed immediately after the joint is completed. Fusion joints for jobsite fusions should be reviewed daily or before being covered with backfill.
2. Mechanical Tests:
- a. Contractor shall mechanically test the first fusion of each operator and each machine used on the project. Installation shall not continue until a fusion test has passed the test. Additional mechanical tests are not required as long as long as the fusions are reviewed with the frequency specified. Testing of fusion joints with no fusion data record review shall be at a frequency specified by the Owner or Engineer.
  - b. The fusion shall be allowed to cool completely, then fusion test straps shall be cut out.
  - c. All samples shall be labeled with operator information. Testing must be done at 73 degrees F plus or minus 5 degrees. The test temperature and sample size are critical to testing. Testing performed at cold or elevated temperatures may not give similar results to tests performed at ambient temperatures.
  - d. Each pipe sample weld shall be subjected to testing at two locations 180 degrees apart from each other in the joint weld. All specimens shall be tested by one of the following methods:
    - i. Reverse Bend Test are allowed for pipe sizes 4" IPS or smaller. The specimens shall be removed and tested in accordance with ASTM F 2620, Appendix X4.
    - ii. Guided Side Bend Test are allowed for all pipe sizes 4" IPS and larger. The specimens shall be removed and tested in accordance to recommendations and procedures provided by the pipe and/or fusion equipment manufacturer.

- iii. Hydrostatic Burst Test is allowed for pipe sizes 2"-24". The specimen length should measure 6 times pipe diameter with the butt fusion joint in the center of the specimen. The specimen should be tested in a tank filled with water, and testing conditions monitored and recorded with computerized equipment. The specimen will be tested at 4 times pipe rated pressure for 5 minutes with no failure of joint allowed.
- e. Results of any mechanical test should be documented. Information on the weld and operator should be transferred from the sample to the testing record.

### **3.6 PIGGING, FLUSHING, CLEANING, AND DISINFECTING**

- A. All mains shall be pigged, cleaned and flushed to remove all dirt, sand, debris and other foreign matter. The Contractor shall be responsible for developing a pigging and flushing plan to be submitted to the Engineer for approval prior to pigging and flushing.
- B. Disinfection:
  - 1. Cleaning and disinfecting of potable water systems shall be in accordance with Section 33 01 10.58 of these specifications, AWWA Manual of Practice M55, and PPI Handbook of Polyethylene Pipe C (latest edition).
  - 2. The disinfection chemicals should be limited to less than 12% active chlorine. The duration of the disinfection should not exceed 24 hours.
  - 3. Upon completion, the system should be thoroughly flushed with fresh water, and sampled to verify the disinfectant chlorine level has been reduced to potable drinking water concentrations in all service water tubing and branch lateral pipes.

### **3.7 TESTING AND LEAKAGE**

- A. All pumps, valves, temporary connections, meters, gauges and other measuring devices shall be furnished, installed and operated by the Contractor and all such equipment and devices and their installation shall be approved by the Owner or Engineer. The contractor shall restrain pipe, components, and test equipment as required to ensure testing can be accomplished in a safe manner, including protection of personnel, equipment, and public in the event of a failure during testing.
- B. The pressure gauges or data recorders should be calibrated and sufficiently sized to provide mid-range data (pressure tested will not be below 10% or greater than 90% of gauge capacity) that result in easy reading, interpretation. Gauges shall be accurate to within 2% of full scale with increments no greater than X psi.
- C. Pressure Pipelines-Pressure testing shall be conducted in accordance with requirements and recommendations of ASTM F 2164 (Field Leak Testing of Polyethylene Pressure Piping Systems Using Hydrostatic Pressure), AWWA Manual of Practice M55, and PPI Handbook of Polyethylene Pipe (latest edition). Pneumatic (compressed air) leakage testing of HDPE pressure piping is prohibited for safety reasons.



1. The section of pipe to be tested shall be filled with potable or generally clean water (uncontaminated river/lake water) approved by the Owner/Engineer. While the system is being filled with water, air shall be carefully and completely exhausted. If permanent air vents are not located at all high points, the Contractor shall install fittings and valves at such points so the air can be expelled as the pipe system is slowly filled with water.
2. If the Contractor elects to perform hydrostatic testing against valves in an existing distribution system, it does so at his own risk and will bear the cost of any damages to the existing valve, piping system, private or public property, or the new pipeline under test.
3. The test procedure for HDPE pipe consists of two steps: 1) the initial phase or expansion phase and 2) the test phase. During the initial/expansion phase, sufficient make-up water shall be added hourly for 3 hours to return to the test pressure. During the test phase, the expansion phase pressure is reduced by 10 psi to test phase pressure and monitored for at least one hour (3 hours maximum).
4. Under no circumstances shall the total time under test exceed eight (8) hours. If the test is not completed due to leakage, equipment failure or any other reason, depressurize the test section and permit the system to "relax" for eight (8) hours prior to the next testing sequence.
5. The test pressure should be related to the lowest point in elevation along the test section's vertical pipeline profile.
6. All pressure and leakage testing shall be done in the presence of a representative of the Owner and Engineer.
7. The test pressure shall be 1.5 times the operating pressure at the lowest point in the system. In accordance with ASTM F 2164, the pipe shall pass if the final pressure is within 5% of the test phase pressure for the testing period (3 hours maximum). If the test section fails this test, the Contractor shall repair or replace all defective materials and/or workmanship at no additional cost to the Owner.

#### **END OF SECTION**

## **SECTION 33 14 16**

### **WATER UTILITY DISTRIBUTION VALVES**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. Furnish and install valves for a water utility distribution system.

##### **1.2 RELATED SECTIONS**

- A. Section 33 05 19 - Ductile Iron Utility Water Pipe.

##### **1.3 REFERENCES**

- A. American Water Works Association (latest edition).
  - 1. AWWA C500 - Gate Valves for Water and Sewerage Systems.
  - 2. AWWA C508 – Swing Check Valves for Waterworks Service
  - 3. AWWA C509 - Resilient-Seated Gate Valves for Water and Sewage Systems.
- B. ASTM International.
  - 1. ASTM A126 - Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  - 2. ASTM B61 - Specification for Steam of Valve Bronze Castings.

#### **PART 2. MATERIALS**

##### **2.1 GENERAL**

- A. Items specified shall be the end products of one manufacturer in order to achieve standardization for operation, maintenance, spare parts, and manufacturer's services.
- B. Valves to be complete with necessary operators, valve boxes, extension stems, floor stands, worm and gear operators, operating nuts, etc., required for proper completion of work.
- C. Renewable parts including discs, packing, and seats shall be of types recommended by valve manufacturer for intended service.
- D. Units shall have name of manufacturer and size of valve cast on the body or bonnet or shown on a permanently attached plate in raised letters.
- E. Products covered under this section are to be NSF approved for public water use.

## **2.2 DESIGN FEATURES**

- A. Brass and bronze components of valves and appurtenances which have surfaces in contact with the water shall be alloys containing less than 16 percent zinc and 2 percent aluminum.
- B. Stainless steel Alloy 18-8 may be substituted for bronze at the option of the manufacturer and with the approval of the Engineer.
- C. All bolts and nuts for valves shall be stainless steel.

## **2.3 VALVE OPERATORS**

- A. Open by turning counterclockwise.
- B. Worm and gear operators to be of totally enclosed design, so proportioned as to permit operation of the valve under full operating head with a maximum pull of 40 pounds on the operator.
- C. Self-locking type to prevent the disc or plug from creeping.
- D. Self-locking worm gears to be a one-piece design of gear bronze material, accurately machine cut.
- E. Worm gear to be hardened alloy steel with thread ground and polished.
- F. Reduction gearing to run in a proper lubricant.
- G. Provide gear operators with position indicators, where specified, to show the position of the valve disc or plug.
- H. Operators to be galvanized and painted the same color as the valve and associated pipeline.
- I. Buried valves to have 2-inch x 2-inch square operating nut.
- J. Above-ground valves to have handwheel operators.

## **2.4 VALVE BOXES**

- A. Valve boxes shall be two-piece screw type, cast iron, with 5-1/4-inch shaft of appropriate length for the installation.
- B. The word WATER shall be cast into the top of the lid.
- C. Extension pieces, if required, shall be the manufacturer's standard type.
- D. Acceptable Products:
  - 1. Mueller H-10364
  - 2. Clow Corporation F-2452
  - 3. Approved equal

- E. Furnish units complete with all necessary bases and accessories.

## **2.5 EXTENSION STEMS FOR VALVE OPERATORS**

- A. Where the depth of the valve is such that its centerline is more than 4 feet below grade, provide operating extension stems to bring the operating nut to a point within 6 inches below the surface of the ground and/or box cover.
- B. Constructed of steel.
- C. Complete with 2-inch square operating nut.
- D. Bolt to valve stem to prevent separation.

## **2.6 GATE VALVES**

- A. Acceptable Products:
  - 1. Clow Model 2638
  - 2. Mueller A-2361
  - 3. Approved equal
- B. Gate Valves:
  - 1. Shall comply with the requirements of AWWA C509 or AWWA C515.
  - 2. Resilient seat type in accordance with AWWA standards with resilient wedge.
  - 3. Mechanical joint with non-rising stems and two-inch square operating nut.
  - 4. Open by turning to the left or counter clockwise.
- C. Gate Valve Body and Bonnet:
  - 1. Ductile Iron in conformance with ASTM A-536.
  - 2. "O" ring type seals and smooth unobstructed waterway when in fully open position.
  - 3. Mechanical joint ends underground; flange joint ends above ground.

## **2.7 TAPPING SLEEVES AND VALVES**

- A. Acceptable Products:
  - 1. Smith-Blair Model 662
  - 2. Approved Equal
- B. All bolts and nuts for tapping sleeve and valve shall be stainless steel.
- C. Resilient seat or resilient wedge gate valve with a flange on one side for connection to the tapping sleeve.
- D. The Owner or Owner's representative shall be present during both the pressure testing of the tapping sleeve and the tapping of the water line.

## **PART 3. EXECUTION**

### **3.1 GENERAL**

- A. Bolt holes of flanged valves shall straddle the vertical centerline of the pipe run.
- B. Prior to installing flanged valves, the flange faces shall be thoroughly cleaned.
- C. After cleaning, insert gasket and bolts, and tighten the nuts progressively and uniformly.
- D. If flanges leak under pressure, loosen, or remove the nuts and bolts, reseal or replace the gasket, retighten or reinstall the nuts and bolts, and retest the joints.
- E. Joints shall be watertight at test pressures before acceptance.
- F. Thoroughly clean threads of screwed joints by wire brushing, swabbing, or other approved methods.
- G. Apply approved joint compound to threads prior to making joints.
- H. Joints shall be watertight at test pressures before acceptance.
- I. Buried valves shall be wrapped in polyethylene material.

### **3.2 PLACEMENT OF VALVES**

- A. Buried valves shall be installed with valve boxes in accordance with the Standard Details.
- B. Buried valves shall have bolts protected by wrapping in polyethylene material.

### **3.3 ACCESS**

- A. Location of valves shall be as required to provide accessibility for control and maintenance.

### **3.4 TESTING**

- A. Valves: Test at same time adjacent pipeline is tested.
- B. Joints shall show no visible leakage under test.
- C. Repair joints that show signs of leakage prior to final acceptance.
- D. If there are any special parts of control systems or operators that might be damaged by the pipeline test, they shall be properly protected. The Contractor will be held responsible for damage caused by the testing.
- E. Tapping sleeves shall be hydrostatic pressure tested at the water line's maximum working pressure for 1 hour prior to the tap being made.

- F. Valve manufacturer shall furnish an affidavit stating the materials options furnished comply with these and other referenced Specifications.

**END OF SECTION**

## **SECTION 33 14 19**

### **VALVES AND HYDRANTS FOR WATER UTILITY SERVICE**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. Furnish and install all hydrants as shown on Drawings and as specified herein.

##### **1.2 RELATED SECTIONS**

- A. Section 33 05 19 - Ductile Iron Utility Water Pipe.
- B. Section 33 05 31.15 - Polyvinyl Chloride Pressure Pipe and Fittings.

#### **PART 2. MATERIALS**

##### **2.1 BLOW-OFF HYDRANTS**

- A. Acceptable Products:
  - 1. Kupferle Foundry Company, #77 Mainguard
  - 2. Approved equal.
- B. Blow-Off Hydrants:
  - 1. Rated Working Pressure: 150 psi minimum.
  - 2. Test Pressure: 300 psi.
  - 3. FIP Inlet Nozzle: 2 inches.
  - 4. Provide with locking cover to protect from theft and protection from elements.
  - 5. Blow-off hydrant shall be designed to permit field replacement of damaged threads without special tools, excavation, or disturbing ground line.
  - 6. Shall be non-freezing, self-draining type and serviceable from above grade.

##### **2.2 FIRE HYDRANTS**

- A. Acceptable Products:
  - 1. Clow Medallion Hydrant
  - 2. Mueller Super Centurion 250
  - 3. American AVK Series 27
  - 4. Approved equal
- B. Fire Hydrants:
  - 1. Meet or exceed AWWA C502.
  - 2. Hydrants shall have a minimum working pressure of 250 psi.
  - 3. Hydrants shall be designed to be disassembled for maintenance without excavation.
  - 4. The barrel and operating system shall be designed so that the main valve will remain closed if the barrel is broken.
  - 5. All hydrants shall be installed with an isolation gate valve on the hydrant lead. The hydrant lead shall be constructed of a ductile iron anchor tee or anchor coupling. No pipe pieces will be allowed.

6. Hydrants shall open to the left, be of the compression or gate type, and be provided with proper drip valve.
7. Each hydrant shall be served by a valve with an adjustable valve box.
8. Hydrants shall be supplied with heavy duty, non-kinking nozzle cap chains.
9. Epoxy coatings and linings shall meet the requirements of AWWA C550.
10. The following specifications shall be included on all fire hydrants:
  - a. Valve opening – 5-1/4"
  - b. Inlet connection – Mechanical Joint Connection
  - c. Outlets – (1) 4-1/2" pumper nozzle  
(2) 2-1/2" hose nozzles
  - d. Nozzle configuration – 3-way configuration with all on the same horizontal plane and the hose nozzles 180 degrees apart.
  - e. Size of gate valve – 6"
  - f. Nozzle Thread – National Standard

### **PART 3. EXECUTION**

#### **3.1 INSTALLATION**

- A. Install fire and blow-off hydrants with nozzle facing as directed by Owner.
- B. Install as shown in Standard Details and per manufacturer's recommendations.

#### **3.2 TESTING**

- A. Test fire and blow-off hydrants after installation. Repair or replace defective hydrant at no additional cost to the Owner.

**END OF SECTION**



## **SECTION 33 19 00**

### **WATER UTILITY METERING EQUIPMENT**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. Furnish and install water service lines, meter boxes, and meter appurtenances for potable water service.

##### **1.2 RELATED SECTIONS**

- A. Section 31 23 33 - Trenching and Backfilling.
- B. Section 33 05 31.15 - Polyvinyl Chloride Pressure Pipe and Fittings.

##### **1.3 SUBMITTALS**

- A. Submit under provisions of Specifications.
- B. Product Data:
  - 1. Materials.
  - 2. Manufacturer's standard installation instructions.

#### **PART 2. PRODUCTS**

##### **2.1 METERS AND APPURTENANCES**

- A. Meter: To be provided by Owner.
- B. Meter Box
  - 1. Meter Box Design & Material Specifications:
    - a. Must be manufactured in the USA.
    - b. Both the Box and Lid must be produced by the same manufacturer.
    - c. Both the Box and Lid shall be made of non-break polypropylene.
    - d. Each box must be stackable with 6" increment risers, produced by the same manufacturer.
    - e. Lid to have non-floating weep hole system.
    - f. Lid to have a minimum of one (1) vertical steel bar for locating purposes.
    - g. Lid to have pre-drilled lag bolt holes for secure bolt down system.
    - h. The box shall be DWF 1200TT, lid shall be Nicor #B9XB1UHDTHB-848, or approved equal.
  - 2. Single 5/8 X 3/4 Meter Box Specifications:
    - a. Box shall be 13" X 24" with a straight wall design. Internal dimensions shall be no less than 12-1/4" X 21-1/2".
    - b. Box weight shall be no more than 21 lbs.
    - c. Lid weight shall be no more than 13 lbs.

3. Meter Box Performance & Testing Requirements:
  - a. Lid must be tested ON the box from the manufacturer.
  - b. Both the Box and Lid shall meet a Tier 15 Rating of the ANSI-SCTE 77 Testing Standards.
  - c. Each Box size MUST HAVE a Certificate of Compliance for ANSI-SCTE 77 Tier 15 Rating for the vertical and lateral load conditions.
- C. Water Service Polyethylene Tubing:
  1. Water service tubing shall be SDR 9 PE tubing provided in copper tube sizes (CTS).
  2. Tubing material shall be manufactured using the high-pressure peroxide extrusion method for cross-linked polyethylene (PEXa) and shall meet or exceed the requirements of AWWA C904, ASTM F876, CSA B137.5, and PPI TR-3.
  3. All service tubing material shall be listed as conforming to NSF-61.
  4. Inserts for PE tubing shall be solid tubular 304 stainless steel made to retain placement within PE tubing. Inserts shall be used on all PE tubing connections. The inserts shall be sized specifically for the PE tubing used for the water service piping.
  5. Acceptable Products:
    - a. Rehau Municipex
    - b. Approved Equal
- D. Corporation Stops:
  1. Acceptable Products:
    - a. McDonald #74701B-22
    - b. Approved Equal
  2. Brass with pack joint outlet for PE tubing.
- E. Saddles:
  1. Brass saddle with strap.
  2. Acceptable Manufacturers:
    - a. McDonald #3891
    - b. Approved Equal
- F. Meter Setter:
  1. Acceptable Manufacturers:
    - a. McDonald #726-207WC2DF44 (3/4"x5/8")
    - b. McDonald #726-410WC2D44 (1")
    - c. Or equal.
  2. Angled or straight depending on bury.
  3. Provide 3/4-inch or 1" pack joint.
- G. Check Valve:
  1. Acceptable Manufacturers:
    - a. Ford Meter Box Company, Inc.; Model HS31-323-NL
    - b. Approved Equal
- H. Lead free solder.

## **PART 3. EXECUTION**

### **3.1 INSTALLATION**

- A. Install in accordance with manufacturer's instructions and as shown in the Standard Details.
- B. Test for leaks and repair or replace defective meters and appurtenances.

**END OF SECTION**

## **SECTION 40 05 78.11**

### **AIR VALVES**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. Furnish and install self-contained automatic process valves, and appurtenances of the sizes indicated.

##### **1.2 REFERENCES**

- A. American Water Works Association.
  - 1. C514: Air Valve and Vent Inflow Preventer Assemblies for Potable Water Distribution System and Storage Facilities

##### **1.3 SUBMITTALS**

- A. Submit under provisions of project specifications.
- B. Certificate of Compliance: Submit Certificates of Compliance attesting that materials provided are in compliance with referenced standards.

#### **PART 2. MATERIALS**

##### **2.1 AIR VALVES**

- A. Type: Combination Air Valve
- B. Body and Cover: Single body; reinforced nylon/polypropylene, ductile iron, or stainless steel.
- C. Combination air valve shall have a minimum working pressure of 250 psi.
- D. Acceptable Products:
  - 1. A.R.I. D-040
  - 2. Approved equal

#### **PART 3. EXECUTION**

##### **3.1 INSTALLATION**

- A. Install valves and fittings in accordance with the manufacturer's written instructions.
- B. Joints shall be watertight at test pressures before acceptance.
- C. Thoroughly clean threads of screwed joints by wire brushing, swabbing, or other methods in accordance with the manufacturer's instructions.

- D. Apply approved joint compound to threads as necessary prior to making joints.
- E. Joints shall be watertight at test pressures before acceptance.

### **3.2 LOCATION**

- A. Location of air valves shall be at the high point of the piping.

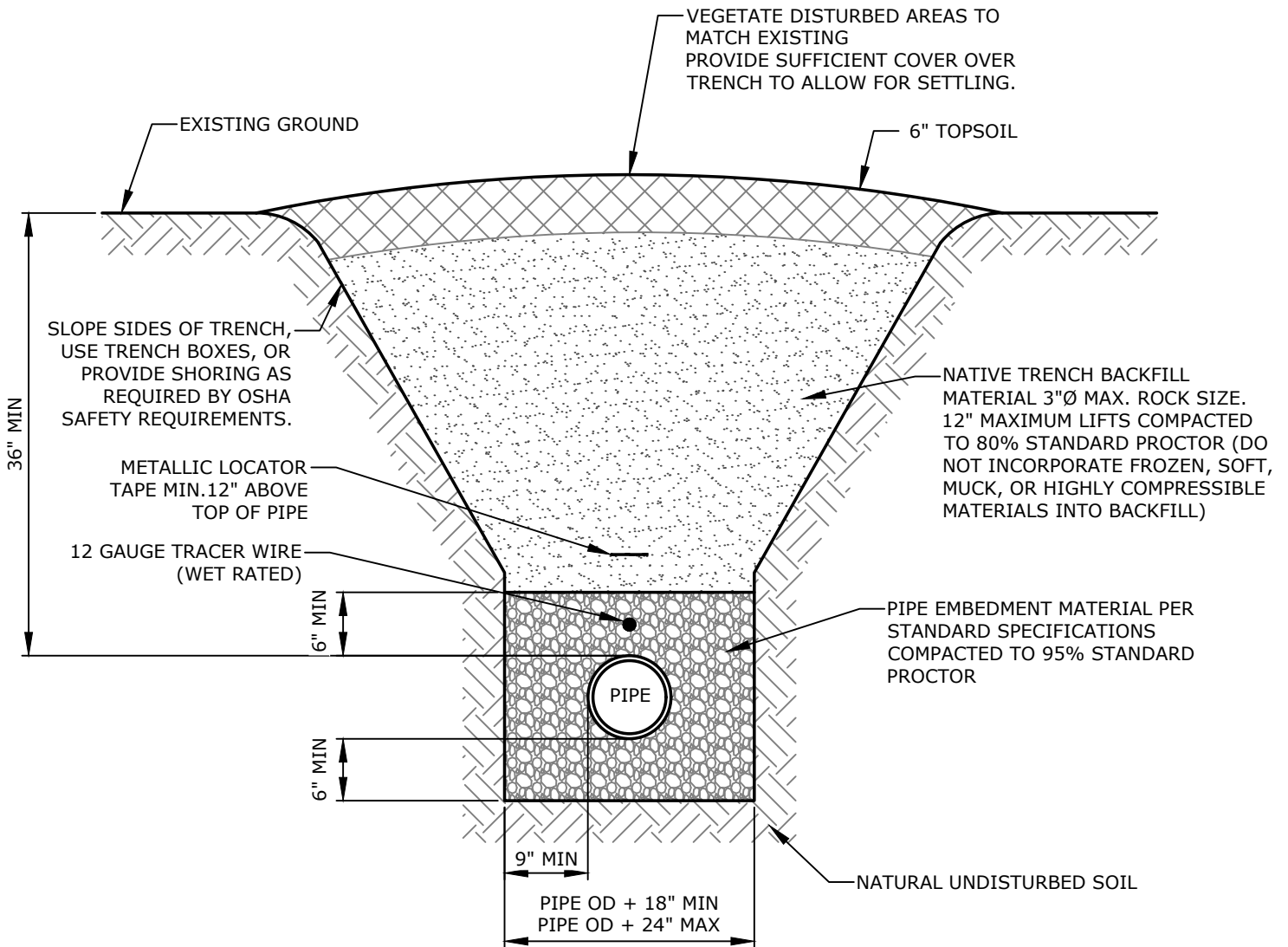
### **3.3 ANCHOR BOLTS**

- A. If any anchor bolts needed, protect threads and clean before nuts are attached and tightened.

### **3.4 TESTING**

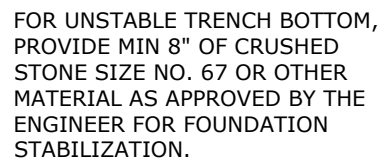
- A. Valves: Test at same time adjacent pumps and pipes are tested.
- B. Joints shall show no visible leakage under test.
- C. Repair joints that show signs of leakage prior to final acceptance.

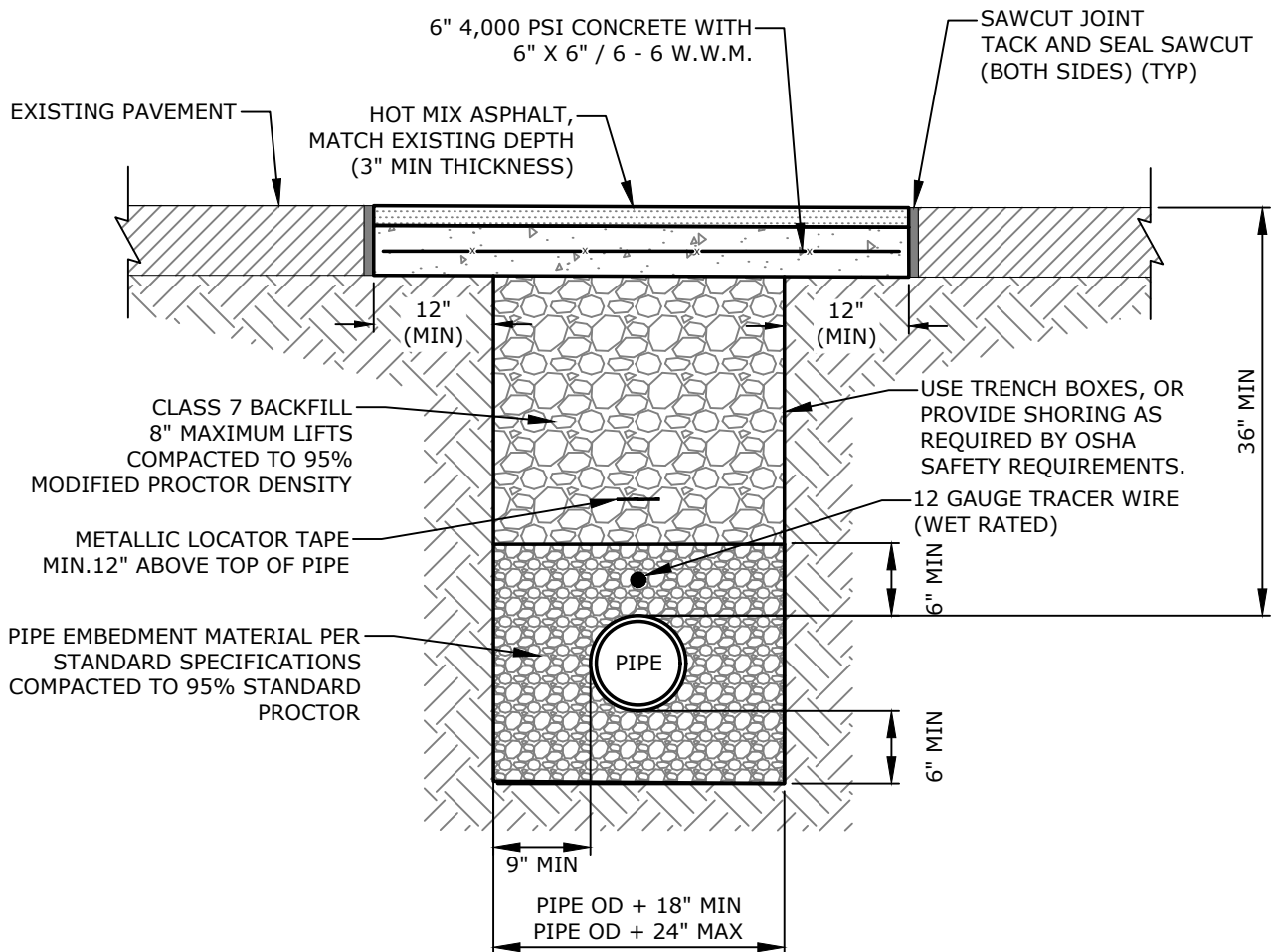
**END OF SECTION**



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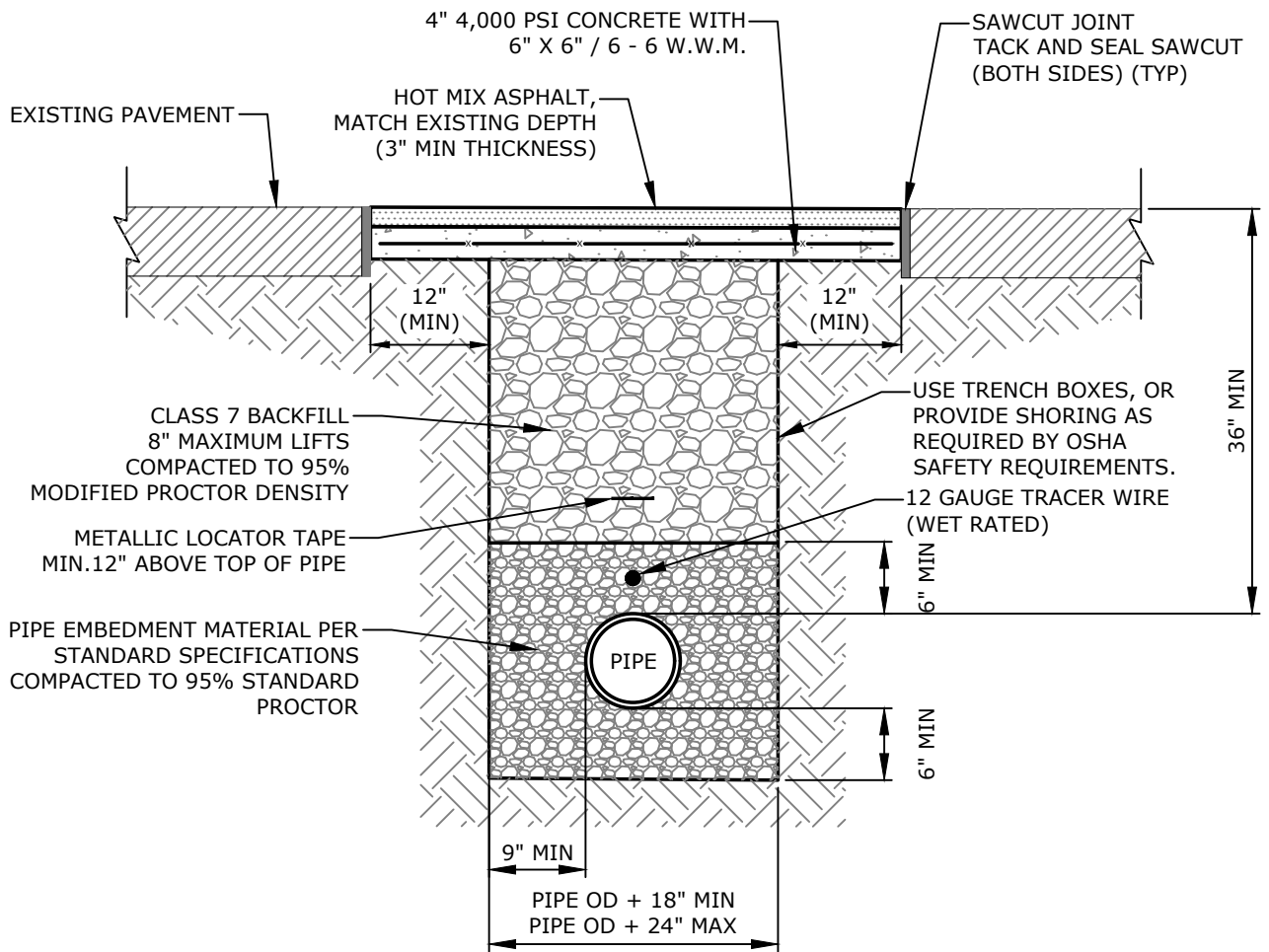




NOTE:  
1. APPLY TACK COAT ON CONCRETE  
CAP & SIDES OF CUT PRIOR TO  
PLACING HOT MIX ASPHALT.



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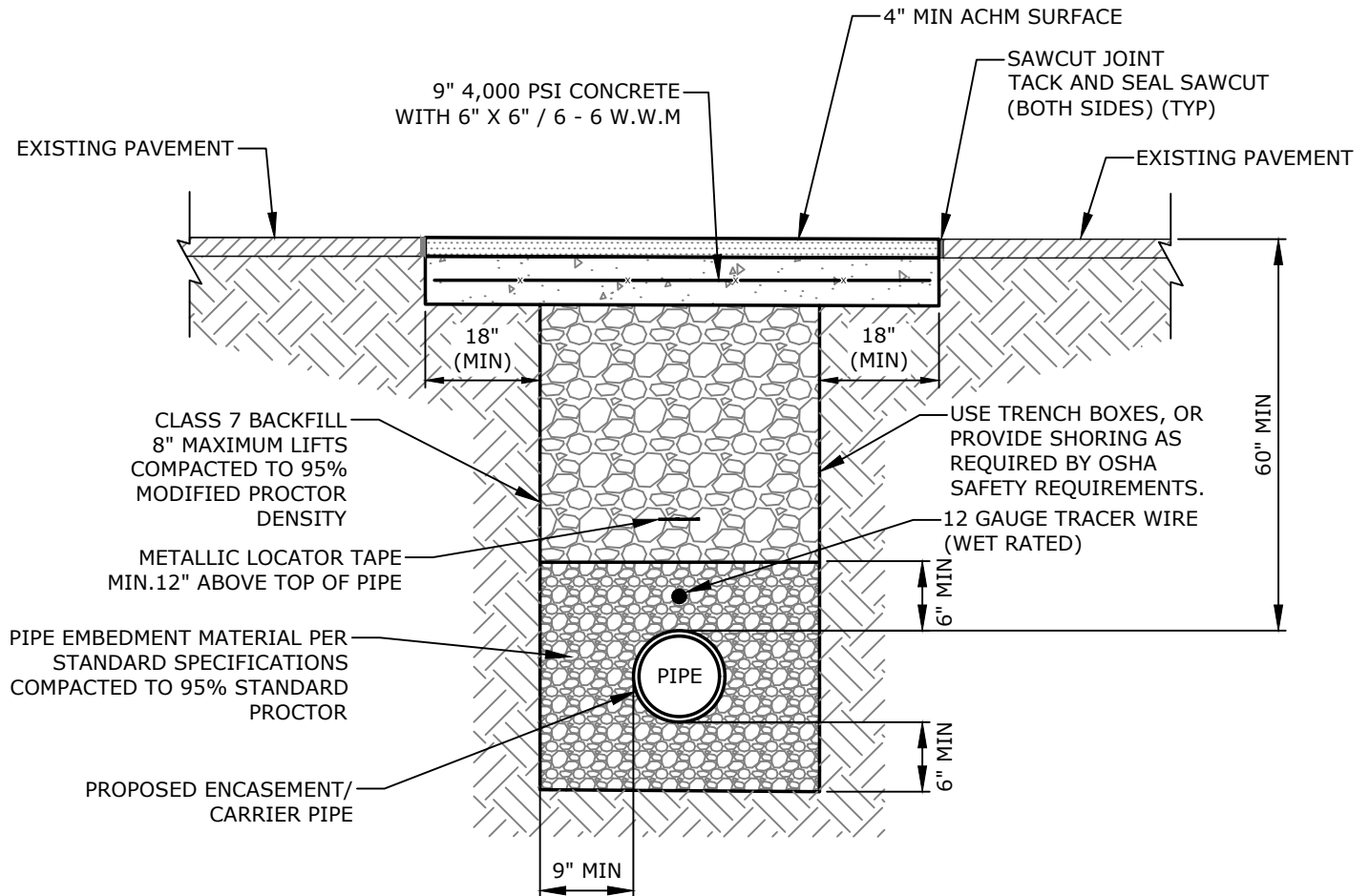


NOTE:

1. APPLY TACK COAT ON CONCRETE  
CAP & SIDES OF CUT PRIOR TO  
PLACING HOT MIX ASPHALT.

**NOTES:**

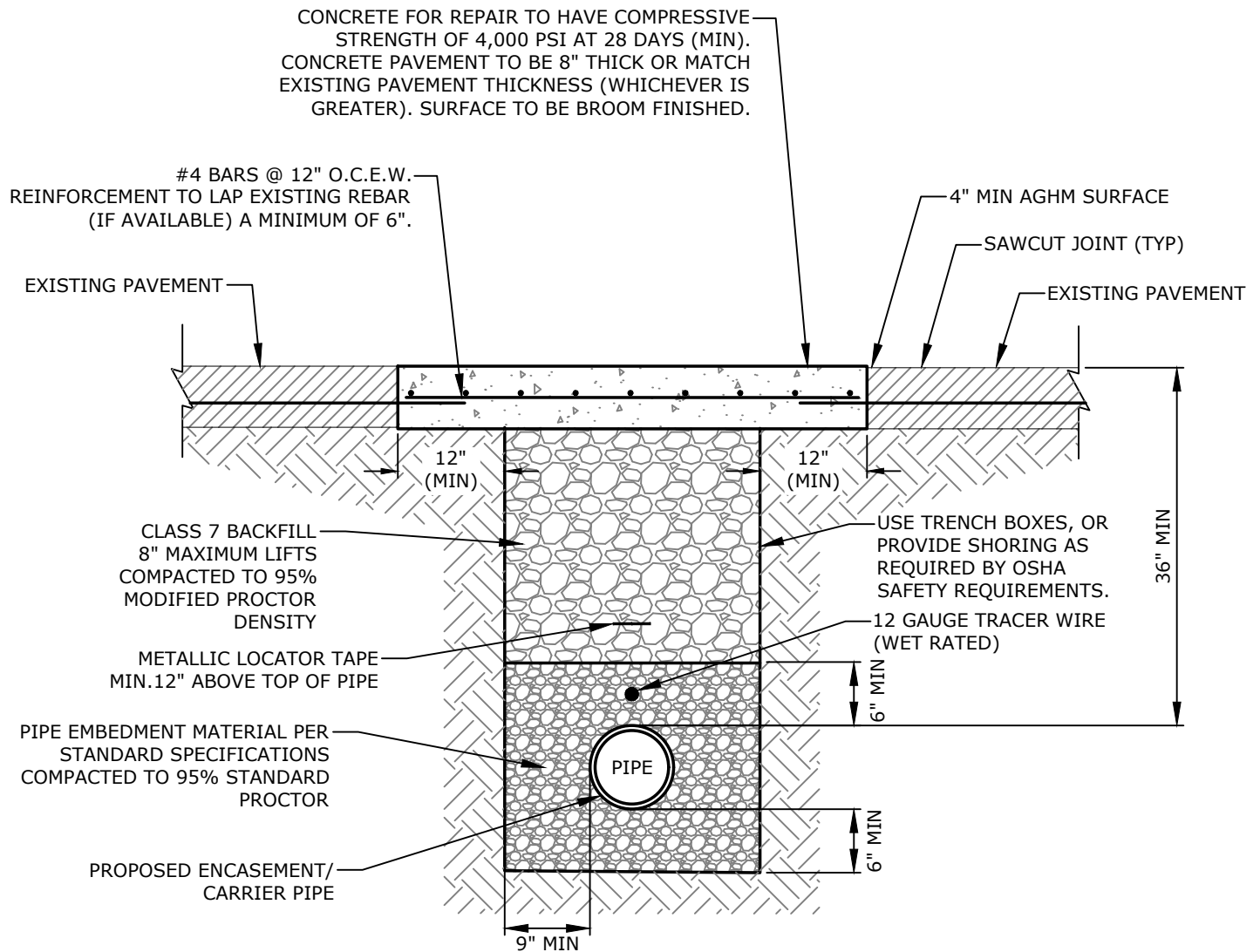
1. APPLY TACK COAT ON CONCRETE CAP & SIDES OF CUT PRIOR TO PLACING HOT MIX ASPHALT.
2. TEMPORARY SURFACE (SHALL BE COLD MIX) UNTIL FINAL PATCH IS MADE.



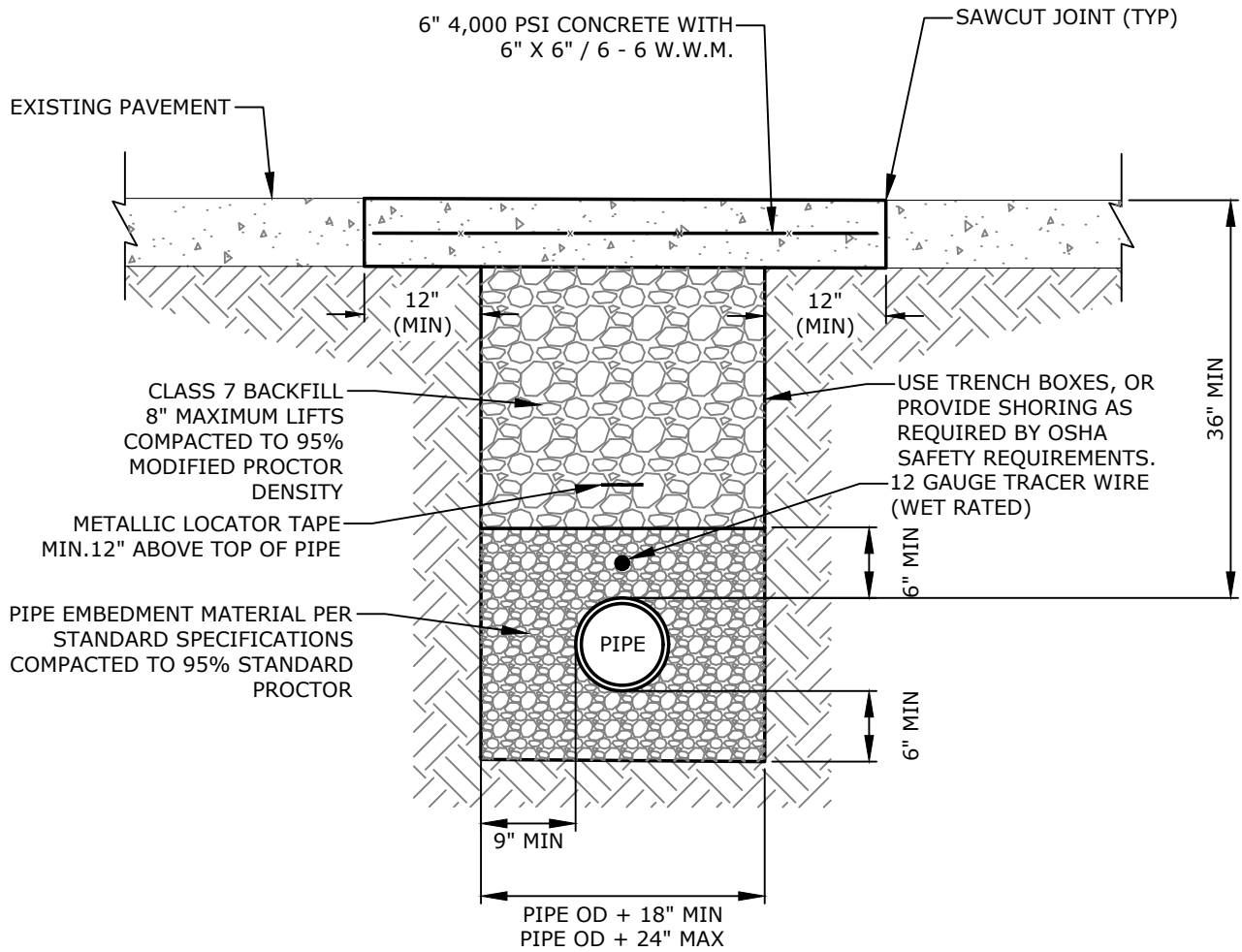
**NOTE:**

1. APPLY TACK COAT ON CONCRETE CAP & SIDES OF CUT PRIOR TO PLACING HOT MIX ASPHALT.

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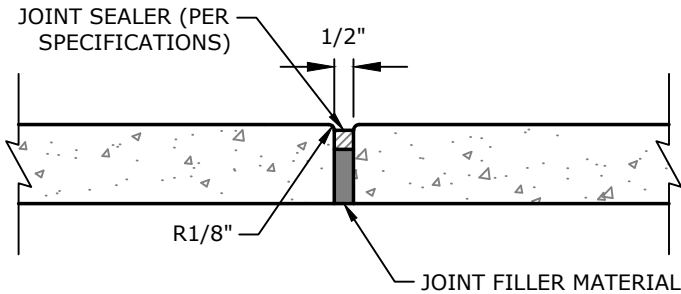


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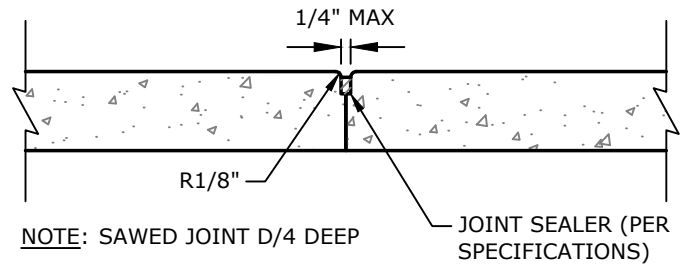


**NOTES:**

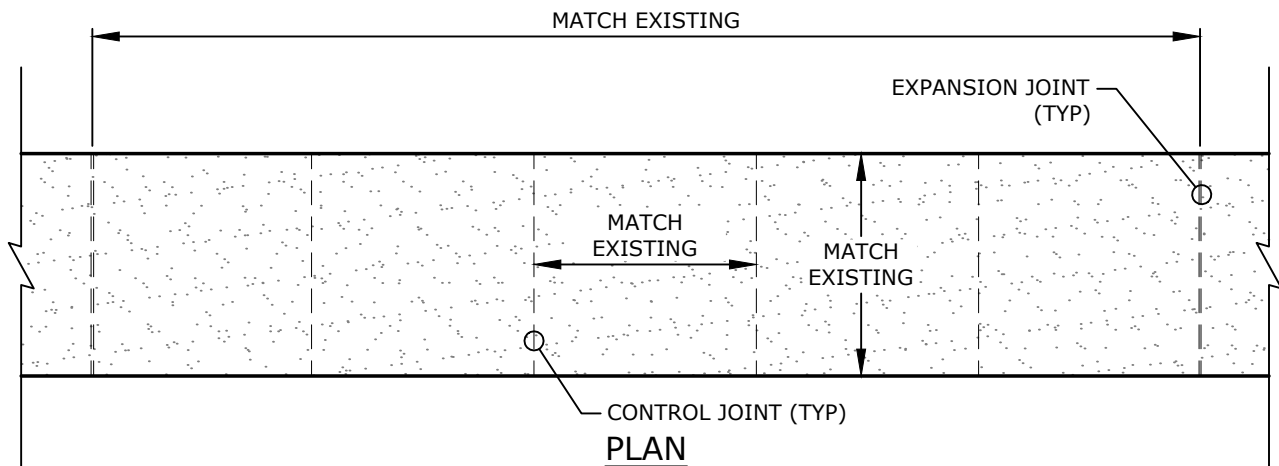
1. CONCRETE FOR SIDEWALK SHALL HAVE A COMPRESSIVE STRENGTH OF 3,000 PSI AT 28 DAYS (MIN).
2. SIDEWALK TO BE 4" THICK OR MATCH EXISTING SIDEWALK THICKNESS (WHICHEVER IS GREATER).
3. ALL SIDEWALKS SHALL HAVE A BROOMED FINISHED UNLESS OTHERWISE SPECIFIED.
4. ALL JOINTING TO MATCH EXISTING JOINT PATTERN.
5. ALL CONTROL JOINTING TO BE SAWCUT OR TOOLED JOINTED PER SIDEWALK JOINTING.
6. CURING COMPOUND IS REQUIRED UNLESS TEMPERATURES STAY BELOW 50° FAHRENHEIT FOR 7 DAYS. CURING COMPOUND MUST BE COLORED WHITE, RED, OR PINK. CLEAR CURING COMPOUND IS UNACCEPTABLE. IF CONCRETE IS NOT CURED WHEN REQUIRED, IT WILL BE CONSIDERED GROUNDS FOR REMOVAL AND REPLACEMENT.



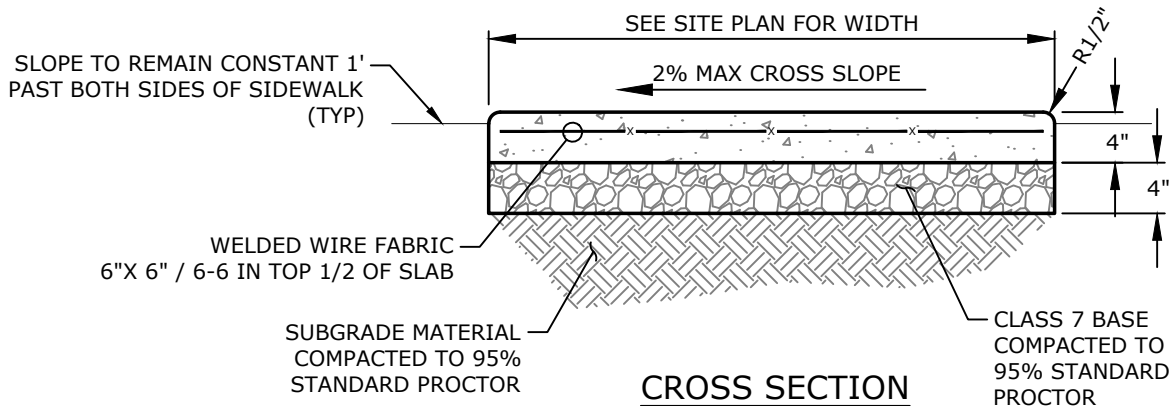
**EXPANSION JOINT**



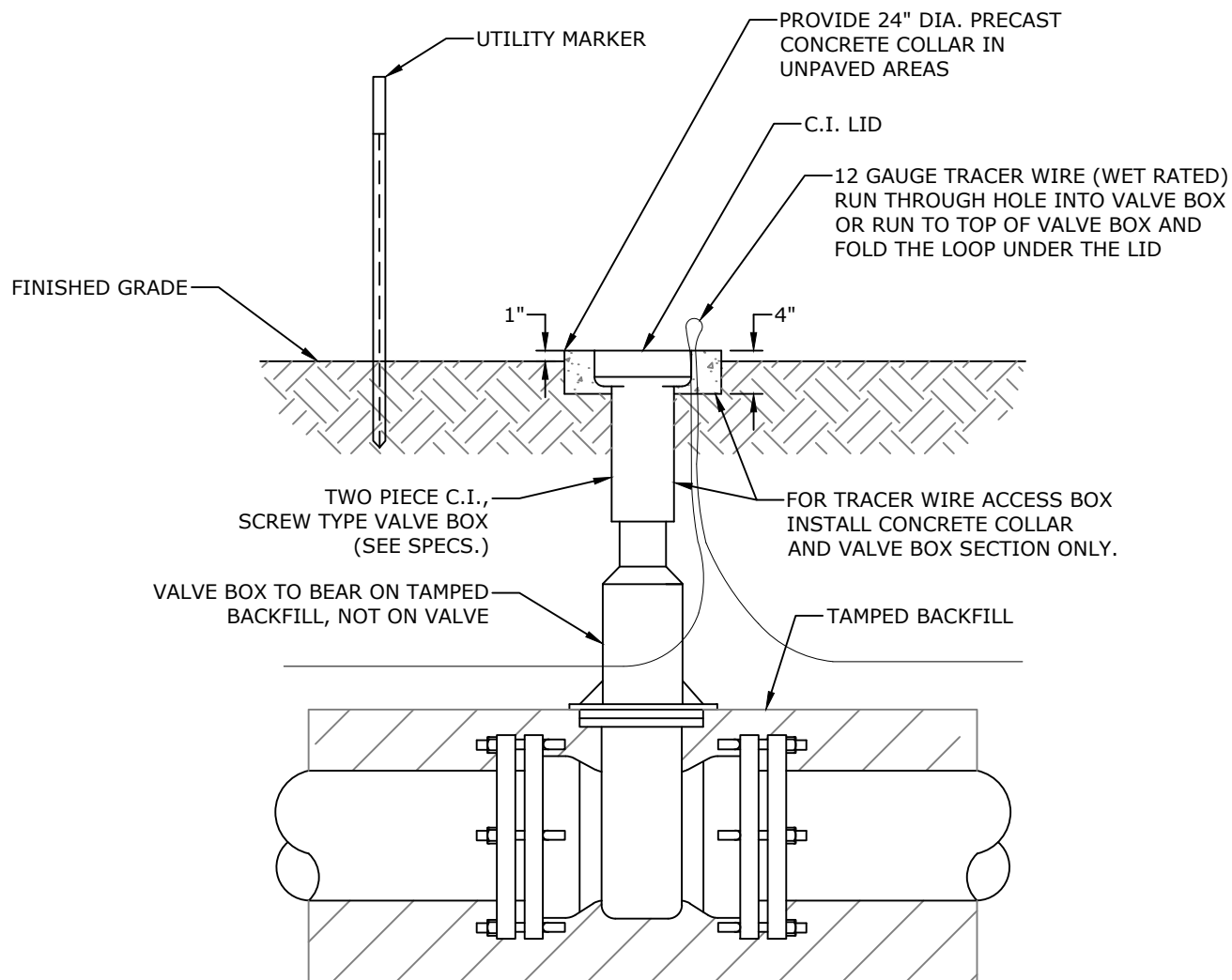
**CONTROL JOINT**  
(LONGITUDINAL OR TRANSVERSE)



**PLAN**



**CROSS SECTION**

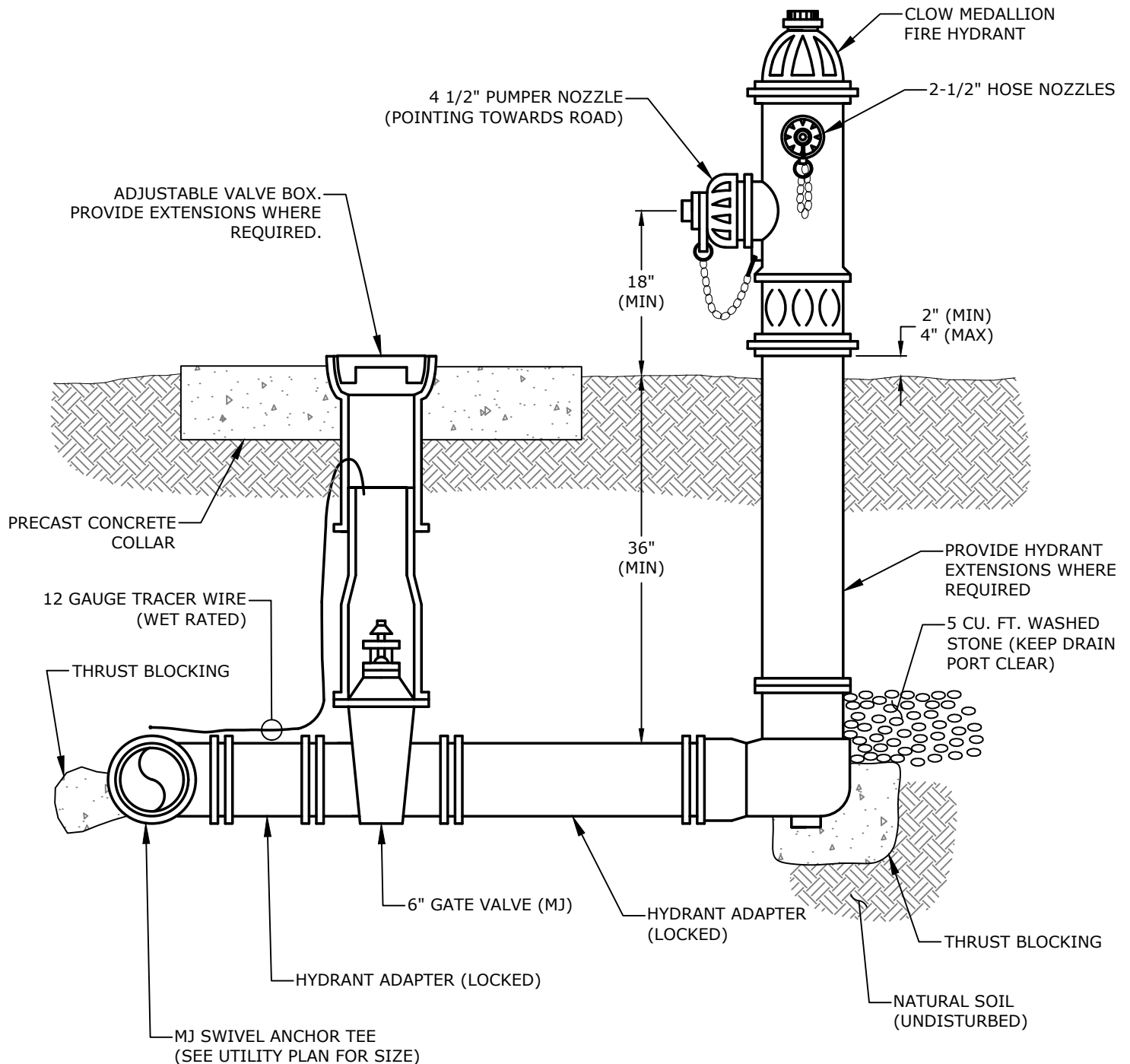


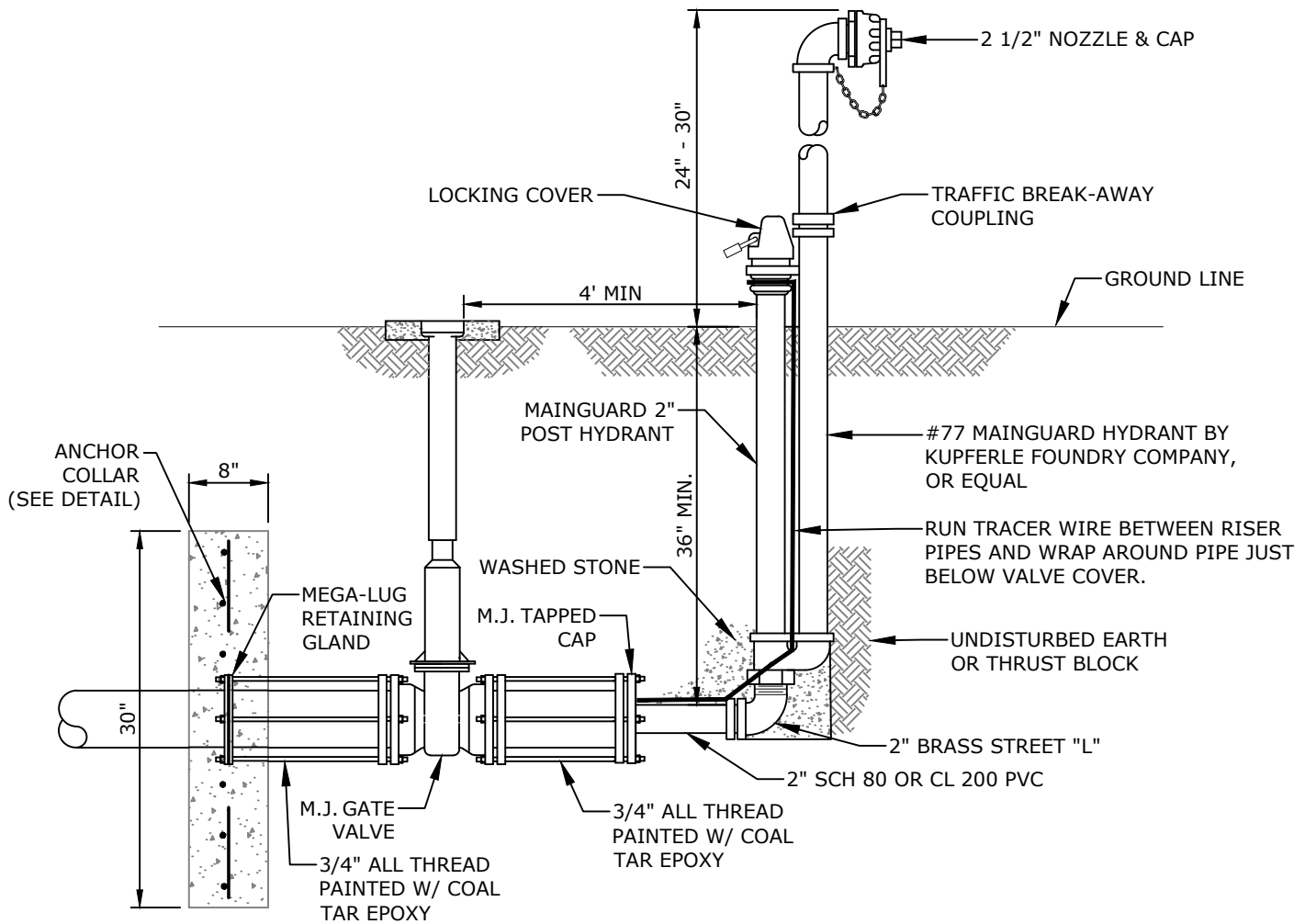
**NOTE:**

1. VALVE BOX SHALL BE MUELLER H-10364, CLOW F-2452 OR APPROVED EQUAL.
2. GATE VALVE SHALL BE CLOW, OR APPROVED EQUAL.

**NOTES:**

1. FIRE HYDRANT TO INSTALLED AS SHOWN AND PER MANUFACTURER'S RECOMMENDATIONS.
2. GATE VALVE TO BE INSTALLED AS SHOWN AND PER MANUFACTURER'S RECOMMENDATIONS.
3. EXTENSIONS SHALL BE PROVIDED (AS NECESSARY) TO POSITION FIRE HYDRANT AND / OR GATE VALVE PER THE PLANS.





**NOTES:**

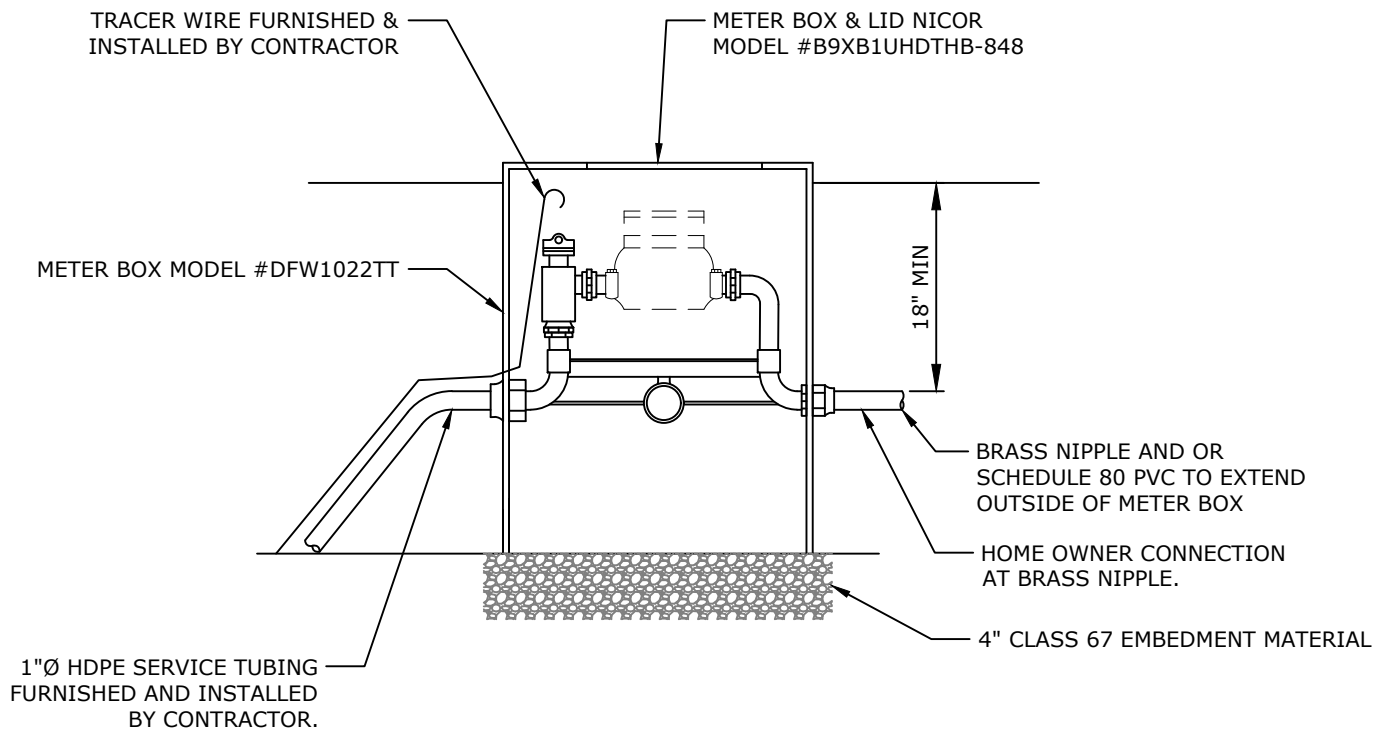
1. BLOW-OFF HYDRANTS SHALL BE NON-FREEZING, SELF DRAINING TYPE.
2. BLOW-OFF HYDRANTS SHALL BE FURNISHED WITH A 2" MJ INLET, A NON-TURNING OPERATING ROD, AND SHALL OPEN TO THE LEFT.
3. THE OUTLET SHALL BE 2-1/2" NST BRASS.
4. ALL WORKING PARTS SHALL BE OF BRONZE-TO-BRONZE DESIGN, AND BE SERVICEABLE FROM ABOVE GRADE WITH NO DIGGING. HYDRANTS SHALL BE LOCKABLE TO PREVENT UNAUTHORIZED USAGE.
5. BLOW-OFF HYDRANTS SHALL BE SET IN FOUR (4) CUBIC FEET OF WASHED STONE TO ALLOW FOR PROPER DRAINAGE.

2" BLOW-OFF HYDRANT

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MAY 2026  
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NOT TO SCALE

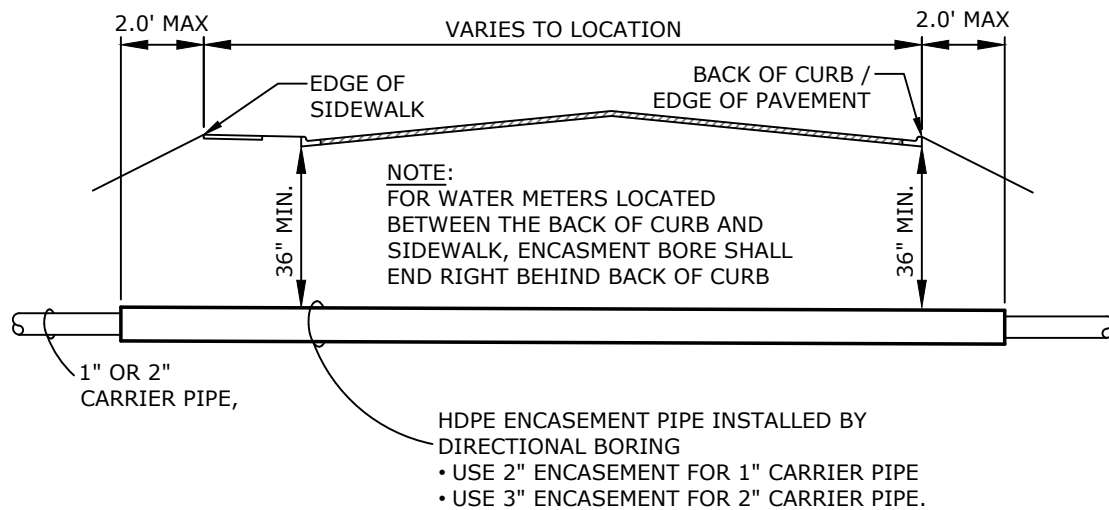


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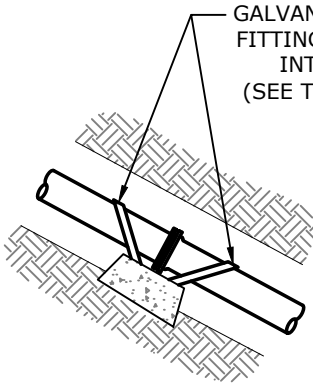
**NOTES:**

1. 3/4"x5/8" METER SETTER McDONALD PART #726-207WC2F 44
2. 1" METER SETTER McDONALD PART #726-410WC2D 44

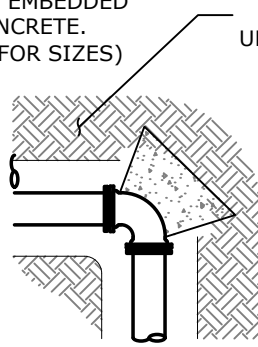


**NOTES:**

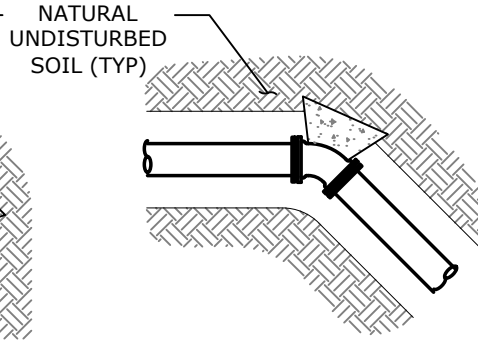
1. CONCRETE FOR THRUST BLOCKS SHALL DEVELOP NOT LESS THAN 3,000 P.S.I. COMPRESSIVE STRENGTH AT 28 DAYS AND BE PLACED AGAINST UNDISTURBED SOIL.
2. ALL BENDS, BOTH HORIZONTAL AND VERTICAL, SHALL BE BACKED WITH CONCRETE. VERTICAL BENDS SHALL BE PLACED ON CONCRETE PADS WHERE BENDS TURN UP, OR LOADED WHERE BENDS TURN DOWN.
3. WRAP PIPE JOINTS IN 8 MIL POLYETHYLENE BEFORE PLACING CONCRETE.
4. BEARING AREA SHOWN IN TABLE IS BASED UPON A 2000 LB/SF. SOIL BEARING AND A PIPELINE PRESSURE OF 200 PSI PLUS 50 PSI SURGE. AREAS SHOWN SHALL BE ADJUSTED AS NECESSARY IF FIELD CONDITIONS VARY FROM THESE STATED CONDITIONS.
5. UTILIZE MEGALUG THRUST RESTRAINTS ON MECHANICAL JOINT FITTINGS AND VALVES, IN ADDITION TO THESE THRUST BLOCKS.



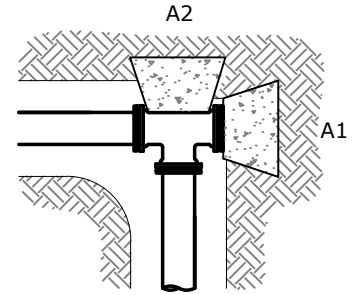
**HORIZONTAL  
RUN**



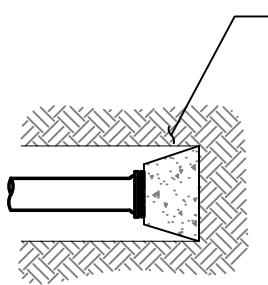
**90° BEND**



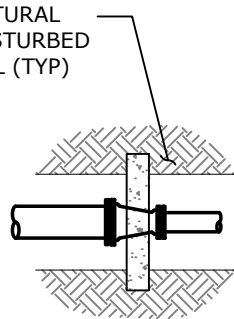
**11.25°, 22.5°,  
AND / OR 45°**



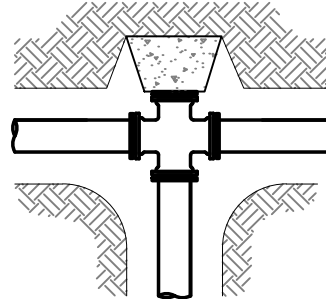
**TEE W/ PLUG**



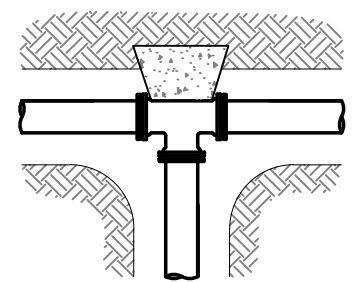
**END PLUG, CAP,  
OR BLIND FLANGE**



**REDUCER  
COLLAR**



**CROSS W/ PLUG**

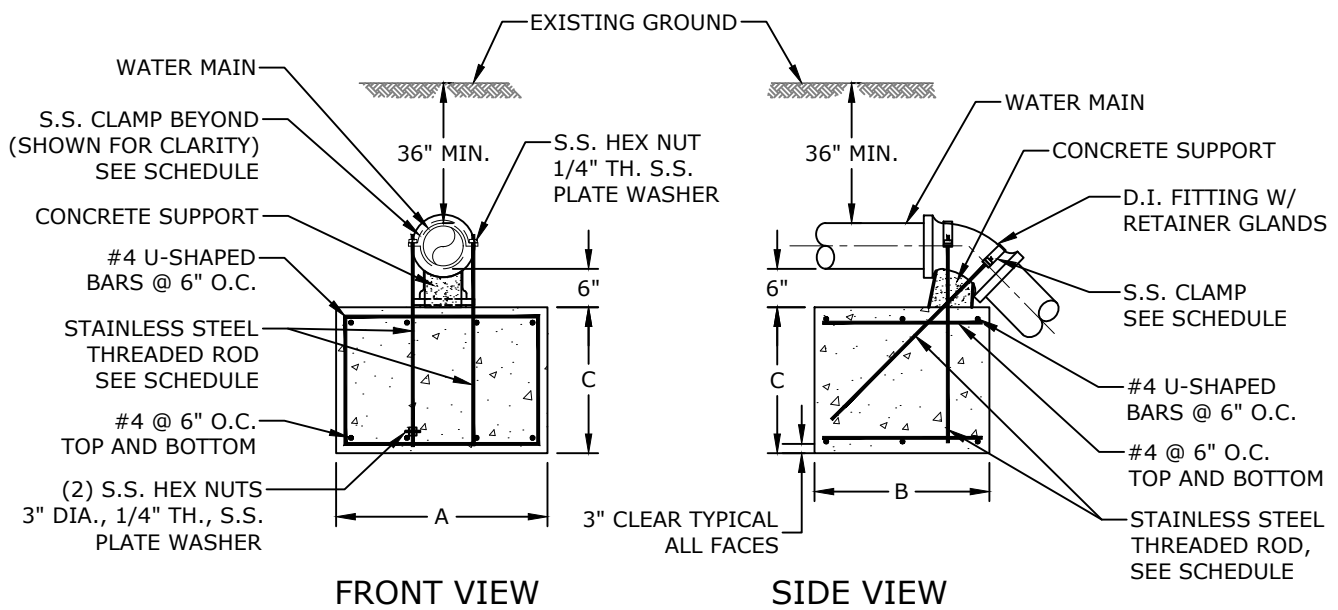


**TEE**

**THRUST BLOCKING SCHEDULE**

BEARING AREA OF THRUST BLOCKING (SQ. FT.)  
(HORIZONTAL BENDS)

| FITTING SIZE | TEE, WYE,<br>PLUG, OR CAP | 90° BEND,<br>PLUGGED<br>CROSS | TEE PLUGGED<br>ON RUN (A1) | TEE PLUGGED<br>ON RUN (A2) | BEND ANGLES |       |        |
|--------------|---------------------------|-------------------------------|----------------------------|----------------------------|-------------|-------|--------|
|              |                           |                               |                            |                            | 45°         | 22.5° | 11.25° |
| 2" & 3"      | 1.6                       | 2.2                           | 1.6                        | 2.2                        | 1.2         | 0.7   | 0.4    |
| 4"           | 2.3                       | 3.2                           | 2.3                        | 3.2                        | 1.8         | 0.9   | 0.5    |
| 6"           | 4.7                       | 6.7                           | 4.7                        | 6.7                        | 3.6         | 1.9   | 1.0    |
| 8"           | 8.1                       | 11.4                          | 8.1                        | 11.4                       | 6.2         | 3.2   | 1.6    |
| 10"          | 12.1                      | 17.2                          | 12.1                       | 17.2                       | 9.3         | 4.8   | 2.4    |
| 12"          | 17.2                      | 24.2                          | 17.2                       | 24.2                       | 13.1        | 6.7   | 3.4    |



**NOTES:**

1. ALL FITTINGS SHALL BE MECHANICAL JOINT WITH RETAINER GLANDS. PIPE EMBEDMENT MATERIAL NOT SHOWN FOR CLARITY.
2. REFER TO SCHEDULE FOR THREADED ROD EMBEDMENT.
3. CONCRETE FOR VERTICAL TIE-DOWN BLOCKING SHALL HAVE A COMPRESSIVE STRENGTH OF 3,000 PSI AT 28 DAYS (MIN).
4. PIPE LAYS WHICH ARE STEEPER THAN 20 DEGREES WILL REQUIRE OWNER AND ENGINEER REVIEW OF BLOCKING.

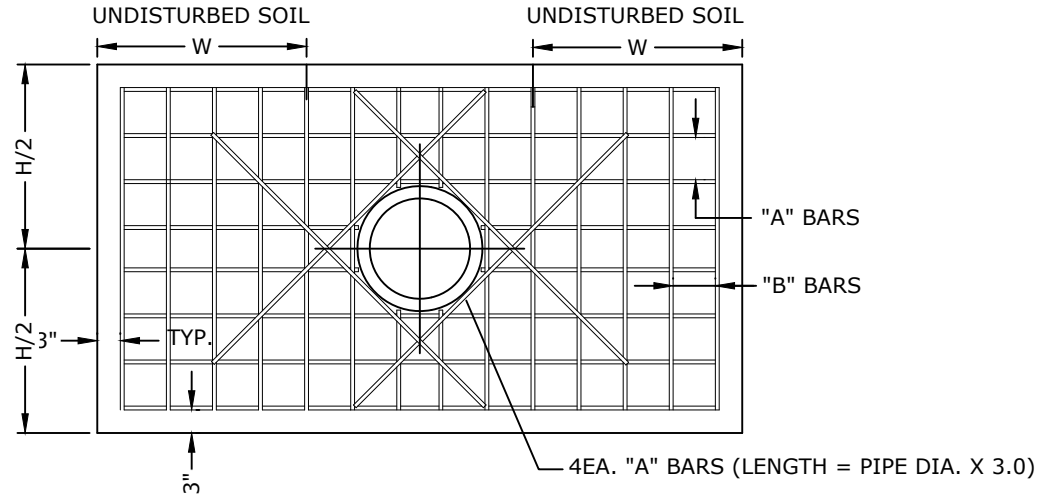
| BLOCKING SCHEDULE                    |         |           |         |         |      |          |
|--------------------------------------|---------|-----------|---------|---------|------|----------|
| PIPE SIZE                            | BENDS   |           |         |         |      | ROD DIA. |
|                                      |         | 45°       | 22 1/2° | 11 1/4° |      |          |
| MIN VOLUME REQ'D (CU. FT.)           |         | 14.6      | 7.9     | 4.1     | 1/2" |          |
| MIN EMBEDMENT DEPTH (IN.) / EACH ROD |         | 8         | 8       | 8       |      |          |
| 2" & 3"                              | A (FT.) | 1.5       | 1.5     | 1       |      |          |
|                                      | B (FT.) | 3.25      | 2.5     | 2.25    |      |          |
|                                      | C (FT.) | 3.25      | 2.5     | 2.25    |      |          |
| MIN. CLAMP (2 EA.)                   |         | 1/4" X 2" |         |         | 1/2" |          |
| MIN VOLUME REQ'D (CU. FT.)           |         | 21.4      | 11.6    | 5.9     |      |          |
| MIN EMBEDMENT DEPTH (IN.) / EACH ROD |         | 8         | 8       | 8       |      |          |
| 4"                                   | A (FT.) | 2         | 1.5     | 1       |      |          |
|                                      | B (FT.) | 3.5       | 3       | 2.5     |      |          |
|                                      | C (FT.) | 3.5       | 3       | 2.5     |      |          |
| MIN. CLAMP (2 EA.)                   |         | 1/4" X 2" |         |         | 3/4" |          |
| MIN VOLUME REQ'D (CU. FT.)           |         | 44.1      | 23.9    | 12.2    |      |          |
| MIN EMBEDMENT DEPTH (IN.) / EACH ROD |         | 8         | 8       | 8       |      |          |
| 6"                                   | A (FT.) | 2.5       | 2       | 1.5     |      |          |
|                                      | B (FT.) | 4.25      | 3.5     | 3       |      |          |
|                                      | C (FT.) | 4.25      | 3.5     | 3       |      |          |
| MIN. CLAMP (2 EA.)                   |         | 3/8" X 2" |         |         | 3/4" |          |
| MIN VOLUME REQ'D (CU. FT.)           |         | 75.9      | 41.1    | 21      |      |          |
| MIN EMBEDMENT DEPTH (IN.) / EACH ROD |         | 8         | 8       | 8       |      |          |
| 8"                                   | A (FT.) | 4         | 3       | 2.5     |      |          |
|                                      | B (FT.) | 4.5       | 3.75    | 3       |      |          |
|                                      | C (FT.) | 4.5       | 3.75    | 3       |      |          |
| MIN. CLAMP (2 EA.)                   |         | 3/8" X 2" |         |         | 3/4" |          |
| MIN VOLUME REQ'D (CU. FT.)           |         | 114.1     | 61.8    | 31.5    |      |          |
| MIN EMBEDMENT DEPTH (IN.) / EACH ROD |         | 8         | 8       | 8       |      |          |
| 10"                                  | A (FT.) | 4.5       | 3.5     | 2.5     |      |          |
|                                      | B (FT.) | 5.25      | 4.25    | 3.75    |      |          |
|                                      | C (FT.) | 5.25      | 4.25    | 3.75    |      |          |
| MIN. CLAMP (2 EA.)                   |         | 3/8" X 2" |         |         | 3/4" |          |
| MIN VOLUME REQ'D (CU. FT.)           |         | 161.3     | 87.3    | 44.5    |      |          |
| MIN EMBEDMENT DEPTH (IN.) / EACH ROD |         | 9         | 8       | 8       |      |          |
| 12"                                  | A (FT.) | 5.5       | 4       | 3       |      |          |
|                                      | B (FT.) | 5.5       | 4.75    | 4       |      |          |
|                                      | C (FT.) | 5.5       | 4.75    | 4       |      |          |
| MIN. CLAMP (2 EA.)                   |         | 1/2" X 2" |         |         |      |          |

**NOTES:**

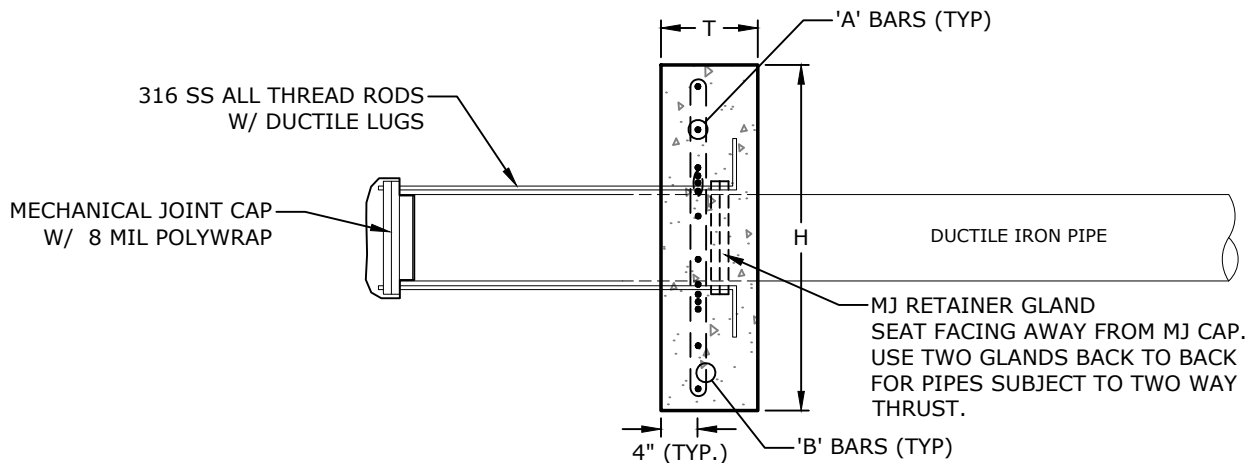
- VOLUME CALCULATED ON THE BASIS OF CONCRETE REACTING THRUST ON THE RESPECTIVE BENDS UNDER AN INTERNAL PRESSURE OF 200 PSI, 50 PSI SURGE AND THE WEIGHT OF CONCRETE IS 150 POUNDS PER CU. FT.

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1. DESIGN PRESSURE IS 200 PSI PLUS 50 PSI SURGE & 2,000 PSI SOIL BEARING.
2. ALL DIMENSIONS ARE MINIMUM REQUIREMENTS. ACTUAL FIELD CONDITIONS MAY REQUIRE LARGER DIMENSIONS.
3. ALL RETAINER GLANDS SHALL BE MEGA-LUG BY EBAA IRON.
4. ALL CONCRETE USED FOR ANCHOR COLLARS SHALL HAVE A COMPRESSIVE STRENGTH OF 3,000 PSI AT 28 DAYS (MIN)
5. PIPE SIZES LARGER THAN 12" WILL REQUIRE OWNER AND ENGINEER REVIEW OF COLLAR.



### ELEVATION VIEW

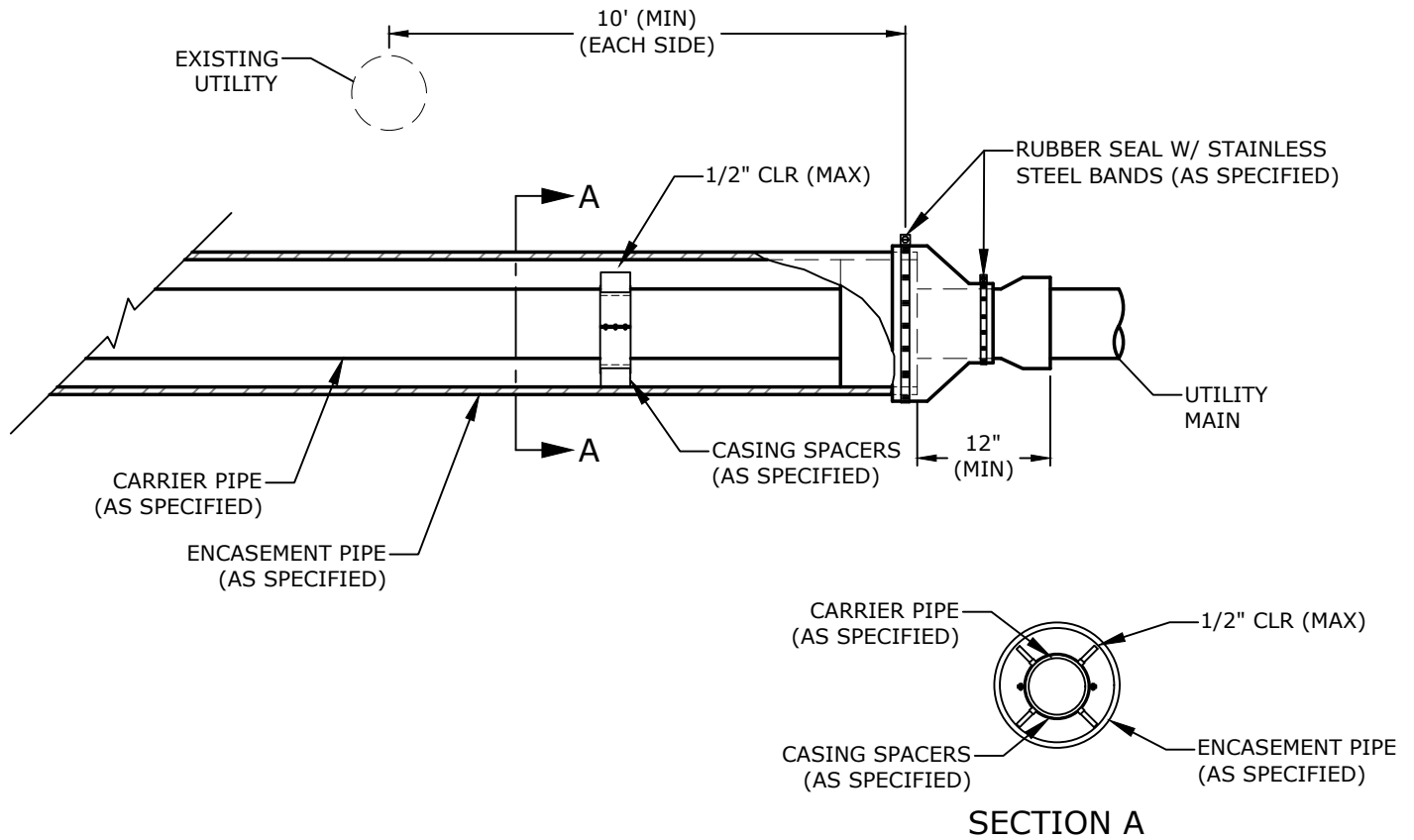


### PLAN VIEW

| ANCHOR COLLAR SCHEDULE |      |      |      |                          |                    |             |               |             |
|------------------------|------|------|------|--------------------------|--------------------|-------------|---------------|-------------|
| DIMENSIONS             |      |      |      |                          | REINFORCEMENT BARS |             |               |             |
| PIPE SIZE              | 'W'  | 'H'  | 'T'  | 'M'                      | 'A' BARS           |             | 'B' BARS      |             |
|                        |      |      |      |                          |                    | # OF LAYERS |               | # OF LAYERS |
| 4"                     | 1'   | 1.5' | 1.0' | (2) RETAINER GLANDS (MJ) | #6s @ 6" O.C.      | 1           | #6s @ 6" O.C. | 1           |
| 6"                     | 1.5' | 2'   | 1.0' | (2) RETAINER GLANDS (MJ) | #6s @ 6" O.C.      | 1           | #6s @ 6" O.C. | 1           |
| 8"                     | 2'   | 2.5' | 1.0' | (2) RETAINER GLANDS (MJ) | #6s @ 6" O.C.      | 1           | #6s @ 6" O.C. | 1           |
| 12"                    | 3'   | 3.5' | 1.5' | (2) RETAINER GLANDS (MJ) | #6s @ 6" O.C.      | 1           | #6s @ 6" O.C. | 1           |

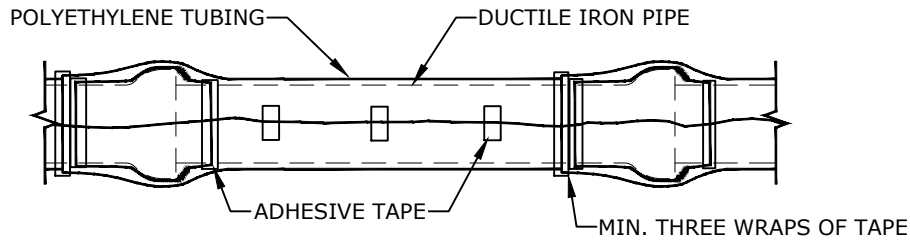
**NOTES:**

1. INSTALL STEEL CASING ON UTILITY MAIN WHERE INDICATED.
2. SPACERS SHALL BE CASCADE MODEL CCS AS MANUFACTURED BY CASCADE WATERWORKS MFG. CO. (OR APPROVED EQUAL).
3. END SEALS SHALL BE CASCADE MODEL CCES AS MANUFACTURED BY CASCADE WATERWORKS MFG. CO. (OR APPROVED EQUAL).
4. QUANTITY OF RUNNERS SHALL BE IN ACCORDANCE W/ CARRIER PIPE SIZES:  
UP TO 14"Ø: 4 RUNNERS  
16"Ø - 36"Ø: 6 RUNNERS
5. DIMENSIONS BETWEEN SPACERS SHALL BE NO MORE THAN 6'.
6. A SPACER SHALL BE PLACED WITHIN 2' OF THE END OF THE ENCASEMENT PIPE ON EACH END.
7. A MINIMUM OF 3 SPACERS SHALL BE USED PER FULL JOINT OF PIPE.
8. WHERE ENCASEMENTS ARE GREATER THAN 25 FEET IN LENGTH, SELF RESTRAINING GASKETS OR BELL RESTRAINTS SHALL BE USED FOR ALL JOINTS INSIDE THE ENCASEMENT PIPE AND FOR THE FIRST JOINT IN EACH DIRECTION OUTSIDE OF THE ENCASEMENT PIPE.
9. ALL ENCASEMENT PIPE SHALL BE NEW, SMOOTH WALL WELDED SHEET & HAVE A MINIMUM WALL THICKNESS PER THE ASSOCIATED ENCASEMENT CHART.
10. DIRECT BURY STEEL ENCASEMENT SHALL BE POLY WRAPPED.



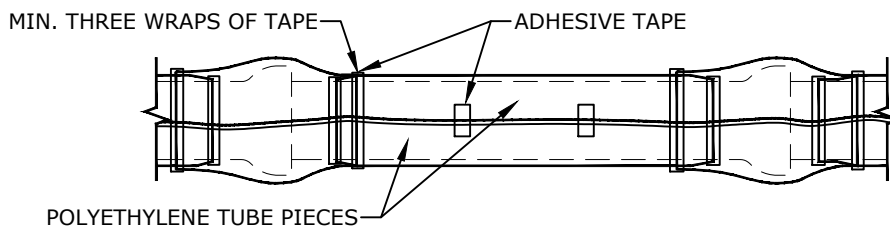
**CARRIER & CASING SIZES**

| CARRIER (ID)          | 2"   | 3"   | 4"   | 6"   | 8"   | 10"   | 12"   |
|-----------------------|------|------|------|------|------|-------|-------|
| CASING (ID)           | 5"   | 6"   | 8"   | 12"  | 16"  | 20"   | 24"   |
| CASING WALL THICKNESS | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.375 | 0.375 |



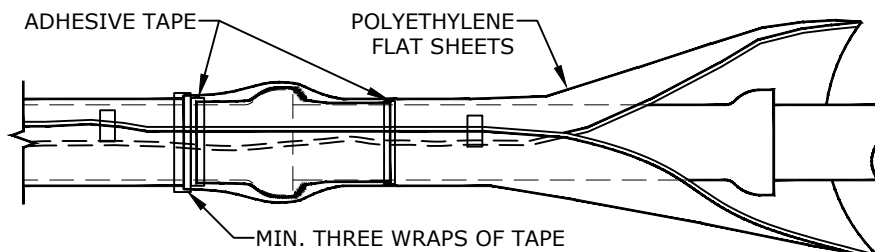
#### **METHOD 'A'**

METHOD 'A' USES ONE LENGTH OF POLYETHYLENE TUBE, OVERLAPPED AT THE JOINTS A MINIMUM OF 2 FEET.



#### **METHOD 'B'**

METHOD 'B' USES SEPARATE PIECES OF POLYETHYLENE TUBE FOR THE BARREL OF THE PIPE AND THE JOINTS. SHORT PIECES SHALL BE APPROXIMATELY 6' LONG AND OVERLAP BARREL SECTION BY A MINIMUM OF 2 FEET.



#### **METHOD 'C'**

METHOD 'C' - USED FOR PIPE-SHAPED AND ODD-SHAPED APPURTENANCES SUCH AS BENDS, REDUCERS, OFFSETS, VALVES, TEES, ETC.

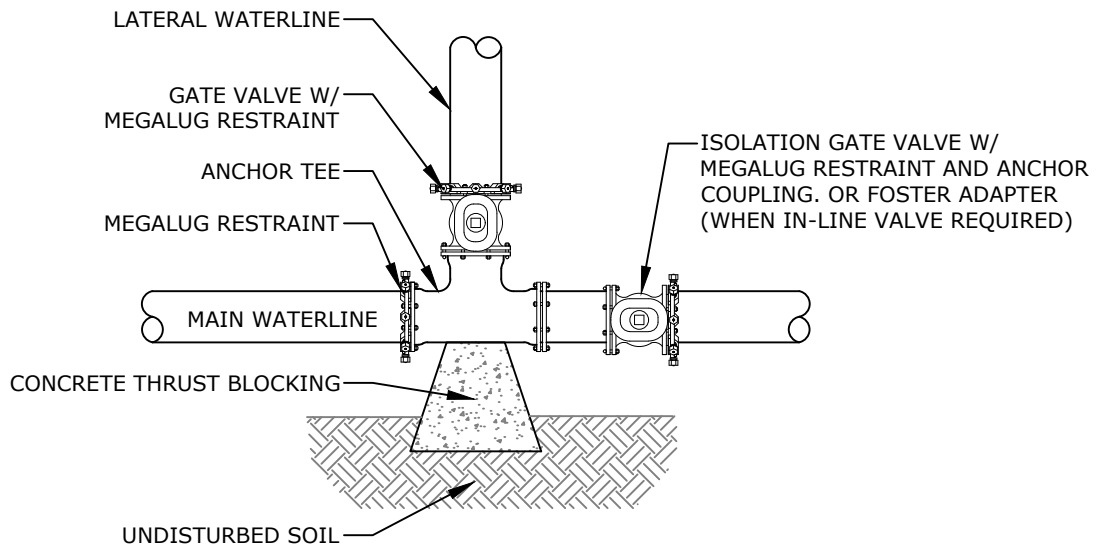
#### **NOTES:**

1. ALL DUCTILE IRON PIPE AND FITTINGS SHALL BE DOUBLE POLY WRAPPED.
2. THE ANSI/AWWA C105/A21.5 STANDARD OUTLINES THREE (3) METHODS OF INSTALLING POLYETHYLENE ENCASEMENT/SLEEVEING.

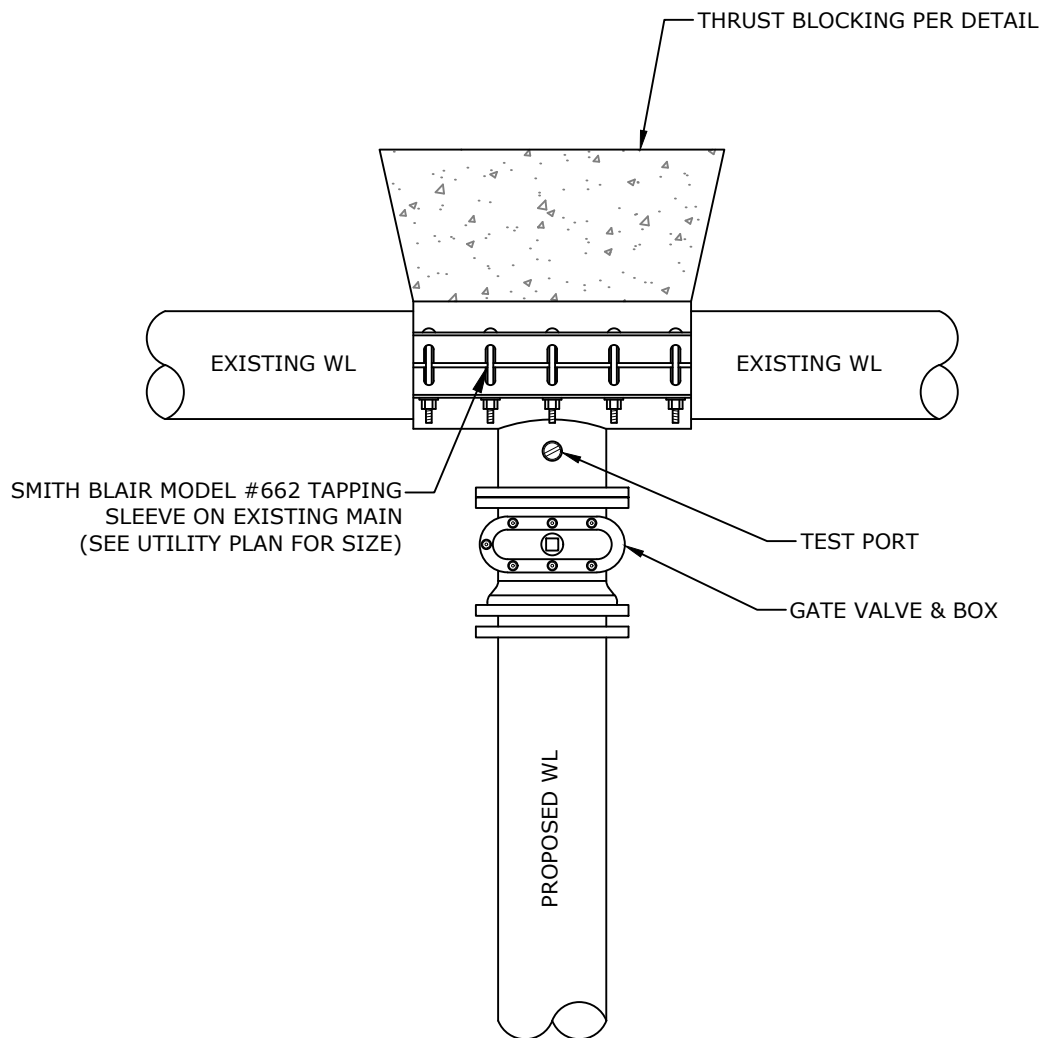


NOTES:

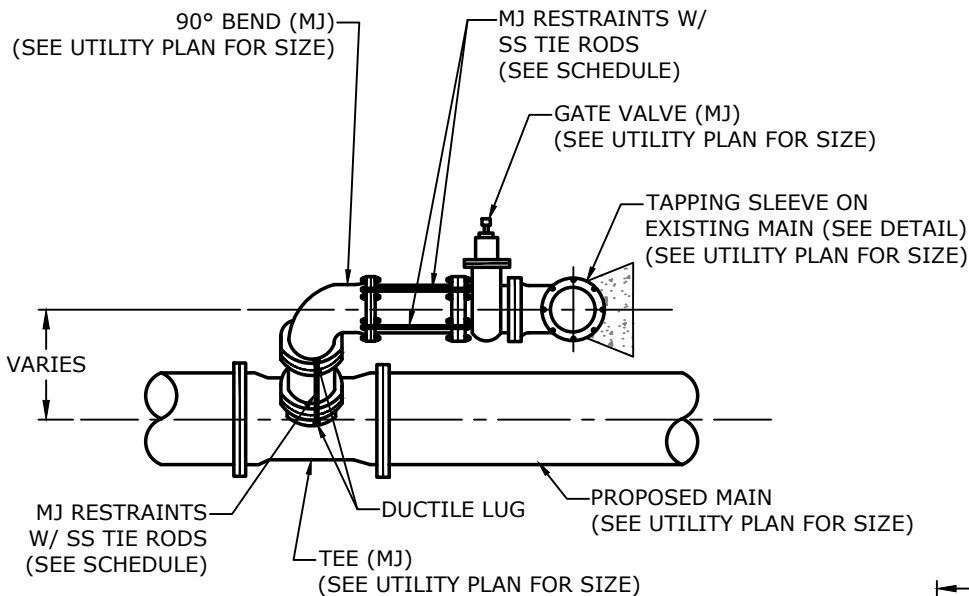
1. ALL JOINTS FROM MAIN TO LATERAL SHALL BE RESTRAINED.
2. ALL VALVES SHALL BE SET IN TRUE PLUMB POSITION.
3. IF TOP OF VALVE NUT IS GREATER THAN 36" IN DEPTH, A VALVE NUT EXTENSION SHALL BE REQUIRED.



LATERAL CONNECTION TO MAIN

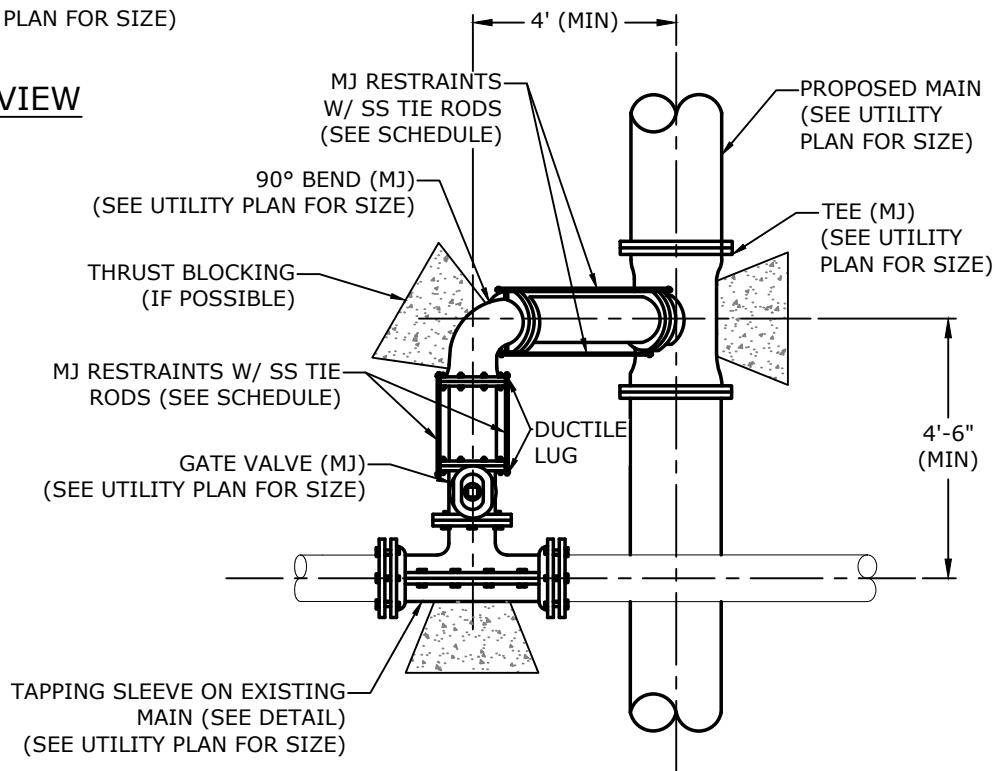


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ELEVATION VIEW

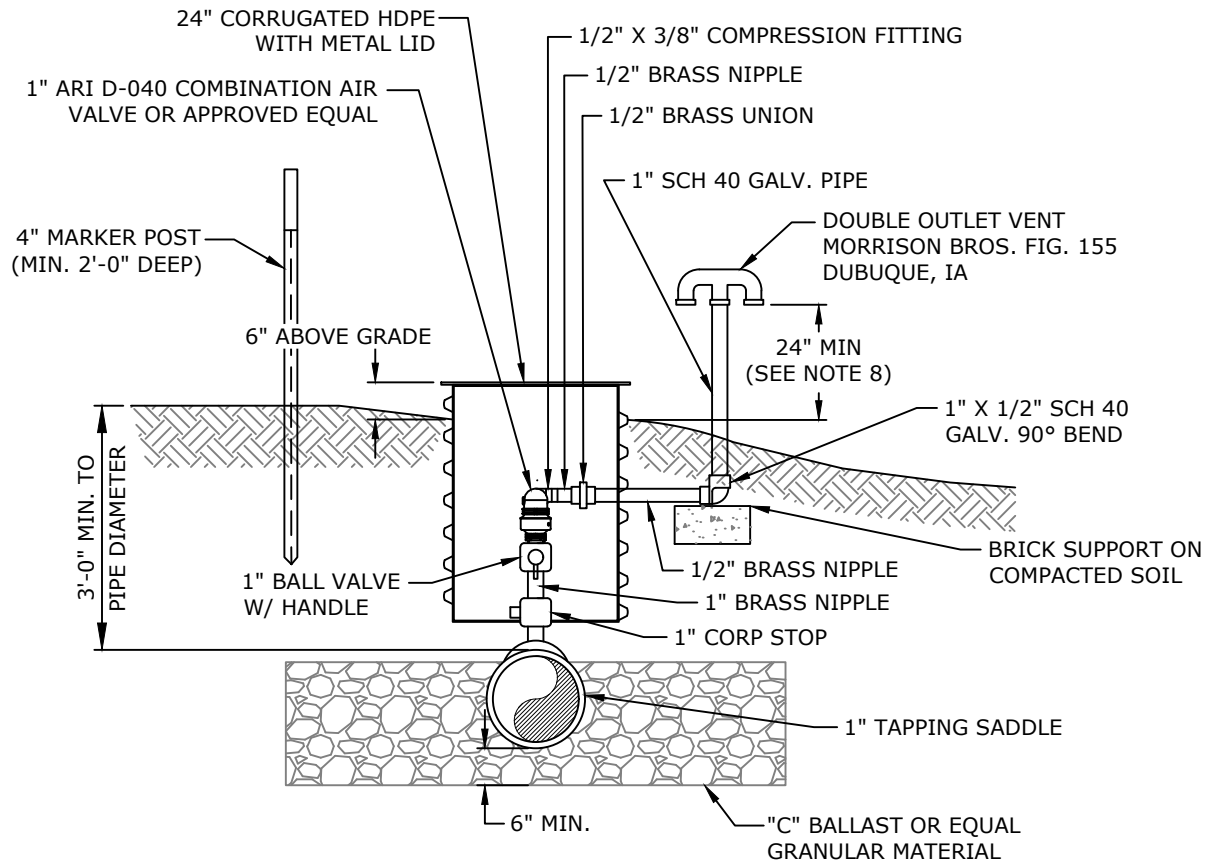
| TIE ROD SCHEDULE |                        |                                   |
|------------------|------------------------|-----------------------------------|
| SIZE             | # OF RODS<br>/ FITTING | Ø OF RODS<br>(STAINLESS<br>STEEL) |
| 4"-12"           | 4                      | 3/4"                              |



PLAN VIEW

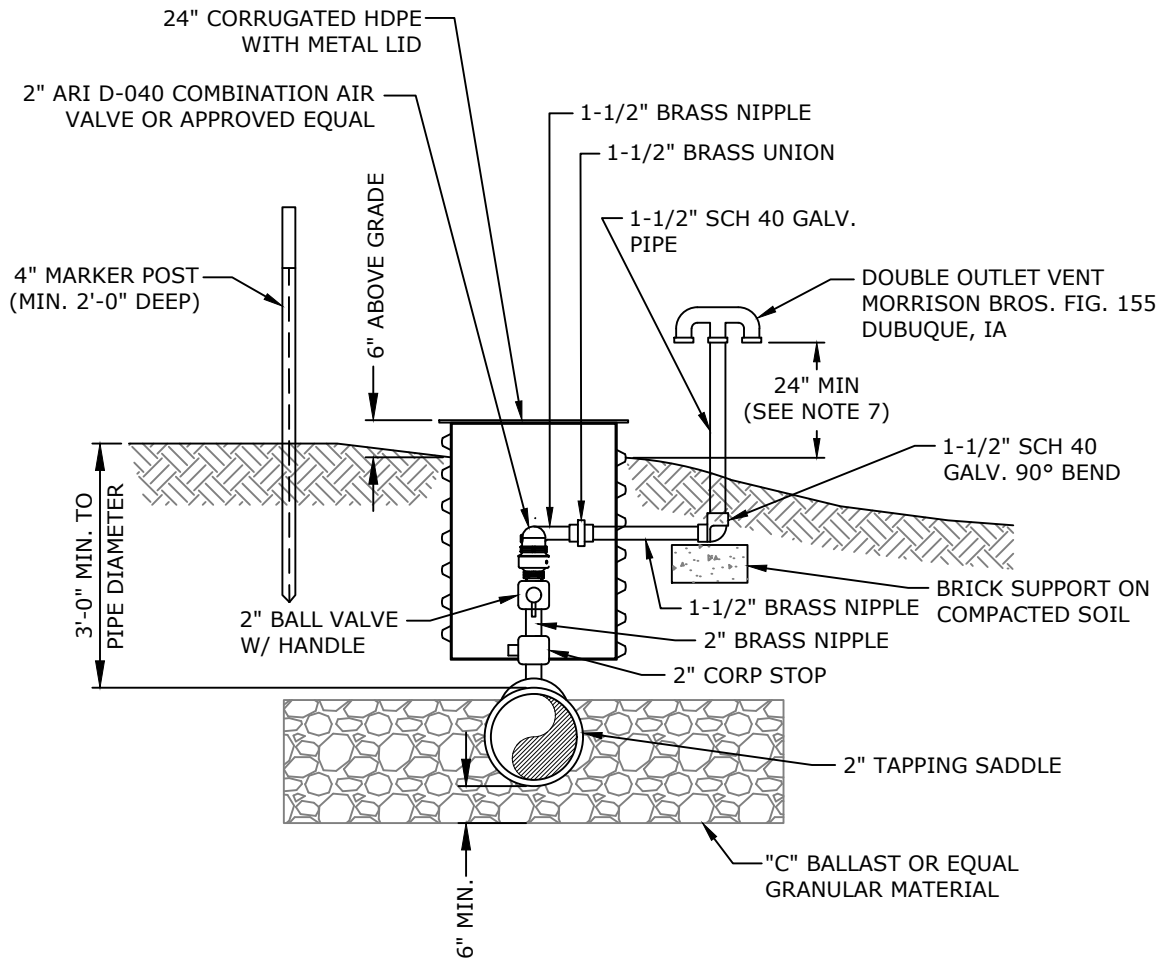
NOTES:

1. CONTRACTOR SHALL LOCATE EXISTING UTILITY MAIN PRIOR TO THE START OF CONSTRUCTION OF SWING CONNECTION.
2. DIMENSIONS SHOWN ARE THE MINIMUM NECESSARY TO PROVIDE ROOM FOR TIGHTENING BOLTS ON JOINTS.
3. PROVIDE ALL THREAD STAINLESS STEEL TIE RODS W/ DUCTILE LUGS FOR ANCHORING ALL JOINTS.
4. ROTATE TEE UP & ELBOW DOWN AS REQUIRED TO MATCH.
5. NEW UTILITY LINE SHALL HAVE TRACER WIRE INSTALLED PER DETAIL.
6. ALL FITTINGS, VALVES, AND DIP SHALL BE POLY WRAPPED



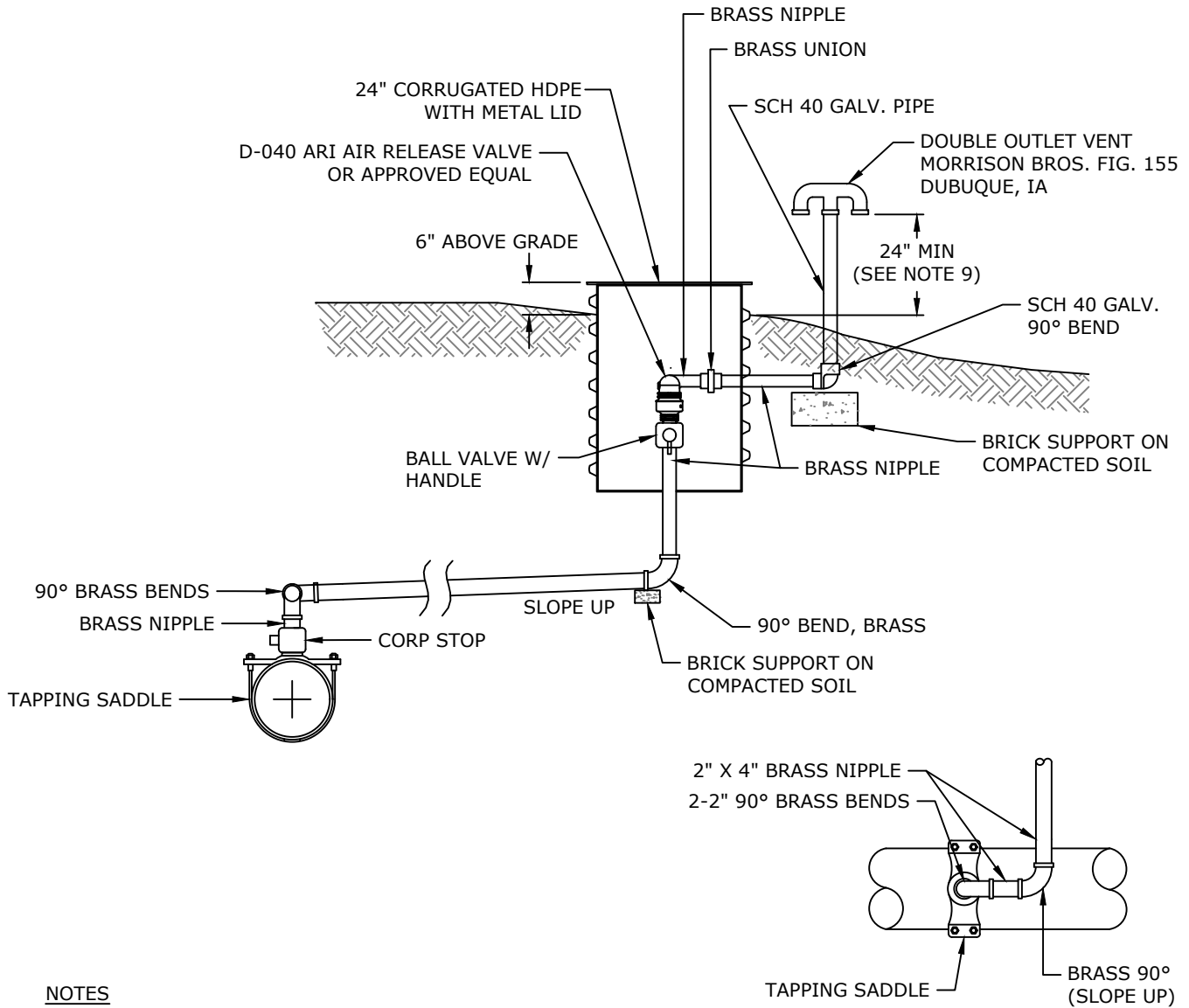
#### NOTES

1. AIR VALVES SHALL BE PIPED TO A POINT BEYOND PAVEMENT.
2. AIR VALVES SHALL HAVE NPT INLET AND OUTLETS.
3. TOP OF AIR VALVE SHALL BE MIN. 12" BELOW GROUND.
4. ALL THREADED CONNECTIONS SHALL HAVE A DOUBLE WRAP OF TEFLON TAPE, TEFLON TAPE, OR RECTORSEAL ON THREADS.
5. SEAL PIPE WALL PENETRATIONS WITH BUTYL SEALANT.
6. 1" CORP STOP SHALL BE McDONALD PART #74701B-22
7. SERVICE SADDLE SHALL BE McDONALD PART #3891 (VERIFY SIZE PRIOR TO INSTALLATION)
8. AIR RELEASE DISCHARGE SHALL TERMINATE A MINIMUM OF 24" ABOVE GRADE OR FLOOD LEVEL, WHICHEVER IS HIGHER. THE OPEN END OF THE DISCHARGE SHALL BE PROVIDED WITH #24 MESH SCREEN DOWNWARD FACING OPENINGS, OR EQUIPPED WITH AN INFLOW PREVENTER CONFORMING TO AWWA C514.



#### NOTES

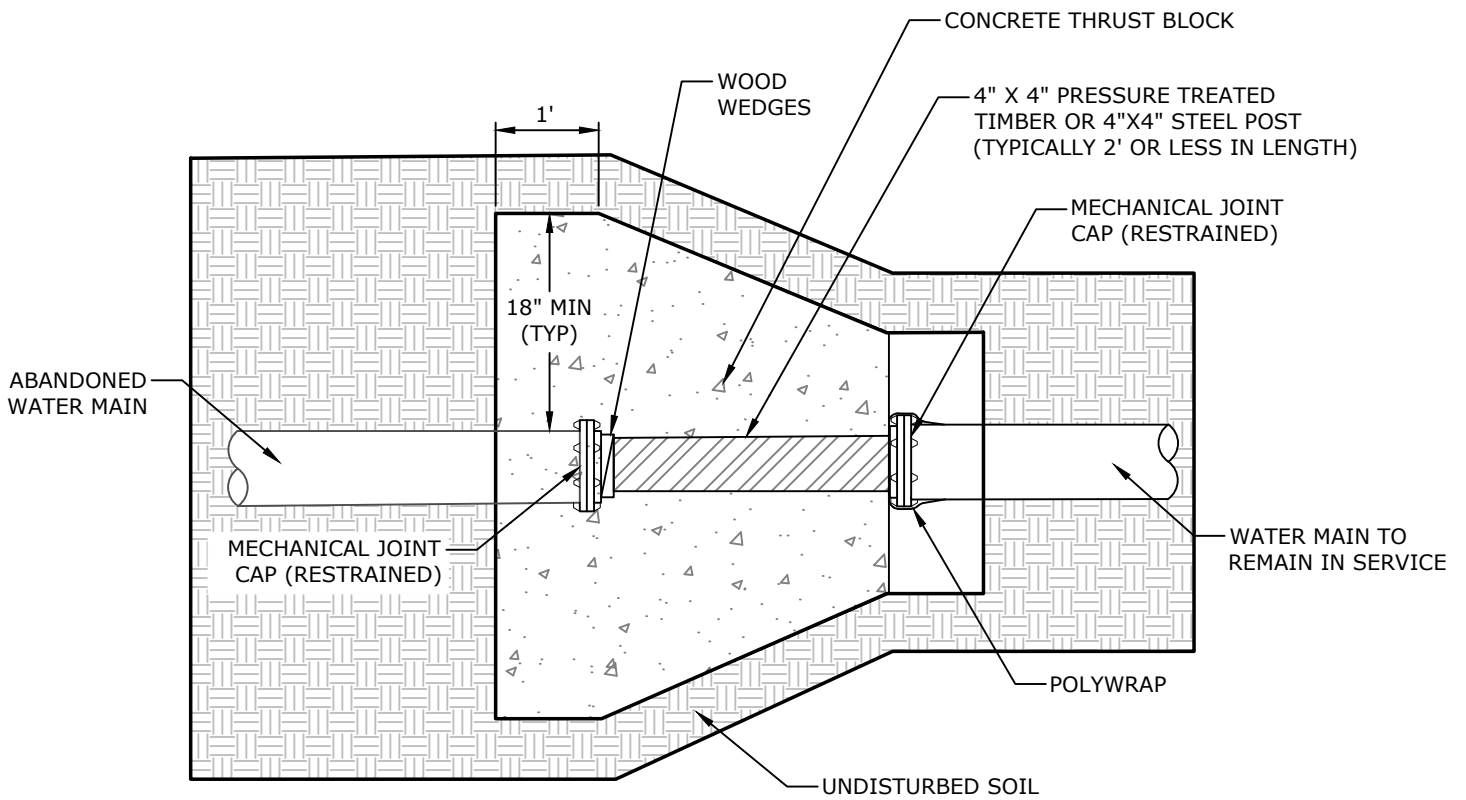
1. AIR VALVES SHALL BE PIPED TO A POINT BEYOND PAVEMENT.
2. AIR VALVES SHALL HAVE NPT INLET AND OUTLETS.
3. TOP OF AIR VALVE SHALL BE MIN. 12" BELOW GROUND.
4. ALL THREADED CONNECTIONS SHALL HAVE A DOUBLE WRAP OF TEFLON TAPE, TEFLON TAPE, OR RECTORSEAL ON THREADS.
5. SEAL PIPE WALL PENETRATIONS WITH BUTYL SEALANT.
6. 2" CORP STOP SHALL BE MCDONALD PART #73122B-2
7. AIR RELEASE DISCHARGE SHALL TERMINATE A MINIMUM OF 24" ABOVE GRADE OR FLOOD LEVEL, WHICHEVER IS HIGHER. THE OPEN END OF THE DISCHARGE SHALL BE PROVIDED WITH #24 MESH SCREEN DOWNWARD FACING OPENINGS, OR EQUIPPED WITH AN INFLOW PREVENTER CONFORMING TO AWWA C514.



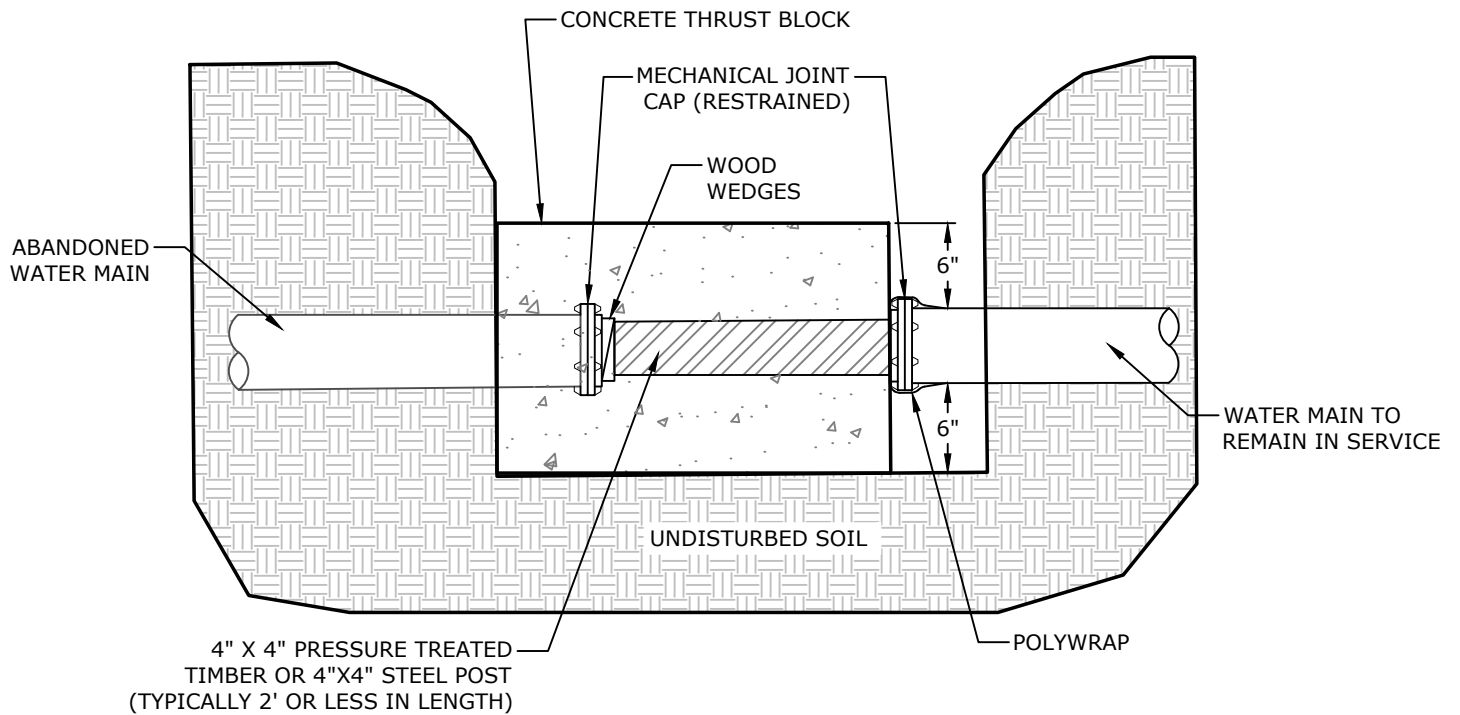
#### NOTES

1. AIR VALVES SHALL BE PIPED TO A POINT BEYOND PAVEMENT.
2. ALL PIPE SHALL SLOPE CONTINUOUSLY UPWARD FROM MAIN TO AIR VALVE.
3. PIPE BETWEEN 2" I.B. VALVE AND AIR VALVE SHALL BE 2" TYPE "K" COPPER. SWEAT ON ALL FITTINGS, ADAPTERS, ELLS, COUPLINGS, ETC. WITH 95-5 SOLDER.
4. AIR VALVES SHALL HAVE NPT INLET AND OUTLETS.
5. TOP OF AIR VALVE SHALL BE MIN. 12" BELOW GROUND.
6. ALL THREADED CONNECTIONS SHALL HAVE A DOUBLE WRAP OF TEFLON TAPE, TEFLON TAPE, OR RECTORSEAL ON THREADS
7. SEAL PIPE WALL PENETRATIONS WITH BUTYL SEALANT.
8. 2" CORP STOP SHALL BE McDONALD PART #73122B-2
9. AIR RELEASE DISCHARGE SHALL TERMINATE A MINIMUM OF 24" ABOVE GRADE OR FLOOD LEVEL, WHICHEVER IS HIGHER. THE OPEN END OF THE DISCHARGE SHALL BE PROVIDED WITH #24 MESH SCREEN DOWNWARD FACING OPENINGS, OR EQUIPPED WITH AN INFLOW PREVENTER CONFORMING TO AWWA C514.

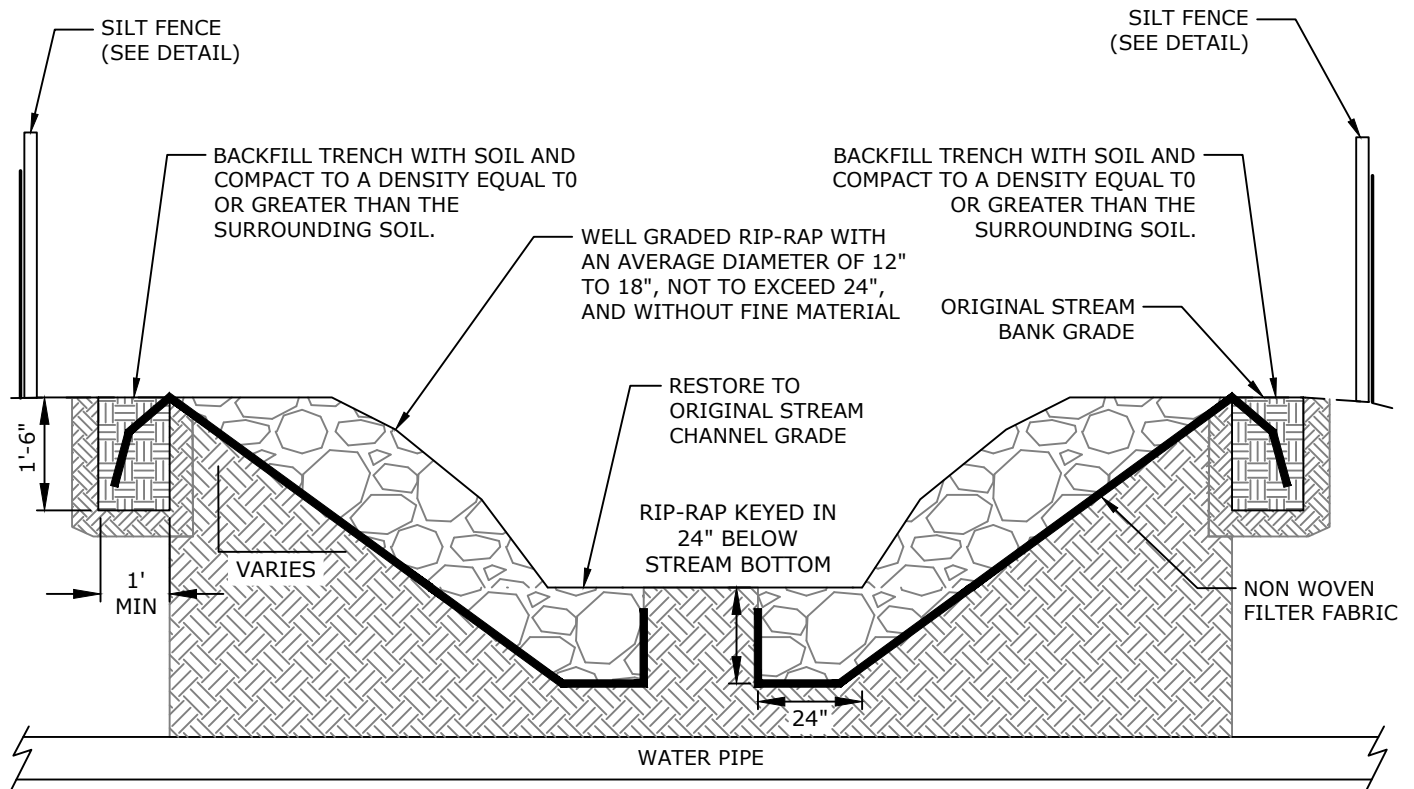
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PLAN VIEW



ELEVATION VIEW



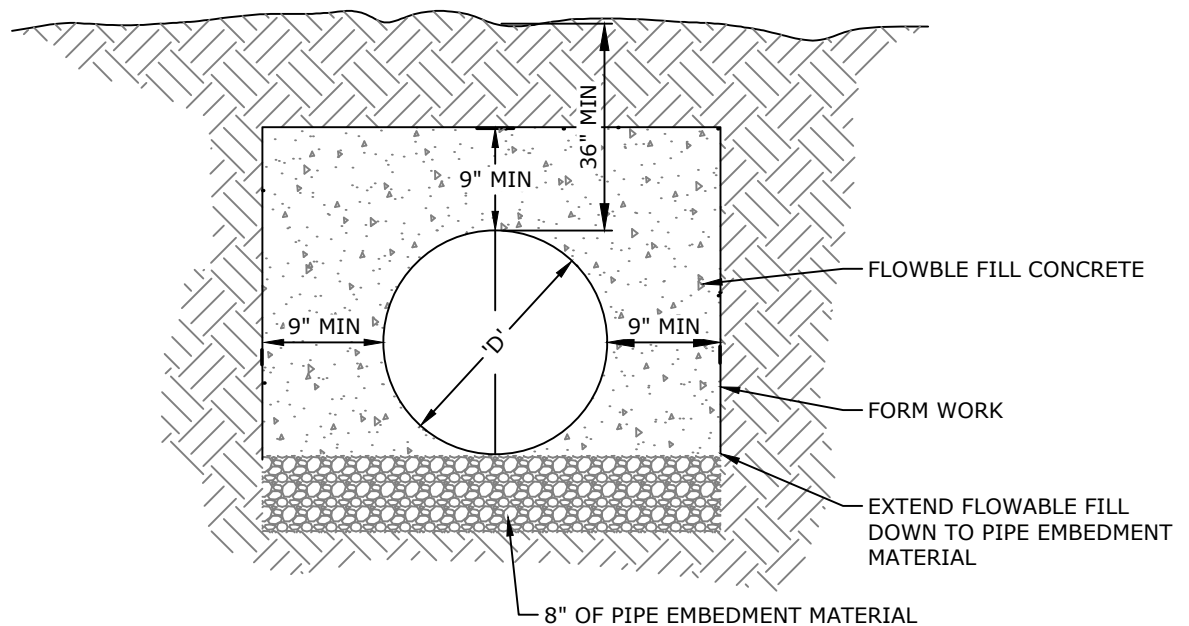
**NOTES:**

1. ALL DISTURBED STREAMBANKS SHALL BE STABILIZED AS SHOWN AND RESTORED TO PRE-CONSTRUCTION GRADES.
2. FILTER BLANKET AND RIP-RAP FOR BANK STABILIZATION SHALL BE IN ACCORDANCE WITH ARDOT STANDARD SPECIFICATION SECTION 816 (2014 EDITION)
3. FULL DEPTH FLOWABLE FILL BACKFILL FROM TOP OF BANK TO TOP OF BANK MAY BE USED IN LIEU OF USING NATIVE BACKFILL WITH BANK STABILIZATION.
4. MINIMUM WIDTH OF RESTORATION SHALL BE 12 FEET.



**NOTES:**

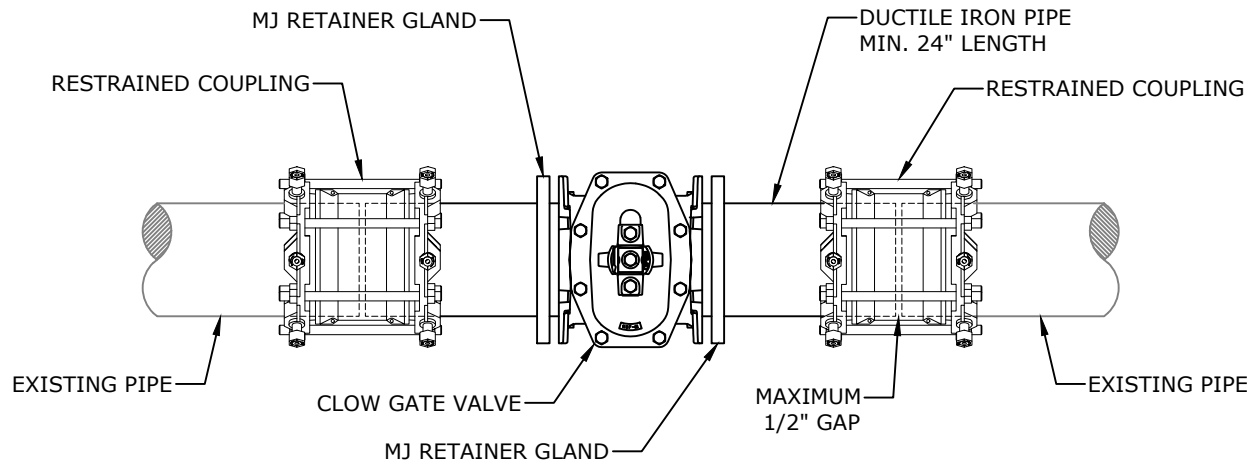
1. PREVENT BONDING OF CONCRETE TO PIPE BELLS WITH POLYWRAP.
2. FLOWABLE FILL TO HAVE COMPRESSION STRENGTH OF MAX 200 PSI.
3. PIPE SHALL BE ANCHORED DURING INSTALLATION OF FLOWABLE FILL AS NECESSARY TO PREVENT FLOATATION.
4. FOR STREAM CROSSINGS, FLOWABLE FILL SHALL BE FULL DEPTH FROM PIPE BEDDING TO EXISTING STREAM GRADE AND EXTEND FROM TOP BANK TO TOP BANK.
5. CONTRACTOR TO COORDINATE WITH THE OWNER FOR TRACER WIRE LOCATION.



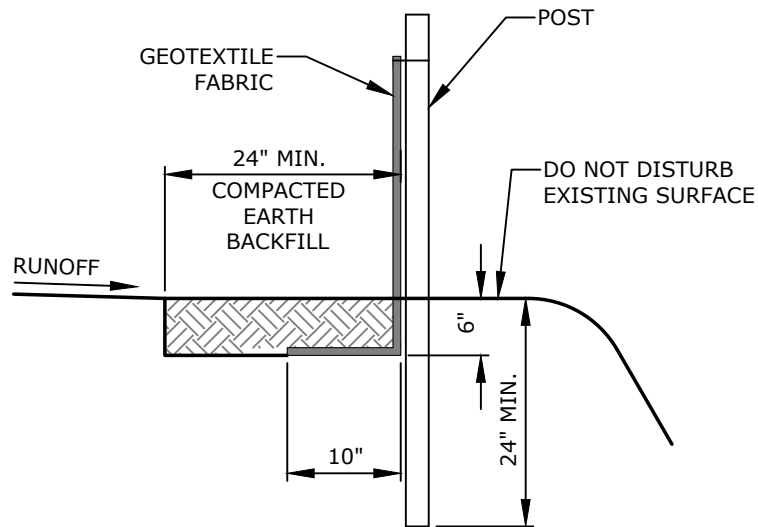
**APPROVED FOR USE WITH METAL PIPE ONLY**

NOTES:

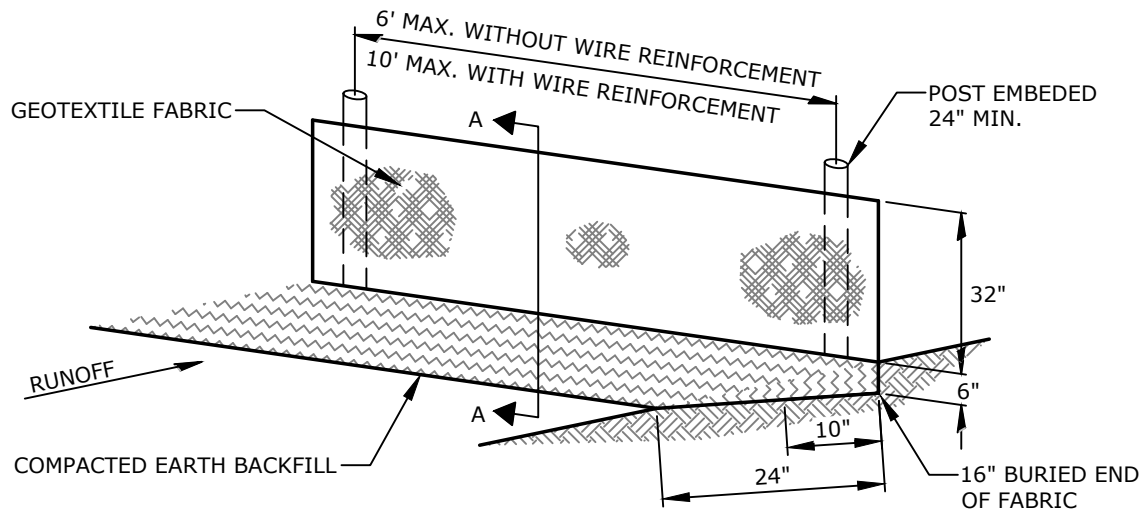
1. ALL VALVES SHALL BE SECURELY ANCHORED.
2. ALL HARDWARE SHALL BE 316 STAINLESS STEEL.
3. IF DEPTH OF BURY EXCEEDS 4 FT., A VALVE STEM EXTENSION NUT SHALL BE REQUIRED. THE VALVE STEM EXTENSION NUT SHALL BE WITHIN 12" TO 24" OF THE FINISHED SURFACE



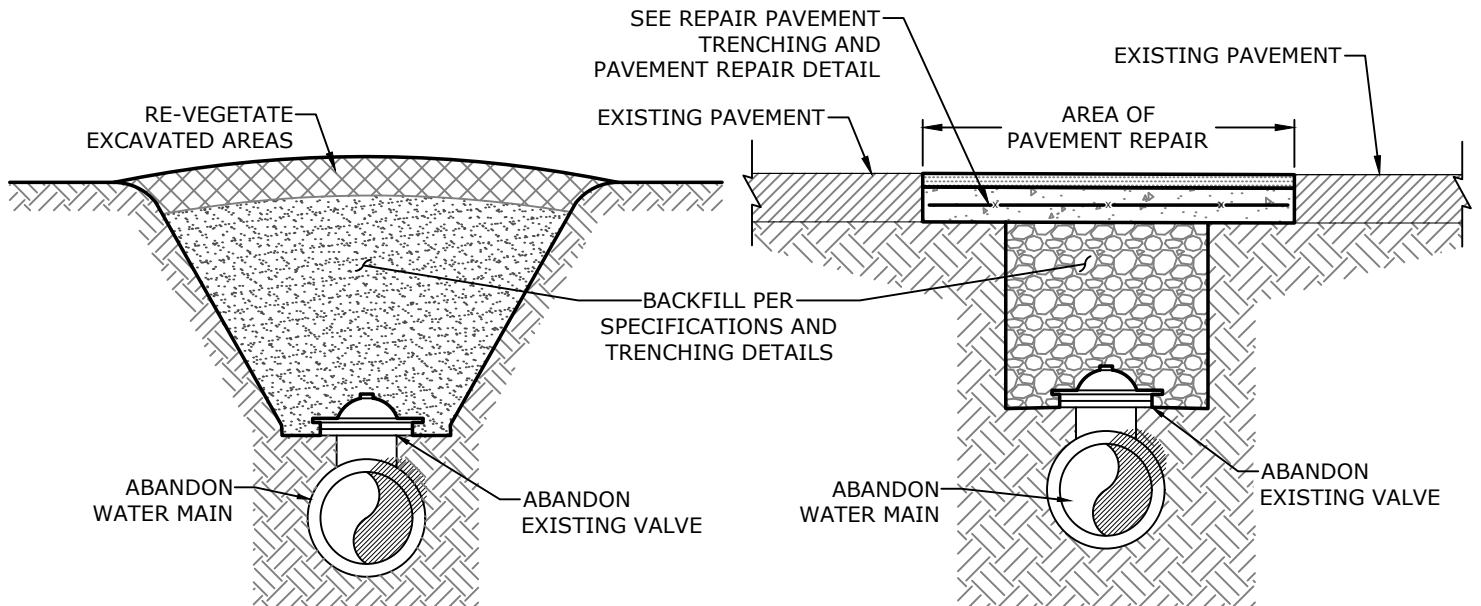
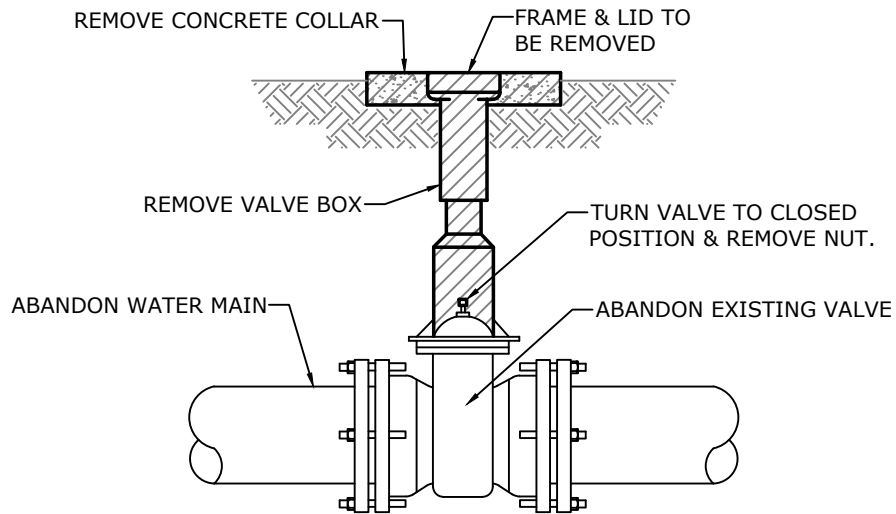
VALVE CUT-IN



SECTION A-A  
NTS



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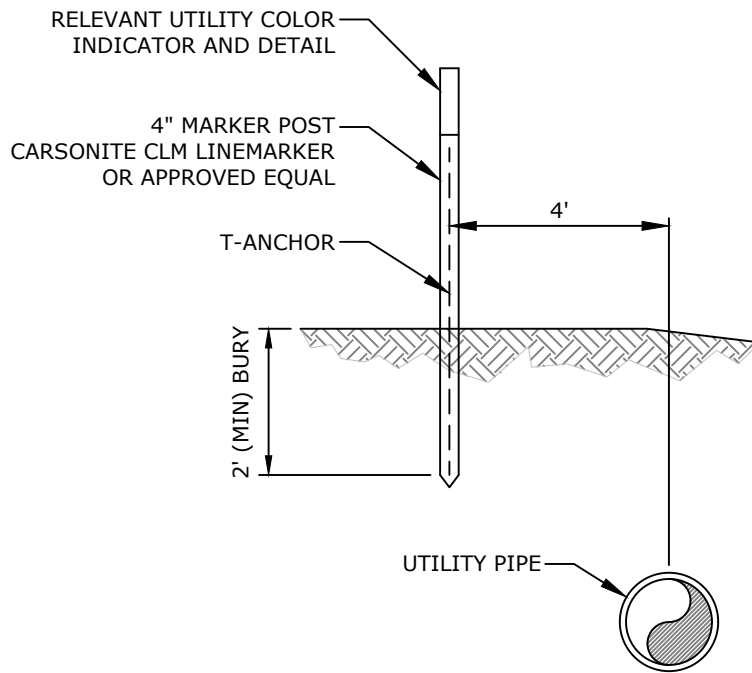
TRENCH AFTER VALVE BOX REMOVED  
NON-PAVED AREA

NTS

TRENCH AFTER VALVE BOX REMOVED  
UNDER ASPHALT

NTS

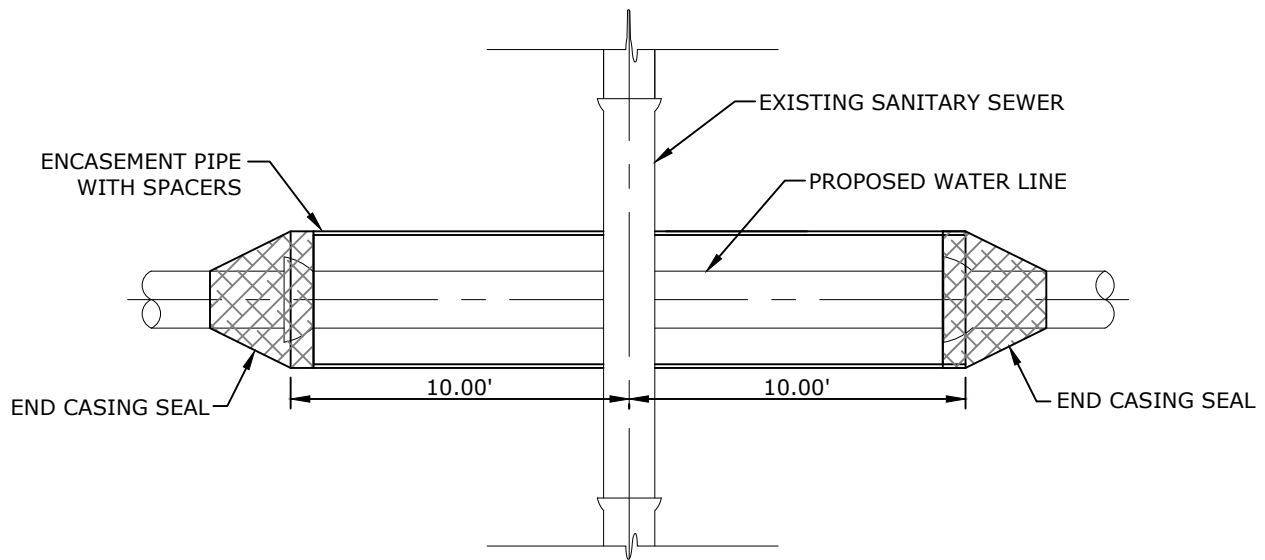
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**NOTES:**

1. CARSONITE CLM LINE MARKER OR APPROVED EQUAL MUST BE USED TO MARK ALL UTILITY LINES.
2. SPACING TO BE APPROVED BY OWNER.

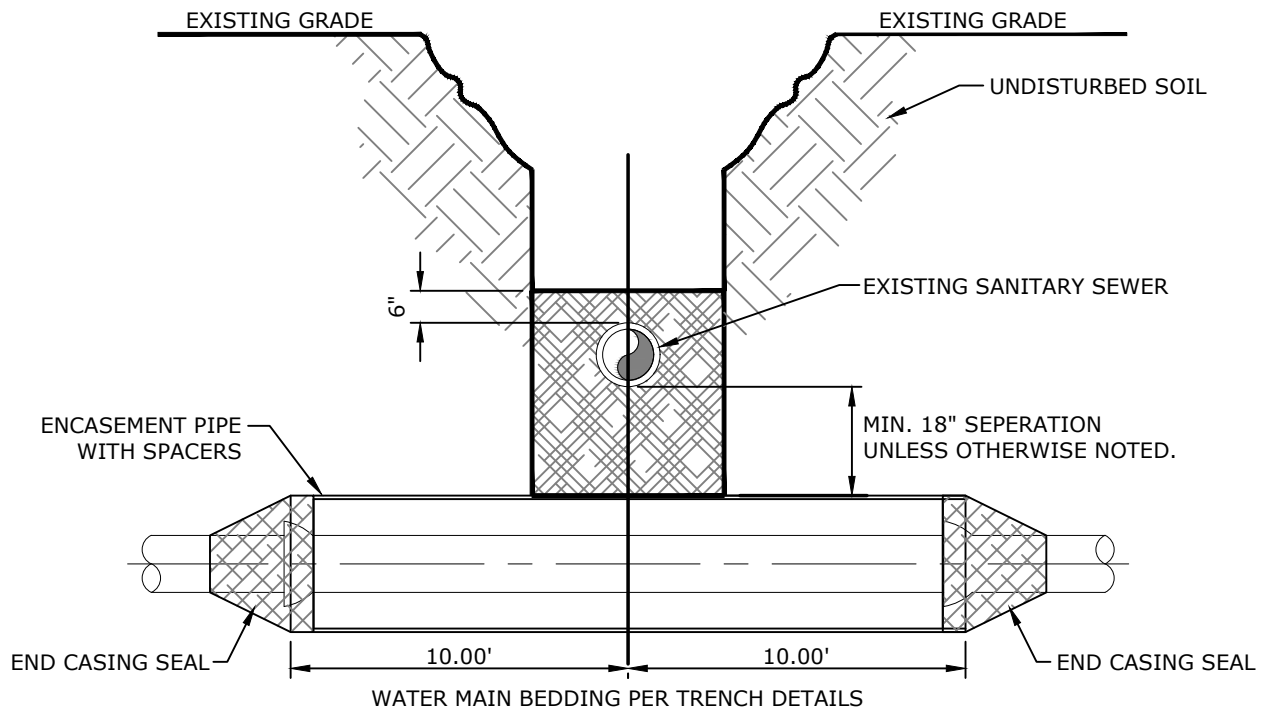
**UTILITY LINE MARKER**



**PLAN VIEW**

**NOTE:**

1. AT SEWER MAIN CROSSING, INSTALL WATER MAIN ABOVE SEWER MAIN AND PROVIDE MINIMUM OF 18" OF SEPARATION BETWEEN THE WATER MAIN AND SEWER MAIN.
2. IF A WATER MAIN MUST UNAVOIDABLY PASS BENEATH A SEWER MAIN, AT LEAST 18" OF SEPARATION MUST BE MAINTAINED BETWEEN THE TWO PIPES AND THE WATER MAIN SHALL BE ENCASED WITH 20' OF ENCASEMENT PIPE CENTERED UNDER THE SEWER MAIN.
3. IF A WATER MAIN IS LOCATED ABOVE A SEWER MAIN BUT THERE IS LESS THAN 18" OF SEPARATION, THE WATER MAIN SHALL BE ENCASED WITH 20' ENCASEMENT PIPE CENTERED OVER THE SEWER MAIN.
4. EXCEPTIONS TO THESE CONDITIONS MUST BE APPROVED IN WRITING BY THE ARKANSAS DEPARTMENT OF HEALTH.
5. ENCASEMENT PIPE MATERIAL SHALL BE APPROVED BY OWNER.

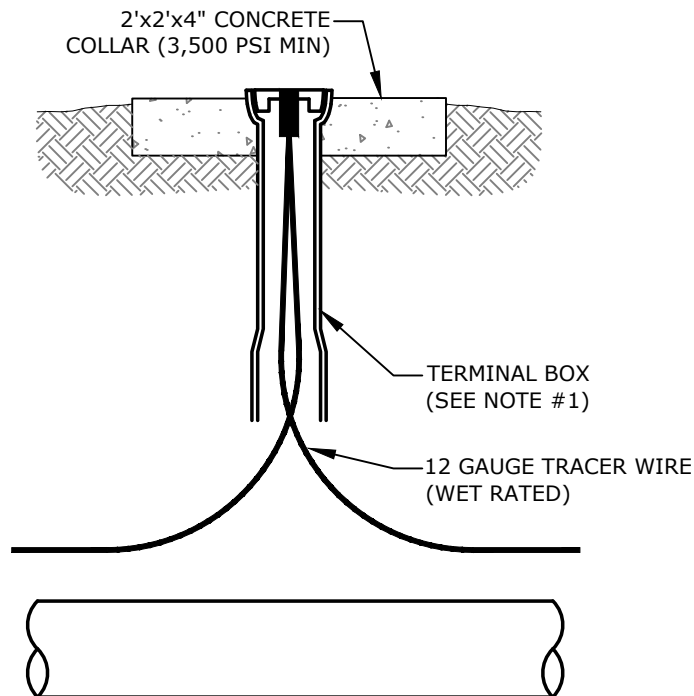


**ELEVATION VIEW**

N.T.S.

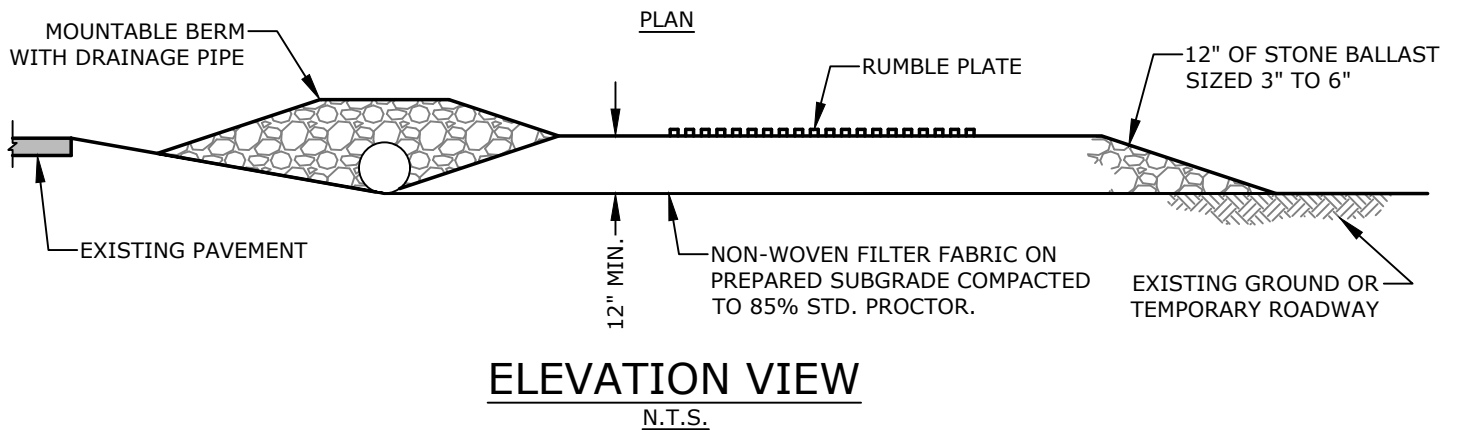
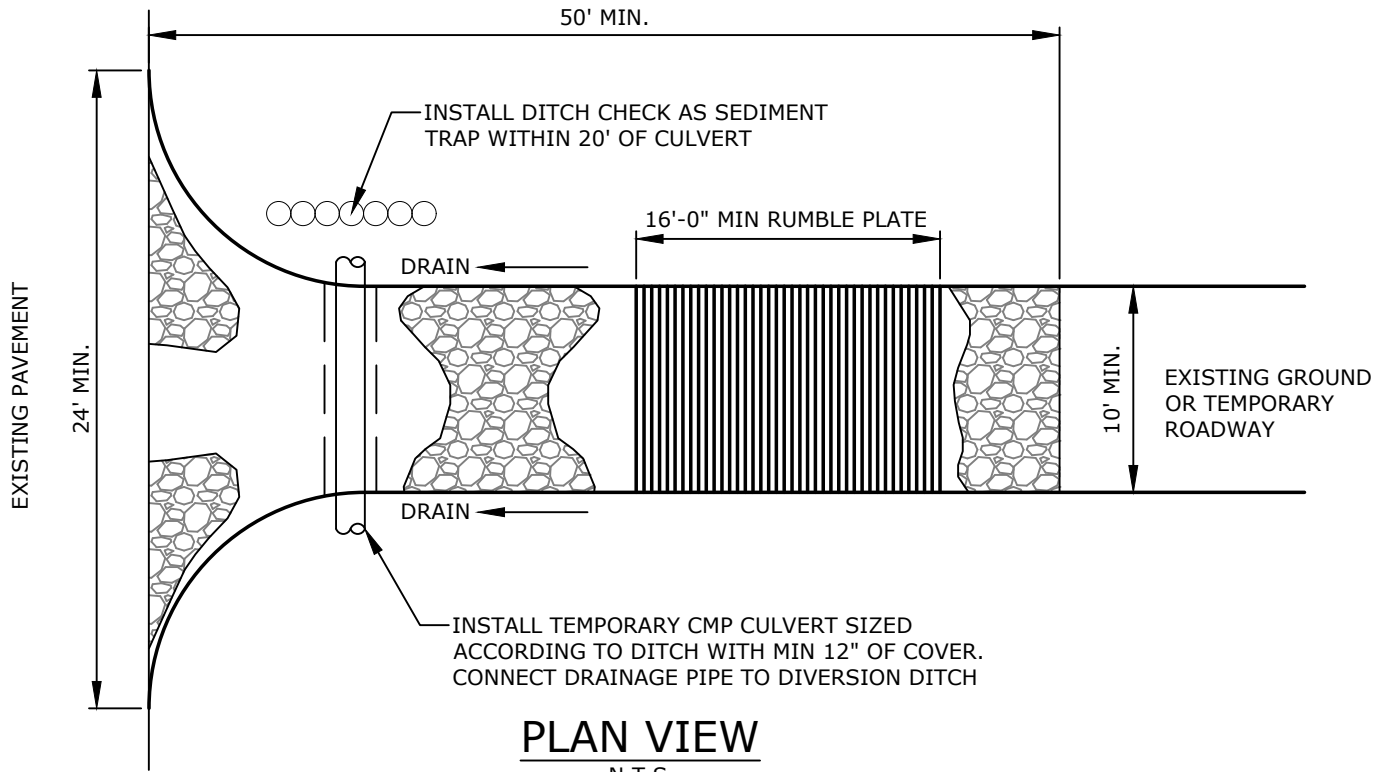
NOTES:

1. TERMINAL BOXES TO BE EAST JORDAN IRON WORKS 8550 SERIES (OR APPROVED EQUAL); EXTENSIONS TO BE PROVIDED WHERE REQUIRED.
2. TERMINAL BOXES SHALL BE LOCATED AT APPROXIMATELY 500' INTERVALS (OR AT LOCATIONS DETERMINED BY THE ENGINEER) AND AT EACH END OF THE PIPING INSTALLATION. A CONCRETE COLLAR SHALL BE PLACED ON EACH TERMINAL BOX LOCATED OUTSIDE OF PAVEMENT SURFACES OR SIDEWALKS.
3. CONTRACTOR SHALL PROVIDE AN INSTRUMENT AND DEMONSTRATE THE ELECTRICAL CONTINUITY OF ALL TRACER WIRES PRIOR TO THE FINAL ACCEPTANCE BY THE OWNER.
4. TRACER WIRE SHALL BE INSTALLED IN THE LOCATION DIRECTED BY THE ENGINEER, BUT SHALL GENERALLY BE LOCATED IMMEDIATELY ADJACENT TO THE PIPE AND AT THE SAME DEPTH. TRACER WIRE SHALL ALSO BE INSTALLED ON SERVICE LINES BETWEEN THE WATER LINE(S) AND WATER METER(S). TRADER WIRE SHALL EXTEND AT LEAST 1' INTO THE METER BOX(S).
5. WIRE SHALL BE SPLICED USING 3M DIRECT BURY SPLICE KIT DBR / Y-6 (OR APPROVED EQUAL).



TRACER WIRE & TERMINAL

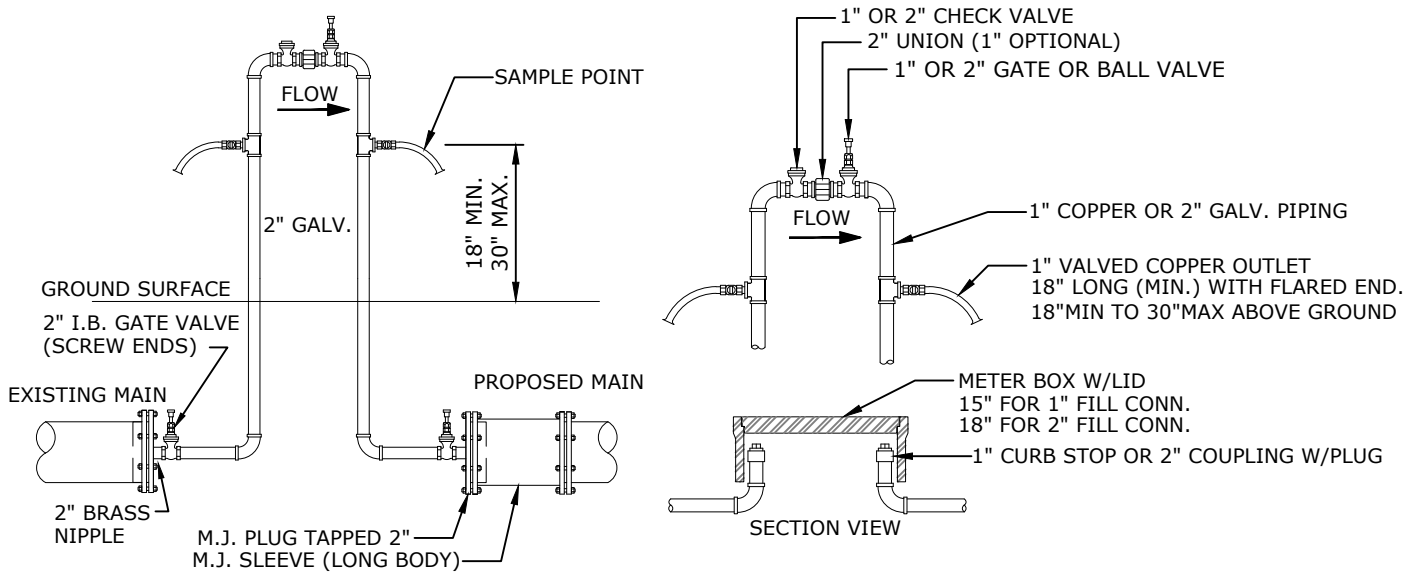
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# NOTES:

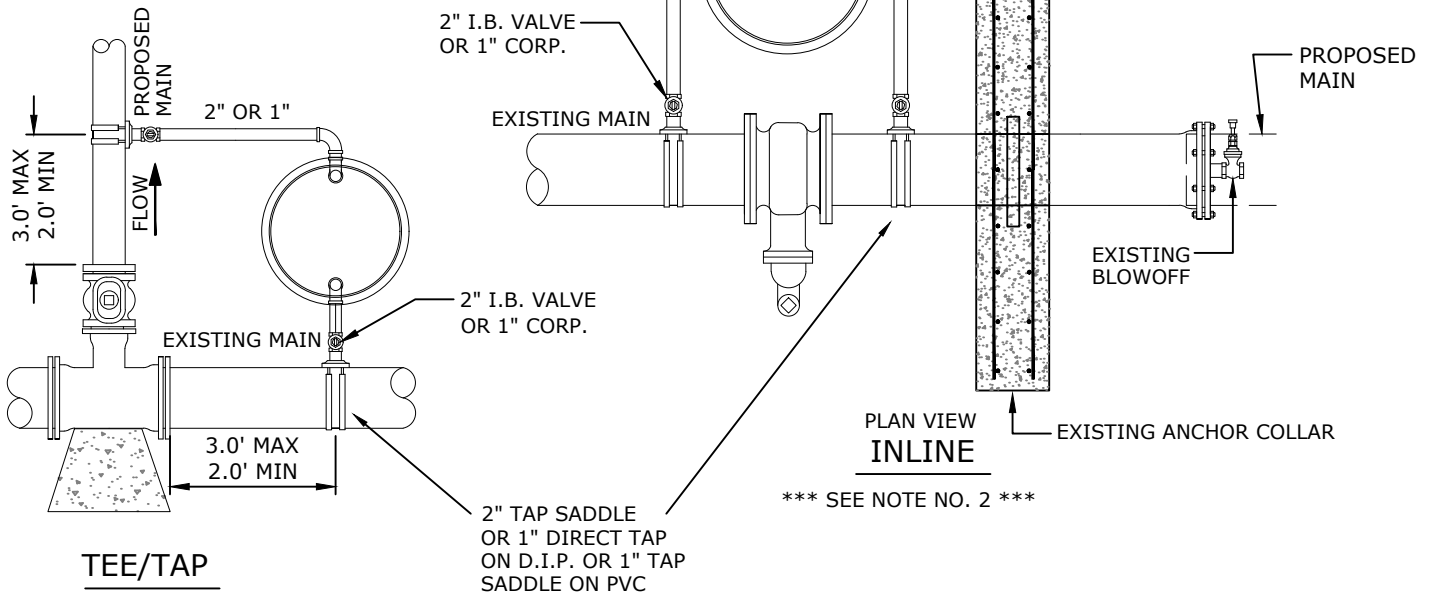
- 2-INCH FILL CONNECTIONS ARE REQUIRED ON ALL MAINS, 12-INCH'S AND LARGER, OR AS DIRECTED BY WOOSTER WATER SYSTEM. 1-INCH FILL CONNECTIONS SHALL BE USED ON ALL MAINS SMALLER THAN 12-INCH'S EXCEPT FOR MAINS WITH TEMPORARY END TO END CONNECTIONS OR AS SPECIFIED.
- FULL SIZE CONNECTIONS WILL BE ALLOWED ONLY WITH WRITTEN APPROVAL OF WOOSTER WATER SYSTEM. THESE CONNECTIONS SHALL HAVE A VALVE BOX TO ACCEPT "TYLER 7-1/2", LOCKING LID. VALVES SHALL BE OPERATED BY WOOSTER WATER SYSTEM PERSONNEL ONLY. ALL OTHER CONNECTIONS TO EXISTING FACILITIES SHALL CONTAIN A CHECK VALVE.
- 2" BLOWOFFS ARE REQUIRED ON ALL MAINS 6" AND LARGER.
- AFTER APPROVAL OF SAMPLES, CLOSE CURB STOPS AND REMOVE FILL ASSEMBLY. FOR 2" PERMANENT CONNECTIONS, CLOSE 2" VALVES, REMOVE FILL ASSEMBLY AND PLUG COUPLINGS. TEMPORARY CONNECTIONS, SHALL HAVE ALL PIPING REMOVED AT MAIN CONNECTION POINTS, AND 2" VALVES PLUGGED.
- 2" VALVES ON MAIN LINES SHALL BE I. B. (R.S.) WITH THREADED ENDS; OPEN LEFT. 2" NIPPLES SHALL BE BRASS.
- 1" VALVES ON MAIN LINES SHALL BE BRASS CORPORATION STOPS.
- ALL 1" TAPS WILL BE BY DIRECT TAP METHOD, UNLESS PREVIOUSLY APPROVED BY WOOSTER WATER SYSTEM. EXCEPTIONS MAY BE: PRESSURE CLASS D.I., C-900, AND SDR17 PVC, WHERE THE USE OF SADDLES MAY BE PERMITTED.
- 1" CORP STOP SHALL BE MCDONALD PART #74701B-22.



## TEMPORARY (END TO END)

(NO METER BOX REQUIRED)

\*\*\* SEE NOTE NO. 1 \*\*\*



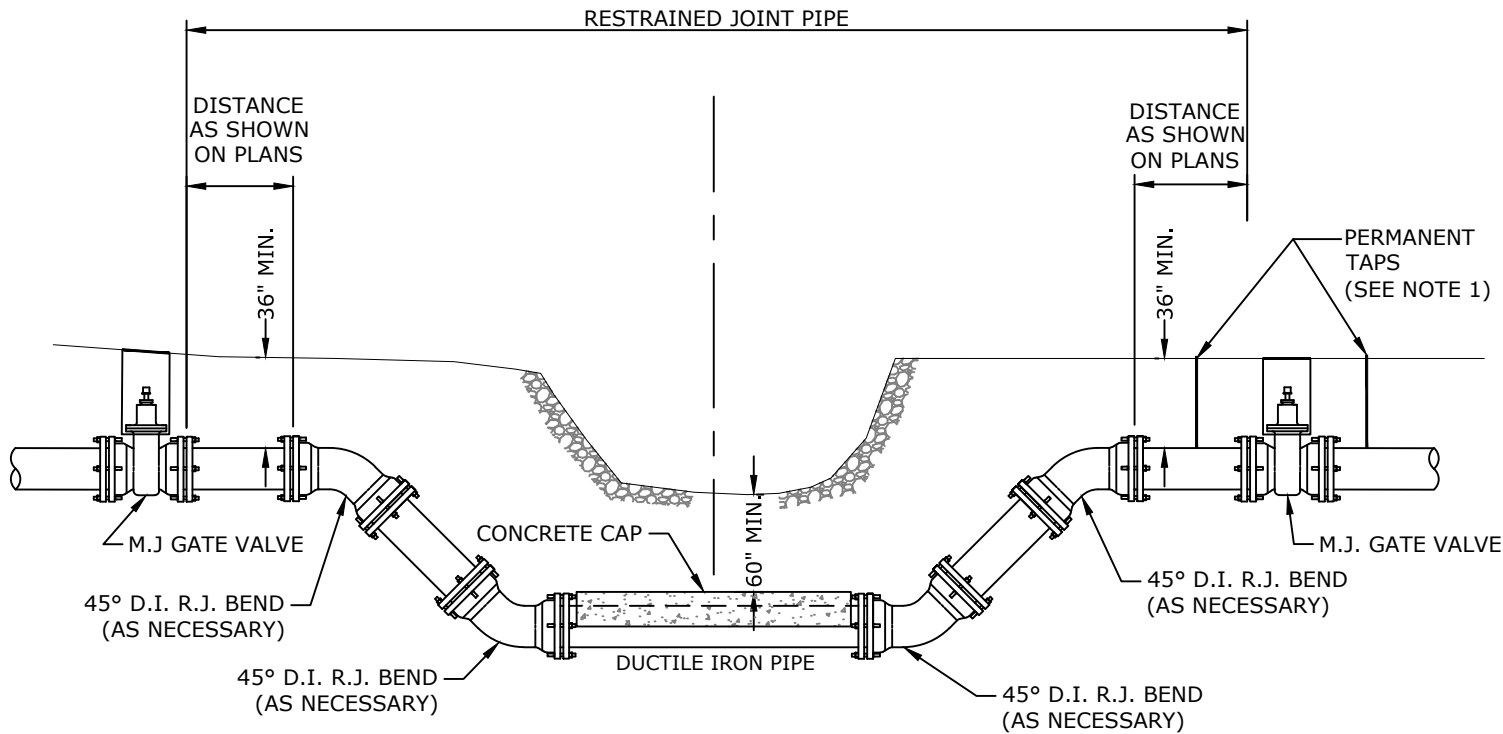
## TEE/TAP

\*\*\* SEE NOTE NO. 2 \*\*\*

NOTE: EX. VALVE & PIPE  
MUST BE HYDROSTATICALLY TESTED PRIOR  
TO TYING IN & RUNNING FILL ASSY.

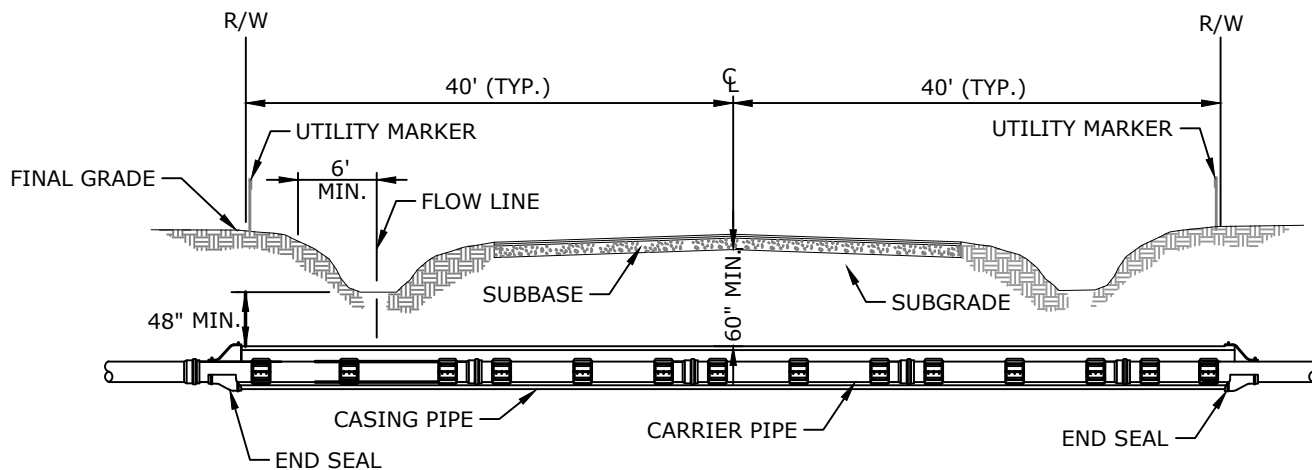
## PLAN VIEW INLINE

\*\*\* SEE NOTE NO. 2 \*\*\*



**NOTES:**

1. PERMANENT TAPS TO BE INSTALLED ON BOTH SIDES OF THE GATE CALVE CLOSEST TO THE WATER SOURCE.
2. VALVES SHALL BE EASILY ACCESSIBLE, AND NOT SUBJECT TO FLOODING.
3. PIPES AND FITTINGS SHALL BE RESTRAINED AND WATERTIGHT.



#### NOTES:

1. ENCASEMENTS SHALL EXTEND ONE FOOT (1') PAST EACH RIGHT-OF-WAY LINE OR AS REQUIRED BY THE ARDOT DISTRICT ENGINEER (AS APPLICABLE). ENCASEMENTS SHALL EXTEND 6 FEET BEYOND THE TOE OF SLOPE IN ANY EMBANKMENT SECTION, THE FLOW LINE OF ANY PARALLEL DITCHES, OR BACK OF ANY CURB AS APPLICABLE.
2. ENCASEMENTS SHALL HAVE A MINIMUM COVER OF 48 INCHES MEASURED VERTICALLY FROM THE FLOW LINE OF PARALLEL DITCHES OR 60 INCHES MEASURED VERTICALLY FROM THE ROADWAY SURFACE; WHICHEVER PROVIDES THE GREATER COVER.
3. CARRIER PIPE FOR WATERLINES SHALL BE CLASS 250 DIP OR PVC C900 AS SPECIFIED.
4. ENCASEMENT PIPE SHALL BE WELDED OR SEAMLESS STEEL PIPE, WITH A MINIMUM THICKNESS OF 0.25 INCHES AND A MINIMUM YIELD STRENGTH OF 35,000 PSI, OR AS OTHERWISE SPECIFIED.
5. THE ANGLE OF THE CROSSING SHALL BE AS NEAR AS PERPENDICULAR TO THE ROADWAY AS POSSIBLE.
6. A MARKER BEARING WOOSTER WATER SYSTEM'S NAME SHALL BE PLACED AT EACH RIGHT-OF-WAY LINE WHERE CROSSED.
7. CASING PIPE SHALL BE SEALED AT THE ENDS WITH A FLEXIBLE END SEAL, AS SPECIFIED.
8. CROSSING THROUGH DRAINAGE STRUCTURES SHALL NOT BE PERMITTED.
9. HIGHWAY BORINGS SHALL MAINTAIN CONFORMANCE TO THE LATEST VERSION OF THE ARDOT UTILITY ACCOMMODATION POLICY.

TYPICAL ROAD BORE

# **APPENDIX**

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**Contractor is responsible for adherence to all  
applicable  
Federal and State Laws and Regulations  
including, but not limited to,  
the following and any applicable amendments:**

**Ark Act 291 of 1993**  
Trench and Excavation Safety Systems

**\*\*\*\*\***

**Code of Federal Regulations Title 29**  
website: <http://ecfr.gpoaccess.gov/>

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**Arkansas State Licensing Law for Commercial Contractors**  
website: [www.arkansas.gov/clb](http://www.arkansas.gov/clb)

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