

Lenoir City Utilities Board

Standard Water Specifications

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End of Section

SECTION 01050 FIELD ENGINEERING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Contractor shall provide field engineering services and establish grades, lines, and levels, by use of recognized engineering survey practices.
- B. The Owner will provide reference point information (if available) that was used as a part of the design. This information will be listed on the Plans. Additional field surveys needed to establish or re-establish reference points for construction is the responsibility of the Contractor and will be considered a part of laying out the Work.

PART 2 PRODUCTS

- A. Not Applicable

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify locations of survey control points prior to starting work. Promptly notify Owner of any discrepancies discovered.

3.02 SURVEY REFERENCE POINTS

- A. Protect survey control points prior to starting site work; preserve permanent reference points during construction. Make no changes without prior written notice to Owner.
- B. Promptly report to Owner the loss or destruction of any reference point or relocation required because of changes in grades or other reasons. Replace dislocated survey control points based on original survey control.
- C. The Contractor shall preserve all USGS, TVA, State of Tennessee, and private markers; do not remove or disturb any such markers without prior approval from the Owner. Any removal and replacement of such markers shall be at the expense of the Contractor. The re-establishment of these markers shall be performed by a surveyor licensed by the State of Tennessee, with a letter indicating the completion of work.

3.03 STAKING

- A. The Contractor shall be responsible for staking the project and preparing cut sheets as needed.

End of Section

SECTION 01090 STANDARDS

PART 1 GENERAL

1.01 Meet the requirements and recommendations of all Standards, Institutes, Associations, etc., referred to throughout these documents and specifications as if they were fully reproduced herein. Unless otherwise noted, the latest editions shall apply.

1.02 ABBREVIATIONS

AAMA	Architectural Aluminum Manufacturers' Association
AASHTO	American Association of State Highway and Transportation Officials
ABMA	American Boiler Manufacturers' Association
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturers' Association
AGA	American Gas Association
AGC	Association of General Contractors
AGMA	American Gear Manufacturers' Association
AIA	American Institute of Architects
AIEE	American Institute of Electrical Engineers
AIMA	Acoustical and Insulating Materials Association
AISC	American Institute of Steel Construction
ISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
APA	American Plywood Association
API	American Petroleum Institute
ARI	Air Conditioning and Refrigeration Institute
ASA	American Standards Association
ASAE	American Society of Automotive Engineers
ASC	Association of Specialty Contractors
ASCII	American Standard Code for Information Interchange
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWPB	American Wood Preservers Bureau
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BIA	Brick Institute of America
CMAA	Crane Manufacturer's Association of America
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standards
CSI	Construction Specifications Institute

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Standard Water Specifications

EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FGMA	Flat Glass Marketing Association
FM	Associated Factory Mutual Laboratories
FS	Federal Specifications
IEEE	Institute of Electrical and Electronic Engineers
IRI	Industrial Risk Insurers
ISA	Instrument Society of America
JIC	Joint Industrial Council
MBMA	Metal Building Manufacturers' Association
MMA	Monorail Manufacturers' Association
NAAMM	National Association of Architectural Metal Manufacturers
NBS	National Bureau of Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturers' Association
NFPA	National Fire Protection Association or National Forest Products Association
NKCA	National Kitchen Cabinet Association
NPT	National Pipe Thread
NRCA	National Roofing Contractors' Association
NSF	National Sanitation Foundation
NSWMA	National Solid Waste Manufacturers' Association
NWMA	National Woodwork Manufacturing Association
OSHA	Occupational Safety and Health Administration
PPI	Plastics Pipe Institute
RIS	Redwood Inspection Service
SAE	Society of Automotive Engineers
SBCC	Standard Building Code Congress
SDI	Steel Deck Institute
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SPII	Southern Pine Inspection Institute
SSBC	Southern Standard Building Code
SSPC	Steel Structures Painting Council
TCA	Tile Council of America
TDOT	Tennessee Department of Transportation
TIMA	Thermal Insulation Manufacturers' Association
UL	Underwriters' Laboratories
USG	United States Gypsum
WCLIB	West Coast Lumber Inspection Bureau
WWPA	Western Wood Products Association

PART 2 PRODUCTS

A. Not Applicable

PART 3 EXECUTION

A. Not Applicable

End of Section

**SECTION 01302
SUBMITTALS AND SUBSTITUTIONS**

PART 1 GENERAL

1.01 SUMMARY

A. Work Included

1. Wherever possible throughout the contract documents, the minimum acceptable quality of workmanship and materials has been defined by a manufacturer's name and catalogue number, reference to recognized industry and government standards, or description of required attributes and performance.
2. To ensure that the specified products are furnished and installed in accordance with the design intent, procedures have been established for advance submittal of design data and for their review by the Engineer.
3. Make all submittals required by the Contract Documents, and revise and resubmit as necessary to establish compliance with the specified requirements.

B. Related Work Described Elsewhere

1. Individual requirements for submittals are described in other pertinent sections of these specifications.

1.02 SUBMITTALS

A. Identification of Submittals

1. General: Consecutively number all submittals.
2. Internal Identification: On at least the first page of each copy of each submittal, clearly indicate the submittal number in which the item was included.
3. Resubmittals: When material is resubmitted for any reason, transmit under a new letter of transmittal utilizing the original submittal number followed by an A, B, C, etc., depending on the number of resubmittals of the original submittal required.

B. Shop Drawings and Coordination of Drawings

1. Deliver or mail all submittals to:

Lenoir City Utilities Board
7698 Creekwood Park Boulevard
Lenoir City, Tennessee 37772
Attention: Water & Wastewater Department
Telephone: 844.687.5282

2. Before issuance of Certificate of Payment for Final Payment, deliver to the Design Engineer:

- a. Waivers of Lien

- b. Affidavit of payment of debts and claims
 - c. Consent of surety company to final payment
 - d. Written guarantees and warranties
 - e. Marked-up record set of drawings showing every alteration or change from the original drawings and specifications
 - f. All certificates of compliance, as a condition of acceptance of the work.
3. Make submittals in strict accordance with the provisions of this section.

C. Required Submittals:

1. Pipe
2. Fittings
3. Tracing Wire and Connectors
4. Detection Tape
5. Thrust Restraint System
6. Fire Hydrants
7. Valves
8. Valve Boxes
9. Service Saddles
10. Corp Stops
11. Curb Stops
12. Service Wye Fittings
13. Service Line Pipe
14. Meter Boxes
15. Meter Linesetter
16. Air Release Valves

1.03 QUALITY ASSURANCE

A. Coordination of Submittals:

1. Prior to each submittal, carefully review and coordinate all aspects of each item being submitted, and verify that each item and the submittal for it conforms in all respects with the requirements of the bidding instruments.
2. Shop drawings and submittals shall bear the stamp of approval of the Contractor as evidence that this coordination has been performed.

1.04 SUBMITTAL SCHEDULE

A. Timing of Submittals:

1. General: Make all submittals far enough in advance of scheduled dates for installation to provide all time required for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery. Submit shop drawings in accordance with the approved schedule of shop drawing submittals.
2. Engineer's Review Time: In scheduling, allow at least 20 calendar days for review by the Engineer following his receipt of the submittal.

3. Delays: Delays caused by tardiness in receipt of submittals will not be an acceptable basis for extension of the contract completion date.

1.05 SUBSTITUTIONS

A. Approval Required

1. The contract is based on the standards of quality established in the contract documents.
2. All products proposed for use, including those specified by required attributes and performance shall require approval by the Engineer before being incorporated into the work.
3. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this work by the Engineer.

B. "Or Equal"

1. Where the phrase "or equal", "or approved equal", or "approved substitute" occurs in the contract documents do not assume that materials, equipment, or methods will be approved as equal unless the item has been specifically approved for this work by the Engineer.
2. The decision of the Engineer shall be final.
3. See pertinent portions of the contract documents for additional information relating to substitutions.
4. Where equipment, materials, or methods do not specify "or equal", "or approved equal", or "approved substitute", substitutions may be submitted by the Contractor in accordance with this section.

PART 2 PRODUCTS

A. Not Applicable

PART 3 EXECUTION

A. Not Applicable

End of Section

SECTION 01310 PROGRESS SCHEDULES

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Preliminary Progress Schedule: Submit at least 7 days prior to preconstruction conference.
2. Detailed Progress Schedule:
 - a. Submit initial Detailed Progress Schedule within 30 days after Effective Date of the Agreement.
 - b. Submit an Updated Progress Schedule at each update, in accordance with Section 1.03 Detailed Progress Schedule.
3. Submit with Each Progress Schedule Submission:
 - a. Contractor's certification that Progress Schedule submission is actual schedule being utilized for execution of the Work.
 - b. Progress Schedule: One legible copy.
 - c. Narrative Progress Report: Same number of copies as specified for Progress Schedule.
4. Prior to final payment, submit a final Updated Progress Schedule.

1.02 PRELIMINARY PROGRESS SCHEDULE

- A.** In addition to basic requirements outlined in General Conditions, show a detailed schedule, beginning with Notice to Proceed, for minimum duration of 90 days, and a summary of balance of Project through Final Completion.
- B.** Show activities including, but not limited to, the following:
1. Notice to Proceed.
 2. Permits.
 3. Submittals, with review time. Contractor may use Schedule of Submittals specified in Section 01302, Submittals and Substitutions.
 4. Early procurement activities for long lead equipment and materials.
 5. Initial Site work.
 6. Earthwork.
 7. Specified Work sequences and construction constraints.
 8. Contract Milestone and Completion Dates.
 9. Major structural, mechanical, equipment, electrical, architectural, and instrumentation and control Work.
 10. System startup summary.

11. Project close-out summary.
 12. Demobilization summary.
- C. Update Preliminary Progress Schedule monthly; as part of progress payment process. Failure to do so may result in the Owner withholding all or part of the monthly progress payment until the Preliminary Progress Schedule is updated in a manner acceptable to Engineer.
- D. Format: In accordance with Article Progress Schedule—Bar Chart.

1.03 DETAILED PROGRESS SCHEDULE

- A. In addition to requirements of General Conditions, submit Detailed Progress Schedule beginning with Notice to Proceed and continuing through Final Completion.
- B. Show the duration and sequences of activities required for complete performance of the Work reflecting means and methods chosen by Contractor.
- C. When accepted by Engineer, Detailed Progress Schedule will replace Preliminary Progress Schedule and become Baseline Schedule. Subsequent revisions will be considered as Updated Progress Schedules.
- D. Format: In accordance with Article Progress Schedule—Bar Chart.
- E. Update monthly to reflect actual progress and occurrences to date, including weather delays.

1.04 PROGRESS SCHEDULE—BAR CHART

- A. General: Comprehensive bar chart schedule, generally as outlined in Associated General Contractors of America (AGC) 580, "Construction Project Planning and Scheduling Guidelines." If a conflict occurs between the AGC publication and this Specification, this Specification shall govern.
- B. Format:
1. Unless otherwise approved, white paper, 11-inch by 17-inch sheet size.
 2. Title Block: Show name of project and Owner, date submitted, revision or update number, and name of scheduler.
 3. Identify horizontally, across the top of the schedule, the time frame by year, month, and day.
 4. Identify each activity with a unique number and a brief description of the Work associated with that activity.
 5. Legend: Describe standard and special symbols used.
- C. Contents: Identify, in chronological order, those activities reasonably required to complete the Work, including as applicable, but not limited to:
1. Obtaining permits, submittals for early product procurement, and long lead time items.

2. Mobilization and other preliminary activities.
3. Initial Site work.
4. Specified Work sequences, constraints, and Milestones, including Substantial Completion date(s).
5. Subcontract Work.
6. Major equipment design, fabrication, factory testing, and delivery dates.
7. Delivery dates for Owner-furnished products, as specified in the Summary of Work.
8. Sitework.
9. Concrete Work.
10. Structural Work.
11. Asphalt Work.
12. Facilities retirement Work.
13. Gravity Sewer Testing activities
14. Water Line Disinfection and Testing Activities
15. Project closeout and cleanup.
16. Demobilization.

1.05 PROGRESS OF THE WORK

A. Updated Progress Schedule shall reflect:

1. Progress of Work to within 5 working days prior to submission.
2. Approved changes in Work scope and activities modified since submission.
3. Delays in Submittals or resubmittals, deliveries, or Work.
4. Adjusted or modified sequences of Work.
5. Other identifiable changes.
6. Revised projections of progress and completion.
7. Report of changed logic.

B. Produce detailed subschedules during Project, upon request of Owner or Engineer, to further define critical portions of the Work such as facility shutdowns.

C. If Contractor fails to complete activity by its latest scheduled completion date and this Failure is anticipated to extend Contract Times (or Milestones), Contractor shall, within 7 days of such failure, submit a written statement as to how Contractor intends to correct nonperformance and return to acceptable current Progress Schedule. Actions by Contractor to complete the Work within Contract Times (or Milestones) will not be justification for adjustment to Contract Price or Contract Times.

D. Owner may order Contractor to increase plant, equipment, labor force or working hours if Contractor fails to:

1. Complete a Milestone activity by its completion date.
2. Satisfactorily execute Work as necessary to prevent delay to overall completion of Project, at no additional cost to Owner.

1.06 NARRATIVE PROGRESS REPORT

A. Format:

1. Organize same as Progress Schedule.
2. Identify, on a cover letter, reporting period, date submitted, and name of author of report.

B. Contents:

1. Number of days worked over the period, work force on hand, construction equipment on hand (including utility vehicles such as pickup trucks, maintenance vehicles, stake trucks).
2. General progress of Work, including a listing of activities started and completed over the reporting period, mobilization/demobilization of subcontractors, and major milestones achieved.
3. Contractor's plan for management of Site (e.g., lay down and staging areas, construction traffic), utilization of construction equipment, buildup of trade labor, and identification of potential Contract changes.
4. Identification of new activities and sequences as a result of executed Contract changes.
5. Documentation of weather conditions over the reporting period, and any resulting impacts to the work.
6. Description of actual or potential delays, including related causes, and the steps taken or anticipated to mitigate their impact.
7. Changes to activity logic.
8. Changes to the critical path.
9. Identification of, and accompanying reason for, any activities added or deleted since the last report.
10. Steps taken to recover the schedule from Contractor-caused delays.

1.07 SCHEDULE ACCEPTANCE

A. Engineer's acceptance will demonstrate agreement that:

1. Proposed schedule is accepted with respect to:
 - a. Contract Times, including Final Completion and all intermediate Milestones are within the specified times.
 - b. Specified Work sequences and constraints are shown as specified.
 - c. Specified Owner-furnished Equipment or Material arrival dates, or range of dates, are included.
 - d. Access restrictions are accurately reflected.
 - e. Startup and testing times are as specified.
 - f. Submittal review times are as specified.
 - g. Startup testing duration is as specified and timing is acceptable.

2. In all other respects, Engineer's acceptance of Contractor's schedule indicates that, in Engineer's judgment, schedule represents reasonable plan for constructing Project in accordance with the Contract Documents. Engineer's review will not make any change in Contract requirements. Lack of comment on any aspect of schedule that is not in accordance with the Contract Documents will not thereby indicate acceptance of that change, unless Contractor has explicitly called the nonconformance to Engineer's attention in submittal. Schedule remains Contractor's responsibility and Contractor retains responsibility for performing all activities, for activity durations, and for activity sequences required to construct Project in accordance with the Contract Documents.

B. Unacceptable Preliminary Progress Schedule:

1. Make requested corrections; resubmit within 10 days.
2. Until acceptable to Engineer as Baseline Progress Schedule, continue review and revision process, during which time Contractor shall update schedule on a monthly basis to reflect actual progress and occurrences to date.

C. Unacceptable Detailed Progress Schedule:

1. Make requested corrections; resubmit within 10 days.
2. Until acceptable to Engineer as Baseline Progress Schedule, continue review and revision process.

- D. Narrative Report: All changes to activity duration and sequences, including addition or deletion of activities subsequent to Engineer's acceptance of Baseline Progress Schedule, shall be delineated in Narrative Report current with proposed Updated Progress Schedule.

PART 2 PRODUCTS

- A. Not Applicable

PART 3 EXECUTION

- A. Not Applicable

End of Section

SECTION 01400 QUALITY CONTROL

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. General Quality Control.
 - 1. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship to produce work of specified quality.
- B. Workmanship.
 - 1. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
 - 2. Perform work by persons qualified to produce workmanship of specified quality.
 - 3. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.
- C. Manufacturers' Instructions.
 - 1. Comply with instructions in full detail, including each step in sequence. Should instructions conflict with contract documents, request clarification from Engineer before proceeding.
- D. Manufacturers' Certificates.
 - 1. When required by individual specifications section, submit manufacturers' certificate, in duplicate, that products meet or exceed specified requirements.
- E. Manufacturers' Field Services.
 - 1. When specified in respective specification sections, require supplier or manufacturer to provide qualified personnel to observe field conditions; conditions of surfaces and installation; quality of workmanship; start-up of equipment; test, adjust, and balance of equipment; and as applicable, to make appropriate recommendations.
 - 2. A representative shall submit a written report to Owner listing observations and recommendations.
- F. Testing Laboratory Services.
 - 1. Owner shall employ and pay for services of an Independent Testing Laboratory to perform inspections, tests, and other services required by individual specification sections.

2. Services will be performed in accordance with requirements of governing authorities and with specified standards.
3. Reports will be submitted to Owner in duplicate giving observations and results of tests, indicating compliance or non-compliance with specified standards and with contract documents.
4. Contractor shall cooperate with testing laboratory personnel; furnish tools, samples of materials, design mix, equipment, storage, and assistance as requested.
 - a. Notify Owner and testing laboratory 24 hours prior to expected time for operations requiring testing services.
 - b. Make arrangements with testing laboratory and pay for additional samples and tests for Contractors' convenience.

PART 2 PRODUCTS

- A. Not Applicable

PART 3 EXECUTION

- A. Not Applicable

End of Section

SECTION 01500 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Sanitary Facilities
- B. Electricity, Lighting
- C. Water
- D. Barriers
- E. Security
- F. Temporary Controls
- G. Protection of Installed Work
- H. Water Control
- I. Cleaning During Construction
- J. Field Offices and Sheds
- K. Removal of Construction Facilities and Temporary Controls

1.02 RELATED REQUIREMENTS

- A. Summary of Work: Abandoned materials, storage, and Contractor's use of premises.
- B. Section 01710 - Cleaning.
- C. Owner's facilities can not be used by any of the contractor's or subcontractor's employees.

1.03 SANITARY FACILITIES

- A. Provide and maintain required temporary facilities and enclosures for job personnel that:
 - 1. Are weather tight, clean, and sanitary.
 - 2. Are provided with either natural light and ventilation or artificial light and mechanical ventilation.
 - 3. Are provided with toilet tissue in a suitable holder.
 - 4. Comply with applicable legal and health requirements.
- B. Remove temporary toilet facilities when work is complete.

1.04 ELECTRICITY, LIGHTING

- A. Connect to existing service, provide branch wiring and distribution boxes located to allow service and lighting by means of construction-type power cords.
 - 1. Make arrangements for and install the poles, wiring, switches, outlets, and other electrical equipment necessary.
 - 2. Pay for current used during construction period.
- B. Provide lighting for construction operations.
- C. Existing and permanent lighting may be used during construction. Maintain lighting and make routine repairs. Replace all lamps of all light fixtures used during construction at final inspection and give used lamps to the Owner for stock.
- D. Remove temporary electrical equipment when construction is completed.

1.05 WATER

- A. Provide service required for construction operations. Extend branch piping with outlets located so that water is available by use of hoses. Connect to existing facilities; extend branch piping with outlets located so that water is available by use of hoses.
 - 1. Contractor to contact LCUB for hydrant meter/backflow preventer. Contractor is responsible for payment/deposit for required equipment and cost of water used at the current cost per gallon in accordance with LCUB's current rates.
 - 2. Make arrangements for and install the piping and equipment necessary.
- B. Remove temporary water facilities when construction is completed unless otherwise directed by Owner. Water will be provided by the Owner for standard, reasonable, project-related use only.

1.06 SECURITY

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.
- B. Coordinate with Owner's security program.

1.07 TEMPORARY CONTROLS

- A. Coordinate, schedule, and perform work to cause the least practical interference with the public, fire protection service, public utility service, and Owner's operations. Coordinate all connections, cut-ins, alterations, or other interruption with designated representative of the Owner or utility service. Notify the representative 48 hours in advance and cooperate with him in minimizing the interruptions.
- B. Comply with the local requirements of EPA, the health department, or other regulatory requirement for construction operations relating to noise, pest, rodent, dust, and pollution controls.

1.08 CLEANING DURING CONSTRUCTION

- A. Construction cleaning shall be as specified in Section 01710.

1.09 REMOVAL OF CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

- A. Remove temporary materials, equipment, services, and construction prior to Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary facilities. Remove underground installations to a depth of 2 feet; grade site as indicated. Restore existing facilities used during construction to specified, or to original, condition.

1.10 PAYMENT

- A. No separate payment will be made for the materials, work, equipment, labor, etc., required herein for Construction Facilities and Temporary Controls. Include the costs thereof in the various lump sum prices on the Bid Form.

PART 2 PRODUCTS

- A. Not Applicable

PART 3 EXECUTION

- A. Not Applicable

End of Section

SECTION 01560 EROSION AND POLLUTION CONTROL

PART 1 GENERAL

1.01 SUMMARY

- A. This work shall consist of erosion control on all cut and fill operations, excavation, backfill, or other construction activities within the limits of the construction site, within any temporary or permanent easements, and within any borrow site used during the period of construction. The protection of these sites shall continue throughout the construction period regardless of weather conditions.
- B. While formally identified as erosion control activities, this work encompasses that necessary to ensure that construction activities do not temporarily or permanently harm the waters of the State of Tennessee, nor properties of the Owner, nor adjoining owners.
- C. These activities, over which neither the Owner nor the Engineer has control during the bidding process, are related to the means and methods the Contractor uses to pursue the work and as such cannot be predicted in advance. For this reason, the Contractor must be solely responsible for conforming to related local, State, and Federal requirements.
- D. Any fines levied by the Federal, State, and/or local governments for non-conformance with their respective regulations related to erosion and pollution control shall be paid for by the Contractor.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Materials, installation, and maintenance of erosion and pollution control structures shall be in accordance with the Drawings and the "Tennessee Erosion and Sediment Control Handbook" (Tennessee Department of Environment and Conservation, latest edition).

PART 3 EXECUTION

3.01 GENERAL

- A. The temporary erosion and pollution control provisions shown on the drawings are considered the minimum necessary, with the final design, implementation, and maintenance being the responsibility of the Contractor.
- B. The Contractor shall prepare a Stormwater Pollution Prevention Plan (SWPPP) and submit or amend the project Notice of Intent (NOI) to include their project specific activities.

- C. Install temporary sediment traps where appropriate. Construct and maintain in accordance with the requirements of Tennessee Erosion and Sediment Control Handbook. Muddy water collected in sediment traps shall be held until it is at least as clear as the upstream water before it is discharged to surface waters. Discharge through a pipe or lined channel so that the discharge does not cause erosion and sedimentation.
- D. Install temporary diversion berms or diversion channels as necessary to divert storm water from running onto the disturbed areas and to divert runoff from disturbed areas to the temporary sediment traps.
- E. Apply temporary seeding whenever grading operations are temporarily halted for over 14 days and final grading of exposed surfaces is to be completed within one year. Apply temporary seeding to soil stockpiles.
- F. The Contractor is responsible for the installation and maintenance of site construction pollution prevention controls throughout the life of the project.

End of Section

SECTION 01570 WORK ZONE TRAFFIC CONTROL

PART 1 GENERAL

1.01 SUMMARY

- A. The Work to be performed shall consist of providing, installing, maintaining, relocating, and removing temporary traffic control devices and services as ordered by the traffic control plan (TCP) and as required for the control and protection of public traffic through the Project work zone.
- B. Notification of the Work commence date and application for permission from the governing body having jurisdiction over the right-of-way is the responsibility of the Contractor.
- C. The Work to be performed under this Section will conform to Part VI of the Manual on Uniform Traffic Control Devices (MUTCD) and shall be subject to local codes, policies, and regulations of the agency having jurisdiction over the area where the Work is performed.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR PRODUCTS

- A. All signage, channeling devices, arrow displays, lighting devices, and other traffic control devices shall conform to the design requirements contained in the MUTCD which specifically govern such features as size, contrast, colors, shape, composition, use of symbols, etc. Use of "home made" or contractor-fabricated devices are prohibited.

PART 3 EXECUTION

3.01 TRAFFIC CONTROL PLAN (TCP)

- A. The Contractor shall submit the TCP along with a request for approval noting the date of proposed construction and the duration to the agency having jurisdiction.
- B. The Contractor shall obtain any and all necessary permits required for performance and execution of the TCP in coordination with the appropriate agencies.
- C. The Contractor shall install and maintain temporary traffic control devices adjacent to and within the Project work zone in accordance with the approved TCP and the MUTCD. Installation of the traffic control devices shall proceed in accordance with MUTCD phasing and shall be performed prior to the start of construction operations.

3.02 TRAFFIC CONTROL DEVICES (TCD)

- A. Furnish and place Traffic Control Devices before the start of construction operations.

- B. Install only those Traffic Control Devices needed for each stage or phase of construction as required by the TCP and the MUTCD.
- C. Relocate temporary or permanent Traffic Control Devices as required by the phasing of the Work. Remove devices that no longer apply to the Work in progress. Temporarily cover signs when they are not applicable to current conditions.
- D. Immediately clean, service, or replace any Traffic Control Device that is defaced, damaged, or when its retro reflectivity is reduced by 50% due to fading, dirt, etc. Keep all temporary Traffic Control Devices clean and serviceable.
- E. If required by the Work in progress maintain Traffic Control Devices 24 hours a day with adequate barricades, lights, arrows, etc. to protect the public from traffic hazards and accidents.
- F. Use flares and/or lights during times of low visibility to delineate traffic lanes and to guide traffic.
- G. Remove all temporary Traffic Control Devices upon completion of the Work and repair all damage caused by their installation.

3.03 CONSTRUCTION PARKING CONTROL

- A. Control parking of construction personnel's vehicles and construction equipment to prevent interference with public traffic and public access to private drives, parking areas, sidewalks, residences, etc.
- B. Prevent parking on or adjacent to side streets or in non-designated areas. The Contractor at his expense will repair vehicle damage caused by the Contractor or his personnel to residential or private property.
- C. Schedule and coordinate delivery and off-loading of materials so as to not interfere with traffic outside of the Contractor's designated work zone or storage yard.

3.04 FLAGMEN

- A. When the TCP requires provide flagmen or traffic control officers who are trained and equipped in accordance with the requirements of Part VI of the MUTCD.
- B. Flaggers shall use Type III or Type IV retro reflective Stop/Slow paddles. Use of flags is prohibited unless it is an emergency situation in low-speed, low-volume locations which can best be controlled by a single flagger.
- C. The flagger or traffic control officer shall wear a retro reflective vest at all times during traffic control operations.

End of Section

**SECTION 01600
MATERIAL AND EQUIPMENT**

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Products.
- B. Transportation and Handling.
- C. Storage and Protection.
- D. Product Options.
- E. Products List.
- F. Substitutions.
- G. Systems Demonstration.

1.02 QUALITY ASSURANCE

- A. Approval Required
 - 1. The contract is based on the standards of quality established in the contract documents.
 - 2. All products proposed for use, including those specified by required attributes and performance, shall require approval by the Owner before being incorporated into the work.
 - 3. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this work by the Owner.

1.03 PRODUCTS

- A. Products include material, equipment, and systems.
- B. Comply with specifications and referenced standards as minimum requirements.
- C. Components required to be supplied in quantity within a specification section shall be the same and shall be interchangeable.
- D. All materials shall be manufactured in the USA unless otherwise approved by LCUB.

1.04 TRANSPORTATION AND HANDLING

- A. Transport products by methods to avoid product damage; deliver in undamaged condition in manufacturer's unopened containers or packaging, dry.

- B. Provide equipment and personnel to handle products by methods to prevent soiling or damage.
- C. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

1.05 STORAGE AND PROTECTION

- A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions. Store mechanical and electrical equipment in a controlled environment as recommended by the manufacturer.
- B. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.
- C. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.
- D. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged, and are maintained under required conditions.

1.06 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards.
- B. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not specifically named.
- C. Products Specified by Naming Several Manufacturers: Products of named manufacturers meeting specifications: No options, no substitutions allowed.
- D. Products Specified by Naming Only One Manufacturer: No options, no substitutions allowed.

1.07 PRODUCTS LIST

- A. Under provisions of Section 01302-Submittals and Substitutions, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

1.08 SUBSTITUTIONS

- A. During bidding period, the Owner will govern times for submitting requests for substitutions under requirements specified in this section.

- B. Concurrent with submission of product list, the Owner will consider requests from Contractor for substitutions. Subsequently, substitutions will be considered only when a product becomes unavailable due to no fault of Contractor. Confirmation of unavailable products must be in writing and certified by the manufacturer that the product is no longer available.
- C. Submit separate request for each substitution. Document each request with complete data substantiating compliance of proposed substitution with contract documents.
- D. Request for substitution constitutes a representation that Contractor:
 - 1. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product.
 - 2. Will provide the same warranty for substitution as for specified product.
 - 3. Will coordinate installation and make other changes which may be required for work to be complete in all respects.
 - 4. Waives claims for additional costs which may subsequently become apparent.
- E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals. Separate written request, must be submitted for any proposed substitutions or deviation from the contract documents.
- F. Owner will determine acceptability of proposed substitution, and the Engineer will notify Contractor of acceptance or rejection in writing within a reasonable time.
- G. Substitute products shall not be ordered or installed without written acceptance.
- H. Only one request for substitution will be considered for each product. When substitution is not accepted, provide specified product.
- I. Engineer will determine acceptability of substitutions.

1.09 SUBMITTAL PROCEDURES

- A. Engineer will review Contractor's requests for substitutions with reasonable promptness.
- B. During the bidding period, Engineer will record acceptable substitutions in Addenda.
- C. Upon proper submission, Engineer will notify Contractor, in writing, of decision to accept or reject requested substitution within 15 days.
- D. For accepted products, submit shop drawings, product data, and samples under provisions of Section 01302 - Submittals and Substitutions.

1.10 SYSTEMS DEMONSTRATION

- A. Prior to final inspection, demonstrate operation of each system to the Owner.
- B. Instruct Owner's personnel in operation, adjustment, and maintenance of equipment and systems, using the operation and maintenance data as the basis of instruction.

PART 2 PRODUCTS

A. Not Applicable

PART 3 EXECUTION

A. Not Applicable

End of Section

SECTION 01700 CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Closeout Procedures
- B. Final Cleaning
- C. Project Record Documents
- D. Operation and Maintenance Data
- E. Warranties and Bonds
- F. Spare Parts and Maintenance Materials

1.02 RELATED REQUIREMENTS

- A. General Conditions: Fiscal provisions, legal submittals, and other administrative requirements.

1.03 CLOSEOUT PROCEDURES

- A. Comply with procedures stated in General Conditions of the contract and procedures specified in this section for issuance of Certificate of Final Completion.
- B. Owner will occupy designated portion of Project for the purpose of conduct of business, under provision stated in Certificate of Substantial Completion.
- C. When Contractor considers work has reached final completion, submit written certification that work is complete in accordance with contract documents and ready for Engineer observation.

1.04 FINAL COMPLETION

- A. The final inspection at the job site will be done by the Engineer once the following items are received from the General Contractor:
 - 1. Notification to Engineer that work is complete and ready for final inspection.
- B. Should Engineer inspection find work incomplete, he will promptly notify Contractor in writing listing observed deficiencies.
- C. Contractor shall remedy deficiencies and send a second certification of final completion.
- D. When Engineer finds work is complete, he will consider closeout submittals.

1.05 STATEMENT OF ADJUSTMENT OF ACCOUNTS

- A. Submit final statement reflecting adjustments to Contract Sum indicating:
 - 1. Original Contract Sum
 - 2. Previous Change Orders
 - 3. Changes Under Unit Prices
 - 4. Deductions for Uncorrected Work
 - 5. Deductions for Liquidated Damages
 - 6. Other Adjustments to Contract Sum
 - 7. Total Contract Sum as Adjusted
 - 8. Previous Payments
 - 9. Sum Remaining Due
- B. Engineer will issue a final Change Order reflecting approved adjustments to Contract Sum not previously made by change orders.

1.06 APPLICATION FOR FINAL PAYMENT

- A. Submit application for final payment in accordance with provisions of Conditions of the contract.

PART 2 PRODUCTS

- A. Not Applicable

PART 3 EXECUTION

- A. Not Applicable

End of Section

SECTION 01710 CLEANING

PART 1 GENERAL

1.01 DESCRIPTION

- A. Work Included: Throughout the construction period, maintain the site in a standard of cleanliness as described in this section.
 - 1. Site generated debris will be cleaned and removed daily. No debris or waste will be allowed to be buried on site including along water lines.
- B. Related Work Described Elsewhere: In addition to standards described in this section, comply with all requirements for cleaning up as described in various other sections of these specifications.

1.02 QUALITY ASSURANCE

- A. Inspection: Conduct inspection daily, and more often if necessary, to verify that requirements for cleanliness are being met.
- B. Codes and Standards: In addition to the standards described in this section, comply with all pertinent requirements of government agencies having jurisdiction.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

- A. Provide all required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

PART 3 EXECUTION

3.01 PROGRESS CLEANING

- A. General:
 - 1. Retain all stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.
 - 2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for the construction of this work.
 - 3. At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the job site.
 - 4. Provide adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection and protection of the ecology.

B. Site:

1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.
2. Weekly, and more often if necessary, inspect all arrangements of materials stored on the site. Restack, tidy, or otherwise service all arrangements to meet the requirements of paragraph 3.01.A.1, above.
3. Maintain the site in a neat and orderly condition at all times.

3.02 FINAL CLEANING

- A. Definition: Except as otherwise specifically provided, "clean" (for the purpose of all paragraphs under paragraph 3.02) shall be interpreted as meaning the level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials.
- B. General: Prior to the completion of the work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning as described under paragraph 3.01, above.
- C. Site: Unless otherwise specifically directed by the Owner, broom clean all paved areas on the site and all public paved areas directly adjacent to the site. Completely remove all resultant debris.
- D. Timing: Schedule final cleaning as approved by the Owner to accept a completely clean project.

End of Section

**SECTION 01720
PROJECT RECORD DOCUMENTS**

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Maintenance of Record Documents and Samples.
- B. Submittal of Record Documents and Samples.

1.02 RELATED REQUIREMENTS

- A. General Conditions: Documents at the site.
- B. Section 01302 - Submittals and Substitutions: Shop drawings, product data, and samples.
- C. Individual Specifications Sections: Manufacturer's certificates and certificates of inspection.

1.03 MAINTENANCE OF DOCUMENTS AND SAMPLES

- A. In addition to requirements in General Conditions, maintain at the site for Owner one record copy of:
 - 1. Contract Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Field test records.
 - 7. Inspection certificates.
 - 8. Manufacturer's certificates.
 - 9. Record drawings with approved modifications to design drawings in red (See 1.04 B).
 - 10. Pre-Construction and Construction Photographs.
 - 11. Verified GIS Data Collected by LCUB-approved Staff.
- B. Maintain Record Documents in a clean, dry, and legible condition. Do not use Record Documents for construction purposes.
- C. Keep Record Documents and samples available for inspection by Owner.

1.04 RECORDING

- A. Record information concurrently with construction progress. Do not conceal any work until required information is recorded by Contractor and verified by Owner.
- B. Contract Drawings and Shop Drawings: Legibly mark each item to record actual construction, including:

1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 2. Field changes of dimension and detail.
 3. Changes made by modifications.
 4. Details not on original contract drawings.
 5. References to related shop drawings and modifications.
- C. Specifications: Legibly mark each item to record actual construction, including:
1. Manufacturer, trade name, and catalog number of each product actually installed, particularly optional items and substitute items.
 2. Changes made by addenda and modifications.

1.05 SUBMITTALS

- A. At Contract closeout, deliver Record Documents and samples to Owner.
- B. Transmit with cover letter in duplicate, listing:
1. Date.
 2. Project title and number.
 3. Contractor's name, address, and telephone number.
 4. Number and title of each Record Document.
 5. Signature of Contractor or authorized representative.

PART 2 PRODUCTS

- A. Not Applicable

PART 3 EXECUTION

- A. Not Applicable

End of Section

SECTION 02110 CLEARING AND GRUBBING

PART 1 GENERAL

1.01 SUMMARY

- A. This work consists of clearing, grubbing, removing, and disposing of all debris and of all vegetation that are within the designated construction areas, except for such objects that the Owner designates to remain. The work shall also include preserving and protecting from injury or defacement all vegetation and objects designated to remain.

PART 2 PRODUCTS

- A. Not Applicable.

PART 3 EXECUTION

3.01 GENERAL

- A. Clear the entire construction area of all weeds, brush, briars, bushes, trees, stumps, and other protruding obstructions not designated to remain.
- B. Perform all clearing and grubbing operations in accordance with the applicable provisions for erosion control as shown on the drawings. The Contractor is responsible for locating disposal sites and for obtaining all related permits from site property owner and any agency having jurisdiction.
- C. The Contractor is solely responsible for the removal, hauling, and disposal of waste material. Completely dispose of all materials resulting from clearing and grubbing off the site, all at the Contractor's expense. The Owner shall not be liable for the improper disposal of waste material.
- D. Secure in writing any approval from a property Owner desiring disposal of debris on their private property.

End of Section

**SECTION 02221
UNCLASSIFIED EXCAVATION FOR UTILITIES**

PART 1 GENERAL

1.01 SUMMARY

- A. All excavation for this project is considered UNCLASSIFIED.
- B. The work called for by this section shall consist of clearing and grubbing, loosening, loading, removing, and disposing of, in the specified manner, all wet and dry materials (including rock) encountered that must be removed for construction purposes; furnishing, placing, and maintaining all sheeting, shoring, bracing, and timbering necessary for the proper protection and safety of the work, the workmen, the public, and adjacent property and improvements; the dewatering of trenches and other excavations; the preparation of satisfactory pipe beds; the backfilling and tamping of trenches, foundations, and other structures; the preparation of fills and embankments; the removal of unsuitable material from outside the normal limits of excavation and, where ordered by the Owner, their replacement with suitable materials; and all other grading or excavation work incidental to or necessary for the work. This work shall be performed as specified below.

1.02 RELATED SECTIONS

- A. Section 02110 – Clearing and Grubbing
- B. Section 02611 – Trenching, Backfilling, & Compacting
- C. Section 02930 - Seeding

PART 2 PRODUCTS

- A. Not Applicable

PART 3 EXECUTION

3.01 PREPARATION OF THE SITE

- A. Before starting construction, remove from the work site all vegetable growth (except as hereinafter excluded), debris, and/or other objectionable matter as well as any buildings and/or other structures that the drawings and/or the Owner specifically indicate are to be removed. Dispose of this refuse material in a manner acceptable to the Owner.
- B. In certain areas it may be desirable for existing trees, shrubs, or other vegetation on the site to be preserved for the permanent landscape. Such vegetation may be shown on the drawings, specifically listed in the specifications, marked on the site, or identified by the Owner. In no case damage or remove such growth without written permission from the Owner.
- C. If the area to be excavated is occupied by trees, brush, or other vegetable growth, clear such growth and grub the excavated area, and remove all large roots to a depth of not less than 2

feet below the bottom of the proposed construction. Dispose of the growth removed in a manner satisfactory to the Owner. Fill all holes or cavities created during this work that extend below the subgrade elevation with suitable material and compact to the same density as the surrounding material.

- D. Trees, cultivated shrubs, etc., that are situated within public rights-of-way and/or construction easements through private property but not directly within the excavation area shall remain undisturbed unless it is necessary to remove them so that the work can be performed safely and unless their removal is specifically ordered by the Owner. Take special precautions to protect and preserve such growth throughout all stages of the construction.
- E. Preparation of the site shall be considered an integral part of the excavation and one for which no separate payment shall be allowed.

3.02 UNSUITABLE MATERIALS

- A. Wherever muck, quicksand, soft clay, swampy ground, or other material unsuitable for foundations, subgrade, pipe laying, or backfilling is encountered, remove it and continue excavation until suitable material is encountered. The material removed shall be disposed of in the manner described below. Then refill the areas excavated for this reason with 1- to 2-inch sized crushed stone up to the level of the lines, grades, and/or cross sections shown on the drawings. The top 6 inches of this refill shall be Class A, Grade D aggregate crushed stone for bedding.

3.03 ROCKS AND BOULDERS

- A. Should rock be encountered in the excavation, remove it by mechanical methods (no blasting is allowed).
- B. Excavate rock over the horizontal limits of excavation and to a depth of not less than 6 inches below the outside bottom of pipe up to 30 inches in diameter and not less than 12 inches below the outside bottom of larger pipes if rock extends to such depth. Then backfill the space below grade with Class A, Grade D aggregate or other approved material, tamp to the proper grade, and make ready for construction. For monolithic concrete sewers or culverts and for structures, excavate rock to the outside bottom of the structure or sewer.

3.04 DISPOSAL OF MATERIALS

- A. Whenever practicable, all materials removed by excavation that are suitable for backfilling pipe trenches or for other purposes shown on the drawings or directed by the Owner shall be used for these purposes. Any materials not so used shall be considered waste materials and disposed of at the Contractor's expense.
- B. Waste materials may be deposited in spoil areas at locations approved by the Owner. Do not leave in unsightly piles but instead spread in uniform layers, neatly level, and shape to drain. Seed as specified in Section 02930 - Seeding.

- C. Once any part of the work is completed, properly dispose of all surplus or unused materials (including waste materials) left within the construction limits of that work. Leave the surface of the work in a neat, workmanlike condition, as described below.
- D. The disposal of waste materials shall be considered an integral part of the excavation work and one for which no separate payment shall be allowed.

3.05 EXCAVATION FOR TRENCHES, MANHOLES, AND STRUCTURES

- A. Unclassified excavation for pipelines shall consist of the excavation necessary for the construction of water, sewer, and other pipes and their appurtenances (including manholes, inlets, outlets, headwalls, collars, concrete saddles, and pipe protection) that are called for by the drawings. It shall include clearing and grubbing where necessary, backfilling and tamping pipe trenches and around structures, and disposing of waste materials; all of which shall conform to the applicable provisions set forth elsewhere in these specifications.
- B. The Contractor may, if he chooses, use a motor-powered trenching machine. If he does; however, he shall be fully responsible for the preservation or repair of existing utilities.
- C. Unless the construction of lines by tunneling, jacking, or boring is called for by the drawings or specifically authorized by the Owner, make excavation for pipelines in open cut and true to the lines and grades shown on the drawings or established by the Owner on the ground. Cut the banks of trenches between vertical parallel planes equidistant from the pipe centerline. The horizontal distance between the vertical planes (or, if sheeting is used, between the inside faces of that sheeting) shall vary with the size of the pipe to be installed, but shall not be more than the distance specified in Section 02611 Part 3.02 E. 2. When approved in writing by the Owner, the banks of trenches from the ground surface down to a depth not closer than 1 foot above the top of the pipe may be excavated to nonvertical and nonparallel planes, provided the excavation below that depth is made with vertical and parallel sides equidistant from the pipe centerline in accordance with the width requirements outlined above. Any cut made in excess of the maximum width shall be at the expense of the Contractor and may be cause for the Owner to require that stronger pipe and/or a higher class of bedding be used at no cost to the Owner.
- D. For rigid pipe, shape the bottom of all trenches to provide uniform bearing for the bottom of the pipe barrel. Pipe bedding shall be thoroughly and completely tamped before backfilling. Bedding for DIP used shall consist of 6-inch envelope of Class A, Grade D aggregate up to the centerline of the pipe. Pipe bedding shall be thoroughly and completely tamped before backfilling.
- E. Excavate bell holes for bell and spigot pipe at proper intervals so that the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes shall be large enough to permit proper jointing of the pipe. Do not excavate bell holes more than two joints ahead of pipe laying.
- F. Excavation for manholes, inlets, and other incidental structures shall not be greater in horizontal area than that required to allow a 2-foot clearance between the outer surface of the structure and the walls of the adjacent excavation or of the sheeting used to protect it. The bottom of the excavation shall be true to the required shape and elevation shown on the

drawings. No earth backfilling will be permitted under manholes, inlets, headwalls, or similar structures. Should the Contractor excavate below the elevations shown or specified, he shall, at his own expense, fill the void with either concrete or granular material approved by the Engineer.

- G. Do not excavate pipe trenches more than 200 feet ahead of the pipe laying. Perform all work so as to cause the least possible inconvenience to the public. Construct temporary bridges or crossings when and where the Owner deems necessary to maintain vehicular or pedestrian traffic.
- H. In all cases where materials are deposited along open trenches, place them so that in the event of rain or surcharge loading from such deposits no damage will result to the work and/or to adjacent property.
- I. Excavation for manholes and other structures may be performed with nonvertical banks except beneath pavements or adjoining existing improvements. Do not permit the horizontal area of the excavation to exceed that required to allow a 2-foot clearance between the outer surface of the structure and the banks of the excavation or the sheeting used to protect the embankments. The bottom of the excavation shall be true to the required shape and elevation shown on the drawings.

3.06 THE DEWATERING OF EXCAVATION

- A. Provide and keep in operation enough suitable pumping equipment whenever necessary or whenever directed to do so by the Engineer. Give special attention to excavations for those structures that, prior to proper backfilling, are subject to flotation from hydrostatic uplift.
- B. All water pump or drained from the work shall be disposed of in a manner satisfactory to the Engineer without damage to adjacent property or other areas.
- C. If necessary, due to the volume of water containing sediment, or due to the location of pumping activities, construct a sediment trap (structure) to pump ground water into until sediment is no longer being removed with the water. Sediment shall not be discharged to the waters of the State.

3.07 BORROW EXCAVATION

- A. Whenever the backfill of excavated areas of the placement of embankments requires more material than is available from authorized excavations or whenever the backfill material from such excavations is unsuitable, then obtain additional material from other sources. This may require the opening of borrow pits at points accessible to the work. In such cases, make suitable arrangements with the property owner and pay all incidental costs, including any royalties, for the use of the borrowed material. Before a borrow pit is opened, the quality and suitability of its material shall be approved by the Engineer. All state and local regulation concerning borrow pits, drainage, and erosion control shall be strictly followed.
- B. Excavate borrow pits in such a way that the remaining surfaces and slopes are reasonably smooth and that adequate drainage is provided over the entire area. Construct drainage ditches wherever necessary to provide outlets for water to the nearest natural channel, thus preventing

the formation of pools in the pit area. Leave the sides of borrow pit cuts at a maximum slope of 2:1 unless otherwise directed by the Engineer.

- C. Properly clear and grub borrow pits. Remove all objectionable matter from the borrow pit material before placing it in the backfill.
- D. The taking of materials from borrow pits for use in the construction of backfill, fills, or embankments shall be considered an incidental part of the work. No separate payment shall be made for this.

3.08 BACKFILLING

- A. Begin backfilling after the line construction is completed and then inspected and approved by the Engineer. On each side of the line, from the top of the bedding material as specified in Paragraph B., the backfill material shall consist either of fine, loose earth like sandy soil or loam or of granular material that is free from clods, vegetable matter, debris, stone, and/or other objectionable materials and that has a size of no more than 2 inches. Place this backfill simultaneously on either side of the pipe in even layers that before compaction are no more than 6-inches deep. Thoroughly and completely tamp each layer into place before placing additional layers. Backfill shall, at locations beneath concrete and asphalt driveways, roadways, sidewalks, parking areas, etc. or closely adjacent to pavement (within 3 feet), consist of No. 57 crushed stone aggregate. Use of aggregate backfill shall be at the direction of the Engineer.
- B. For all site piping used, install No. 57 crushed stone bedding in a 6-inch envelope on all sides of the pipe to be compacted as outlined in Paragraph A. Then add the remaining backfill as described in the previous paragraph.
- C. At locations beneath or closely adjacent to pavement (within 3 feet) or at locations of improvements subject to damage by displacement, tamp and thoroughly compact the backfill in layers that, before compaction, are 6 inches deep. In other areas, the backfill for the upper portion of the trenches may be placed without tamping but shall be compacted to a density equivalent to that of adjacent earth material as determined by laboratory tests. Use special care to prevent the operation of backfilling equipment from causing any damage to the pipe.
- D. If earth material for backfill is, in the opinion of the Engineer, too dry to allow thorough compaction, then add enough water so that the backfill can be properly compacted. Do not place earth material that the Engineer considers too wet or otherwise unsuitable.
- E. Wherever excavation has been made within easements across private property, the top 1 foot of backfill material shall consist of fine loose earth free from large clods, vegetable matter, debris, stone, and/or other objectionable materials. Top soil shall be placed a minimum of 6 inches on top of this backfill material.
- F. Wherever trenches have been cut across or along existing pavement, temporarily pave the backfill of such trenches by placing Class A, Grade D crushed stone as the top 12 inches of the backfill. Maintain this temporary pavement either until the permanent pavement is restored or until the project is accepted by the Owner. On heavy-traveled roadways, cold mix or leveling course binder 2 inches thick shall be installed and maintained until permanent pavement is installed.

- G. Conduct backfilling around manholes, inlets, outfalls, and/or structures in the same manner as specified above for pipelines except that even greater care is necessary to prevent damage to the utility structure.
- H. Wherever pipes have diameters of 15 inches or less, do not use power-operated tampers to tamp that portion of the backfill around the pipe within 1 foot above the pipe.
- I. Perform backfilling so as not to disturb or damage any pipe and/or structure against which the backfill is being placed. If any pipe or structure is damaged and/or displaced during backfilling, open up the backfill and make whatever repairs are necessary, whenever directed to do so by the Engineer.
- J. Backfilling and clean-up operations shall closely follow pipe laying. Failure to comply with this provision will result in the Owner's requiring that the Contractor's other activities be suspended until backfilling and clean-up operations catch up with pipe laying.
- K. Compaction Requirements: Under buildings and two times the depth of pipe beyond, and under roads and two times the depth beyond the shoulder, compact to 95-percent maximum density in accordance with ASTM D698. In all other locations, compact to 90-percent maximum density.
- L. See Section 02611, Trenching, Backfilling, & Compacting for additional requirements.

3.09 MAINTENANCE

- A. Seed and mulch and maintain in good condition all excavated areas, trenches, fills, embankments, and channels until final acceptance by the Engineer.
- B. Maintain trench backfill at the approximate level of the original ground surface by periodically adding backfill material wherever necessary and whenever directed to do so by the Engineer. Continue such maintenance until final acceptance of the project or until the Engineer issues a written release.

3.10 SLOPES

- A. Neatly trim all open cut slopes and finish to conform either with the slope lines shown on the drawings or the directions of the Engineer. Leave the finished surfaces of bottom and sides in reasonably smooth and uniform planes like those normally obtainable with hand tools, though the Contractor will not be required to use hand methods if he is able to obtain the required degree of evenness with mechanical equipment. Conduct grading operations so that material is not removed or loosened beyond the required slope.

End of Section

**SECTION 02415
HORIZONTAL DIRECTIONAL DRILLING AND BORING**

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section covers the work necessary for installation of pipelines by directionally controlled horizontal drilling or boring equipment.

1.02 SCOPE OF WORK

- A. Fabricate, directionally drill or bore and install the pipeline to the approximate lines and grades shown on the project plans.
- B. Pressure test the pipeline section before installation; Pressure test the pipeline section after installation.
- C. Clean up all affected sites, and restore all areas to pre-construction or better condition.
- D. The CONTRACTOR shall deliver the pipeline to OWNER in a clean and operable condition. The pipe shall be internally cleaned with a suitable type pig cleaner as approved by OWNER. The cleaning must be conducted with an OWNER approved pig. All water must be removed from the pipeline as required by OWNER.

1.03 SUBMITTALS

- A. The CONTRACTOR shall prepare a schedule for the work and submit it to OWNER for approval. The schedule shall include all major tasks to be performed including the following:
 - 1. Rig mobilization and setup
 - 2. Pipe assembly
 - 3. Pilot hole drilling
 - 4. Pre-reaming
 - 5. Pretesting and pigging pipe before installation
 - 6. Pipe pulling
 - 7. Testing and pigging pipe after installation
 - 8. Restoration and demobilization
- B. At least 10 days prior to mobilization of equipment, the CONTRACTOR shall submit a detailed installation plan to OWNER for review and approval. This plan must also include a detailed description as to contingencies for potential fissures of drilling fluid.
- C. The CONTRACTOR will supply Material Safety Data Sheets (MSDS) for all material used in making up drilling fluids. The drilling fluid composition must meet all federal, state, and local laws and environmental regulations governing the use, handling, storage, and disposal of such material.

1.04 PERMITS

- A. The CONTRACTOR shall maintain and operate all construction equipment and perform all work within designated easements, temporary construction easements, working areas, public rights-of-way, and access roads.
- B. The CONTRACTOR shall be responsible for obtaining all permits and regulatory authorizations for activities off of the defined easements and working areas, including any permits required for mobilizing materials and equipment and disposal of drilling fluids and industrial debris. The CONTRACTOR will be responsible for paying all fines that may be imposed due to illegal discharge.

PART 2 PRODUCTS**2.01 GENERAL**

- A. The CONTRACTOR shall provide all materials, equipment and labor for completing the drill/bore and for adequate protection of the work.

2.02 EQUIPMENT AND MATERIALS TO BE FURNISHED BY CONTRACTOR

- A. The CONTRACTOR shall furnish all equipment and material required to complete the Scope of Work which shall include but not be limited to the following:
 - 1. Drilling equipment
 - 2. Water pumps, hoses, fittings, storage tanks, filters, hay bales, and silt fencing (as required)
 - 3. Drilling fluids containment, collection, cleaning and disposal equipment, and material
 - 4. Fuel and lubricant
 - 5. Bentonite and related mixing equipment
 - 6. All welding equipment and materials as required
 - 7. All hydrostatic and pneumatic testing equipment and materials
 - 8. Sidebooms, cranes, backhoes, trucks and other equipment and materials necessary to load and unload pipe and to support and smoothly transition the pipe while being pulled into the reamed hole
 - 9. All equipment and materials necessary to restore project areas to pre-existing condition or better

PART 3 EXECUTION**3.01 INSTALLATION**

- A. General: The CONTRACTOR shall install the section of the pipeline by the horizontally dilled or bored, directionally controlled method of construction. This method shall consist of the drilling of a pilot hole within the designed tolerances for radius requirements, followed by enlargement of the hole to accommodate the product line.
- B. Instrumentation: The CONTRACTOR will at all times provide and maintain instrumentation which will accurately locate the pilot hole position relative to ground surface. Drill fluid flow

rate and pressure must also be monitored. CONTRACTOR shall maintain and provide to OWNER, upon request, access to the data generated by the downhole survey tools.

C. Tolerances:

1. Pipe installed by horizontal directional drilling or boring must be located as shown on the project drawings. The CONTRACTOR shall employ experienced personnel to operate the directional drilling or boring equipment and the monitoring and steering equipment. At the completion of the pilot hole, the CONTRACTOR shall provide OWNER with the coordinates of the pilot hole as specified.
2. A smoothly drilled pilot hole shall follow the design centerline of the pipe profile and alignment described on the project drawings.
3. The pilot hole (Borehole Entry Point) shall penetrate the ground surface at the approximate location shown on the project drawings.
4. The course of the pilot hole must stay within the given right-of-way at all points along the drilled route.
5. The CONTRACTOR shall have accurate working gauges, which register tensile force being used to pull the pipeline back through the reamed borehole. It is the CONTRACTOR's responsibility to prepare the reamed out hole such that pulling back operations do not exceed the tensile strength of the pipe. The CONTRACTOR shall provide estimated calculations for the pulling loads and allowable loads before pull back operations begin. If during the pipeline pulling process this force reaches 75% of the allowable load for the pipeline, the project inspector must be notified immediately. Logs must be kept intact referencing all forces exerted on the pipeline during the project.
6. The CONTRACTOR shall provide adequate supports along the stringing area to protect the pipe and allow free movement of the pipeline during pullback.
7. During pullback operations, CONTRACTOR shall monitor roller operation and use sidebooms if required to assist movement of the pipe. Situations which could cause damage to the pipe material shall be corrected immediately. Damaged pipe shall be repaired to the satisfaction of the OWNER or replaced by the CONTRACTOR before pulling operations resume.

3.02 DRILLING MUD AND CUTTINGS

- A. The Horizontal Directional Drilling or Boring operation is to be operated in a manner to eliminate the discharge of water, drilling mud and cuttings to water and land areas involved during the construction process. CONTRACTOR shall immediately contain and clean up any inadvertent returns.
- B. Disposal of drilling fluids shall be the responsibility of the CONTRACTOR and shall be conducted in compliance with all relative environmental regulations, easement and workspace agreements and permit requirements. All costs related to disposal shall be the responsibility of the CONTRACTOR.

- C. Transportation, makeup, and Material Safety Data Sheets (MSDS) for drilling fluids shall be provided to OWNER.
- D. Water supply is the CONTRACTOR's responsibility, whether purchased locally or hauled in.
- E. Drilling fluids must be free of all additives that will adversely affect the environment.

3.03 REAM AND PULL BACK

- A. Pre-reaming: Pre-reaming operations shall be conducted at the discretion of the horizontal directional drilling or boring CONTRACTOR. All provisions of this specification relating to simultaneous reaming and pulling back operations shall pertain to pre-reaming operations.
- B. Pulling loads: CONTRACTOR shall be responsible for determining safe pulling loads required for proper installation. Such loads shall be minimized as required to prevent failure of the pipeline during installation.
- C. Torsional Stress: A properly sized and fully operational swivel will be installed between the reaming assembly at the end of the drill pipe, and the pipeline to restrict torsional stress from being transmitted to the pipeline.
- D. CONTRACTOR may opt to fill the pipeline with water (ballasting) as installation proceeds to help prevent buckling and reduce buoyancy. The CONTRACTOR must completely clean and dry the pipeline after installation.
- E. Pull Section Support: The pull section shall be supported as it proceeds during pull back so that it moves freely and the pipe material is not damaged.

3.04 CLEANUP, REPAIRS AND RESTORATION

- A. The CONTRACTOR is responsible for leaving all areas affected by construction activities in a condition equal to or better than the condition before construction.
- B. The CONTRACTOR shall restore area around entry and exit pits as soon as work is completed. Fill to previous existing ground elevation and grade any areas where settlement occurs due to subsidence. Seed and straw as directed in Section 02930, Seeding.

End of Section

SECTION 02444
GALVANIZED CHAIN LINK FENCING

PART 1 GENERAL

1.01 SUMMARY

- A. Submit complete specifications and shop drawings for OWNER'S approval.
- B. Fencing and all accessories shall be produced by a single manufacturer. Submit copies of the manufacturer's technical data, layout and installation instructions per Section 01302.
- C. Refer to other Sections for work related to that specified under this heading.

PART 2 PRODUCTS

2.01 POSTS, RAILS, AND BRACES

- A. All structural and roll formed shapes shall conform to the provisions of ASTM A123 for galvanized coating.
- B. All tubular members shall comply with the provisions of ASTM A120, Schedule 40, for weight and coating or be high strength triple coated steel in accordance with ASTM A569.
- C. End, Corner, and Pull Post: For fence up to and including 12 feet 0 inches in height, 3-1/2 inches by 3-1/2 inches roll formed corner section shall have a minimum bending strength of 452 pounds (2.875 inches outside diameter, Schedule 40 pipe with a minimum bending strength of 381 pounds at 6 feet).
- D. Line Posts (10 feet 0 inches Maximum Spacing):
 - 1. Fabric Up To 8 feet 0 inches in Height: C-section, standard roll formed, 1.875 inches by 1.625 inches with a minimum bending strength of 245 pounds (1.90 inches outside diameter, Schedule 40 or high strength pipe with a minimum bending strength of 117 pounds)
 - 2. Fabric Over 8 feet 0 inches in Height: C-section, heavy roll formed, 2.25 inches by 1.70 inches with a minimum bending strength of 314 pounds (2.375 inches outside diameter, Schedule 40 pipe with a minimum bending strength of 201 pounds)
- E. Gate Posts:
 - 1. Gate Leaves Up to and Including 6 feet 0 inches Wide: 3-1/2 inches by 3-1/2 inches roll formed section (2.875 inches outside diameter, Schedule 40 or high strength steel pipe)

2. Gate Leaves Over 6 feet 0 inches and Up To and Including 13 feet 0 inches Wide: 4 inches outside diameter, Schedule 40 pipe or high strength steel pipe
3. Gate Leaves Over 13 feet 0 inches and Up To and Including 18 feet 0 inches Wide: 6-5/8 inches outside diameter, Schedule 40 pipe or high strength steel pipe
4. Gate Leaves Over 18 feet 0 inches Wide: 8-5/8 inches outside diameter, Schedule 40 pipe or high strength steel pipe

F. Top Rail:

1. The top rail shall be a 1.625 inches by 1.25 inches roll formed section with a minimum bending strength of 192 pounds (1.660 inches outside diameter, Schedule 40 pipe with a minimum bending strength of 202 pounds at 10 feet).
2. Furnish in the manufacturer's standard lengths of approximately 21 feet 0 inches, with couplings approximately 6 inches long for each joint. One coupling in each five shall have an expansion spring. Provide means for attaching top rails securely to each gate, corner, pull, and end posts. The top rail shall form a continuous brace from end to end to each run of fence.

G. Tension Wire: 7 gage galvanized or aluminum coated coil spring wire

H. Post Bracing Assembly: to match top rail. Brace rail assembly shall be complete with a 3/8 inch diameter rod and adjustable take-up.

2.02 CHAIN LINK FABRIC

- A. The fabric shall consist of one-piece fabric widths for fences up to 12 feet 0 inches - 2 inches mesh, 9 gage or 11 gage, as indicated on the drawings.
- B. Selvage Edges: Fabric in heights 60 inches and less shall be knuckled at both selvages. Fabric 72 inches and more shall be knuckled at the bottom selvage and be twisted and barbed at the top.
- C. Finishes: heavy galvanized, 2.0 ounces of zinc per square foot, complying with ASTM A392, Class II, or aluminum coated with 0.40 ounces of aluminum per square foot, complying with ASTM A491, Class II

2.03 ACCESSORIES

- A. All accessories, except tie wires and barbed wire, shall be galvanized to comply with ASTM A153.
- B. Barbed Wire Supporting Arms: heavy pressed steel, complete with provisions for anchorage to tubular end, corner, and pull posts attaching 3 rows of barbed wire to each arm. Barbed wire arms are not required on roll formed terminal posts. Single arms shall be integral with a post top weather cap. Intermediate arms shall have a hole for the passage of the top rail. Arms shall be capable of withstanding, without failure, 250 pounds downward pull at outermost end of arm.

- C. Barbed Wire: 2 strand, 12-1/2 gage wire with 14 gage, 4 point round barbs spaced approximately 5 inches on center, with finishes as follows:
 - 1. Galvanized: ASTM A121, Class 3
 - 2. Aluminized: ASTM A585, Class 2
- D. Post Tops: pressed steel or malleable iron (designed as a weathertight closure cap for tubular posts). Where top rail is used, provide tops to permit the passage of the top rail.
- E. Stretcher Bars (for tubular end, corner, pull, or gate posts only): one-piece lengths equal to the full height of the fabric, with a minimum cross section of 3/16 inch by 3/4 inch. Provide one stretcher bar for each gate and end post and two for each corner and pull post.
- F. Stretcher Bar Bands: heavy pressed steel spaced not over 15 inches on center to secure stretcher bars to tubular end, corner pull, and gate post
- G. Wire Ties: For tying fabric to line posts, use 11 gage steel wire clips for C-section posts and a minimum 9 gage aluminum wire ties for tubular posts, spaced 14 inches on center. For tying fabric to rails and braces, use 9 gage aluminum wire ties spaced 24 inches on center. For tying fabric to tension wire, use 11 gage hog rings spaced 24 inches on center.

2.04 GATES

- A. Fabricate gate perimeter frames of 1.90 inches outside diameter tubular members galvanized in accordance with ASTM A120. Provide additional horizontal and vertical members to ensure proper gate operation and to allow for attachment of fabric, hardware, and accessories.
- B. Assemble gate frames by welding or fittings and rivets for rigid connections. Use same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges, and tie at top and bottom edges. Attach stretcher bars to gate frame at not more than 15 inches on center. Attach hardware with rivets or by other means that will provide security against removal or breakage.
- C. Provide diagonal cross bracing that consists of 3/8 inch diameter adjustable length truss rods on gates where necessary to provide frame rigidity without sag or twist.
- D. Gate Hardware: Provide the following hardware and accessories, with a heavy galvanized finish, for each gate:
 - 1. Hinges: pressed steel or malleable iron to suit gate size, nonlift-off type, offset to permit 180 degrees gate opening. Provide one pair of hinges for each leaf.
 - 2. Latch: forked type or plunger bar type to permit operation from either side of the gate. Provide padlock eye as an integral part of the latch.
 - 3. Keeper: Provide a keeper for all vehicle gates that automatically engages the gate leaf and holds it in the open position until manually released.

4. Double Gates: Provide gate stops for all double gates consisting of mushroom type or flush plate with anchors. Set in concrete to engage the center drop rod or plunger bar. Provide locking device and padlock eyes as an integral part of the latch, with one padlock for locking both gate leaves.
5. Sliding Gates: Provide the manufacturer's standard heavy-duty track, ball bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, and accessories, as required.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The packing for all products shall be Level C.
- B. SET ALL POSTS IN A 3,000 PSI CONCRETE FOOTING. Trowel smooth the top of each footing at a 20 degrees angle from the post to the surrounding ground so as to shed water away from the post. The post shall extend to the full depth of the footing. The diameter and depth of footings for various fence heights shall be as specified on the drawings.
- C. INSTALL ALL FENCING TO THE LIMITS SHOWN ON THE DRAWINGS. Install end or corner posts at any break in the alignment greater than 20 degrees. Install intermediate posts between end or corner posts, spaced equally at a maximum of 10 feet center to center. Install end, corner, or gate posts on both sides of a gate. Only one end or corner post shall be installed at the junction of different heights of fence and shall be consistent with the largest post required at the junction. Install gates to allow a clear and level swing in either direction to their maximum limit. Set all posts with a vertical tolerance of less than 1 inch in 10 feet as measured with a plumb bob.
- D. All corner, terminal, and gate posts for fence 6 feet and higher shall have a midrail and 3/8 round adjustable truss rod to the next post.
- E. All gates shall have a full wraparound hinge system with a positive latch with provision for a padlock. Gates 5 feet and under shall have a self-closing mechanism.
- F. All fence shall have a bottom tension wire attached to the fabric and posts.

End of Section

SECTION 02510
WATER DISTRIBUTION LINES, VALVES, AND APPURTENANCES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Water-distribution piping and related components for combined water service and fire-service mains.

B. Related Sections

1. Section 01090 – STANDARDS
2. Section 01302 – SUBMITTALS AND SUBSTITUTIONS
3. Section 01720 – PROJECT RECORD DOCUMENTS
4. Section 02611 – TRENCHING, BACKFILLING, AND COMPACTING
5. Section 02511 – WATER SERVICE CONNECTIONS

C. References

1. ANSI/AWWA C104/A21.4 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
2. ANSI/AWWA C110/A21.10 – Ductile-Iron and Gray-Iron Fittings for Water
3. ANSI/AWWA C111/A21.11 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. ANSI/AWWA C151/A21.51 – Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
5. ASTM B88 – Standard Specification for Seamless Copper Water Tube
6. ASTM D2241 – Standard Specification of Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series).
7. AWWA C500 – Metal-Seated Gate Valves for Water Supply Service.
8. AWWA C502 – Dry-Barrel Fire Hydrants.
9. AWWA C504 – Rubber-Seated Butterfly Valves
10. AWWA C508 – Swing-Check Valves for Waterworks Service, 2 In. (50 mm) through 24 In. (600 mm) NPS.
11. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service.
12. AWWA C512 – Air Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service
13. AWWA C600 – Installation of Ductile-Iron Water Mains and Their Appurtenances.
14. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.

15. AWWA C906 – Polyethylene (PE) Pressure Pipe and Fittings, 4 in. Through 65 in. (100 mm Through 1,650 mm), for Waterworks.
16. NFPA 291 – Recommended Practice for Fire Flow Testing and Marking of Hydrants.

1.03 SUBMITTALS

- A. Submittals shall be submitted as specified in Section 01302 – SUBMITTALS AND SUBSTITUTIONS, promptly and in accordance with approved schedule, in such a sequence that no delay to the Work, or to the work of other Contractors is caused.
- B. Product data shall be submitted as required.
- C. Certification signed by Manufacturer and CONTRACTOR that pipe and fittings meet specification requirements shall be submitted.
- D. One (1) certified copy of disinfection test results shall be submitted.

1.04 QUALITY ASSURANCE

- A. The CONTRACTOR shall install, test, and disinfect water lines in accordance with regulations issued by the Tennessee Department of Environment and Conservation and the Lenoir City Utilities Board.
- B. Adequate numbers of skilled workmen, who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work in this section shall be used.
- C. Use equipment adequate in size, capacity and numbers to accomplish the Work in a timely manner shall be used.
- D. HDPE Pipe
 1. Manufacturer Qualifications, Delivery, Shipping, and Storage shall be consistent with requirements identified by the pipe manufacturer.
 2. For Public Main Line installation, persons fusing HDPE pipe shall have 2 years of experience with fusing HDPE pipe and shall have received a minimum of 8 hours of training for fusing HDPE Pipe from pipe supplier or fusing equipment supplier. Training course certification shall be updated annually.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Ductile iron pipe shall be protected from damage to coating and lining.
- B. All Types of pipe shall be handled using canvas or nylon slings. If a forklift is to come in direct contact with HDPE pipe, the forks shall be padded. HDPE pipe shall be stored in a manner, which minimizes crushing or bending. HDPE pipe should lay flat and be stacked no higher than 84 inches. HDPE pipe coils shall not be stored in a vertical position. HDPE pipe shall be transported and stored so that it does not come in contact with debris or materials that could cause damage to the pipe.

- C. Keep All material shaded from direct sunlight prior to installation in trench.
- D. Limit stacking of pipe to a height that will not cause deformation of bottom layers of pipes under anticipated temperature conditions. Space supports at widths as not to allow deformation of pipe at point of contact with support or between supports.
- E. Interior of pipe and fittings shall be cleaned of dirt and other foreign material immediately prior to lowering into the trench.
- F. Carefully examine each pipe and fitting for cracks and other defects while suspended above the trench immediately before installation.

1.06 PROJECT CONDITIONS

- A. Whenever pipe laying is not actively in progress, open ends of all installed pipe and fittings shall be fitted with a watertight plug as approved by the Owner's representative.
- B. Separation of Water Mains and Services:
 - 1. Water lines shall be installed in locations to provide a minimum of 18 inches of clearance (horizontally and vertically) between all other existing and proposed utilities including but not limited to; sewer, natural gas, electric, telecommunications, and storm. See following paragraphs 2 through 4 for installation near sewer lines.
 - 2. The new water main has been located so the proper horizontal and vertical separation from the existing sewers has been provided where the water line parallels a sewer line. However, in the event field conditions reveal that a horizontal separation of 10 feet cannot be obtained, the water line shall be laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer so the bottom of the water main is at least 18 inches above the top of the sewer pipe.
 - 3. Whenever the water main crosses a sewer main, a minimum vertical distance of 18 inches shall be provided between pipes. This distance shall be provided whether the water main is above or below the sewer pipe. At crossings, one full length of water pipe must be located so both joints will be as far from the sewer line as possible. Special structural support for the water and sewer lines shall be provided.
 - 4. Water line shall not pass through or come in contact with sewer manholes.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

- A. Ductile-Iron Pipe: AWWA C151, Pressure Class 350.
 - 1. Fittings: Ductile, AWWA C110, Pressure Rating 350 psi, Mechanical Joints.
 - 2. Joints: AWWA C111, Push on Joints with Gaskets of Neoprene, or Rubber. Restrained joint system shall be U.S. Pipe: Field Lok®/TR Flex® or approved equal.
 - 3. Lining: Cement mortar, AWWA C104, for Pipe and Fittings

- B. Polyvinyl Chloride Pipe (PVC): C900 Pressure Class 305 psi (DR14) PVC pipe shall be acceptable for pipe 8 inches in diameter and less only. Class required shall be based on working pressure as designated by owner. The pipe shall be clearly marked with the Manufacturer's name, nominal diameter, SDR, pressure rating and NSF approval seal. All PVC pipe for a particular project shall be provided by the same manufacturer, and shall be the same color.
1. Fittings: Ductile, as above
 2. Joints: Push-on with gaskets as recommended by Manufacturer, for the application.
- C. High Density Polyethylene (HDPE) Pipe, 8 inches in diameter and less only, shall be PE4710 and have a heat indented print line containing the information required in ASTM D3035. All HDPE pipe shall be in compliance with NSF 61 and must be made by a pipe manufacturer that must be approved by the Owner before pipe installation. HDPE pipe must be designated for potable water use by having a minimum of three blue stripes extruded along the entire length of the pipe and also being equally spaced around the outside diameter of the pipe. Color print lines are not an acceptable method for color marking of pipe. Pipes larger than 2-inch shall be Ductile Iron Pipe Size (DIPS) in compliance with AWWA C906 PE4710 and ASTM F 714. Pipes 2 inch and less shall be Iron Pipe Size (IPS) in compliance with AWWA C901 and ASTM D3035. HDPE pipe 2 inch and larger shall be SDR 11 and pipe smaller than 2 inches shall be SDR 9.
1. Fittings: Ductile, as above with AquaGrip by Mueller or approved equal mechanical restraints.
 2. Fittings molded and fabricated from polyethylene pipe may be used with Owner approval. Use thermal butt-fusion.
 3. Joints: Thermal butt-fusion. Electrofusion may be approved by Owner only at tie-ins to existing pipe.

2.02 GATE VALVES AND BOXES

- A. Gate valves shall be iron body, bronze trim, resilient-seated wedge type, fusion bonded epoxy coated, non-raising stem, turning counterclockwise to open. Valves shall meet the requirements of AWWA C509/C515. Valve shall be furnished with standard operating nut. Valve shall operate smoothly through the entire lift and shall provide zero leakage at 250 psi working pressure.
- B. Valve boxes shall be standard design ductile iron with cover. Boxes shall have an outside diameter of not less than 6 inches with a minimum thickness of metal at any point of not less than 0.1875 inches. Boxes outside of pavement shall be set in a concrete pad of minimum dimensions 18-inch x 18-inch x 6-inch thick with four (4) - #4 bars in each direction, poured after final grade has been established. See Typical Detail W2. In the event of required height adjustment, all riser material shall be ductile iron.
- C. All gate valves shall be mechanical joint type in features and quality equal to Mueller, Kennedy, M&H or American Valve.
- D. Valves used in lines serving any fire protection system shall be UL listed and Factory Mutual approved with roadway boxes provided where valves are under pavement.

2.03 BUTTERFLY VALVES

- A. Butterfly Valves may be required by owner on water lines greater than 12 inches if necessary to achieve desired cover or grade. Butterfly valves shall be in accordance with AWWA C504 and coated in accordance with AWWA C550.

2.04 FIRE HYDRANT

- A. Fire hydrant shall meet the requirements of AWWA C502, and shall be designed for 200 psi working pressure. Valve opening shall be 5 1/4 inches.
- B. Hydrant shall be equipped with two (2) – 2 1/2-inch nozzles, with National Standard threads and one (1) brass pumper nozzle with National Standard Fire Hose coupling screw threads together with caps fastened securely to each hydrant and threaded to fit nozzles.
- C. Hydrants shall have a safety “breakaway flange” section located above the ground line. The distance from the finished ground line of the hydrant to the “breakaway flange” shall not be less than 2-inches or more than 6-inches.
- D. The waterways of hydrants shall be as free as possible of obstructions, sharp turns, corners, or other causes for resistance. The hydrant shall have a 6-inch mechanical joint shoe.
- E. The hydrant main valve shall be of the compression type, closing with pressure. The valve shall be faced with heavy impregnated waterproof ballast or other approved material. The hydrant shall be “dry head type.”
- F. Hydrants shall be painted as shown below, in accordance with the latest NFPA code for marking of hydrants, and/or in accordance with the Lenoir City Fire Department standards.

Red	Less than 500 gpm
Orange	500 – 999 gpm
Green	1000 – 1499 gpm
Light Blue	1500 gpm or greater
- G. The hydrant operating and outlet nozzle cap nuts shall be pentagonal in shape. The pentagon shall measure 1 ½ inches from point to flat at the base of the nut and 1-7/16 inches at the top. Nut faces shall taper uniformly and the height of the nut shall no be less than 1-inch.
- H. The hydrant shall be opened by turning the operating nut counterclockwise. A clearly visible arrow and the word “open” shall be cast in relief on the top of the hydrant so as to designate the direction of opening.
- I. In the interest of standardization, fire hydrants shall be “AWWA Improved Type” hydrants as manufactured by Mueller Company, Super Centurion #250 – factory powder coated yellow, and shall meet the approval of the Lenoir City Utilities Board. The ENGINEER will assist the CONTRACTOR by furnishing information and coordinating approval.
- J. Fire hydrants shall be UL listed and Factory Mutual approved.

- K. Hydrant drainage shall be provided by excavating a pit, 2 feet x 3 feet x 1-½ feet deep below the bottom of the trench and filling the pit with clean crushed stone around the elbow of the hydrant to above the drain hole.
- L. All Hydrants shall be installed in accordance with Typical Detail W1 and include a gate valve on the hydrant line.
- M. Locations and distances between fire hydrants shall be determined by current Local Codes.

2.05 CHECK VALVES

- A. Swing check valves shall be iron body, bronze mounted, with seat rings, faces, and hinge pins suitable for operation in horizontal or vertical lines.
- B. A removable cover shall be provided for the removal of internal parts without necessitating removal of the valve from the line. The high point of the valve shall be tapped and equipped with a plug. When shown on the drawings, a valve or curb stop for the removal of air shall be provided. All check valves shall be of mechanical joint or ANSI 125 or 250# drilled and faced as shown.

2.06 AIR RELEASE VALVES

- A. All valves shall conform to AWWA C512.
- B. Combination type air valve with the features of both an air release valve and air and vacuum valve.
- C. Air release component shall be designed to automatically release small pockets of air to the atmosphere as they accumulate along a pipeline or piping system when it is full and operating under pressure.
- D. Air and vacuum component shall be designed to automatically discharge or admit large volumes of air during the filling and draining of a pipeline or piping system. The valve shall open to relieve negative pressures whenever water column separation occurs.
- E. Automatic air release component and the air and vacuum component shall be independently acting valves bolted together or single body.
- F. Working pressure shall be between 3 and 285 psi.
- G. Maximum working temperature: 140°F.
- H. Air valves shall be manufactured by ARI D-040, APCO 140C series, Crispin UL series, Golden Anderson or approved equal and shall be furnished and installed as shown on the Contract Drawings. These valves will be field located by the OWNER or OWNER's Representative during construction.
- I. Automatic air release valves shall be installed at all high points in the water main as noted on the drawings and/or as required by the Owner's representative. Air valves shall be 1-

inch on pipelines less than 12 inches in diameter. For 12-inch and 16-inch pipelines, the air valves shall be 2-inch. Air valves on pipelines larger than 16-inch diameter shall be sized appropriately by the valve manufacturer's engineer.

- J. Air Release Valves shall be installed in a 4-foot diameter precast manhole in accordance with the Standard Detail W4.

2.07 PRESSURE REDUCING VALVES

- A. The pressure reducing valve shall function to reduce an existing high pressure to a predetermined lower outlet pressure without shock or jar.
- B. The valve shall be of the single seated, balanced design type, globe (angle) body, with threaded inlet and outlet ports. It shall be diaphragm operated and spring loaded, permitting convenient adjustment over a range of no less than 30 psi.
- C. The valve body shall be bronze construction with bronze or stainless steel stem and be furnished with a replaceable rubber seat.

2.08 DETECTION WIRE

- A. Detection wire shall be required for ALL piping.
- B. All water lines, including DIP, shall be installed with a 12-gauge tracer wire throughout the entire system, including service laterals to the meter. Wire shall be installed with (directly beneath or beside of) the water main. Keep wire as continuous as possible. Where connections are needed, strip wire back approximately 1-inch and connect with waterproof direct-bury lug with dual conductor slots (DryConn #90220 or approved equal). Wrap connection well on each side connection with electrical tape. When installation is complete, the entire system must be tested for continuity in the presence of a LCUB inspector. LCUB will require re-excavation and improvement to areas that do not trace well and/or show low or poor continuity. Tracer wire shall be high-strength copper clad steel conductor that is specifically made for underground utility locating purposes, and shall be #12 AWG HS-CCS HDPE 30 mil as manufactured by "Copperhead Industries, LLC" or approved equal, and shall be insulated with a 30 mil, high density, high molecular weight polyethylene blue insulation and rated for direct burial use at 30 volts.
- C. Heavier wire may be required for directional drilling.

2.09 WARNING TAPE

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored blue for water. Warning tape required (in addition to tracer wire) for all open cut installation of water line.

2.10 THRUST BLOCKS

- A. Concrete thrust blocks shall meet the requirements of Section 03300 – CAST-IN-PLACE CONCRETE, and shall be placed in accordance with the typical details shown in the Contract Drawings.

2.11 RETAINER GLANDS

- A. Retainer glands for ductile iron pipe shall be Romac Industries, Inc. GripRing Pipe Restraint, Megalug Series 1100, as manufactured by EBAA Iron, Sigma One-Lok series SLDE, or approved equal.
- B. Retainer glands for PVC pipe shall be Romac Industries, Inc. GripRing Pipe Restraint, Megalug Series 2000PV, as manufactured by EBAA Iron, Sigma One-Lok series SLCE or approved equal.
- C. Restraint for HDPE shall be M.J. Adapters by Central Plastics or Performance Pipe, AquaGrip by Mueller or approved equal.
- D. Restrained joint system for push-on joint pipe shall be U.S. Pipe: Field Lok®/TR Flex® or approved equal.

2.12 HYDRANT BOLLARD

- A. Contractor shall furnish and install bollards as directed by the OWNER in areas where vehicular damage may be anticipated.
- B. The quantity and arrangement of the bollards shall be as directed by the OWNER's Engineer or Resident Project Representative.
- C. Bollard shall be minimum 4-inch schedule 40 steel pipe and installed in accordance with detail W21.

PART 3 EXECUTION**3.01 PREPARATION**

- A. Install barriers and other devices to protect areas adjacent to construction.
- B. Protect and maintain all benchmarks and other survey points.

3.02 INSTALLATION OF DIP AND PVC OPEN CUT

- A. Trenching and backfill shall meet the requirements of Section 02611 – TRENCHING, BACKFILLING, AND COMPACTING.
- B. Install pipe in accordance with AWWA C600/C605 and Manufacturer's recommendations.

- C. During pipe installation CONTRACTOR shall take every precaution to prevent foreign material from entering the pipe or fittings. The CONTRACTOR shall place a heavy, tightly woven canvas bag over each end of joint of pipe before lowering it into the trench.
- D. Jointing procedures, including cleaning of ends of pipe, and lubrication shall be in accordance with the Manufacturer's recommendations. Pipe shall be laid with the bells pointing in the direction of laying.
- E. All unnecessary material shall be removed from the bell and spigot end of each pipe. Before any pipe is laid, the outside of its spigot end and the inside of its bell shall be cleaned and left dry and oil free.
- F. Field cutting of pipe shall be done according the Manufacturer's recommendations. Cut end shall be smooth and at right angles to the axis of the pipe. Field cuts shall be filed to resemble the spigot end of the pipe as manufactured. Depth marks shall be placed on the pipe to assure pipe is inserted to the full depth when joint is made.
- G. Mechanically restrained joints (Megalug, One-Lok, GripRing, or equal) shall be provided at all bends of $11\frac{1}{4}^{\circ}$ or greater, tees and valves. Restraining gaskets (Field-lok or equal) shall be used for specified length from each fitting.
- H. Thrust blocking shall be provided at all bends of $11\frac{1}{4}^{\circ}$ or greater, tees and valves. Blocking shall be poured against undisturbed earth, be a minimum of 8 inches thick, and constructed so the pipe and fitting joints will be accessible for repairs. Install as shown on typical details in the Contract Drawings.
- I. All valves shall be installed plumb and true in a workmanlike manner.
- J. For new developments, the Lenoir City Utilities Board may require a meter box and yoke to be installed for services on the opposite side of the road as the main. Installation shall be in accordance with Section 02511 - WATER SERVICE CONNECTIONS.
- K. Unless otherwise indicated by the drawings, all water lines shall have at least 36 inches of cover. Exceptions shall be approved by the Owner.

3.03 INSTALLATION OF HIGH DENSITY POLYETHYLENE (HDPE)

- A. Prior to installing pipe through a bored hole, ensure that the size of the hole is of sufficient diameter to prevent pipe stress during installation. The leading end of the pipe to be inserted shall be closed to prevent the entrance of dirt and debris. After insertion, the leading end of the pipe shall be examined in the exit bell hole to ensure that the pipe has not been damaged during insertion. Damaged pipe shall be replaced after corrective measures have been taken to prevent damage to the replacement pipe.
- B. Any pipes placed along the route of the proposed lines before the actual installation of the lines shall not be lowered into the trench until they have been swabbed to remove any mud, debris, etc., that may have accumulated within them. Pipe shall be placed along the route a maximum of one day ahead of pipe laying. HDPE pipe shall be inspected prior to fusion and prior to lowering the pipe into the trench to ensure that the pipe does not contain any debris. The pipe shall be cleaned if necessary to remove debris.

- C. Pipe shall be inspected prior to and after lowering into the trench for any damage. HDPE pipe shall be carefully inspected for cuts, gouges, deep scratches, or other defects. Any segment containing defects shall be removed and replaced. HDPE pipe shall not be used if gouges or cuts are greater than 10 percent of the wall thickness. When lowering HDPE pipe into the trench, the pipe shall not be subjected to excessive twisting and bending stresses. Allow for contraction of small diameter HDPE pipe by "snaking" the pipe from side to side in the trench.
- D. All pipe shall be joined in the exact manner specified by the manufacturers of the pipe and joining materials.
- E. HDPE fusion joints shall be allowed to cool for the required time. The CONTRACTOR shall be qualified to perform HDPE fusion by the product manufacturer and shall provide proof of qualification prior to beginning work.
- F. Unless otherwise indicated by the drawings, all water lines shall have at least 36 inches of cover. Exceptions shall be approved by the Owner.

3.04 HDPE PIPE JOINING – PROCEDURES AND QUALIFICATIONS

- A. HDPE pipe must be joined using a qualified joining procedure and by persons qualified on that procedure.
- B. HDPE shall be joined using butt fusion, unless otherwise approved by owner. All mains and services shall be butt fused, unless otherwise approved by owner. Fusion shall take place in weather conditions acceptable to the OWNER.
- C. Procedure Qualification - all joining methods for polyethylene pipe shall be qualified and approved by Owner. The polyethylene pipe manufacturers have developed qualified procedures for heat fusion of HDPE pipe. LCUB has adopted the Plexco Pipe procedure for all saddle and butt fusion of polyethylene pipe and fittings. LCUB has adopted Central Plastics Procedures for electrofusion. All heat fusion joints will be visually inspected to determine if they have the same appearance as a joint properly made under the qualified procedure.
- D. Joiner Qualification - persons making either heat fusion or mechanical joints shall be qualified using applicable joining procedures mentioned above. Each person will be required to qualify for each of the joints they are expected to make. The qualifying procedure for polyethylene pipe joiners will consist of:
 - 1. Training and experience with the qualified procedure.
 - 2. Making a specimen joint according to the qualified procedure.
 - 3. Visual inspection of the specimen joint to determine if it has the same appearance as a joint properly made under the qualified procedure.
- E. For heat fusion joints, three longitudinal straps, 1 inch wide, cut from the joint will be examined for defects and then deformed by back bend, root bend, or torque. If failure indicates outside the joined area, the joint is acceptable.

- F. For service saddle tee fusion, the test specimen will be secured and struck with a 3 lb. hammer.
- G. Qualification of persons making joints for each procedure will remain effective for 1 year from the date of testing, unless the OWNER requires more frequent retraining due to quality of joints completed.
- H. CONTRACTOR fusion training shall be completed by a manufacturer or manufacturer representative acceptable to the OWNER. CONTRACTOR shall provide proof of training acceptable to the OWNER.
- I. All personnel performing plastic pipe fusion shall at all times while performing the fusion have readily available on the job site proof of qualification from the manufacturer or other acceptable training company approved by OWNER.
- J. Mechanical couplings designed for use in HDPE piping systems have qualified installation procedures developed by the manufacturers. These procedures shall be followed for installation. All field mechanical joints will be visually inspected to determine if they have the same appearance as a joint properly made under the qualified procedure. All mechanical couplings used in plastic piping systems shall be designed to resist pullout.
- K. Aqua-grip or other OWNER approved fittings shall be used for wet tie-ins.
- L. HDPE pipe shall have a co-extruded blue cover or extruded blue stripes designating use for water. Color print lines are not an acceptable method for designation of water mains. Pipe with extruded blue stripes shall have a minimum of three equally spaced stripes. Pipe shall have a heat indented print line containing the information required in ASTM D 3035.

3.05 PLACING DETECTION WIRE AND WARNING TAPE

- A. All buried water pipes shall be identified by buried wire and warning tape.
- B. Detection wire shall be placed just below or beside pipe. Wire shall be stubbed out of valve box with a minimum of 36 inches of slack above grade (see Gate Valve Standard Drawing).
- C. Warning tape shall be installed directly above water line 18 inches below finished grade.

3.06 HYDROSTATIC PRESSURE TEST

- A. See Section 02520 – DISINFECTION AND TESTING OF WATER DISTRIBUTION SYSTEM

3.07 DISINFECTING WATER LINES

- A. See Section 02520 – DISINFECTION AND TESTING OF WATER DISTRIBUTION SYSTEM

End of Section

**SECTION 02511
WATER SERVICE CONNECTIONS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Water service connection piping and related components for domestic water service and fire-service lines.

B. Related Sections

1. Section 01090 – STANDARDS
2. Section 01302 – SUBMITTALS AND SUBSTITUTIONS
3. Section 01720 – PROJECT RECORD DOCUMENTS
4. Section 02611 – TRENCHING, BACKFILLING, AND COMPACTING
5. Section 02510 – WATER DISTRIBUTION LINES, VALVES, AND APPURTENANCES

C. References

1. ASTM B88 – Standard Specification for Seamless Copper Water Tube
2. AWWA C700 – Cold-Water Meters—Displacement Type, Bronze Main Case.
3. AWWA C701 – Cold-Water Meters—Turbine Type, for Customer Service.
4. AWWA C800 – Underground Service Line Valves and Fittings.
5. NSF/ANSI 61 – Drinking Water System Components – Health Effects

1.03 SUBMITTALS

- A. Submittals shall be submitted as specified in Section 01302 – SUBMITTALS AND SUBSTITUTIONS, promptly and in accordance with approved schedule, in such a sequence that no delay to the Work, or to the work of other Contractors is caused.

B. Product data shall be submitted as required.

1. Pipe material data.
2. Materials of construction for corporation stops, curb stops, and meter stops.
3. Fitting types
4. Manufacturer's Certificate of Compliance, in accordance with AWWA C800
5. Manufacturer's Certificate of Compliance, in accordance with NSF/ANSI 61

- C. Certification signed by Manufacturer and Contractor that pipe and fittings meet specification requirements shall be submitted.

- D. One (1) certified copy of disinfection test results shall be submitted.

1.04 QUALITY ASSURANCE

- A. The Contractor shall install, test, and disinfect water service lines in accordance with regulations issued by the Tennessee Department of Environment and Conservation and the Lenoir City Utilities Board.
- B. Adequate numbers of skilled workmen, who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work in this section shall be used.
- C. Equipment adequate in size, capacity and numbers to accomplish the Work in a timely manner shall be used.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

- A. Copper Service Tubing: ASTM B88, AWWA C800, Type K, seamless, suitable for use in underground water services. Copper service tubing shall be utilized for all service lines unless otherwise directed by Owner.
1. Fittings: As outlined in AWWA C800.
- B. Cross Linked Polyethylene (PEX)
1. Crosslinked polyethylene piping by high-pressure peroxide method of crosslinking (PEXa) may be installed for service lines as approved by Owner.
 - a) Produced in accordance with AWWA C904, ASTM F876, F877 and NSF 61
 - b) Required 200 psi pressure rating at 73.4°F when using a 0.63 design factor
 - c) Required 1 year UV resistance rating in accordance with ASTM F876
 2. Approved AWWA C800 compression joint valves and fittings, suitable for buried applications, using stainless steel support liners inside pipe at each joint and/or cold-expansion and compression –sleeve fittings.
 3. Copper Tubing Size (CTS) Municipex PEXa by Rehau, or pre-approved equal.
- C. PVC Service lines 2 inches and larger may be approved by Owner. Materials in accordance with Section 02510, Water Distribution Lines, Valves, and Appurtenances.
- D. Ductile-Iron Pipe services shall meet all requirements for Ductile Iron Pipe and Fittings as specified in Section 02510, Water Distribution Lines, Valves, and Appurtenances.
- E. High Density Polyethylene (HDPE) services shall meet all requirements for HDPE Pipe and Fittings as specified in Section 02510, Water Distribution Lines, Valves, and Appurtenances.

2.02 SERVICE METERS AND SERVICE CONNECTIONS

- A. Service meters shall meet the standards of AWWA C700. The meter shall be installed in accordance with the Typical Details shown in the Standard Water Specifications and Contract Drawings. They shall be sized according to flow, frost proof with a cast bronze casing and hinged cover. The meter shall be direct reading in gallons. It shall have a strainer located over the inlet to the measuring chamber and have the Manufacturer's name and serial number permanently affixed. Verify with LCUB for current Requirement.
- B. 5/8-inch x 3/4-inch Meters shall be Badger Recordall Disc Series Meters; M25-LL, M55-LL, M120-LL, or M170-LL Lead Free Alloy Meter, Cast Iron Bottom, ADE 6 Dial (10 Gal) Resolution, USG, 5-ft Itron Cable with female connector, Plastic Lid/Shroud, Sidewalk Read, YOM S/N's on Housing and Outside Lid, AWWA Certified, Torx Screws, Less Connections. NSF/ANSI Standard 61 Certified, Annex F/G. Verify with LCUB for current Requirement.
- C. Meters 2-inch through 6-inch shall be compound meters installed in accordance with Typical Detail W10. Badger Recordall Compound Series CSM-LL-NS Lead Free-Alloy Compound Series Meter, Elliptical with Test Plug, (2) ADE Registers, USG, 6 Dial (100 Gal Resolution) High Flow/6 Dial (10 Gal Resolution) Low Flow, (2) 5-ft Itron cables with female connectors, Plastic Lid/Shroud, Torx Screws, BMI YOM Serial Numbers on Housing and Outside Lid, AWWA Certified Test, Less Connections. NSF/ANSI Standard 61 Certified, Annex F/G. Verify with LCUB for current Requirement.
- D. 8-inch Meter shall be Badger Turbo Series T-3500-LL-NS Lead Free-Alloy Turbo Series Meter with Test Plug, ADE Register, USG, 6 Dial (1000 Gal Resolution), 5-ft Itron cable with female connector, Plastic lid/shroud, Sidewalk Read, BMI YOM Serial Numbers on Housing and Outside Lid, Torx Screw, AWWA Certified Test, Less Connections. NSF/ANSI Standard 61 Certified, Annex F/G.
- E. Water main connection shall be in accordance with pipe manufacturer's recommendations. The tap shall be at 45°.
- F. Corporation stops (Mueller H-15008N or Ford Equivalent) shall conform to AWWA C800 and be installed and protected prior to installation in accordance with Manufacturer's recommendations.
- G. Meter yokes shall be Mueller In-Line Meter Yoke (or Ford Equivalent), Mueller B-2418R for 3/4-inch meter with Mueller Connections H-14227N (3/4 CTS) and Mueller H-14222N (3/4 in. F.I.P.) of copper construction with an integral brace and meter stop. It shall have a minimum of 4-inch rise and provide outlets for use of copper service tubing. 1-inch In-Line Meter Yoke shall be Mueller B-2418R and 2-inch In-Line Meter Yoke shall be Mueller B-2423N.
- H. Installation of short-side and long-side double service laterals shall include a 1-inch corporation stop (Mueller H-15008N or Ford Equivalent), 1-inch type K copper line, 1-inch ball valve before 'Y', and 3/4-inch x 1-inch 'Y' branch connection (Mueller H-15343N or Ford Equivalent).

- I. All long-side 1-inch service lines shall be encased with 3-inch PVC/HDPE and ¾-inch service lines shall be encased with 2-inch PVC/HDPE.
- J. Service Saddles for DIP and PVC shall be steel with neoprene gaskets and double straps or stainless steel band. These shall be equal to those manufactured by Mueller.
- K. For HDPE pipe, HDPE Service Saddle ROMAC Model No. 202N-H or pre-approved equal.
- L. Curb Stop (Mueller B-25209N Ball Angle Meter Valve or Ford Equivalent) shall conform to AWWA C800 and be installed and protected prior to installation in accordance with Manufacturer's recommendations.
- M. Meter boxes shall be steel (meter box and lid as manufactured by Darter Steel and sized appropriately based on the size of the meter being installed). They shall be installed and conform to the typical details and as shown in the Contract Documents.

2.03 DETECTION WIRE and WARNING TAPE

- A. Detection wire shall be required for open cut/encased service piping between main and meter. Warning Tape shall be required for open cut service piping between main and meter.
- B. All water service lines shall be installed with a 12-gauge tracer wire throughout the entire system, including service laterals to the meter. Wire shall be installed with (directly beneath or beside of) the service line. Keep wire as continuous as possible. Where connections are needed, strip wire back approximately 1-inch and connect waterproof direct-bury lug with dual conductor slots (DryConn #90220 or approved equal). Wrap connection well on each side connection with electrical tape. When installation is complete, the entire system must be tested for continuity in the presence of a LCUB inspector. LCUB will require re-excavation and improvement to areas that do not trace well and/or show low or poor continuity. Tracer wire shall be high-strength copper clad steel conductor that is specifically made for underground utility locating purposes, and shall be #12 AWG HS-CCS HDPE 30 mil as manufactured by "Copperhead Industries, LLC" or approved equal, and shall be insulated with a 30 mil, high density, high molecular weight polyethylene blue insulation and rated for direct burial use at 30 volts.
- C. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored blue for water.

2.04 WATER SERVICE CONNECTION MATERIALS – APPROVED MANUFACTURERS

- A. Meter Yokes

Meter Yokes		
LCUB Stock #	Mueller Description and Part #	Ford Equivalent
0100	5/8" x ¾" MUELLER METER YOKES (B-2418R)	LSVB41-233W-NL-Q
0102	¾" COMPRESSION ENDS (H-14227N)	

0104	3/4" MULTI-PURPOSE ENDS (H-14222N)	
0112	1" x 1" MUELLER METER YOKES (B-2418R)	LSVB41-444W-NL-Q
0114	1" COMPRESSION ENDS (H-14227N)	
0116	1" MULTI-PURPOSE ENDS (H-14222N)	
0120	5/8" x 3/4" MUELLER METER YOKES w/7" RISE (B-2418R)	VB42-7W-NL
0130	5/8" x 3/4" MUELLER METER YOKES w/15" RISE (B-2418R)	VB42-15W-NL
0140	1" x 1" MUELLER METER YOKES w/10" RISE (B-2418R)	VB44-10W-NL
0150	5/8" x 3/4" MUELLER METER YOKES w/12" RISE (B-2418R)	VB42-12W-NL
0160	5/8" x 3/4" MUELLER METER YOKES w/18" RISE (B-2418R)	VB42-18W-NL
0170	5/8" x 3/4" MUELLER METER YOKES w/24" RISE (B-2418R)	VB42-24W-NL
0180	2" MUELLER METER YOKE WITHOUT BYPASS (B-2422N)	VB77-12-11-77-NL
0185	2" MUELLER METER YOKE w/BYPASS (B-2423N)	VB77-12B-11-77-NL

B. Fittings

Brass Compression Fittings		
LCUB Stock #	Mueller Description and Part #	Ford Equivalent
0600	3/4" MUELLER CORP STOPS (H-15008N)	FB1000-3-Q-NL
0610	1" MUELLER CORP STOPS (H-15008N)	FB1000-4-Q-NL
0900	3/4" x 3/4" MUELLER BRASS COMP UNION (H-15403N)	C44-33-NL-Q
0910	1" x 1" MUELLER BRASS COMP UNION (H-15403N)	C44-44-NL-Q
0920	2" x 2" MUELLER BRASS COMP UNION (H-15403N)	C44-77-NL-Q
0930	3/4" x 1" MUELLER BRASS COMP UNION (H-15403N)	C44-34-NL-Q
0940	3/4" MUELLER 110 COMPRESSION NUTS	QJN4-3 (Nut, Gasket & Gripper - Assembly Complete)
No #	MUELLER 110 COMPRESSION NUT GASKETS	QJNGA4-3 (3/4") & QJNGA4-4 (1") Gasket & Gripper Ring
0950	1" MUELLER 110 COMPRESSION NUTS	QJN4-4 (Nut, Gasket & Gripper Ring - Assembly Complete)
1000	3/4" x 3/4" MUELLER BRASS MALE COMP COUP (H-15428N)	C84-33-NL-Q
1010	1" x 1" MUELLER BRASS MALE COMP COUP (H-15428N)	C84-44-NL-Q

1020	2" x 2" MUELLER BRASS MALE COMP COUP (H-15428N)	C84-77-NL-Q
1030	1" MALE x 3/4" COMP COUP (H-15428N)	C84-43-NL-Q
1035	3/4" MALE x 1" COMP COUP (H-15428N)	C84-34-NL-Q
1100	3/4" MUELLER BRASS FEMALE COMP COUP (H-15451N)	C14-33-NL-Q
1110	1" MUELLER BRASS FEMALE COMP COUP (H-15451N)	C14-44-NL-Q
1120	2" MUELLER BRASS FEMALE COMP COUP (H-15451N)	C14-77-NL-Q
1125	1" FEMALE x 3/4" COMP (H-15451N)	C14-43-NL-Q
1130	3/4" FEMALE x 1" MALE	C14-34-NL-Q
4200	3/4" BRASS COMP TEES (H-15381N)	T444-333-NL-Q
4210	1" BRASS COMP TEES (H-15381N)	T444-444-NL-Q
4220	3/4" x 1" BRASS COMP TEES (H-15381N)	T444-334-NL-Q
4230	3/4" x 1" Y BRASS COMP TEES (H-15381N)	Y44-243-NL-Q
NO #	2" BRASS COMP TEES (H-15381N)	T444-777-NL-Q
4300	3/4" BRASS COMP, ¼ BEND UNION (H-15526N)	L44-33-NL-Q
4310	1" BRASS COMP, ¼ BEND UNION (H-15526N)	L44-44-NL-Q
4320	2" BRASS COMP, ¼ BEND UNION (H-15526N)	L44-77-NL-Q

C. Valves/Curb Stops

Valves/Curb Stops		
LCUB Stock #	Mueller Description and Part #	Ford Equivalent
2000	3/4" MUELLER METER YOKE VALVES (B-24265R)	BA13-232W-NL (FIPT x Meter Swivel Nut)
2010	1" MUELLER METER YOKE VALVES (B-24265R)	BA13-444W-NL (FIPT x Meter Swivel Nut)
2020	2" MUELLER METER YOKE VALVES (B-24286N)	BFA13-777W-NL (FIPT x Meter Flange)
2100	3/4" MUELLER CURB STOPS COMP x COMP (B-25209N)	B44-233W-NL-Q
2102	3/4" MUELLER CURB STOPS FIP x FIP (B-20200N)	B11-233W-NL
2104	3/4" MUELLER CURB STOPS FIP x COMP (B-25170N)	B41-233W-NL-Q
2106	3/4" MUELLER CURB STOPS MALE x COMP (B-25122N)	B84-233W-NL-Q
2110	1" MUELLER CURB STOPS COMP x COMP (B-25209N)	B44-344W-NL-Q
2112	1" MUELLER CURB STOPS FIP x FIP (B-20200N)	B11-344W-NL
2114	1" MUELLER CURB STOPS FIP x COMP (B-25170N)	B41-344W-NL-Q
2120	1 1/4"	B11-555-NL (FIPTxFIPT) & B44-555-NL (Comp x Comp)

2130	1 1/2"	B11-666-NL (FIPTxFIPT) & B44-666-NL (CompxComp)
2140	2" (B-20200N)	B11-777W-NL
2240	2" MUELLER GATE VALVES (2360)	This is a 2" Iron Body Threaded Gate Valve

PART 3 EXECUTION

3.01 PREPARATION

- A. Install barriers and other devices to protect areas adjacent to construction.
- B. Protect and maintain all benchmarks and other survey points.
- C. Coordinate water outages, both domestic and fire protection, with property owner, LCUB, and local Fire Department. Maintain access to property during construction

3.02 INSTALLATION

- A. Trenching and backfill shall meet the requirements of Section 02611 – TRENCHING, BACKFILLING, AND COMPACTING.
- B. Trenchless installation of service lines shall be approved by Owner or Owner's representative.
- C. During pipe installation Contractor shall take every precaution to prevent foreign material from entering the pipe or fittings.
- D. Jointing procedures, including cleaning of ends of pipe, and lubrication shall be in accordance with the Manufacturer's recommendations.
- E. For new developments, the Lenoir City Utilities Board may require a meter box and yoke to be installed for services on the opposite side of the road as the main. Installation shall be in accordance with Paragraph 2.09.

3.03 PLACING DETECTION WIRE AND WARNING TAPE

- A. All buried water service pipes shall be identified by buried wire.
- B. Detection wire shall be placed just below or beside pipe. Wire shall be stubbed out of meter box a minimum of 12 inches.
- C. Warning tape shall be placed 18-inches above service line and at least 6-inches below grade.

3.04 FIELD TESTS

- A. See Section 02520 – DISINFECTION AND TESTING OF WATER DISTRIBUTION SYSTEM

End of Section

**SECTION 02519
BACKFLOW AND CROSS CONNECTION**

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

- A. In accordance with the Tennessee Code Annotated, and Lenoir City Utilities Board (LCUB) Rules and Regulations, no person shall cause a cross-connection or inter-connection to be made, or allow one to exist for any purpose whatsoever unless the construction and operation of the same have been approved by the Owner (LCUB).
- B. Protective devices are required to:
 - 1. Protect the Owner's water system from contamination.
 - 2. Eliminate or control existing or potential cross connections between potable and non-potable water systems.
 - 3. Protect the occupants or users of the water supply within the customers' premises in certain situations from in-house contamination.
- C. Protective devices will be required when the nature of use of the water supplied to a premise by the Owner is such that it is deemed:
 - 1. Impractical to provide an effective air gap separation.
 - 2. That the property owner and/or occupant cannot or will not demonstrate to the Owner that the water use and protective features of the plumbing are such that they pose no threat to the safety or potability of the water supply.
 - 3. That the nature and mode of operations within a facility are such that frequent plumbing changes are made.
 - 4. There is likelihood that protective measures may be subverted, altered, or disconnected (portable or temporary meters).
 - 5. A type of facility requiring protection as listed by the Tennessee Department of Environment and Conservation (TDEC) and/or the Environmental Protection Agency (EPA).
 - 6. To come into contact with chemicals or remain stagnant within the water line. Including but not limited to the use of secondary meters to supply fire suppression systems, irrigation systems, pools, fountains, and hot tubs.
- D. The procedures outlined herein are based on the principle of containment of the potential or actual hazard within the customer's premises. Should a customer refuse the right of entry of the Owner or their designated representative, the Owner must assume maximum hazard and therefore require the highest degree of protection on such a customer's service line.
- E. Dual devices installed in parallel are required where continuous, uninterrupted service is required and there is no auxiliary service line. Refusal to install two parallel devices shall constitute agreement by the property owner or occupant that the water service may be interrupted as necessary to test the device.

- F. Area Plumbing Inspectors' Offices may require a plumbing permit and inspection for the installation of backflow prevention devices (BFD). TDEC should be contacted to determine their requirements prior to installing a BFD. If a permit and inspection is not required by the City or County, then the property owner or occupant must call LCUB to schedule an inspection after the device is installed. Inspections shall be conducted annually in accordance with LCUB and TDEC requirements.
- G. All costs associated with the backflow prevention and cross connection program are to be borne by the customer or appropriate party, including the initial purchase of the BFD and its proper installation, testing, and maintenance.

1.02 DEFINITIONS

- A. Cross-Connection: Any physical connection whereby the public water supply is connected with any other water supply system, whether public or private, either inside or outside of any public building or buildings, in such a manner that a flow of water into the public water supply is possible either through the manipulation of valves, ineffective check or back pressure valves, or because of any other arrangement.
- B. Inter-Connection: Any system of piping or other arrangement whereby the public water supply is connected directly with a sewer, drain, conduit, pool, storage reservoir or other device which does or may contain sewage or other waste, or liquid which would be capable of importing contamination to the public water supply.
- C. Owner: Lenoir City Utilities Board (LCUB), the owner of the public water system.

1.03 ACRONYMS

- A. BFD – backflow device
- B. DCDA – double check detector assembly
- C. DWS – Division of Water Supply
- D. EPA- United States Environmental Protection Agency
- E. RPZ – reduced pressure zone valve
- F. TDEC – Tennessee Department of Environment and Conservation

1.04 REFERENCES

- A. EPA Cross Connection Control Manual
- B. TDEC DWS Cross Connection Control Manual
- C. ANSI/AWWA Standards C-510-89 and C-511-89
- D. ASSE Standard 1013

- E. Foundation for Cross Connection Control and Hydraulic Research, Current Edition. University of Southern California Standards.

1.05 SUBMITTALS

- A. Submittals shall be submitted as specified in Section 01302 – SUBMITTALS AND SUBSTITUTIONS, promptly and in accordance with approved schedule, in such a sequence that no delay to the Work, or to the work of other Contractors is caused.
- B. BFP Product data shall be submitted as required.
- C. Chemicals, including MSDS literature, used in fire suppression systems, as applicable.
- D. Layout drawings showing how the private system will be connected to public water system.

PART 2 PRODUCTS

2.01 REDUCED PRESSURE ZONE (RPZ)

- A. A reduced pressure zone (RPZ) BFD is required for protection of the water distribution system. Only RPZ's listed in the "Approved Backflow Prevention Assemblies" listing available through TDEC Division of Water Supply (DWS) and approved by LCUB shall be installed on the Owner's water system. (The only exception is on non-chemical fire suppression systems, where a DC may be used instead of an RPZ. See Section VI. Materials – DC for non-chemical fire suppression systems.)
- B. BFD should be of sufficient size to deliver the same gallons per minute (gpm) capacity as the water meter supplying the premises when it is installed in the main line.
- C. The RPZ device must contain two spring loaded, resilient seat check valves and be equipped with a relief valve mechanism between the two check valves that ensures the pressure in the zone is always at least 2 psi lower than the inlet pressure.
- D. Devices ¾-inch through 2-inch shall have bronze bodies and 2-1/2 inch through 10-inch shall have fusion epoxy coated bodies rated at a minimum 175 pounds working pressure and water temperature 32 to 140 degrees Fahrenheit. Contact Owner for questions regarding operating pressure before installation. Some locations may require a minimum of 250 pounds working pressure.
- E. The RPZ device must be installed with either a bronze or inside and out coated fusion epoxy strainer, complete with a blow down.
- F. The device must be installed between two tight-closing resilient seated, inside and outside coated fusion epoxy gate valves, or full port ball valves.
- G. Test cocks must be of bronze, stainless steel, or polymer construction. They must also be resilient seated, have full port characteristic, and be located as follows:
 - 1. On the upstream side of the #1 shut off valve.

2. Between the #1 shut off valve and the #1 check valve.
3. Between the check valves.
4. Between the #2 check valve and the #2 shut off valve.

2.02 DOUBLE CHECK DETECTOR ASSEMBLY (DCDA) BACKFLOW PREVENTER

- A. Double check detector assemblies (DCDA) BFDs are required for protection of the water distribution system on non-chemical fire lines only. A DCDA does not provide the same degree of protection as the RPZ. Only DCDA's listed in the "Approved Backflow Prevention Assemblies" listing maintained by TDEC DWS and approved by LCUB shall be installed on the Owner's water system. DCDA shall be Model 3000 as manufactured by Ames or pre-approved equal.
- B. The DCDA device must have two internally loaded, independently acting, resilient seat valves in series. The unit includes tightly closing shutoff valves located on each end of the assembly and suitable connections for testing the water-tightness of each check valve.
- C. The DCDA will function under pressure for extended periods and, when functioning properly, will protect against backpressure and back-siphonage conditions. Unlike the RPZ, protection against backflow is not provided when both check valves leak.
- D. Devices ¾-inch through 2-inch shall have bronze bodies and 2-1/2 inch through 10-inch shall have fusion epoxy coated bodies rated at a minimum 175 pounds working pressure and water temperature 32 to 140 degrees Fahrenheit. Contact Owner for questions regarding operating pressure before installation. Some locations may require a minimum of 250 pounds working pressure.
- E. Test cocks must be of bronze, stainless steel, or polymer construction. They must also be resilient seated, have full port characteristic, and be located as follows:
 1. On the upstream side of the #1 shut off valve.
 2. Between the #1 shut off valve and the #1 check valve.
 3. Between the check valves.
 4. Between the #2 check valve and the #2 shut off valve.

2.03 DUCTILE IRON PIPING AND FITTINGS

- A. Provide materials per specification Section 02510 – WATER DISTRIBUTION LINES, VALVES, AND APPURTENANCES

PART 3 EXECUTION

3.01 GENERAL

- A. Install piping, valves, and fittings in accordance with manufacturer's recommendations and Owner's specifications.

- B. Provide work in accordance with applicable State and Local Fire Marshall's Office requirements.
- C. The TDEC DWS determines the types of facilities requiring cross connection protection. A current list of these facilities may be obtained by contacting the Owner or by referring to the Foundation for Cross Connection Control and Hydraulic Research, USC Standards, latest edition. Based upon the identified degree of risk, the Owner will specify the type of BFD required.

3.02 REDUCED PRESSURE ZONE (RPZ) INSTALLATION

- A. RPZ's shall be installed in a location such that:
 - 1. The master valve (if installed) is located after the backflow.
 - 2. The device is located before the first use of water.
 - 3. The device is not installed in a way that allows it to be bypassed.
 - 4. The device can be easily accessed for testing on an annual basis and repaired as needed.
 - 5. The device is installed with at least 12 inches between the ground, floor, or mulch and the bottom of the BFD.
 - 6. The device is installed at least 6 inches away from walls for BFDs size 2-inch and under and at least 12 inches away from walls for BFDs over 2-inch.
 - 7. The device is not installed below ground or inside a pit.
 - 8. The device is not exposed to grit, sticky, corrosive, or abrasive substances.
 - 9. The device is protected from mechanical abuse, freezing, and flooding.
 - 10. The device is adequately supported to prevent the unit from sagging. Special supports are needed for units in the 4-inch to 10-inch size range.
- B. The water line shall be thoroughly flushed to expel all debris prior to installation of the BFD. Debris lodging under check valves is one of the most common reasons of device failure.
- C. RPZ devices shall be installed according to manufacturers' instructions.

3.03 DOUBLE CHECK DETECTOR ASSEMBLY (DCDA) INSTALLATION

- A. DCDA's shall be installed in a location such that:
 - 1. The device is located before the first use of water.
 - 2. The device is not installed in a way that allows it to be bypassed.
 - 3. The device can be easily accessed for testing on an annual basis and repaired as needed.
 - 4. The device is installed with at least 12 inches between the floor and the bottom of the BFD.
 - 5. The device is installed at least 6 inches away from walls for BFDs size 2-inch and under and at least 12 inches away from walls for BFDs over 2-inch.
 - 6. The device is not installed below ground or inside a pit.
 - 7. The device is not exposed to grit, sticky, corrosive, or abrasive substances.

8. The device is protected from mechanical abuse, freezing, and flooding.
 9. The device is adequately supported to prevent the unit from sagging. Special supports are needed for units in the 4-inch to 10-inch size range.
- B. The water line shall be thoroughly flushed to expel all debris prior to installation of DCDA.
- C. DCDA devices shall be installed in accordance with manufacturers' instructions.

3.04 TESTING AND INSPECTION

- A. Cleaning and Disinfection – per Section 02520 – DISINFECTION AND TESTING OF WATER DISTRIBUTION SYSTEM.
- B. Hydrostatic and Bacteriological Testing - per Section 02520 – DISINFECTION AND TESTING OF WATER DISTRIBUTION SYSTEM.
- C. Unless otherwise specified, it shall be the duty of the property owner/occupant to ensure annual (or more frequent, if necessary) testing of backflow devices in accordance with TDEC and LCUB requirements.
- D. BFDs shall be successfully tested:
1. Immediately upon completion of installation.
 2. At least every 12 months, recommended more often for high-hazard installations.
 3. When unit has been disassembled for cleaning and/or repairs.
 4. When there is any indication the BFD is not functioning properly.
- E. The Owner shall examine:
1. Properties subject to frequent changes in on-site plumbing, where new cross-connections may be installed and existing protection may be bypassed, removed or otherwise made ineffective shall be subject to an annual inspection.
 2. New Construction – all new commercial construction plans and specifications shall be made available to the Owner for review.
 3. Existing Facilities – existing facilities' cross connection protection shall be subject to inspection to determine the degree of hazard. Should installation of BFD or plumbing changes be required, the Owner will notify the occupant of the requirements and a follow-up inspection will be made to assure proper protective devices have been installed.

End of Section

**SECTION 02520
DISINFECTION AND TESTING OF WATER DISTRIBUTION SYSTEM**

PART 1 GENERAL

1.01 REFERENCES

A. American Water Works Association (AWWA):

1. B300, Hypochlorites
2. B301, Liquid Chlorine
3. C600, Installation of Ductile Iron Water Mains and Their Appurtenances
4. C605, Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
5. C906 – Polyethylene (PE) Pressure Pipe and Fittings, 4 in. Through 65 in. (100 mm through 1,650 mm), for Waterworks.
6. C651, Disinfecting Water Mains
7. C655, Field Dechlorination

B. NSF International (NSF):

1. NSF/ANSI 61, Drinking Water System Components – Health Effects
2. NSF/ANSI 372, Drinking Water System Components – Lead Content

1.02 SUBMITTALS

A. Informational Submittals:

1. Plan describing and illustrating conformance to appropriate AWWA standards and this specification.
2. Procedures and plans for cleaning, disinfecting, and testing.
3. Type of disinfecting solution and method of preparation and application
4. Proposed locations where samples will be taken.
5. Method of disposal for highly chlorinated disinfecting water.

B. One (1) certified copy of disinfection test results shall be submitted

C. Submittals shall be submitted as specified in Section 01302 – SUBMITTALS AND SUBSTITUTIONS, promptly and in accordance with approved schedule, in such a sequence that no delay to the Work, or to the work of other Contractors is caused.

D. Related Sections

1. Section 01090 – STANDARDS
2. Section 01302 – SUBMITTALS AND SUBSTITUTIONS
3. Section 01720 – PROJECT RECORD DOCUMENTS
4. Section 02510 – WATER DISTRIBUTION LINES, VALVES, AND APPURTENANCES
5. Section 02611 – TRENCHING, BACKFILLING, AND COMPACTING

PART 2 PRODUCTS**2.01 GENERAL**

- A. Components and materials in contact with water for human consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the authority having jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.
 - 1. Temporary or permanent use or reuse of components and materials without a traceable certification is prohibited.
- B. Contractor shall furnish all equipment including but not limited to; pumps, hoses, fittings, meters, gauges, and all chemicals to accomplish disinfection and testing.

2.02 WATER FOR DISINFECTION AND TESTING

- A. Owner will supply potable quality water. Contractor shall convey in disinfected pipelines or containers.
- B. Water shall be clean, uncontaminated, and potable
- C. Contractor shall report quantity of water used for disinfection and testing (in gallons) to Owner in writing. Determine by metering or calculation of flow rate and time as directed by Owner. For informational purposes only, there will be no charge for water used specifically for disinfection and testing.

PART 3 EXECUTION**3.01 HYDROSTATIC PRESSURE TEST – DUCTILE IRON or PVC**

- A. Conduct Pressure test in accordance with AWWA C600 (DIP) or AWWA C605 (PVC).
- B. All testing shall be scheduled with the Owner and Owner's Representative (RPR) at least 48 hours in advance.
- C. Mains and services shall be pressure tested as a complete system or as directed by the Owner. Make approved necessary taps in piping prior to testing.
- D. All newly installed and backfilled pipe or any valved section thereof shall be subjected to a hydrostatic pressure test, conducted in the presence of the Owner or Owner's Resident Project Representative (RPR).
- E. Conduct Hydrostatic Pressure Test on buried piping after trench has been completely backfilled and compacted. Testing may be performed prior to placement of concrete or asphalt surface restoration as approved by Owner or RPR.

- F. Contractor shall install temporary thrust blocking and/or other restraint as necessary to prevent movement of pipe. Thrust blocking shall cure for 5 days prior to pressure tests. Restrained length calculations shall be prepared and stamped by a Professional Engineer, licensed in Tennessee.
- G. Remove or isolate appurtenant instruments or devices that could be damaged by pressure testing.
- H. Each valved section of pipe shall be slowly filled with water (0.25 feet per second based on full area of pipe). Expel air from piping system during filling. A test pressure equal to 1.5 times the normal working pressure (but not less than 200 psi and not greater than pressure rating of the pipe) shall be applied for a minimum of 2 hours (maximum of 4 hours). Test pressure shall be based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge. A pump shall be connected to the pipe in a manner satisfactory to the Owner.
- I. Minimum test pressure at the high point of each test segment must be equal to or greater than 1.25 times the working pressure at the high point elevation.
- J. The hydrostatic pressure test shall be conducted by measuring, through a calibrated meter, the amount of water, which enters the test section under 200 psi or normal working pressures (whichever is greater) for a period of at least 2 hours. No installation will be accepted until the hydrostatic testing leakage is zero. Should tests disclose leakage greater than the allowable amounts, the Contractor, at his expense, shall locate and repair defective joints until the leakage is within the specified tolerance.
- K. Cracked or defective pipes, fittings, valves, or hydrants discovered in consequence of this hydrostatic pressure test shall be replaced with sound material in the manner specified at no cost to the Owner. The test shall be repeated until the results are satisfactory to the Owner.
- L. Test results shall be recorded including date, name of Contractor, name and signature of Contractor's employee responsible for testing, name and signature of RPR, test pressure, and test duration. A recording chart shall be used to document the results of the test if requested by the Owner.

3.02 HYDROSTATIC PRESSURE TEST – HDPE

- A. All requirements of Paragraph 3.01 also apply to HDPE
- B. Hydrostatic pressure test shall be conducted following manufacturer and accepted industry recommendations.
- C. Monitored make-up water test shall consist of an initial expansion and test phase. During the initial expansion phase, the test section is pressurized to the test pressure and sufficient make-up water is added each hour for three hours to return to the test pressure.

- D. After the initial expansion phase, about four hours after pressurization, the test phase begins. The test phase lasts two hours and no make-up water should have to be added during this phase in order to achieve the required zero leakage.
- E. The total test time including initial pressurization, initial expansion and time at test pressure shall not exceed eight hours. If the pressure test is not completed within 8 hours, the test section shall be depressurized, and allowed to relax for at least 8 hours before reapplying the test pressure.

3.03 DISINFECTING WATER LINES (Reference AWWA C651 for further details)

- A. Disinfection and testing of the completed lines shall be done in accordance with AWWA C651 current edition and in a manner approved by the Tennessee Department of Environment and Conservation.
- B. Disinfect new pipelines that connect to existing pipelines up to point of connection.
- C. The basic disinfection procedure consists of the following steps:
 - 1. Inspecting all materials to be used to ensure the integrity of the materials.
 - 2. Preventing contaminating materials from entering the water main or components during storage, construction, or repair.
 - 3. Removing, by flushing or other means, those materials that may have entered the water main.
 - 4. Disinfecting any residual contamination that may remain, and flushing the disinfected water from the main.
 - 5. Protecting the existing distribution system from backflow due to hydrostatic pressure test and disinfection procedures.
 - 6. Hydrostatic Pressure Test with potable water.
 - 7. Chlorinating and documenting that an adequate level of disinfectant contacted each pipe to provide disinfection. See AWWA C651 for methods and amounts of different types of disinfectant to achieve required levels of disinfectant.
 - 8. Flushing the chlorinated water from the main.
 - 9. Determining the bacteriological quality by laboratory test after disinfection.
 - 10. Final connecting of the approved new water main to the active distribution system.
- D. Chlorinate line with either calcium hypochlorite (tablets or granules), or continuous feed of chlorinated water as described in AWWA C651. Tables 1 through 3 show the chlorine doses required for each method (adapted from AWWA C651)

Table 1 Weight of calcium hypochlorite granules to be placed at beginning of main and at each 500-ft interval (adapted from AWWA C651)

Pipe Diameter (d)	Calcium Hypochlorite Granules
Inches	oz.
4	1.7
6	3.8
8	6.7

10	10.5
12	15.1
14 and larger	$D^2 \times 15.1$

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

Table 2 Number of 5-g calcium hypochlorite tablets required for dose of 25 mg/L (adapted from AWWA C651)

Pipe Diameter Inches	Length of Pipe Section , ft				
	13 or less	18	20	30	40
Number of 5-g Calcium Hypochlorite Tablets					
4	1	1	1	1	1
6	1	1	1	2	2
8	1	2	2	3	4
10	2	3	3	4	5
12	3	4	4	6	7
16	4	6	7	10	13

Table 3 Chlorine required to produce an initial 25-mg/L concentration in 100 ft of pipe by diameter (adapted from AWWA C651)

Pipe Diameter (inches)	100% Chlorine (lb)	1% Chlorine Solution (gal)
4	0.013	0.16
6	0.030	0.36
8	0.054	0.65
10	0.085	1.02
12	0.120	1.44
16	0.217	2.60

- E. Prior to chlorination by continuous feed method, the main shall be flushed as thoroughly as possible with the water pressure and outlets available. Flushing shall be done after the pressure tests are made. The flushing velocity in the main shall not be less than 3.0 ft/sec. Table 4 below (adapted from AWWA C651) shows the rates of flow required to produce a velocity of 3.0 ft/sec. After flushing, all valves shall be carefully inspected to see the entire operating mechanism is in good condition.

Table 4 Required flow and openings to flush pipelines at 3.0 ft/sec (40 psi residual pressure in main) adapted from AWWA C651

Pipe Diameter Inches	Flow Required Gpm	Size of Tap (inches)			Number of Hydrant Outlets	
		1	1.5	2	2 ½ inch	4 ½ inch
4	120	1			1	1
6	260		1		1	1
8	470		2		1	1
10	730		3	2	1	1
12	1,060			3	2	1
16	1,880			5	2	1

- F. After the applicable retention period per AWWA C651, the Contractor shall flush the heavily hyperchlorinated water from the line until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system, but not less than

0.20 mg/l. The Contractor shall perform such flushing only at sites where there is adequate drainage and as approved by the Owner. The Owner shall document the start and end date, time, and chlorine concentration of the final flush.

1. Contractor shall report quantity of water used for disinfection and testing (in gallons) to Owner in writing. Determine by metering or calculation of flow rate and time as directed by Owner. For informational purposes only, there will be no charge for water used specifically for disinfection and testing.
- G. The Contractor shall use dechlorination and/or other treatment techniques if the treated water flushed from the line presents a hazard to the environment. Refer to ANSI/AWWA C655 Field Dechlorination for dechlorination procedures.
- H. Once a new water line has undergone final flushing but before it is placed into service, the Owner shall collect samples for bacteriological testing in accordance with AWWA C651 at a minimum from both ends of the main line and the ends of any branch lines connected to the main line. In the case of extremely long lines, additional samples will be collected at intervals of approximately 2500 feet or as determined by the Owner. Additional sampling may be required if the Owner determines sanitary conditions have not been maintained.
- I. Samples will be collected in sterile bottles containing sodium thiosulfate as specified by Standard Methods for the Examination of Water and Wastewater. A hose shall not be used to collect samples; as a last resort, fire hydrants may be used as sampling points. A corporation cock may be installed in the main with a copper-tube gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed and retained for future use.
- J. Samples will be taken as required by TDEC and AWWA C651. At a minimum, two sets of samples taken 24 hours apart or one set of samples taken 48 hours or longer after flushing will be collected by the Owner and tested for bacteriological quality by a state-certified laboratory. Each set of samples will consist of at least two samples representing water from both ends of the main line. If the initial disinfection fails to produce satisfactory samples, the Contractor at no cost to the Owner will repeat disinfection and flushing until the two consecutive sample sets taken 24 hours apart produce satisfactory results.

3.04 DISINFECTING PROCEDURE FOR WORK ON EXISTING LINES (Reference AWWA C651 for further details)

- A. The disinfection procedure for tie-ins on existing components is slightly different from that for new mains. Tie-ins made under pressure and where the components remain full will, in general, not require internal disinfection and sampling. Flushing and sampling is necessary when a tie-in requires the components to be dewatered and depressurized, as it presents the possibility of contamination being introduced into the system. The Owner shall provide guidance as needed to the Contractor to determine proper action in these situations.
- B. Disinfection procedure for work on existing lines shall be in accordance with AWWA C651 Sec. 4.11
- C. The general procedure for handling tie-ins is listed in the following steps:

1. Inspecting all materials to be used to ensure the integrity of the materials.
 2. Preventing contaminating materials from entering the water main or components during storage and construction (trench treatment).
 3. Disinfecting, swabbing, and cleaning replacement components prior to installation
 4. Removing, by flushing or other means, those materials that may have entered the water main or other components.
 5. Sampling to determine bacteriological quality by laboratory test after disinfection.
 6. Returning the replacement components back into service after bacteriological samples are taken. It is permissible to return tie-in sections to service as soon as samples are taken and before results are obtained.
 7. If necessary, removing the repaired components from service and repeating flushing and sampling until bacteriological samples are negative as directed by Owner.
- D. When an existing line is opened, the Contractor shall, as directed by the Owner, apply liquid hypochlorite to disinfect the exposed trench area around the tie-in. Dry granular or tablet hypochlorite shall be used for pools of standing water due to the more controlled release of disinfectant. Application amount shall be sufficient to cause a faint chlorine odor and be reapplied as necessary to maintain sanitary conditions. These steps shall be repeated as necessary to minimize the possibility of contamination of the main, fittings, or other components.
- E. The sampling procedure for a tie-in section, which has been dewatered and/or lost pressure is as follows:
1. The Owner shall take a single bacteriological sample from a point, which represents the water in the tie-in area. If the direction of flow is unknown, two samples, one from each side of the tie-in area shall be taken. The main and other components can then be returned to service as soon as samples are taken. It is not necessary to wait until sample results are available before putting the main back into service.
 2. If the sample is positive for coliform, repeat sampling by the Owner shall include one sample from each side of the original sample point, as well as the point itself (total of three samples). The process shall be repeated until sampling results are negative. Additional flushing/disinfection may be required prior to taking the repeat samples.
 3. Actions following positive sample results may vary according to regulatory requirements. The Contractor shall act at the direction of the Owner until satisfactory sampling results are obtained.
- F. Tennessee Department of Environment and Conservation Public Water System (Rule 0400-45-01-17, 8, a):
1. General-Public water systems, construction contractors, and engineers shall follow, and document sanitary practices used in inspecting, constructing or repairing water lines, finished water storage facilities, water treatment facilities, and wells. Public water systems, construction contractors, and engineers shall follow the latest edition of the AWWA standards C-651, C-652, C-653, C-654, or equivalent methods provided the method has been approved in writing by the Department and is available during the inspection, construction, maintenance, or repair activity. In lieu

of following AWWA standards or approved equivalent methods, public water systems, construction contractors, and engineers may write their own disinfection standard operating procedures. Disinfection standard operating procedures shall be approved in writing by the Department and be available during the inspection, construction, maintenance, or repair activity.

The documentation shall include disinfection procedures used, bacteriological sample results, construction logs, and repair logs and may include photographs where appropriate. All wells, pipes, tanks, filters, filter media and other materials shall be properly disinfected prior to being placed in service. Any disinfectant used to disinfect shall be NSF approved or plain household bleach and used in a manner that assures sufficient contact time and concentration to inactivate any pathogens present. Bacteriological results including line repair records indicating adequacy of disinfection shall be maintained on file by the public water system for five years. Procedures to ensure that water containing excessive concentrations of disinfectant is not supplied to the customers or discharged in such manner as to harm the environment shall be implemented.

All materials used for new or repaired water lines, storage facilities, water treatment facilities, and wells will be inspected prior to use for any evidence of gross contamination. Any contamination observed shall be removed and the materials protected during installation.

2. Bacteriological Sampling of New Facilities-Bacteriological samples will be collected and analyzed to verify the effectiveness of the disinfection practices prior to placing new facilities in service. Bacteriological samples for finished water storage facilities, water treatment facilities, and wells shall be collected as specified by AWWA standards C-652, C-653, and C-654.

Adequacy of disinfection of new lines shall be demonstrated by collecting two sets of microbiological samples 24 hours apart or collecting a single set of microbiological samples 48 hours or longer after flushing the highly chlorinated water from the lines. In either case microbiological samples in each set will be collected at approximately 2,500-foot intervals with samples near the beginning point, the end point, and at the end of each branch line, unless written approval of alternate sampling frequency and distance between sampling points has been obtained from the Department. If the newly constructed facility yields positive bacterial samples, the line shall be flushed, and re-sampled. If subsequent samples are positive, the line shall be re-disinfected, flushed and sampled again.

3. Bacteriological Sampling of Existing Facilities:
 - a. Finished water storage facilities, water treatment facilities, and wells that have been compromised and potential contamination is introduced during inspection or repair shall be disinfected, flushed, and sampled as specified by AWWA standards C-652, C-653, and C-654. Bacteriological samples shall be collected from a location representing the water contained in the compromised facility. The repaired facility may be returned to service prior to obtaining bacteriological results.

- b. Drinking water mains where positive pressure has not been maintained during inspection or repair shall be disinfected and flushed prior to being placed back in service. Disinfection and flushing shall be in accordance with AWWA standard C-651 or other method approved in writing by the Department. Bacteriological samples shall be collected immediately after the repair is completed and from a location representing the water contained in the repaired main. The repaired main may be returned to service prior to obtaining bacteriological results. If the repaired main has been placed back into service and yields positive bacteriological samples, the main shall be flushed and re-sampled. One sample is to be collected at the original positive site, one sample is to be collected upstream of the repair and one sample is to be collected in the downstream area of the repair. Sampling shall continue until the water is coliform free.
 - c. If one-half or more of the bacteriological samples collected from the repaired facility are total coliform positive, the system shall notify the Department within 30 days that it has reviewed its disinfection and sampling practices in an attempt to identify why the positive samples occurred and revise its disinfection and sampling plans accordingly.
 - d. If any public water system collects a fecal coliform positive repeat sample or E-coli positive repeat sample or a total coliform positive repeat sample following an initial positive fecal coliform or E-coli sample collected from the repaired facility, the system shall notify the Department within 24 hours and issue a Tier 1 public notice using the language specified in Appendix B of Rule 0400-45-01-.19.
4. Inspectors, contractors, operators, public water systems or engineers that fail to document and follow adequate disinfection procedures, and fail to collect bacteriological samples during repairs, inspections or maintenance activities that potentially would compromise the microbial quality of the water shall issue a boil water advisory to the customers served by that portion of the public water system prior to returning the facility to service. The boil water advisory shall remain in effect until satisfactory microbial tests results and written approval from the Department are obtained.

End of Section

SECTION 02545 BORING AND CASING FOR UTILITY LINES

PART 1 GENERAL

1.01 SUMMARY

- A. The work to be performed hereunder shall consist of the installation of a casing pipe for the purpose of installing a water or sewer line as shown on the Drawings or as called for in these specifications. It shall include the excavation of a boring pit, auger boring between the points specified on the Drawings, furnishing and installing of the carrier pipe, and disposing of the excavated materials in the manner herein provided.
- B. The Owner will provide the necessary control points required by the Contractor for this construction. The Contractor will provide the detailed layout required to keep the tunnel or bore on grade.

PART 2 PRODUCTS

2.01 CASING PIPE

- A. The casing pipe shall be of steel meeting the latest approved American Railway Engineering Association "Specifications for Pipelines for Carrying Flammable and Nonflammable Substances." The steel casing pipe shall have a minimum yield strength of 35,000 psi and shall have the minimum wall thickness shown in the following table:

(For Highway H20 Loading)			(For Railroad E72 Loading)	
Carrier Pipe (inches)	Casing Pipe (inches)	Nominal Thickness (inches)	Casing Pipe (inches)	Nominal Thickness (inches)
2	6	0.250	8	0.250
4	8	0.250	10	0.250
6	12	0.250	14	0.250
8	16	0.250	18	0.281
12	20	0.281	24	0.375
16	24	0.375	30	0.500
20	30	0.500	30	0.500
24	36	0.500	36	0.625
30	42	0.500	42	0.625
36	48	0.625	48	0.750
42	54	0.625	54	0.875
48	60	0.750	60	0.875

2.02 CARRIER PIPE

- A. The carrier pipe shall meet the standards specified in Section 02532, Sanitary Sewers and Appurtenances (Gravity), Section 02534, Wastewater Force Mains, and Section 02510, Water

Distribution Lines, Valves, and Appurtenances. Use Field-Lok gaskets for all carrier pipe joints.

PART 3 EXECUTION

3.01 BORING

- A. The boring shall be accomplished by means of auguring to the size, line, and grade shown on the Drawings.

3.02 INSTALLATION OF CASING PIPE

- A. Jack the steel casing pipe into place as the boring proceeds. Weld sections of casing pipe together to provide watertight joints.
- B. Do not remove unacceptable casing without prior approval from the Engineer. If the removal of casing pipe is permitted, make proper provisions to prevent caving in of the earth surrounding the casing.

3.03 INSTALLATION OF CARRIER PIPE

- A. The carrier pipe(s) shall be furnished by the Contractor. Upon acceptance of the casing, install the carrier pipe in the casing by jacking it through the casing. Spacers shall be used within the casing pipe. Casing Spacers shall be bolt style with a shell made in two sections of heavy T-304 Stainless Steel. Connecting flanges shall be ribbed for extra strength. The shell shall be lined with a PVC liner .090" minimum thickness with 85-90 durometer. All nuts and bolts are to be 18-8 stainless steel. Runners shall be made of ultra high molecular weight polymer with inherent high abrasion resistance and a low coefficient of friction. Runners shall be supported by risers made of heavy 304 Stainless Steel. The supports shall be mig welded to the shell and all welds shall be passivated. The height of the supports and runners combined shall be sufficient to keep the carrier pipe at least 0.75" from the casing pipe wall at all times. A minimum of three spacers shall be placed on each joint of pipe. Casing spacers shall be made by Cascade Waterworks Mfg. Co. or Pipeline Seal and Insulator, Inc., Model S 12G-2. Each end of the casing pipe shall be sealed with a wrap-around end seal. (See Standard Drawing 1024).

3.04 TUNNELING ALTERNATIVE

- A. In the event boring and jacking is impossible because of pipe size, rock, or other factors and the highway department or railroad will not permit open cutting, make crossings by tunneling using liner plates. Conduct tunneling operations as approved by the railroad or highway department. If voids are caused by the tunneling operations, fill by pressure grouting or by other approved methods that will provide proper support.
- B. Galvanized Plates
 - 1. After the plates are formed to shape, the plates shall be galvanized on both sides by the hot dip process. A coating of prime western spelter, or equal, shall be applied at

the rate of not less than 2 ounces per square foot of double exposed surface. If the average spelter coating as determined from the required samples is less than the amount specified above, or if any 1 specimen shows a deficiency of 0.2 ounce, the lot shall be rejected. Spelter coating shall be of first class commercial quality free from injurious defects such as blister, flux, and uncoated spots.

2. The outside of the plates shall be given a bituminous coating meeting the AASHO M-190 specifications for bituminous protected corrugated metal pipe.

C. Design and Construction

1. Construct the tunnel by the tunnel method, and completely line on the inside with structural steel liner plates meeting all requirements specified hereinafter. The dimensions of the tunnel shall be as shown on the Drawings.
2. The tunneling operation is to commence from a pit that is a minimum of 12 feet long and 4 feet wider than the diameter of the tunnel, bottom to grade, and sheeted and shored, if necessary. Furnish line and grade stakes.
3. All excavation for the entire length of the tunnel shall be done by tunneling, and the work may be done from either or both ends of the conduit. Trim the periphery of the tunnel smooth to fit the outside of the steel liner plate as nearly as is practical, and fill all space outside of the steel liner plate with a sand cement grout mixture.
4. Install the steel liner plates immediately after the excavated material has been removed. Do not remove material more than 24 inches ahead of the installed liner plates.
5. Provide all necessary bracing, bulkheads, and/or shields to ensure complete safety to all traffic at all times during the progress of the work, and perform the work in such a manner as to not interfere with normal traffic over the work.
6. The steel lining shall consist of plates 16 inches wide, and each circumferential ring shall be composed of the number and length plates necessary to complete the required diameter.
7. The inside diameter of the completed ring shall be of a minimum size as called for as a casing pipe in Paragraph 2.1A, and no part of the plate or reinforcing ribs will be allowed to extend inside this net diameter.
8. The strength of the tunnel lining will be determined by its section modulus. In no case shall it be less than 0.0590 inch cubed per inch of plate width based on the average for 1 ring of plates. Thickness of the metal for these steel plates shall be not less than 10 gauge, allowing for standard mill tolerances. The tunnel strength shall be equal to AASHO railroad E80 loading at the depth of cover obtaining.
9. All plates shall be punched for bolting on both longitudinal and circumferential seams and shall be fabricated so as to permit complete erection from the inside of the tunnel. The longitudinal seam shall be of the lap type with offset equal to gauge of metal for

the full width of the plate, including flanges, and shall have staggered bolt construction fabricated so as to allow the cross section of the plate to be continuous through the seam. All plates shall be of uniform fabrication, and those intended for 1 size tunnel shall be interchangeable.

10. The material used for the construction of these plates shall be new and unused and suitable for the purpose intended. Workmanship shall be first class in every respect.
11. Install the carrier pipe to the line and grade shown on the Drawings. The carrier pipe shall be adequately blocked inside the tunnel so that no part of the carrier pipe touches the tunnel liner. The blocking shall be such that the carrier pipe cannot move horizontally or vertically. The blocking shall be installed within one foot on each side of the bell of the carrier pipe and at the center of each joint. The main portion of the support shall be stainless steel with a PVC liner between the support and the carrier pipe. Detailed plans and specifications shall be submitted showing the proposed bracing and support of the carrier pipe inside the tunnel. Each end of the tunnel liner shall be plugged with brick and mortar.
12. All tunnel liners shall have one 2-inch grout coupling in every ring. Grout back of the rings as required.

PART 4 GUARANTEE OF WORK

4.01 SUMMARY

- A. Guarantee a usable completed casing or tunnel between the points specified and to the line and grade specified. The allowable tolerance at the downstream end point of the bore shall be such that the invert of the carrier pipe may be positioned within a vertical area limited on the top by an elevation no higher than the elevation shown on the Drawings and on the bottom by an elevation no lower than the existing inlet pipe invert.
- B. The allowable tolerance at the upstream end point of the bore shall be such that the invert of the carrier pipe may be positioned at the elevation shown on the Drawings.

End of Section

SECTION 02575 PAVEMENT REPAIR

PART 1 GENERAL

1.01 SUMMARY

- A. The work specified by this section shall consist of repairing or replacing all damaged pavement, whether public or private. Dirt shoulders, roads, streets, drives, and walks are to be restored to their original condition as an incidental part of the installation of utilities. Repair damaged base on either side of a trench wherever necessary. Trim the oxidation surface to neat lines outside of the trench wall and repave the entire area as specified below and as shown on the drawings or on the standard drawings.
- B. Both these specifications and the drawings make reference to the current edition of the standard specifications of the Tennessee Department of Transportation (TDOT). Even though the weather limitations, construction methods, and materials specifications contained in the TDOT specifications may not be explicitly repeated in these specifications, they shall, wherever applicable to the work called for by this section, be considered as implied and therefore adhered to. However, the various subsections "Basis for Payment" contained in the TDOT specifications shall not be considered applicable. Refer to other sections for work related to that covered by this section.
- C. All pavement repair work must meet the requirements of the Loudon County Highway Department, Lenoir City Street Department, and/or all other local agencies having jurisdiction over the roadway being repaired. Where Loudon County Highway Department and/or Lenoir City Street Department requirements differ from the specifications herein, the more stringent of the two shall be used.

PART 2 PRODUCTS

- A. Mineral Aggregate Base: Type A Base, Grading D crushed stone (TDOT Specification Section 303);
- B. Bituminous Prime Coats: cutback asphalt, Grade RC-250, or material emulsified asphalt, Grade AE-P (TDOT Specification Section 402);
- C. Aggregate For Cover Material: Size 7, 8 or 78 (TDOT Specification Section 402) ;
- D. Tack Coat: Grade AE-3 (TDOT Specification Section 403);
- E. Bituminous Plant Mix Base (Hot Mix): Grading A, B, B (modified), or C, AS or CW, as directed by the Engineer (TDOT Specification Section 307);
- F. Asphaltic Concrete Surface: Grading D or E as specified (TDOT Specification Section 411).

PART 3 EXECUTION**3.01 SUBGRADE**

- A. Before any base material is installed, compact the subgrade of the area to be paved to 95 percent of optimum density as determined by ASTM D698 (Standard Proctor).
- B. The backfill material shall contain no topsoil or organic matter. For all areas where subgrade has been prepared, test for uniformity of support by driving a loaded dump truck at a speed of 2 to 3 mph over the entire surface. Make further improvements on all areas that show a deflection of 1 inch or more. When completed, the finished subgrade shall be hard, smooth, stable, and constructed in reasonably close conformance with the lines and grades that existed prior to beginning construction.
- C. When a base course is compacted, cut back the surface course of the existing pavement a minimum of 1 foot beyond the limit of the joint between the old and new base course or as shown on the standard drawings. Take special care to ensure good compaction of the new base course at the joint. Apply and compact the surface to conform to the existing pavement so that it will have no surface irregularity.

3.02 BASE

- A. Install a mineral aggregate base of the type specified above in accordance with TDOT specifications. The maximum compacted thickness of any one layer shall be 6 inches and the total thickness of the base shall be that indicated by the standard drawings or as shown on the plans.

3.03 SEAL COAT SURFACE

- A. Uniformly apply a bituminous prime coat of either emulsified asphalt, Grade AE-P, or cutback asphalt, Grade RC-250, over the entire width of the area to be surfaced at a rate of 0.3 gallons/square yard. Immediately after application, uniformly cover the entire area with Size 7 crushed stone chips at a rate of 12 pounds/square yard.
- B. Pavement repairs/replacements shall be thermally bonded with existing asphalt edges.

3.04 ASPHALTIC CONCRETE BINDER

- A. Apply a bituminous prime coat of emulsified asphalt, Grade AE-P, or cutback asphalt, Grade RC-250, at a rate of 0.38 to 0.42 gallons/square yard. Take care to prevent the bituminous material's splashing on exposed faces of curbs and gutters, walls, walks, trees, etc. If such splashing does occur, remove it immediately. After the prime coat has been properly cured, apply an asphaltic concrete binder to the thickness shown on the standard drawings or the plans.
- B. Carefully place the material to avoid segregation of the mix. Broadcasting of the material will not be permitted. Remove any lumps that do not readily break down.

3.05 ASPHALTIC CONCRETE SURFACE

- A. If the asphaltic concrete surface course is to be placed directly on the mineral aggregate base, place a bituminous prime coat as described above. If, however, the surface course is to be placed on a binder course, then apply a bituminous tack coat of the sort specified above under PRODUCTS at a rate of 0.05 to 0.10 gallons/square yard. Take care to prevent the bituminous material's splashing on exposed faces of curbs, gutters, walls, walks, trees, etc. If such splashing does occur, remove it immediately. After the prime or tack coat has been properly cured, apply the asphaltic concrete to the thickness shown on the drawings or standard drawings. Apply the surface course as described above for the binder course.

3.06 SMOOTHNESS

- A. The finished surfaces shall conform to the lines and grades that existed prior to construction. No deviations, variations, or irregularities exceeding 1/4 inch in any direction when tested with a 12-foot straightedge will be permitted in the finished work, nor will any depressions that will not drain. Correct all such defects.

3.07 SAMPLING AND TESTING

- A. Submit to the Owner test reports made by an independent testing laboratory on the crushed stone aggregate, bituminous materials, and asphaltic concrete design mixes, and obtain his approval of these reports before starting paving operations.
- B. Tests shall be made on the completed elements of the pavement to ascertain the compacted thickness of the base and surface courses. If sections with deficient thicknesses are found, the full section for a reasonable distance on each side of the deficiency shall be refused. Remove and reinstall all such sections. Patch all test holes in connection with thickness tests.
- C. When making surface tests, furnish one man to mark all surface defects for corrections.

End of Section

SECTION 02611 TRENCHING, BACKFILLING, AND COMPACTING

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 01050 – Field Engineering
- B. Section 01560 – Erosion and Pollution Control
- C. Section 01570 – Work Zone Traffic Control
- D. Section 01720 – Project Record Documents
- E. Section 02221 – Unclassified Excavation for Utilities
- F. Section 02311 – Control Blasting
- G. Section 02510 – Water Distribution Lines, Valves and Appurtenances
- H. Section 02532 – Sanitary Sewers and Appurtenances (Gravity)
- I. Section 02534 – Wastewater Force Mains
- J. Section 02536 – Low Pressure Sewer Mains and Laterals
- K. Section 02930 – Seeding

1.02 JOB CONDITIONS

- A. Provide for uninterrupted surface water flow during the work. Provide means whereby storm water can be uninterrupted in existing gutters and surface drains, or temporary drains.
- B. All pipe shall be installed in a dry trench. No extra compensation shall be allowed for trench dewatering.
- C. Immediately notify the Engineer of any unexpected subsurface or other unforeseen conditions. Discontinue work in area until Engineer provides notification to resume work.
- D. Existing utilities, poles, service lines, fences, structures, trees, shrubs, or other improvements encountered during the construction, whether above or below ground, shall be protected by the Contractor. Any item damaged or removed by the Contractor shall be repaired or replaced at the Contractor's expense to at least its original condition and to the satisfaction of the Owner. It shall be the Contractor's responsibility to locate any existing utilities in the path of construction.
- E. Adjacent structures which may be damaged by excavation work shall be underpinned or supported by other means.

- F. Excavations shall be protected by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave in or loose dirt from falling into excavation.

1.03 PERMITS

- A. Permits shall be obtained from authorities having jurisdiction prior to any explosives being brought to the site. The Contractor shall be responsible for providing such insurance that is required to hold the Owner harmless from any claims that may arise due to blasting operations at the site. The minimum insurance requirement will be that which is outlined in the General Conditions.
- B. All conditions set forth in the Corps of Engineers 404 Permit and Tennessee Valley Authority 26A Permit (if applicable) shall be strictly adhered to. The Owner shall obtain the appropriate permit.

1.04 QUALITY ASSURANCE

- A. Adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for the proper performance of the work in this section shall be used.
- B. Equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner shall be used.

PART 2 PRODUCTS

2.01 SANITARY SEWERS

A. BEDDING MATERIAL

- 1. Angular gravel, crushed gravel, or crushed limestone meeting the following gradation requirements set forth in ASTM 33 shall be used:

<u>SIEVE SIZE</u>	<u>PERCENT PASSING</u>
1"	100
3/4"	90 - 100
1/2"	20 - 55
3/8"	0 - 15
#4	0 - 5

- 2. Shall be used for bedding, haunching, and initial backfill of PVC pipe.
- 3. Shall be used for bedding and haunching of Ductile Iron Pipe.
- 4. Frozen materials shall not be used.

B. BACKFILL MATERIALS

- 1. Material excavated from the trench, free from large stones (any dimension greater than two (2") inches), clods, debris, or frozen lumps shall be used:

- a. For final backfill of PVC pipe.
- b. For initial and final backfill of Ductile Iron Pipe.

C. CRUSHED STONE BACKFILL MATERIAL: UNDER ROADS OR AREAS TO BE PAVED

- 1. Shall be used for final backfill for all pipe under roads and in areas indicated as future roads on the drawings.
- 2. Material shall be approved by the Engineer.

2.02 WATER LINES

A. BEDDING MATERIALS

- 1. Angular gravel, crushed gravel, or crushed limestone, meeting the following gradation requirements set forth in ASTM 33:

<u>SIEVE SIZE</u>	<u>PERCENT PASSING</u>
1"	100
3/4"	90 - 100
1/2"	20 - 55
3/8"	0 - 15
#4	0 - 5

- a. Shall be used for bedding, haunching, and initial backfill of PVC and HDPE pipe.
 - b. Shall be used for bedding and haunching of Ductile Iron Pipe.
- 2. Suitable materials excavated from the trench, free from large stones (any dimension greater than two inches), clods, debris, or frozen lumps may be used for bedding and haunching of water lines outside of paved areas with approval of Owner or Engineer.

B. BACKFILL MATERIALS

- 1. Material excavated from the trench, free from large stones (any dimension greater than two inches), clods, debris, or frozen lumps shall be used:
 - a. For final backfill of PVC and HDPE pipe outside of paved areas.
 - b. For initial and final backfill of Ductile Iron Pipe outside of paved areas.
- 2. Borrow materials previously approved by the Engineer may be used for backfill material if suitable material is not available from trench.
- 3. Frozen materials shall not be used.

C. CRUSHED STONE MATERIAL SHALL BE USED AS FOLLOWS:

- 1. On road crossings where open cut crossings are made, crushed stone shall be used for

bedding, haunching, and backfill. (See Standard Details).

2. In areas where rock excavation is required for installation of pipe, crushed stone shall be used for bedding, haunching, and initial backfill.
3. In other areas as directed by the Owner or Engineer and not otherwise required by the Contract Documents, crushed stone shall be replaced at a cost per ton previously agreed by the Owner and Contractor. The quantity of excavation work anticipated to be placed with crushed stone shall be mutually agreed to by the Contractor and the Engineer before excavation.

D. TOPSOIL

1. The final six inches of trench in non-paved areas shall be backfilled with topsoil and finished with crown. See Section 02612, Finish Grading for topsoil specification.

PART 3 EXECUTION

3.01 PREPARATION

- A. Line and grade for trench shall be established.
- B. Location of all underground utilities, existing and proposed shall be located.
- C. Location of existing sewer laterals, manholes and service connections shall be located prior to commencement of trenching.
- D. Location of existing water services, meters, and appurtenances shall be located prior to commencement of trenching.

3.02 PERFORMANCE

- A. All earthwork and trenching operations shall comply with the requirements of OSHA Construction Standards for the construction industry (29 CFR part 1926).
- B. Unless otherwise shown on the drawings or required by the specifications or authorized by the Engineer, all work shall be done in open, vertical trenches. Any sheeting driven below the level of the top of the pipe shall not be disturbed or removed. The responsibility for assessing the need for sheeting and analyzing the stresses induced shall be the total responsibility of the Contractor.
 1. Trench sheeting left in place shall be backfilled to a level of 12 inches above the top of the pipe. It shall then be cut off and the upper portion removed.
 2. Sheeting for structures shall be left in place until backfill has been brought to a level of 12 inches above the top of the bottom footing. It shall then be cut off and removed.
- C. Clearing, including removal of surfacing and pavement, shall be done as necessary to carry on the construction in the proper manner. Material shall be removed only to minimum width necessary to allow adequate construction area. Concrete and asphalt shall be saw cut.

- D. Trenches shall be excavated to such depth as required by the drawings. Trenches for water lines shall be excavated to such depth as required to provide a minimum of 30 inches cover in all directions from the pipe wall, unless otherwise indicated.
- E. Trench Width:
 - 1. Minimum Trench Width
 - a. Outside Diameter Less than 4-inches: trench 4-inches greater on each side of the pipe.
 - b. Outside Diameter 4-inches to 12-inches: trench 6-inches greater on each side of the pipe.
 - c. Outside Diameter 12-inches to 24-inches: trench 8-inches greater on each side of the pipe.
 - 2. Maximum Trench Width shall not be greater than the minimum trench width plus 8-inches nor greater than the minimum width required in order to insert the smallest trench box appropriate for the pipe installation.
- F. If rock is encountered in the trench, it shall be excavated in a manner approved by the Owner and as specified below:
 - 1. No separate payment for trench rock excavation will be made. Trench excavation shall be considered unclassified.
 - 2. Trench shall be undercut one foot where rock is in the trench and backfilled with crushed stone.
 - 3. Drilling and blasting operations shall be conducted with due regard for the safety of persons and property in the vicinity and in strict conformity with requirements of all ordinances, laws, and regulations governing blasting and the use of explosives. Rock excavation near existing pipelines or other structures shall be conducted with the utmost of care to avoid damage.
 - 4. All drilling, blasting, and use of explosives shall be in strict accordance with OSHA standards for the construction industry (29 CFR part 1926).
- G. Excavated material suitable for backfilling shall be stockpiled no closer than 2 feet from the edge of the trench and shall not obstruct crosswalks, sidewalks, or street intersections, and shall not cause unreasonable interference with travel on the streets by occupants of adjacent property. Gutters and other drainage facilities shall not be obstructed. Free access shall also be maintained to fire hydrants, mailboxes, sewer and water manholes, gas meters, or other municipal facilities.

3.03 BEDDING, HAUNCHING, AND BACKFILLING

- A. Pipe shall be installed as shown on the drawings.
- B. Bedding shall be shaped and compacted utilizing a vibratory compactor in order to firmly integrate the bedding material into the subgrade resulting in a firm, unyielding, consolidated bedding surface to provide uniform bearing of the pipe. Bell holes shall be excavated to allow for unobstructed assembly of the joint. Bell holes shall be made as small as practical. After the joint has been made, bell holes shall be filled with bedding material.

- C. After pipe is jointed and aligned, haunching material shall be installed and compacted to 60 percent relative density, ASTM D2049. Ensure material is worked under the haunch of the pipe to provide adequate side support. Precautions shall be taken to prevent movement of the pipe during placement and compaction of haunching material.
- D. Initial backfill shall be hand placed and compacted to provide cover over the pipe as detailed. Pipe shall be protected from large particles of backfill material.
- E. Balance of backfill shall be placed by a method which will not damage or displace the pipe, nor cause bridging action in the trench. Backfill material shall be compacted with earthmoving equipment as material is placed so that excessive settlement of the trench material will not occur. Material shall be neatly mounded over the trench. Trench and settled areas shall be maintained as they occur. Finish grade shall be completed to eliminate uneven areas.
- F. Where pavement is to be placed over the backfilled trench as indicated on the drawings, the backfill shall be crushed stone under the full trench depth. Under future roads, compaction will be required up to within one foot of existing grade with remaining one foot backfill as per paragraph 3.03. E. above.
- G. See Section 02221, Unclassified Excavation for Utilities for additional requirements.

3.04 CREEK AND DITCH CROSSINGS

- A. Construct pipe encasement as shown on typical details. Concrete shall be placed in the dry. Concrete: ASTM C94, 2500 psi, at twenty-eight (28) days.
- B. Construction methods that will minimize siltation and erosion shall be utilized.
- C. All backfill shall be granular material as specified for embedment material or crusher run stone.
- D. Clean up, grading, seeding, and other restoration work shall begin immediately and exposed areas shall not remain unprotected for more than seven (7) days.

3.05 TEST FOR DISPLACEMENT OF SEWERS

- A. A check of sewer pipe shall be made to determine whether displacement has occurred after the trench has been backfilled to above the pipe and has been compacted as specified.
- B. A light shall be flashed between manholes or between locations of manholes with a flash light or sun reflecting mirror.
- C. If the pipe line shows poor alignment, displaced pipes, or any other defects, defects shall be corrected to the specified conditions at no additional cost to the Owner.

3.06 TESTING OF BACKFILL

- A. A testing laboratory or the Owner shall verify compaction of the bedding and haunching material after placement and compaction.

End of Section

SECTION 02612 FINISH GRADING

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 02221: Unclassified Excavation for Utilities
- B. Section 02611: Trenching, Backfilling, and Compacting
- C. Detailed Specification Sections

1.02 SITE COMPACTION TESTING

- A. Testing of compacted fill materials shall be performed by an independent testing laboratory appointed and paid for in accordance with Detailed Specification Section.
- B. When work of this section or portions of work are completed, notify the testing laboratory to perform density tests. Do not proceed with additional portions of work until results have been verified.
- C. If, during progress work, tests indicate that compacted materials do not meet specified requirements, remove defective work, replace, and retest at no cost to Owner.

1.03 SAMPLES

- A. Submit minimum ten (10 lb.) pound samples of each type of excavated fill material to be used. Forward samples to testing laboratory, packed tightly in containers to prevent contamination.
- B. If recent test results are available for fill materials to be used, disregard sample submission and submit such test results to the testing laboratory for approval. Such test results are to clearly indicate types of materials and composition, hardness, compactability, and suitability for proposed usage.

1.04 PROTECTION

- A. Prevent damage to existing fencing, trees, landscaping, natural features, benchmarks, pavement, utility lines, and structures. Correct damage at no cost to the Owner.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Topsoil: Friable loam free from subsoil, roots, grass, excessive amount of weeds, stones and foreign matter; acidity range (pH) of 5.5 to 17.5; containing a minimum of four (4%) percent and a maximum of twenty-five (25%) percent organic matter. Use topsoil stockpiled on site if conforming to these requirements.

PART 3 EXECUTION**3.01 SUB-SOIL PREPARATION**

- A. Rough grade sub-soil systematically to allow for a maximum amount of natural settlement and compaction. Eliminate uneven areas and low spots. Remove debris, roots, branches, stones, and etc., in excess of three (3") inches in size. Remove sub-soil which has been contaminated with petroleum products.
- B. Cut out areas, to sub-grade elevation, which has been contaminated with petroleum products.
- C. Bring sub-soil to required levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas.
- D. Slope grade away from building minimum two (2") inches in ten (10') feet unless indicated otherwise on drawings.
- E. Cultivate sub-grade to a depth of three (3") inches where topsoil is to be placed. Repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted sub-soil.
- F. Compact sub-soil to the following:
 - 1. Under Topsoil: 85 percent modified Proctor, ASTM D1557.
 - 2. Under Streets, Drives, and Parking Areas: 95 percent modified Proctor ASTM D1557.
 - 3. Under Walks: 85 percent modified Proctor, ASTM D1557.

3.02 PLACING TOPSOIL

- A. Place topsoil in areas where seeding and planting is to be performed. Place to the following minimum depths, up to finished grade elevations.
 - 1. Six (6") inches for seeded areas.
 - 2. Twenty-four (24") inches for shrub beds.
- B. Use topsoil in relatively dry state. Place during dry weather.
- C. Fine grade topsoil eliminating rough and low areas to ensure positive drainage. Maintain levels, profiles, and contours of sub-grades.
- D. Remove stone, roots, grass, weeds, debris, and other foreign material while spreading.
- E. Manually spread topsoil around trees, plants, and buildings to prevent damage which may be caused by grading equipment.
- F. Lightly compact placed topsoil.

3.03 SURPLUS MATERIAL

- A. Remove surplus sub-soil and topsoil from site.

- B. Leave stockpile areas and entire job site clean and raked, ready to receive landscaping.

End of Section

SECTION 02930 SEEDING

PART 1 GENERAL

1.01 SUMMARY

- A. This work shall consist of supplying and placing soil additives, seed, and mulch as specified on prepared ground in accordance with the Plans and these Specifications. All non-construction areas that show signs of excessive erosion and all newly graded earthen areas that are not to be paved, stabilized, or sodded, shall be seeded unless otherwise indicated on the Plans or as directed by the Engineer.

1.02 RELATED SECTIONS

- A. Section 02221 – Unclassified Excavation for Utilities

PART 2 PRODUCTS

2.01 MATERIALS

- A. Grass Seed: Use a drought tolerant hybrid Kentucky 31 Fescue (Jaguar, Lancer, Rebel II, Falcon II, etc.). Supplement with an annual rye or other appropriate mixture to assure stabilization during the winter season. Furnish seed in new bags or bags that are sound and not mended; no "below standard" seed accepted.
- B. Fertilizer: Use a slow-release starter fertilizer in standard containers that are clearly marked with name, weight, and guaranteed analysis of the contents and that ensure proper protection in transportation and handling; and in compliance with all local, state, and federal fertilizer laws.
- C. Lime: Use lime containing a minimum of 85% calcium carbonate and magnesium carbonate, 85% of which passes a No. 10 mesh sieve.
- D. Mulch: Stalks of rye, oats, wheat, or other approved grain crops properly cured prior to baling, air dried, and reasonably free of noxious weeds and weed seeds or other material detrimental to plant growth.

PART 3 EXECUTION

3.01 GENERAL

- A. Before starting seeding operations on any area, final dressing and placing of topsoil shall have been completed in accordance with the applicable Specifications. Seed, fertilize, lime, and mulch within 30 days of attainment of finish grade.

- B. Apply temporary seeding whenever grading operations are temporarily halted for over 14 days and final grading of exposed surfaces is to be completed within one year. Also apply temporary seeding to soil stockpiles.

3.02 PREPARATION

- A. Each area to be seeded shall be scarified, disked, harrowed, raked or otherwise worked until it has been loosened and pulverized to a depth of not less than 2 inches and brought to the lines and grades indicated on the Plans or directed by the Engineer. This operation shall be performed only when the soil is in a tillable and workable condition.
- B. Apply fertilizer at the rate of 1 pound of nitrogen per 1,000 square feet, and lime at the rate of 50 pounds per 1,000 square feet, shall be uniformly incorporated in the soil for a depth of approximately 1 inch. Fertilizer need not be incorporated in the soil as specified above when mixed with seed in water and applied with power sprayer equipment. Do not apply lime without a soil test.

3.03 SEEDING

- A. Seed shall be sown as soon as preparation of the seed bed has been completed. It shall be sown uniformly by means of a rotary seeder, hydraulic equipment, or other satisfactory means. Seed shall be sown at the rate of 6 to 8 pounds per 1,000 square feet.
- B. No seeding shall be done during windy weather or when the ground surface is frozen, wet or otherwise non-tillable.
- C. When seeding during February 1 through April 1 and October 1 through November 30, add an additional 3 pounds per 1000 square feet of annual rye grass. No seeding shall be performed during December and January unless otherwise permitted.

3.04 MULCHING

- A. When the mulching material is hay or straw, it shall be spread evenly over the seeded area at an approximate rate of 2 bales (100 pounds minimum) per 1,000 square feet for straw and 150 pounds per 1,000 square feet for hay immediately following the seeding operations. The Engineer depending on the texture and condition of the mulch material and the characteristics of the area seeded may vary this rate.

3.05 MAINTANENCE

- A. All seeded areas shall be cared for properly to the Engineer's satisfaction until acceptance of the work. Areas, which have been previously seeded and mulched in accordance with this Section, but which, have been damaged or failed to successfully establish an acceptable stand of grasses shall be repaired as directed by the Engineer. All material and labor required to repair seeded areas made necessary by negligence on a part of the Contractor will be furnished by the Contractor at no cost.

- B. If within 60 days of the planting less than 50% is successful, rework the ground, refertilize, reseed, and remulch.

3.06 CLEANUP AND PROTECTION

- A. After the completion of seeding, the area shall be cleaned of all rubbish, excess material, and any other items that will mar the appearance of the projects as in accordance with the General Specifications.

End of Section

**SECTION 03303
CONCRETE FOR UTILITIES**

PART 1 GENERAL

1.01 SUMMARY

- A. This item shall include furnishing and installing concrete blocking, cradles, anchors, caps, pipe protection, and/or encasement at the locations shown on the drawings and/or as directed by the Owner.
- B. Submit concrete mix design, including all add mixtures with past strength data for review per the requirements of Section 01302, Submittals and Substitutions.

PART 2 PRODUCTS

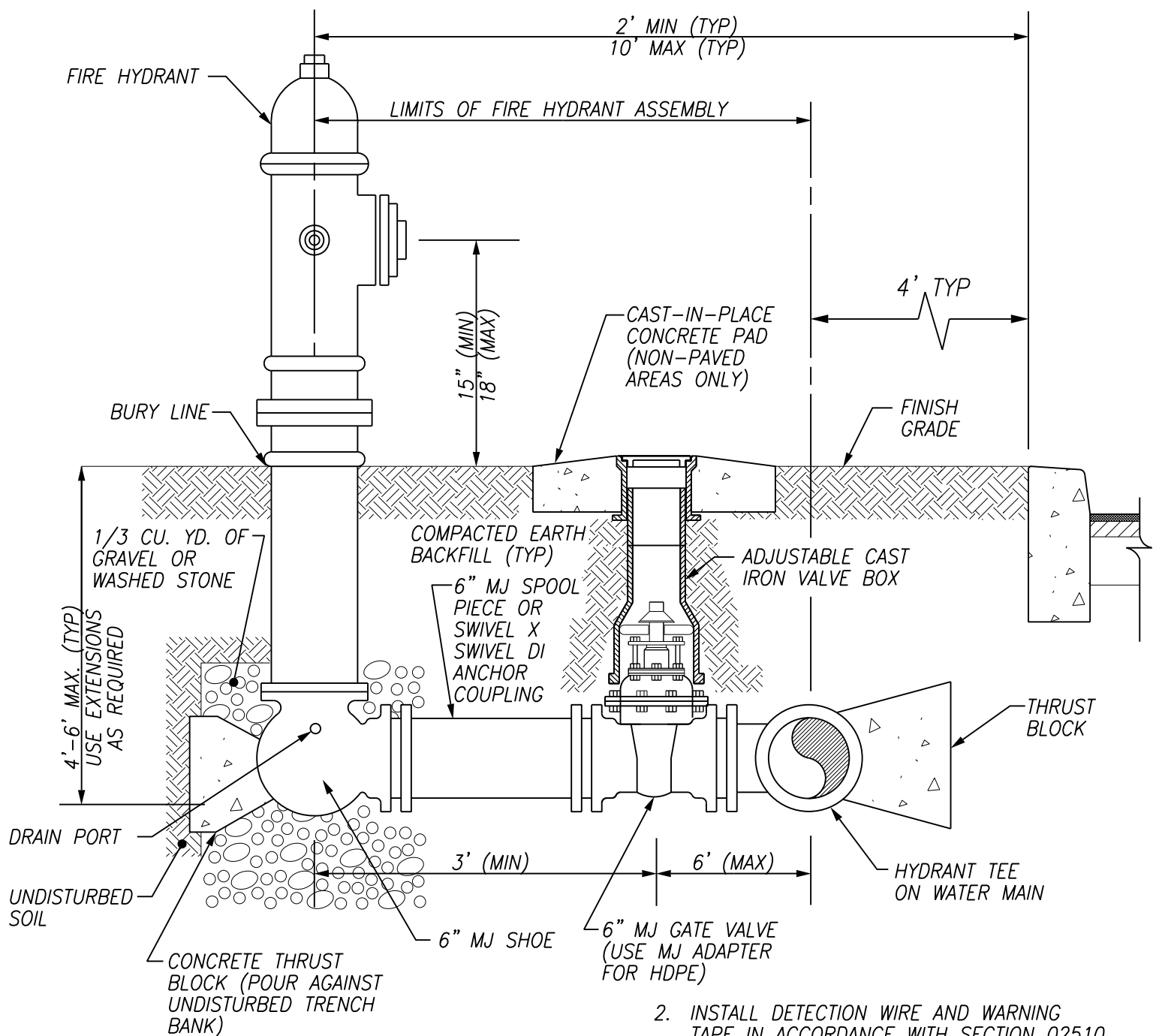
- A. Not Applicable.

PART 3 EXECUTION

3.01 SUMMARY

- A. Concrete work shall conform to ACI 301-72 (as revised), as modified by the supplemental requirements listed below.
 - 1. Strength: The strength of concrete shall be 4,000 psi unless otherwise shown on the drawings.
 - 2. Durability: All concrete exposed to weather shall be air entrained.
 - 3. Slump: Concrete shall be proportional and produced to have a slump of 3-inches with a 1-inch tolerance.
 - 4. Admixtures: Air entrainment, mandatory for concrete exposed to weather, may be used. A water reducing admixture [retarding (normal or accelerating) depending on placing temperature] may be used if approved by the Owner.
 - 5. Reinforcing Steel: Yield strength of reinforcing steel shall be 60,000 psi.

End of Section



NOTES:

1. FIRE HYDRANTS SHALL BE MUELLER SUPER CENTURION #250 FACTORY COATED YELLOW, WITH 5-1/4" OPENING VALVE, (OPEN COUNTERCLOCKWISE) HYDRANTS SHALL BE PAINTED AS SHOWN BELOW, IN ACCORDANCE WITH THE LATEST NFPA 291 CODE FOR MARKING HYDRANTS, AND/OR IN ACCORDANCE WITH THE LENOIR CITY FIRE DEPARTMENT STANDARDS.
RED: LESS THAN 500 GPM
ORANGE: 500-999 GPM
GREEN: 1000-1499 GPM
LIGHT BLUE: 1500 GPM OR GREATER

2. INSTALL DETECTION WIRE AND WARNING TAPE IN ACCORDANCE WITH SECTION 02510.
3. DIG BELL HOLES, LAY PIPE ON BOTTOM OF DITCH.
4. ALL HYDRANTS SHALL BE TRAFFIC TYPE WITH BURY LINE POSITIONED AS SHOWN IN SECTION.
5. FOSTER ADAPTOR IS ACCEPTABLE BETWEEN THE TEE AND THE GATE VALVE.



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TELEPHONE 844.687.5282

APPROVED BY: RWSG

DRAWN BY: FMA

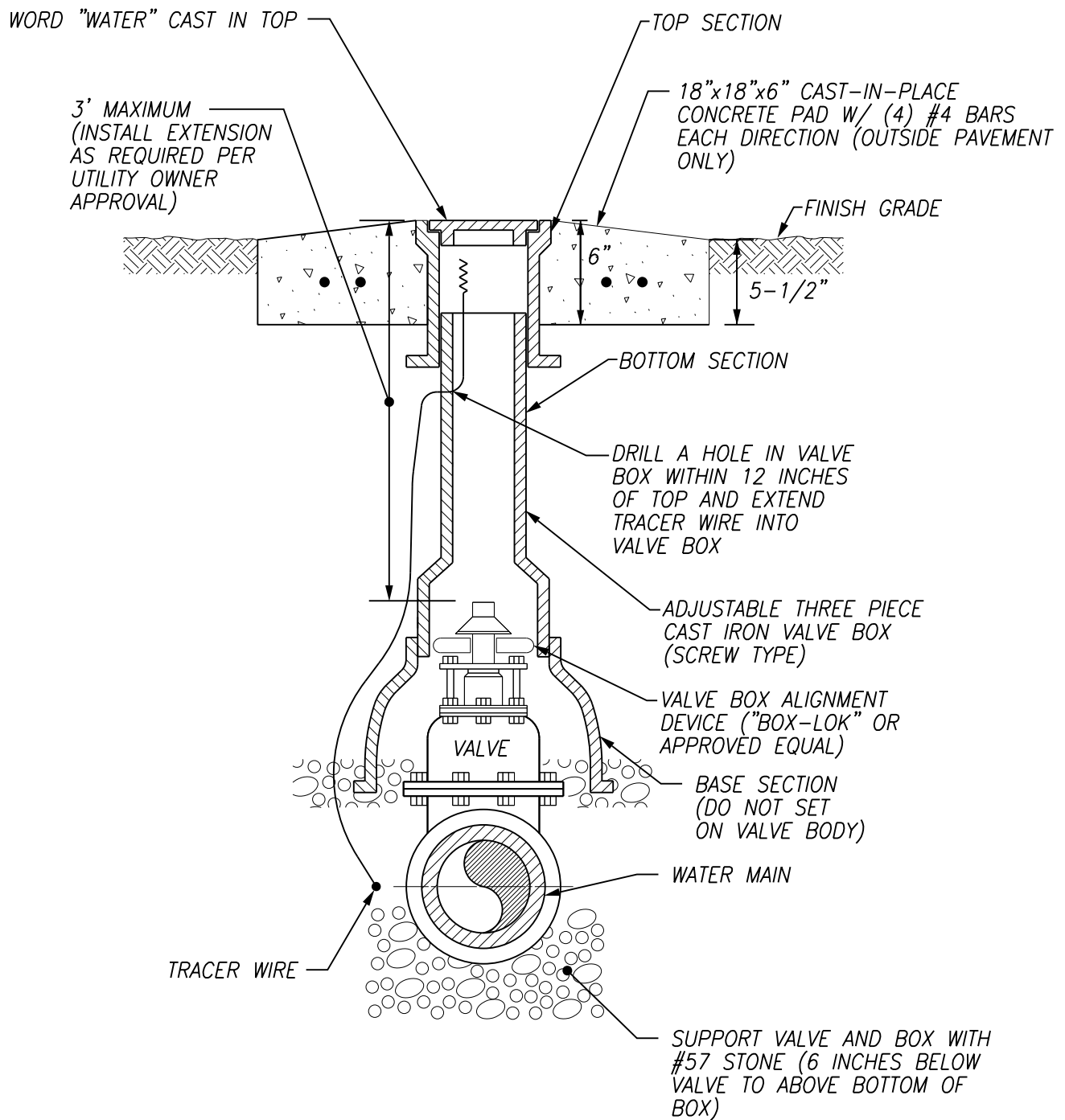
Scale: NTS

TYPICAL HYDRANT ASSEMBLY

Date: 04/11/23

DRAWING NUMBER:

W1



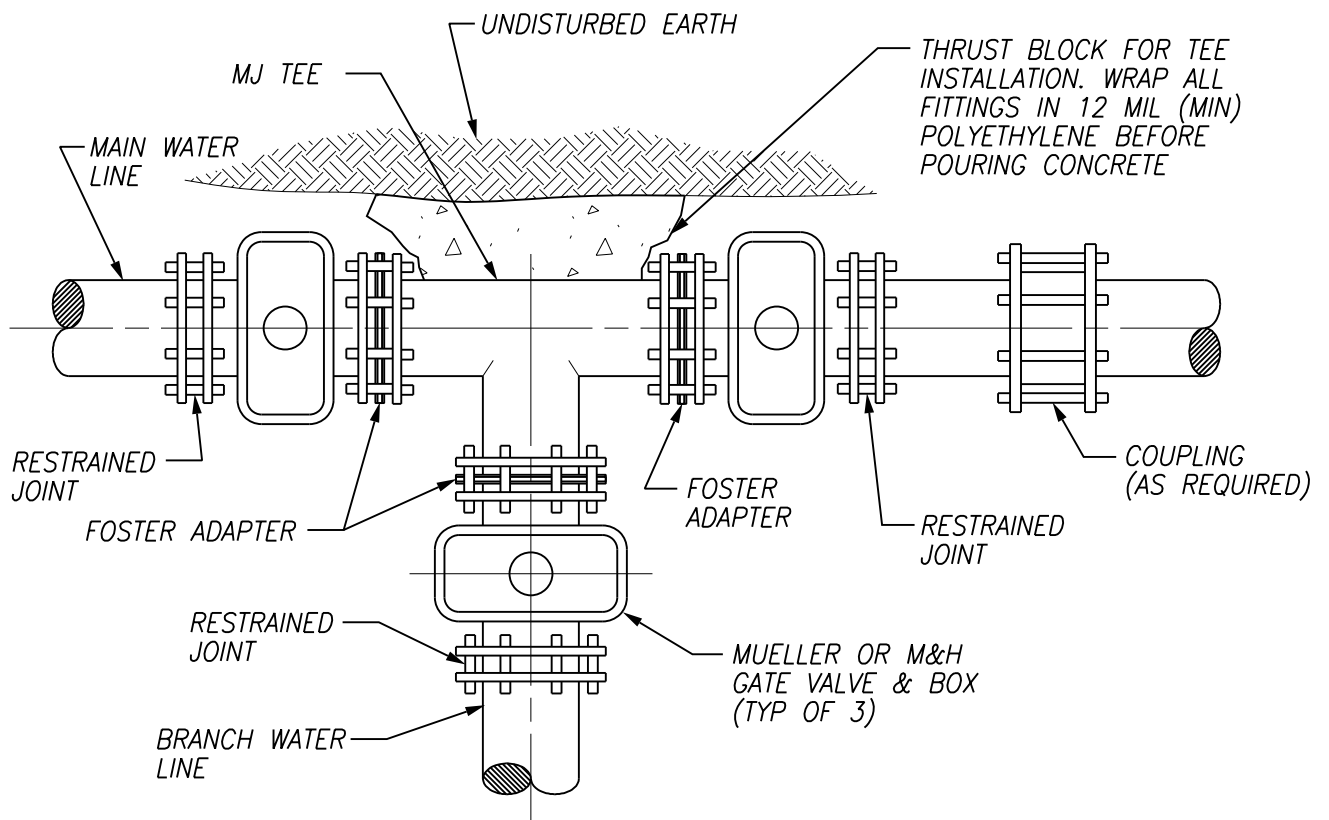
NOTES:

1. WATER VALVE SHALL HAVE A FIBERGLASS LOCATOR MARKER (OUTSIDE OF PAVEMENT ONLY) AT OWNER'S DIRECTION.



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TYPICAL GATE VALVE AND BOX				Date:	07/12/19
				DRAWING NUMBER:	W2



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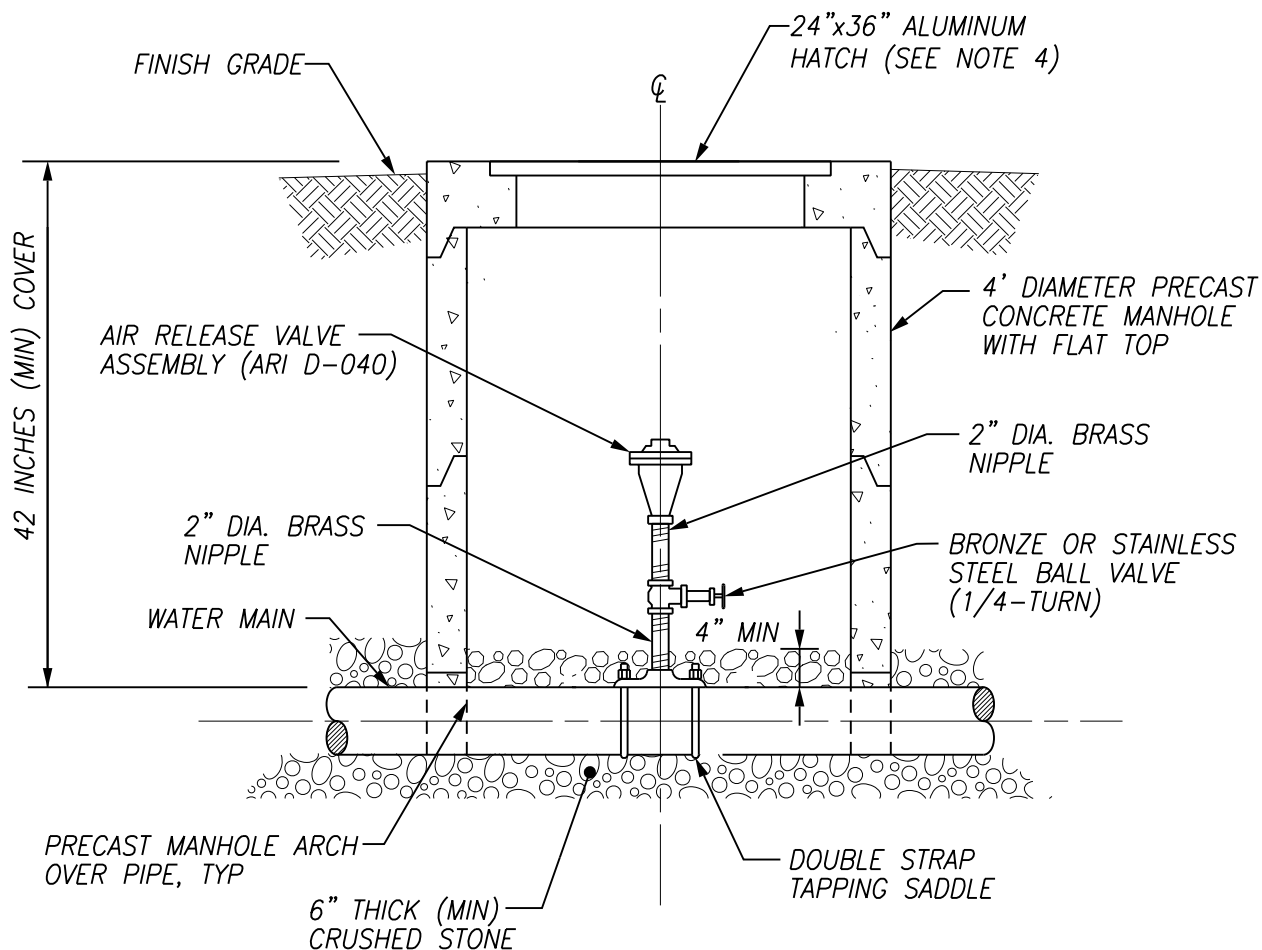
Scale: NTS

Date: 07/15/21

3-VALVE CLUSTER DETAIL

DRAWING NUMBER:

W3



NOTES:

1. AIR RELEASE VALVES SHALL BE INSTALLED AT ALL HIGH POINTS ON WATER MAINS OR AS SHOWN ON PLANS OR AS DIRECTED BY OWNER'S REPRESENTATIVE.
2. USE FOR 1" AND 2" AIR RELEASE VALVE INSTALLATIONS.
3. ANCHOR FRAME TO MANHOLE WITH (4) EACH 3/4-INCH DIA. x 6-INCH LONG STAINLESS STEEL APPROVED CHEM-SET TYPE ANCHOR BOLTS COMPLETE WITH WASHERS AND NUTS.
4. ALUMINUM HATCHES SHALL BE DOUBLE-LEAF ACCESS DOORS AS MANUFACTURED BY HALLIDAY, OR APPROVED EQUAL, AND SHALL INCLUDE 1/4" ALUMINUM DIAMOND PATTERN COVER, 1/4" ALUMINUM CHANNEL WITH RECESSED ANCHORS, STAINLESS STEEL HARDWARE, STAINLESS STEEL LIFTING SPRING MECHANISM, REMOVABLE SQUARE KEY WRENCH, AND PROTECTIVE SAFETY GRATING.
5. DARTER STEEL BOXES ARE ACCEPTABLE IN LIEU OF 4' DIAMETER PRECAST CONCRETE MANHOLE UPON LCUB APPROVAL.



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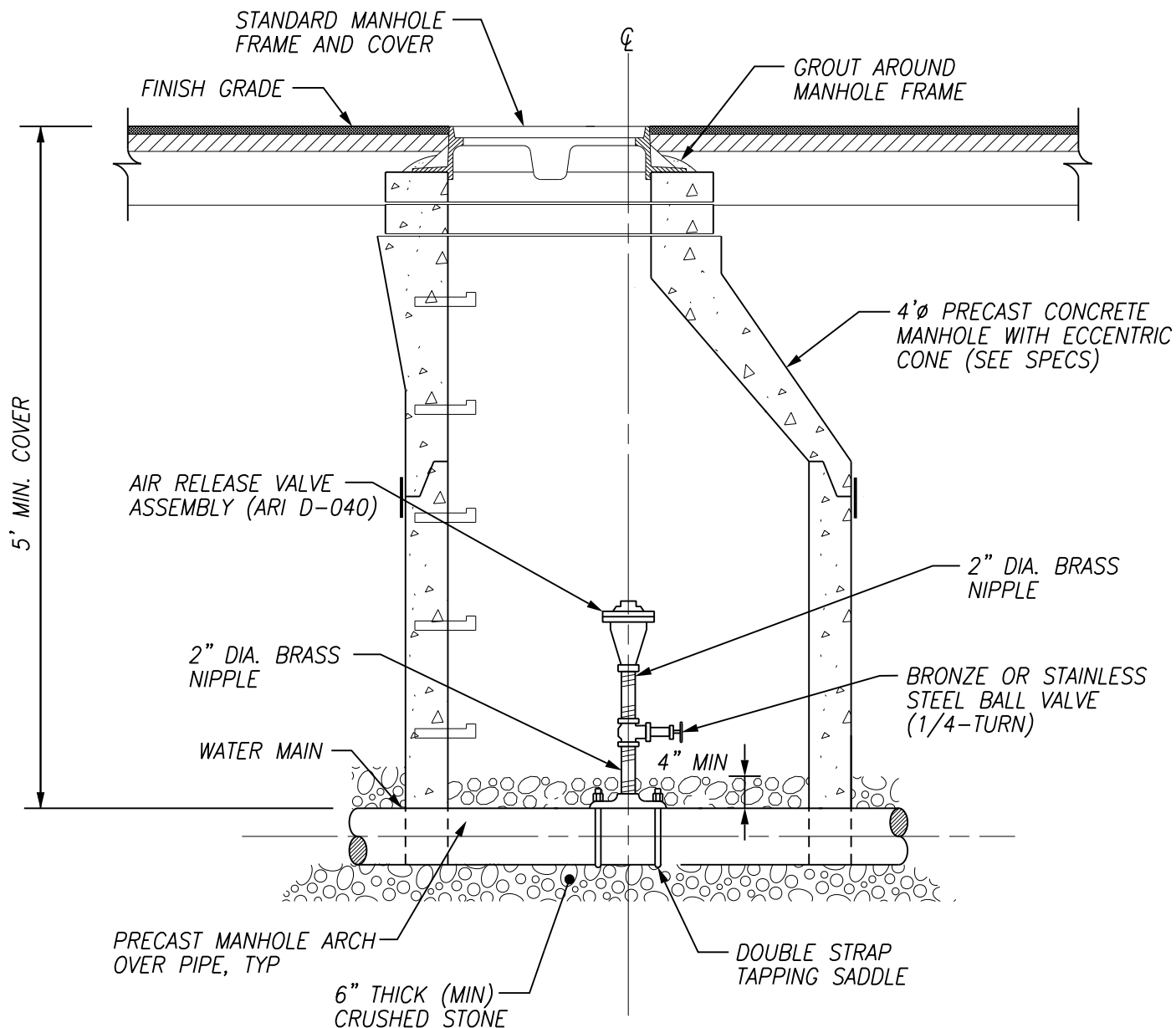
DRAWN BY: FMA

Scale: NTS

**AUTOMATIC AIR RELEASE
VALVE ASSEMBLY
(NON-PAVED AREAS)**

Date: 07/30/21

DRAWING NUMBER:
W4.1



NOTES:

1. AIR RELEASE VALVES SHALL BE INSTALLED AT ALL HIGH POINTS ON WATER MAINS OR AS SHOWN ON PLANS OR AS DIRECTED BY OWNER'S REPRESENTATIVE.
2. USE FOR 1" AND 2" AIR RELEASE VALVE INSTALLATIONS.
3. ANCHOR FRAME TO MANHOLE WITH (4) EACH 3/4-INCH DIA. x 6-INCH LONG STAINLESS STEEL APPROVED CHEM-SET TYPE ANCHOR BOLTS COMPLETE WITH WASHERS AND NUTS.



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APPROVED BY:

LCUB

DRAWN BY:

FMA

Scale:

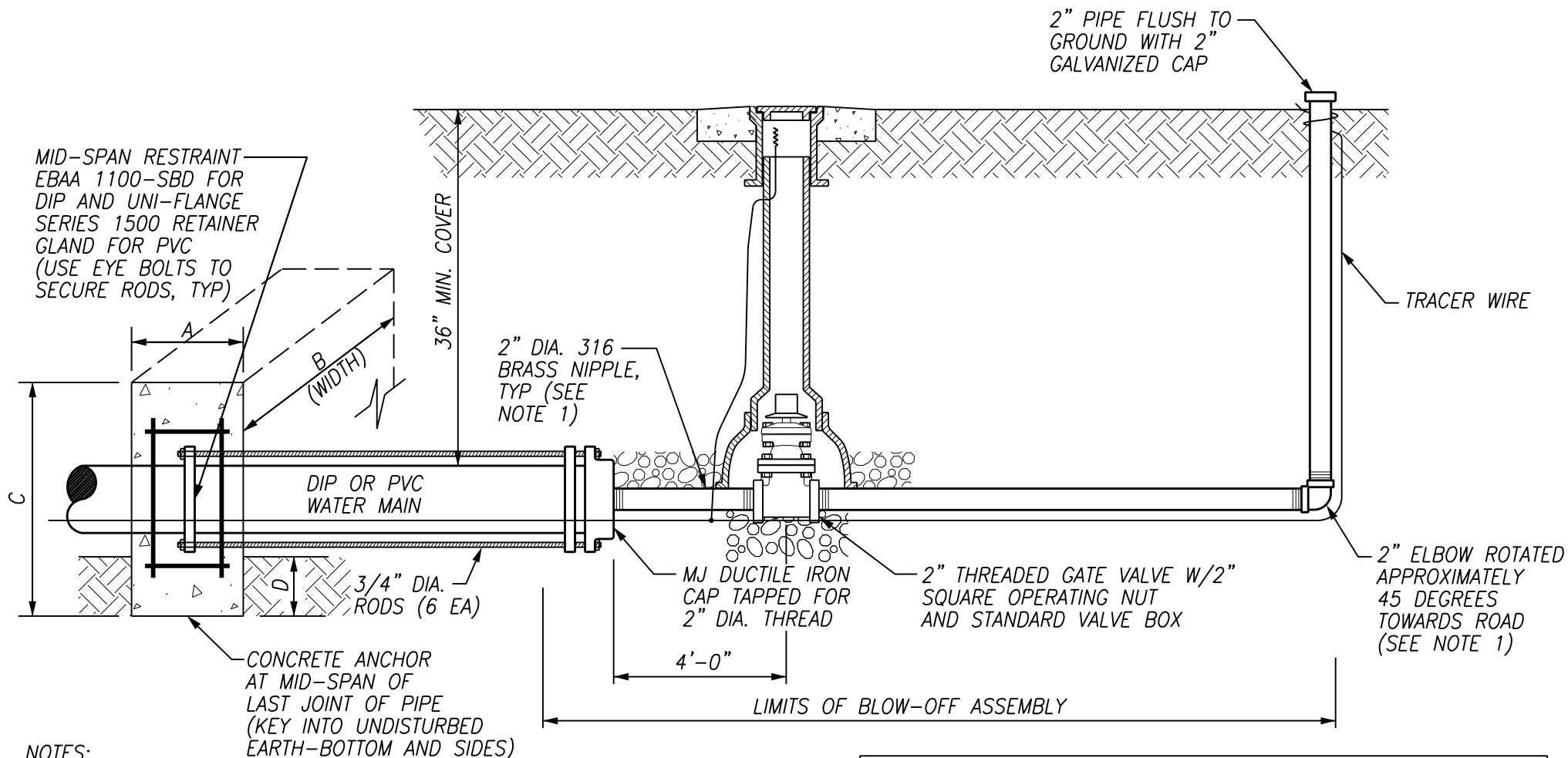
NTS

**AUTOMATIC AIR RELEASE
VALVE ASSEMBLY
(PAVED AREAS)**

Date: 07/30/21

DRAWING NUMBER:

W4.2



NOTES:

1. ALL THREADED PIPE SHALL BE JOINTED USING HEAVY DUTY TEFLON JOINT TAPE. ALL EXPOSED THREADS AND ALL PIPE SHALL BE CLEANED OF ALL GREASE, OIL, DEBRIS AND OTHER SOILING AND SHALL RECEIVE A HEAVY COAT OF COAL-TAR EPOXY COATING PRIOR TO BACKFILLING.
2. WATER VALVE SHALL HAVE A FIBERGLASS LOCATOR (OUTSIDE OF PAVEMENT ONLY) AT OWNER'S DIRECTION.
3. USE GRIPRING RESTRAINT AT CAP PLUS FIELD-LOK GASKETS FOR NEW DIP BLOW-OFF VALVE INSTALLATIONS; USE GRIPRING AT CAP PLUS CONCRETE ANCHOR FOR CONNECTIONS TO EXISTING DIP AND FOR PVC PIPE BLOW-OFF VALVE INSTALLATIONS.
4. HDPE IS ACCEPTABLE TO USE PAST THE BLOW-OFF GATE VALVE IN LIEU OF GALVANIZED PIPE.

CONCRETE COLLAR DIMENSIONS

WATER MAIN DIA.	A	B	C	D	STEEL REINFORCING
4", 6", OR 8"	1'-0"	4'-0"	4'-0"	0'-8"	#5 @ 12" O.C., E.W.E.F.
12"	1'-2"	5'-3"	5'-3"	1'-0"	#6 @ 12" O.C., E.W.E.F.



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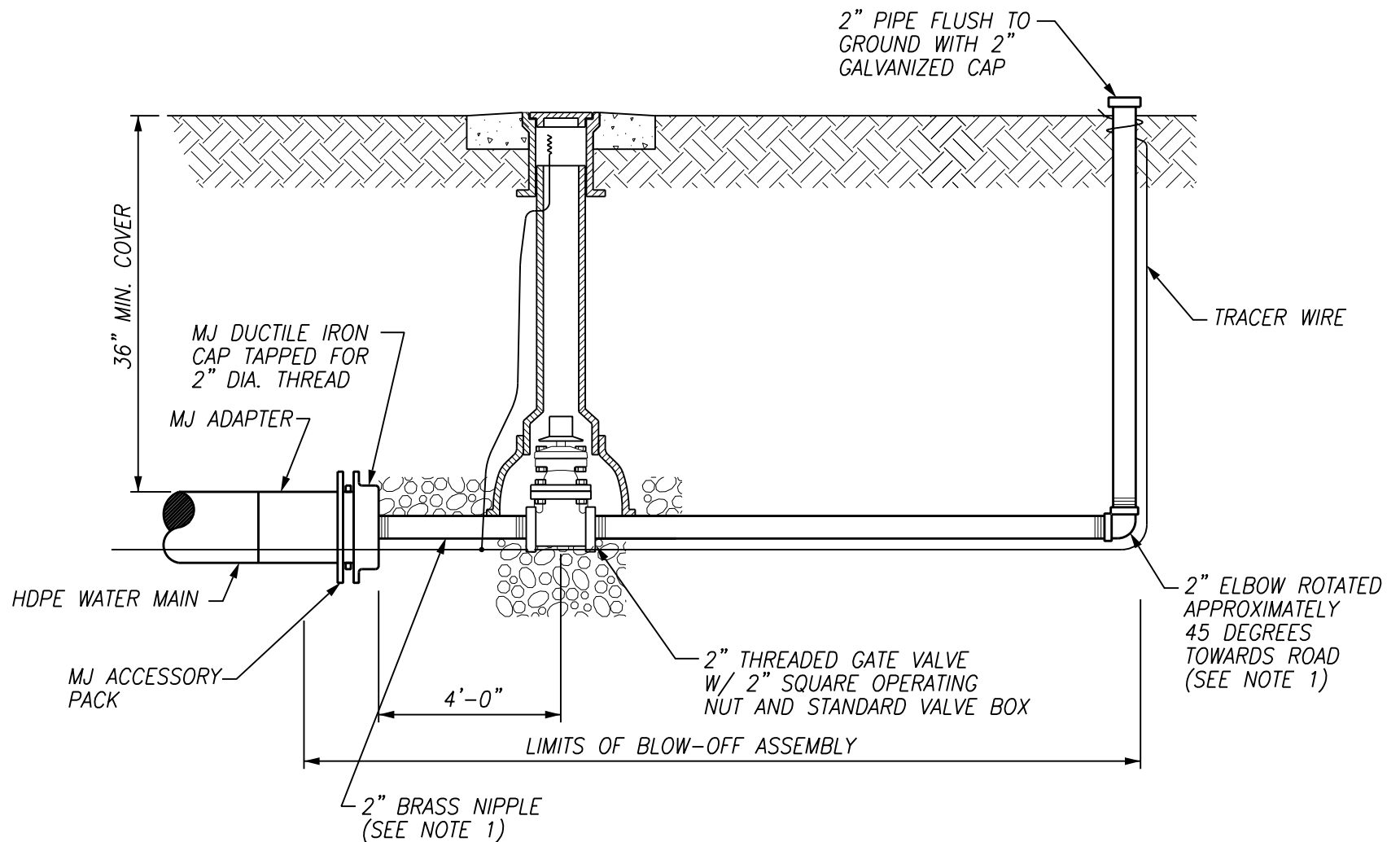
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TYPICAL BLOW-OFF ASSEMBLY (FOR PVC AND DIP)

Date: 07/14/21

DRAWING NUMBER:

W5



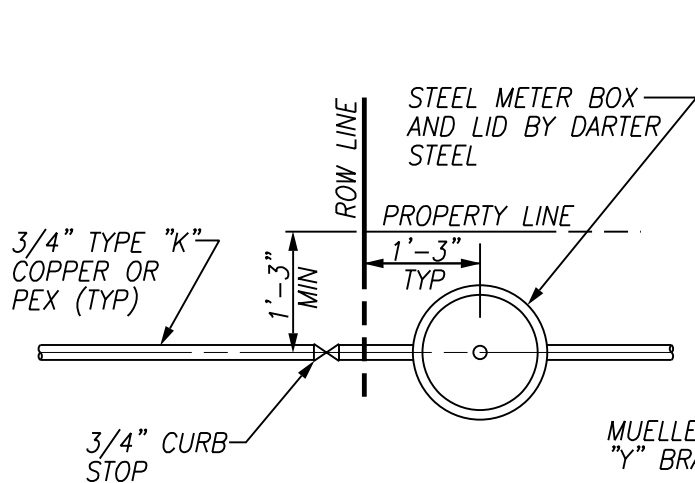
NOTES:

1. ALL THREADED PIPE SHALL BE JOINTED USING HEAVY DUTY TEFLON JOINT TAPE. ALL EXPOSED THREADS AND ALL PIPE SHALL BE CLEANED OF ALL GREASE, OIL, DEBRIS AND OTHER SOILING AND SHALL RECEIVE A HEAVY COAT OF COAL-TAR EPOXY COATING PRIOR TO BACKFILLING.
2. WATER VALVE SHALL HAVE A FIBERGLASS LOCATOR MARKER (OUTSIDE OF PAVEMENT ONLY) AT OWNER'S DIRECTION.
3. HDPE IS ACCEPTABLE TO USE PAST THE BLOW-OFF GATE VALVE IN LIEU OF GALVANIZED PIPE.

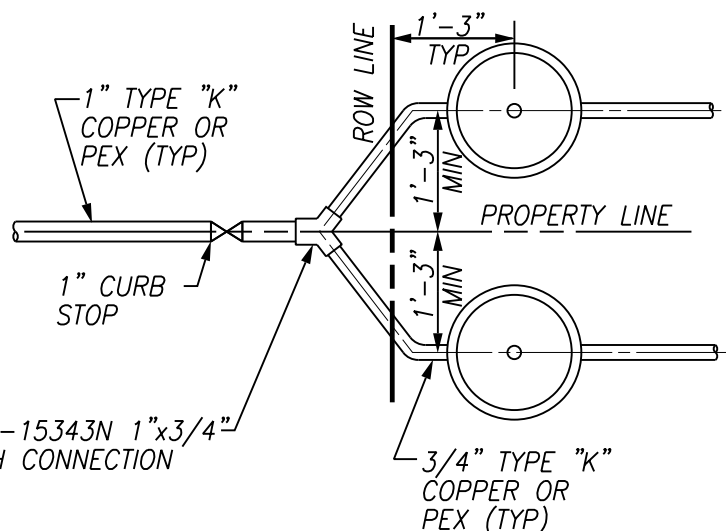


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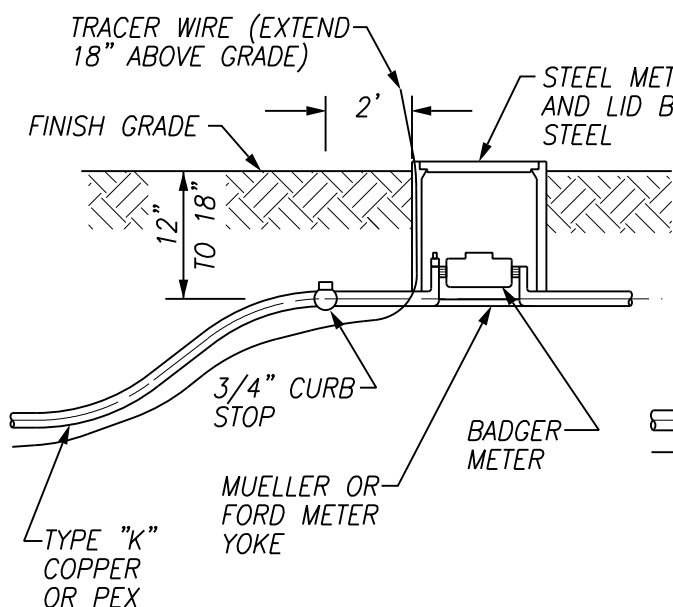
APPROVED BY:	LCUB	DRAWN BY:	FMA	Scale:	NTS
TYPICAL BLOW-OFF ASSEMBLY (FOR HDPE)				Date:	07/12/19
				DRAWING NUMBER:	W6



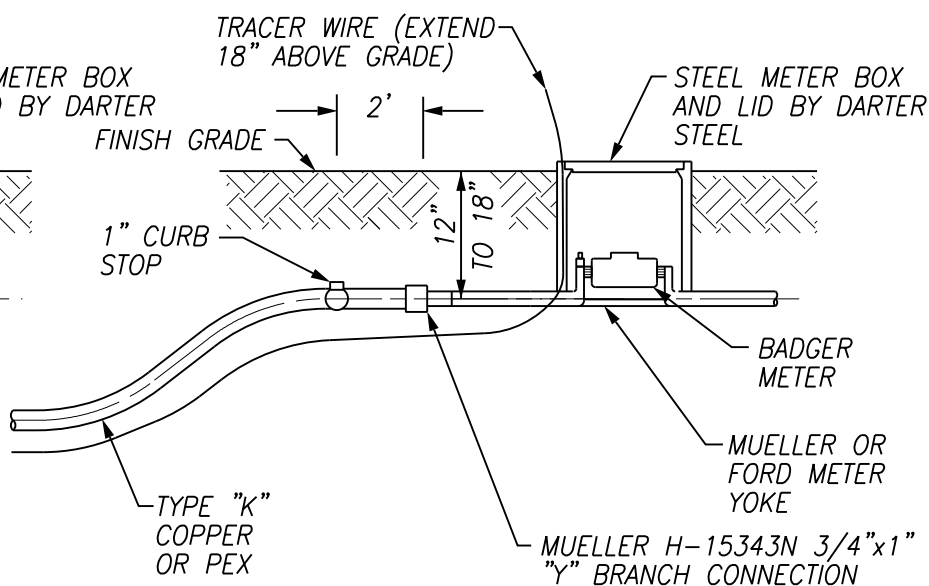
SINGLE METER PLAN



DOUBLE METER PLAN



SINGLE METER SECTION



DOUBLE METER SECTION

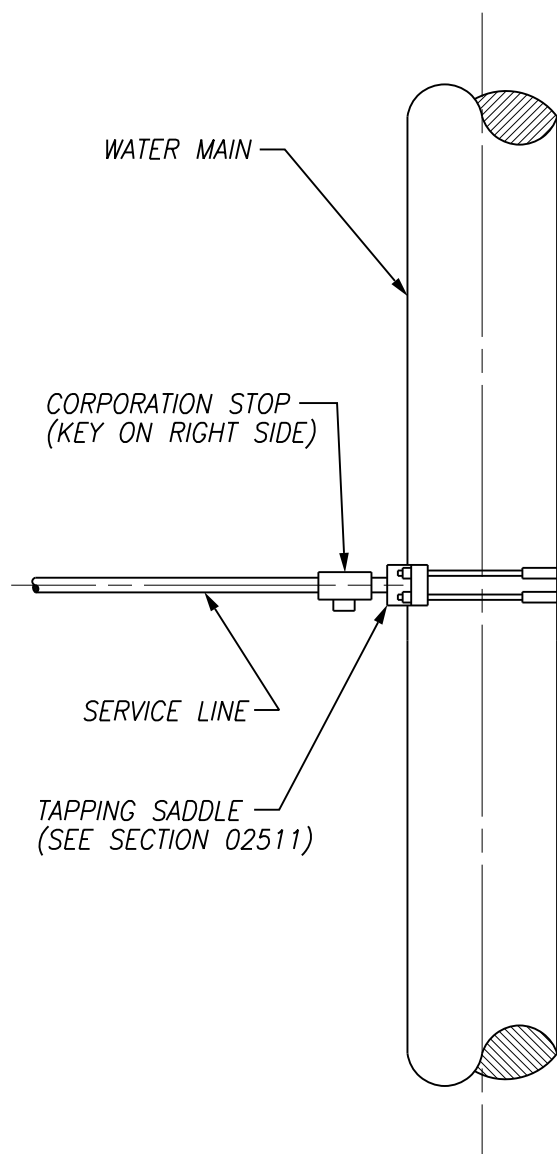
NOTES:

1. CONTRACTOR TO COORDINATE FIELD LOCATION OF PROPOSED WATER METERS WITH LCUB.
2. CONTRACTOR RESPONSIBLE FOR RE-CONNECTING TO EXISTING WATER SERVICE LINE.
3. METER BOXES, SETTERS, ETC. TO BE PER LENOIR CITY UTILITIES BOARD REQUIREMENTS
4. CONNECT TRACER WIRE FOR SERVICE TO TRACER WIRE FOR MAIN TO ENSURE CONTINUITY OF SIGNAL.
5. FOR 1-INCH AND 2-INCH WATER METERS, CONTRACTOR SHALL PROVIDE AND INSTALL GALVANIZED PIPING SECTIONS OF THE APPROPRIATE SIZE AND LENGTH WITHIN THE METER BRACING EYES (LOOPS) TO STABILIZE METER.

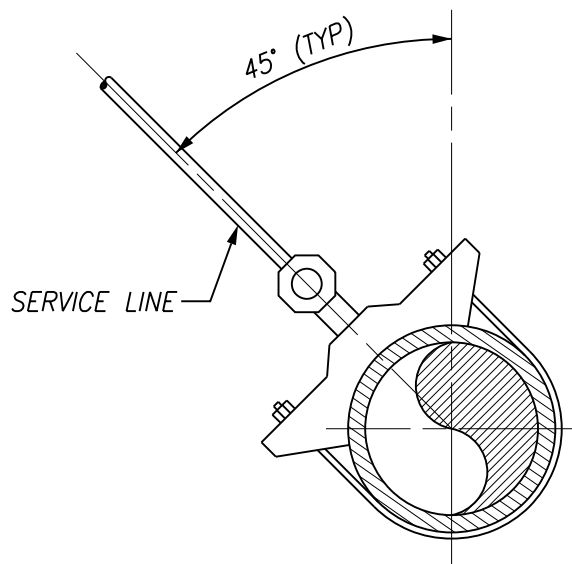


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TYPICAL METER SETTING DETAIL		Date: 07/30/21
		DRAWING NUMBER: W7



PLAN



SECTION



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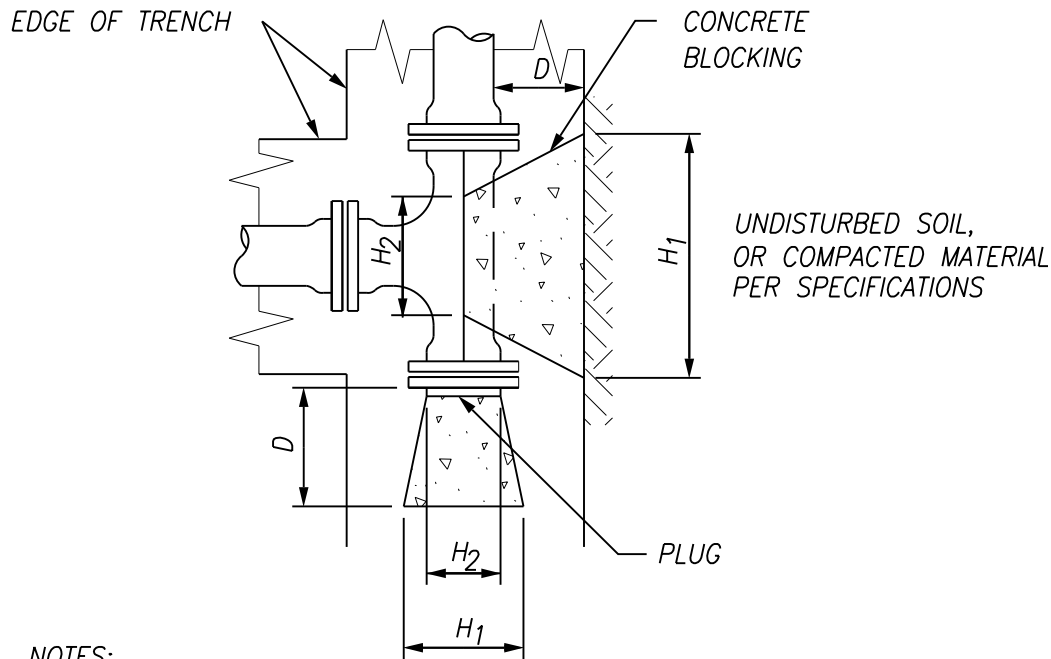
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TYPICAL SERVICE CONNECTION

Date: 07/12/19

DRAWING NUMBER:
W8



NOTES:

1. THRUST BLOCKING BASED UPON AN INTERNAL HYDROSTATIC PRESSURE OF 200 PSI AND AN ALLOWABLE SOIL BEARING CAPACITY OF 4000 LBS/SF. SHOULD HYDROSTATIC PRESSURE BE GREATER AND/OR SOIL BEARING CAPACITY SHOULD BE LESS THAN THAT NOTED ABOVE, CONTRACTOR SHALL INCREASE SIZE AS REQUIRED AND PROVIDE CALCULATIONS TO SUPPORT SAID MODIFICATION.
2. LCUB SHALL APPROVE ALL THRUST BLOCKS.
3. FITTING JOINTS SHALL NOT BE POURED IN CONCRETE OR HAVE CONCRETE SPILLED ON THE BOLTS OR NUTS. WRAP ALL FITTINGS, BOLTS, FLANGES, ETC. IN 6 MIL PLASTIC PRIOR TO PLACING CONCRETE.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR PROPER APPLICATION OF THRUST RESTRAINT SYSTEM TO PREVENT MOVEMENT OF PIPE AND FITTINGS.
5. ALL FITTINGS SHALL BE MECHANICAL JOINT AND HAVE RESTRAINED JOINTS AT THE FITTING IN ADDITION TO THE CONCRETE THRUST BLOCK. ALSO, DUCTILE IRON PIPE SHALL BE INSTALLED WITH JOINT RESTRAINING GASKETS FOR THE REQUIRED DISTANCES FROM EACH FITTING AS SPECIFIED ON DETAIL W10.
6. DIMENSIONS FOR THRUST BLOCKS FOR CAPS AND VALVES SHALL BE THE GREATER OF THE VALUE SHOWN IN THE TABLE OR THE VALUE GOVERNED BY TRENCH WIDTH SHOWN IN THE DETAIL.

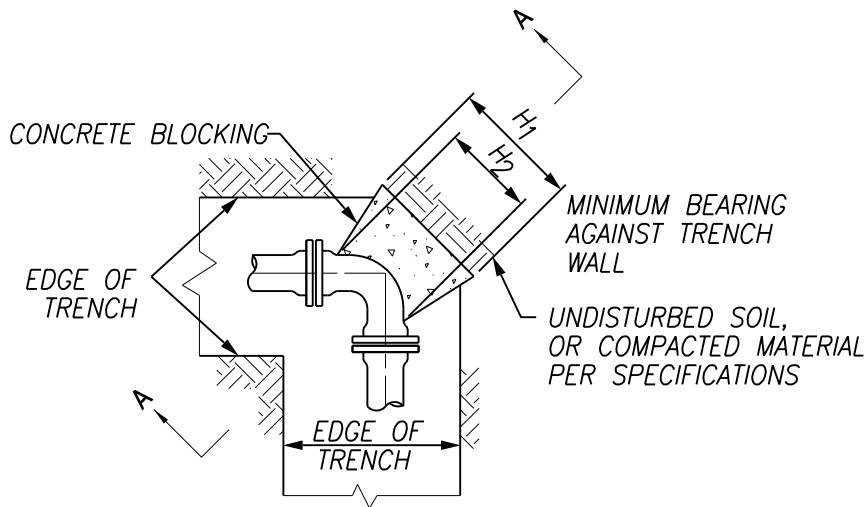
TABLE OF DIMENSIONS FOR CONCRETE BLOCKING

SIZE PIPE (INCHES)	TEES, PLUGS CROSSES				
	H_1	H_2	V	D	CU FT.
2&2-1/4	18	10	12	18	1.9
3 & 4	24	12	12	18	2.3
6	24	16	18	18	3.5
8	36	18	18	18	5.1
10	48	24	18	24	7.2
12	54	30	24	24	13.4
16	60	34	36	24	22.5

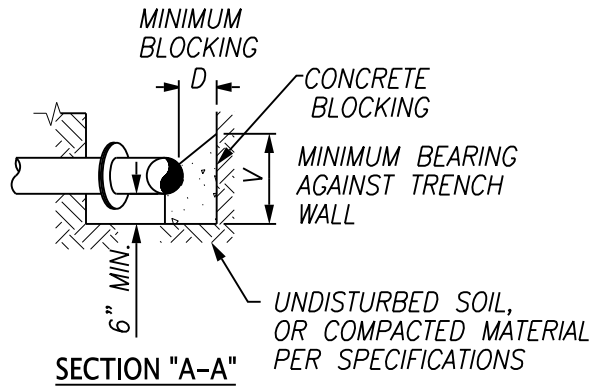


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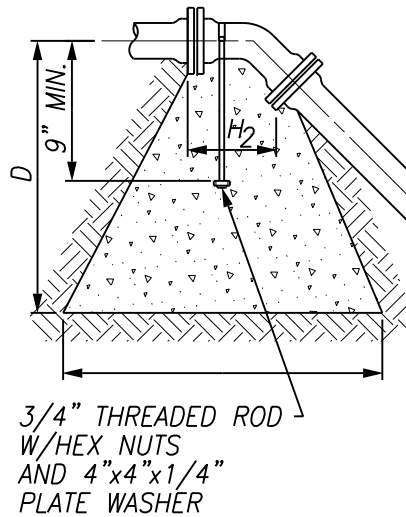
APPROVED BY:	LCUB	DRAWN BY:	FMA	Scale:	NTS
TYPICAL THRUST BLOCKS FOR TEES, PLUGS, AND CROSSES				Date:	07/12/19
				DRAWING NUMBER:	W9.1



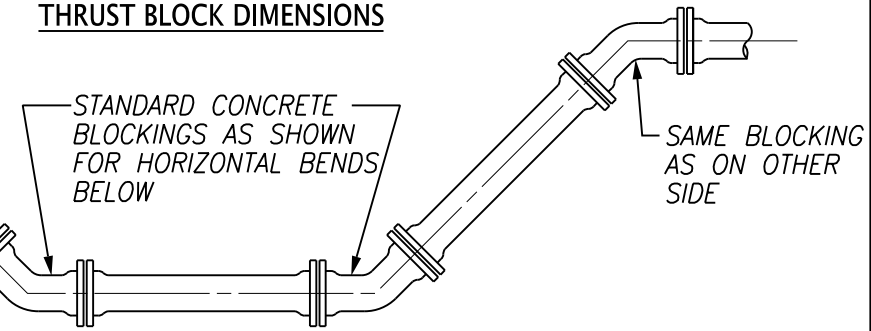
HORIZONTAL BENDS



SECTION "A-A"



THRUST BLOCK DIMENSIONS



VERTICAL BENDS

- CONTRACTOR SHALL BE RESPONSIBLE FOR PROPER APPLICATION OF THRUST RESTRAINT SYSTEM TO PREVENT MOVEMENT OF PIPE AND FITTINGS.
- ALL FITTINGS SHALL BE MECHANICAL JOINT AND HAVE RESTRAINED JOINTS AT THE FITTING AND FOR THE DISTANCE SPECIFIED IN STANDARD DETAIL W10.
- DIMENSIONS FOR THRUST BLOCKS FOR CAPS AND VALVES SHALL BE THE GREATER OF THE VALUE SHOWN IN THE TABLE OR THE VALUE GOVERNED BY TRENCH WIDTH SHOWN IN THE DETAIL.

TABLE OF DIMENSIONS FOR CONCRETE BLOCKING

SIZE	90° BENDS					45° BENDS					22 1/2° BENDS					11 1/4° BENDS					SIZE
PIPE (INCHES)	H ₁	H ₂	V	D	CU FT.	H ₁	H ₂	V	D	CU FT.	H ₁	H ₂	V	D	CU FT.	H ₁	H ₂	V	D	CU FT.	PIPE
2&2-1/4	18	10	12	18	1.9	18	6	12	18	1.5	18	6	12	18	1.5	18	6	12	18	1.5	2&2-1/4
3 & 4	24	12	12	18	2.3	18	8	12	18	1.6	18	8	12	18	1.6	18	8	12	18	1.6	3 & 4
6	30	16	18	18	4.1	24	10	16	18	3.2	24	10	16	18	3.2	24	10	16	18	3.2	6
8	39	18	24	18	7.3	30	11	18	18	4.0	24	11	18	18	3.5	24	11	16	18	3.4	8
10	54	32	24	18	10.3	24	18	21	18	4.6	24	18	21	18	4.6	24	18	21	18	4.6	10
12	54	32	36	24	18.2	42	18	24	24	9.6	24	18	24	24	6.6	24	18	21	24	6.1	12
16	69	48	48	24	29.0	48	30	36	24	17.0	36	30	27	24	11.8	27	24	27	24	9.1	16

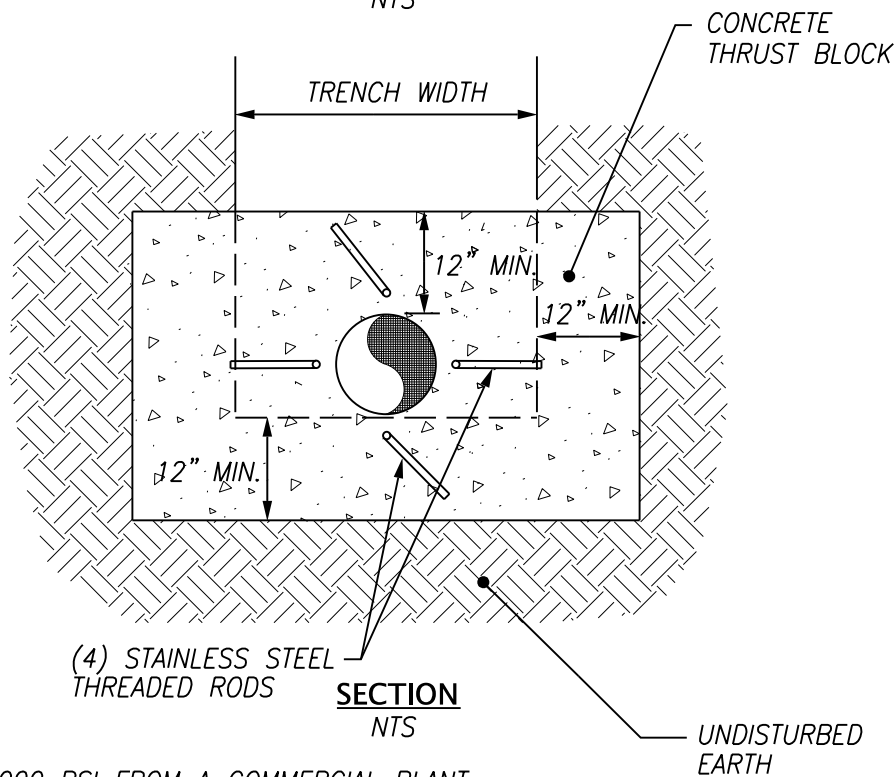
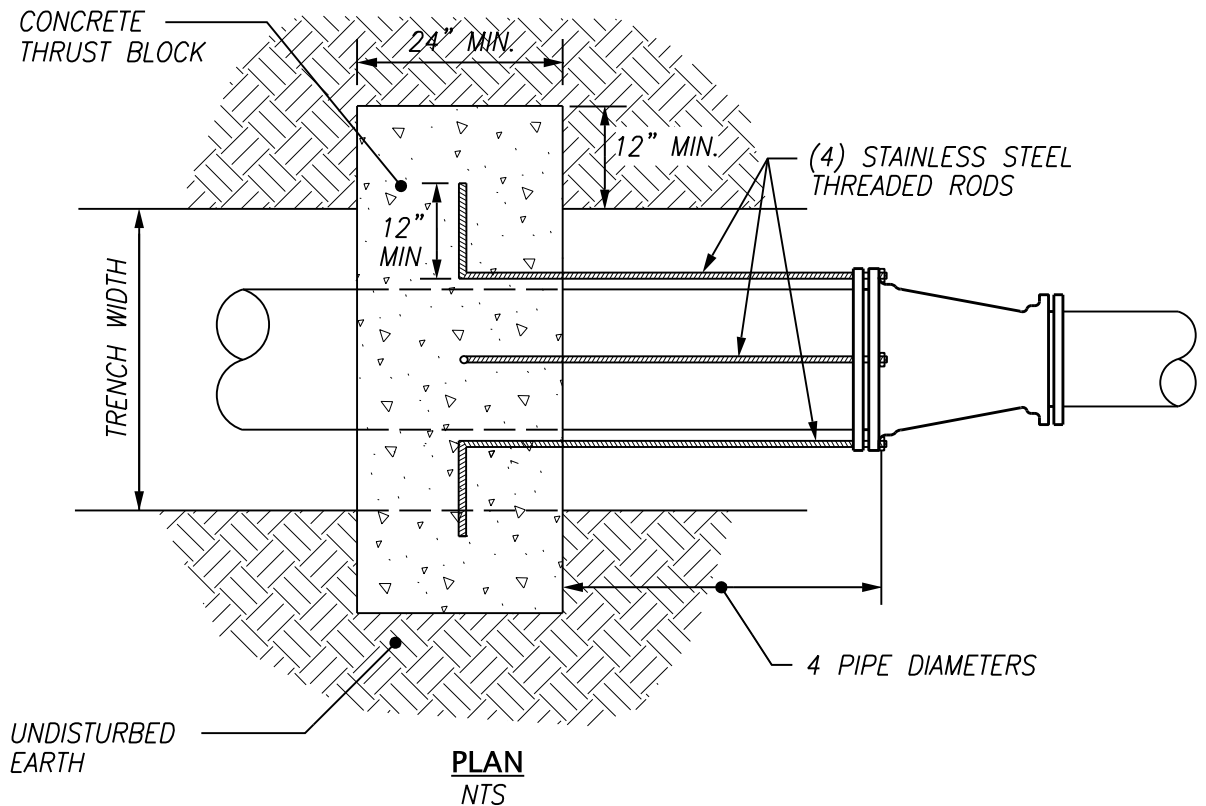
NOTES:

- THRUST BLOCKING BASED UPON AN INTERNAL HYDROSTATIC PRESSURE OF 200 PSI AND AN ALLOWABLE SOIL BEARING CAPACITY OF 4000 LBS/SF. SHOULD HYDROSTATIC PRESSURE BE GREATER AND/OR SOIL BEARING CAPACITY SHOULD BE LESS THAN THAT NOTED ABOVE, CONTRACTOR SHALL INCREASE SIZE AS REQUIRED AND PROVIDE CALCULATIONS TO SUPPORT SAID MODIFICATION.
- LCUB SHALL APPROVE ALL THRUST BLOCKS.
- FITTING JOINTS SHALL NOT BE POURED IN CONCRETE OR HAVE CONCRETE SPILLED ON THE BOLTS OR NUTS. WRAP ALL FITTINGS AND PIPE IN PLASTIC PRIOR TO PLACING CONCRETE.



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APPROVED BY:	LCUB	DRAWN BY:	FMA	Scale:	NTS
THRUST BLOCK AND ANCHOR BLOCK FOR BENDS				Date:	07/12/19
				DRAWING NUMBER:	W9.2



NOTES:

1. CONCRETE SHALL BE 4,000 PSI FROM A COMMERCIAL PLANT.
2. ALL FITTINGS SHALL BE MECHANICAL JOINT AND HAVE RESTRAINED JOINTS AT THE FITTING IN ADDITION TO THE CONCRETE THRUST BLOCK. ALSO, DUCTILE IRON PIPE SHALL BE INSTALLED WITH JOINT RESTRAINING GASKETS FOR THE REQUIRED DISTANCES FROM EACH FITTING AS SPECIFIED ON DETAIL W10.



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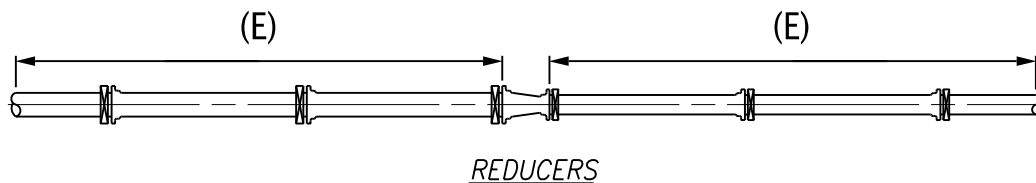
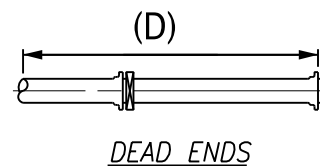
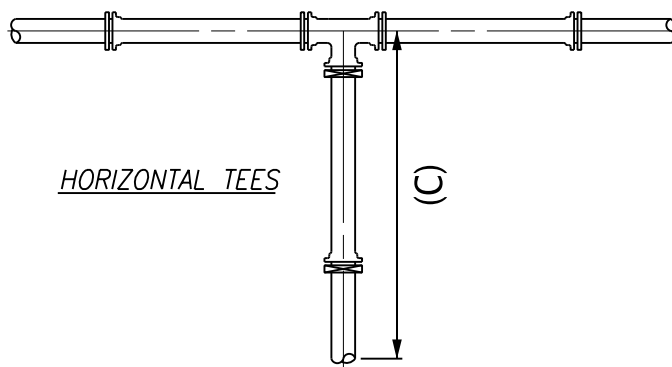
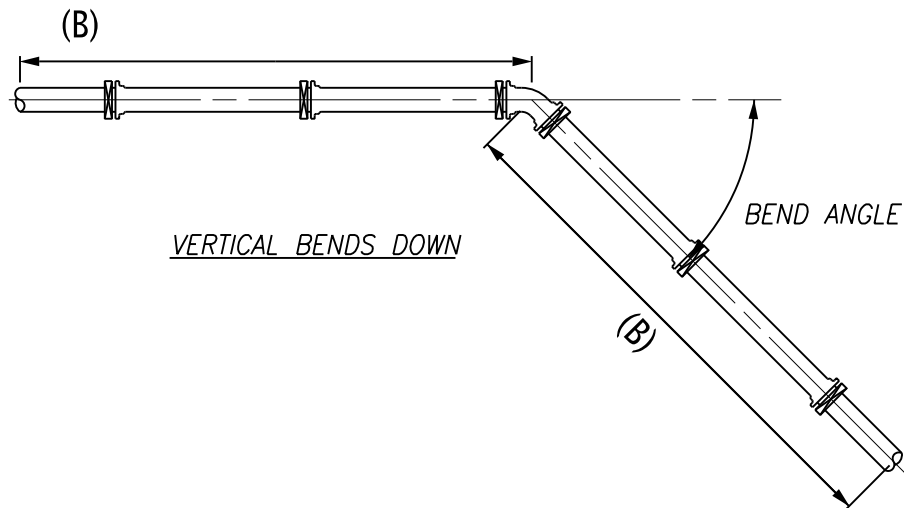
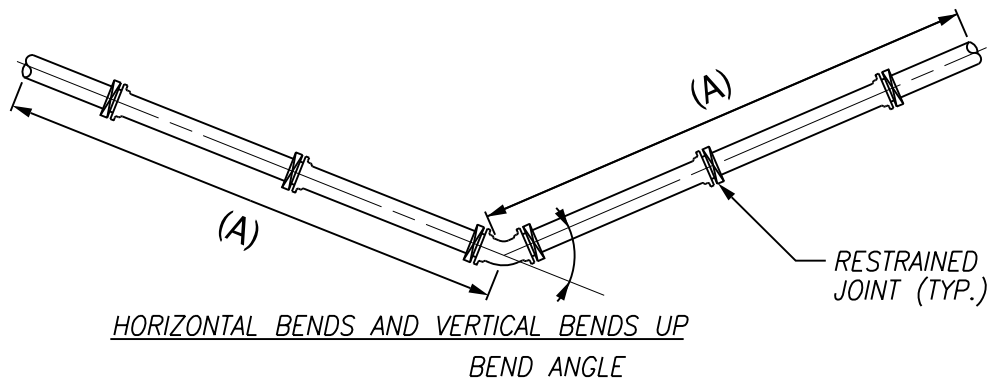
DRAWN BY: FMA

Scale: NTS

**TYPICAL THRUST BLOCK
FOR REDUCER DETAIL**

Date: 07/12/19

DRAWING NUMBER:
W9.3



NOTES:

1. SEE DETAIL W10.2 FOR RESTRAINED JOINT DIMENSION TABLE.



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Scale: NTS

**RESTRAINED JOINT
DIMENSIONS**

Date: 07/12/19

DRAWING NUMBER:
W10.1

TABLE OF LENGTHS REQUIRING JOINT RESTRAINT FOR DUCTILE IRON PIPE

NOMINAL PIPE DIAMETER (INCHES)	(A)				(B)				(C)	(D)	REDUCERS		
	RESTRAINED LENGTH FOR HORIZONTAL BENDS AND FOR VERTICAL UP BENDS BY FITTING TYPE (FEET)				RESTRAINED LENGTH FOR VERTICAL BENDS DOWN BY FITTING TYPE (FEET)				RESTRAINED LENGTH FOR HORIZONTAL TEES BY BRANCH SIZE (FEET)	RESTRAINED LENGTH FOR DEAD ENDS (FEET)			
	11.25	22.5	45	90	11.25	22.5	45	90			LARGER PIPE SIZE (INCHES)	SMALLER PIPE SIZE (INCHES)	(E) RESTRAINED LENGTH (FEET)
4	3	6	13	31	5	11	22	53	26	27	4	3	N/A
6	4	9	19	45	8	15	32	77	38	38	6	4	23
8	6	12	24	59	10	20	42	100	50	50	8	6	22
10	7	14	30	72	12	25	51	123	61	62	10	8	21
12	8	17	35	85	14	29	61	147	73	73	12	10	21
											12	6	53

NOTES:

1. ALL PIPE JOINTS THAT FALL WITHIN THE RESTRAINED LENGTHS SHOWN FOR THE VARIOUS CONFIGURATIONS SHALL BE RESTRAINED JOINTS USING MECHANICAL JOINT GRIPRING PIPE RESTRAINTS OR MEGALUGS AND JOINT RESTRAINING GASKETS.
2. IF ANOTHER BEND, TEE, OR REDUCER FALLS WITHIN THE RESTRAINED LENGTH, THE TABLE VALUES MUST BE ADJUSTED. IN-LINE REDUCERS MAY ALSO REQUIRE ADDITIONAL JOINT RESTRAINT. IF THE PLANS HAVE NO SPECIFIC INSTRUCTIONS, CONSULT WITH THE DESIGN ENGINEER OR THE OWNER'S FIELD REPRESENTATIVE.
3. THE RESTRAINED LENGTHS SHOWN ARE BASED ON THE FOLLOWING CONDITIONS. IF FIELD CONDITIONS VARY FROM THESE CONDITIONS, CONSULT WITH THE DESIGN ENGINEER OR THE OWNER'S FIELD REPRESENTATIVE.

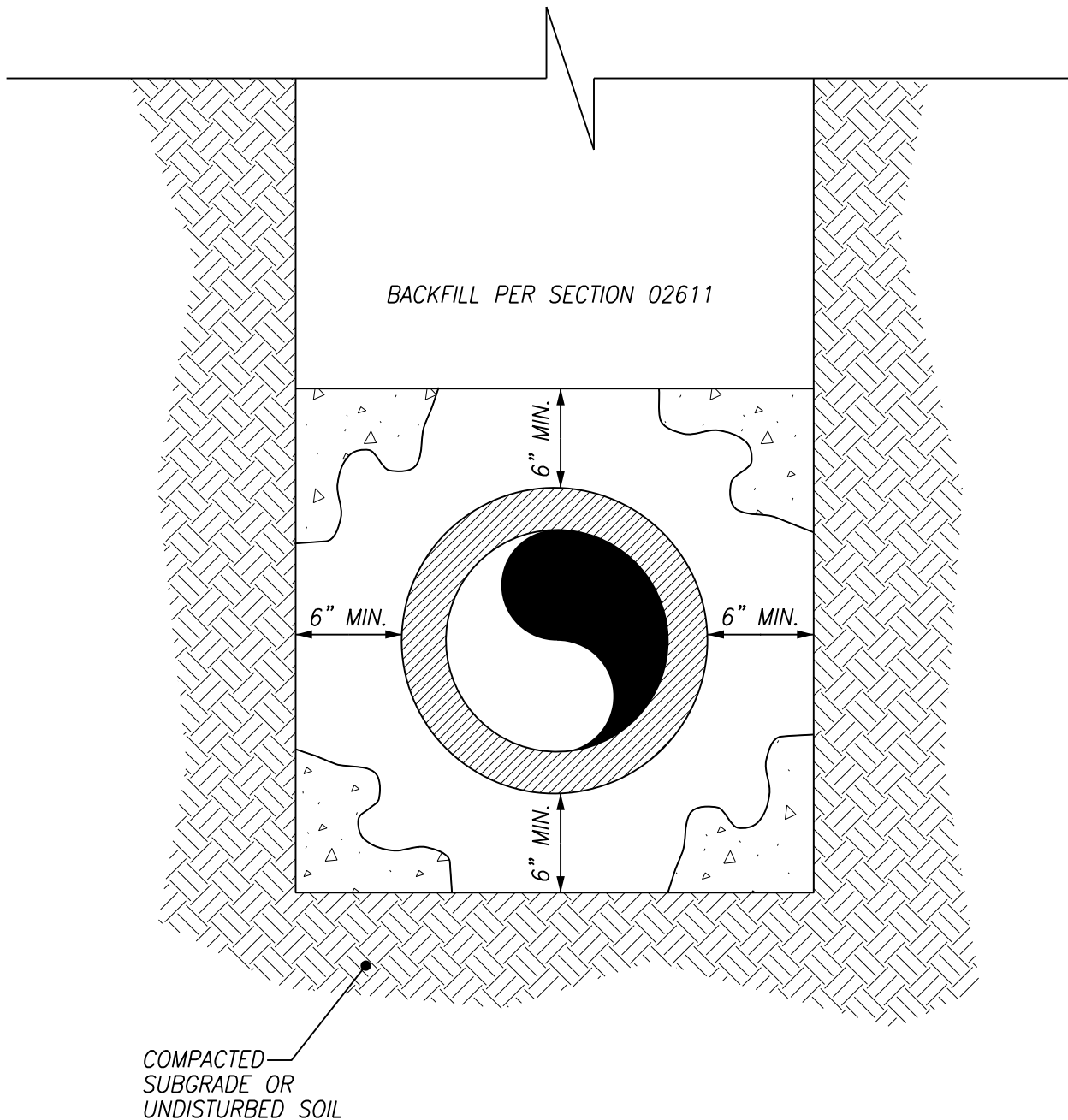
SOIL TYPE: CLAY OF MEDIUM TO LOW PLASTICITY, LL<50, 25% COARSE PARTICLES - CLAY 2
 LAYING CONDITIONS: FLAT BOTTOM TRENCH. BACKFILL CONSOLIDATED TO PIPE CENTERLINE - TYPE 2
 DEPTH OF COVER: 3 FEET MINIMUM
 WORKING PRESSURE: 185 PSI
 SAFETY FACTOR: 1.5
 POLYETHYLENE ENCASEMENT: NONE

4. SUBMIT DETAILS OF RESTRAINT SYSTEM FOR REDUCERS TO OWNER FOR APPROVAL.
5. RETAINER GLANDS SHALL BE "GRIPRINGS" AS MANUFACTURED BY ROMAC INDUSTRIES, "MEGALUG" AS MANUFACTURED BY EBAA IRON, INC., SIGMA ONE-LOK SERIES SLDE, OR APPROVED EQUAL AND SHALL BE INSTALLED ON EVERY FITTING.
6. CONTRACTOR SHALL INSTALL DUCTILE IRON PIPE WITH RESTRAINING GASKETS FOR PUSH-ON JOINT PIPE A MINIMUM DISTANCE FROM EACH VALVE OR FITTING AS REQUIRED IN THE ABOVE TABLE. GASKETS SHALL BE FIELD LOK 350 AS MANUFACTURED BY U.S. PIPE OR APPROVED EQUAL.



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 TELEPHONE 844.687.5282

APPROVED BY:	LCUB	DRAWN BY:	FMA	Scale:	NTS
RESTRAINED JOINT TABLE				Date:	07/12/19
				DRAWING NUMBER:	W10.2



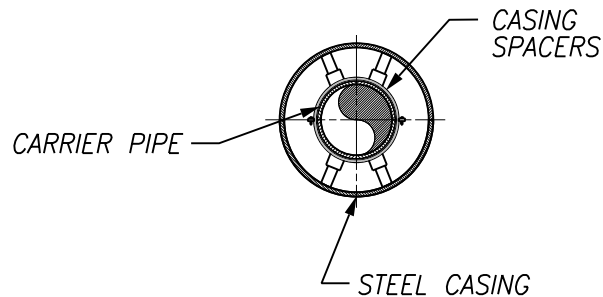
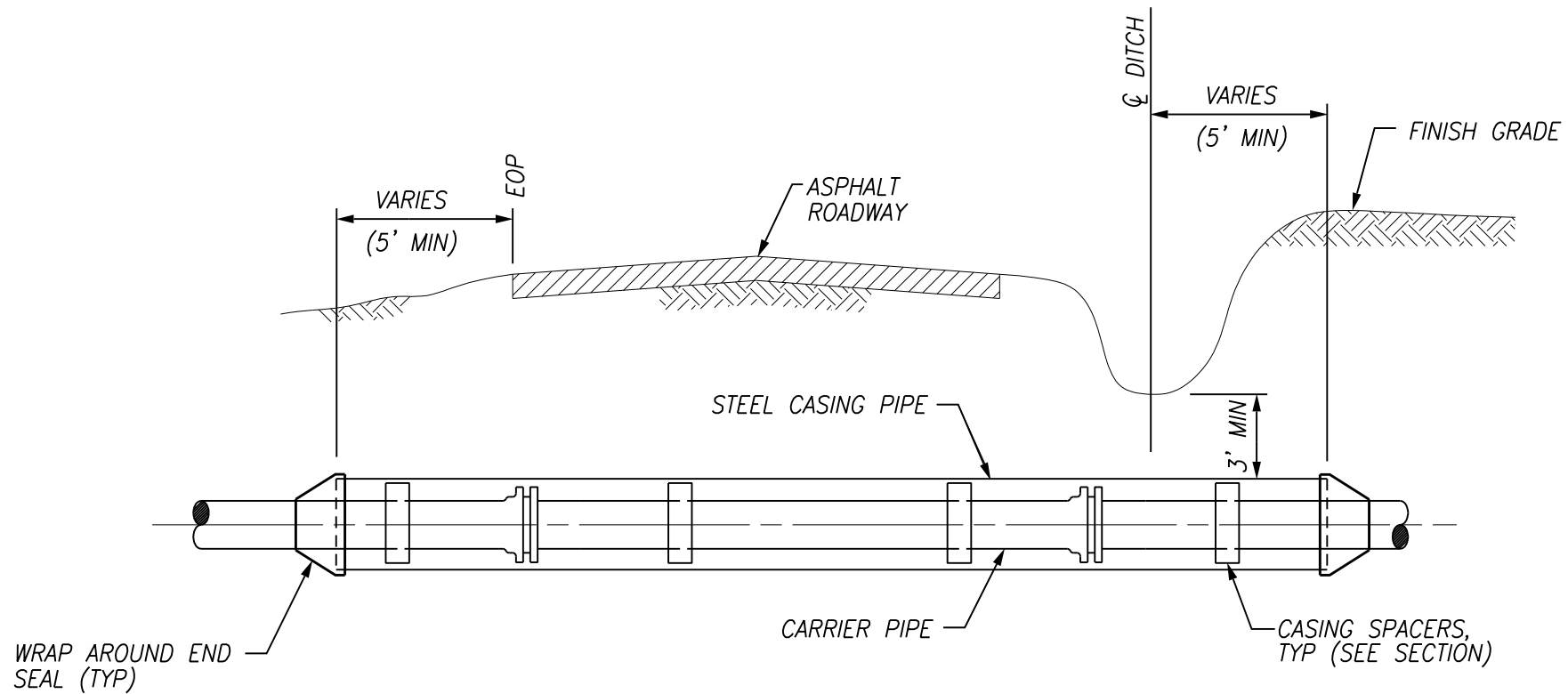
NOTE: CONCRETE- $f' = 2,500 \text{ psi}$

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APPROVED BY:	LCUB	DRAWN BY:	FMA	Scale:	NTS
TYPICAL CONCRETE ENCASEMENT				Date:	07/12/19
				DRAWING NUMBER:	W11



SECTION
NTS

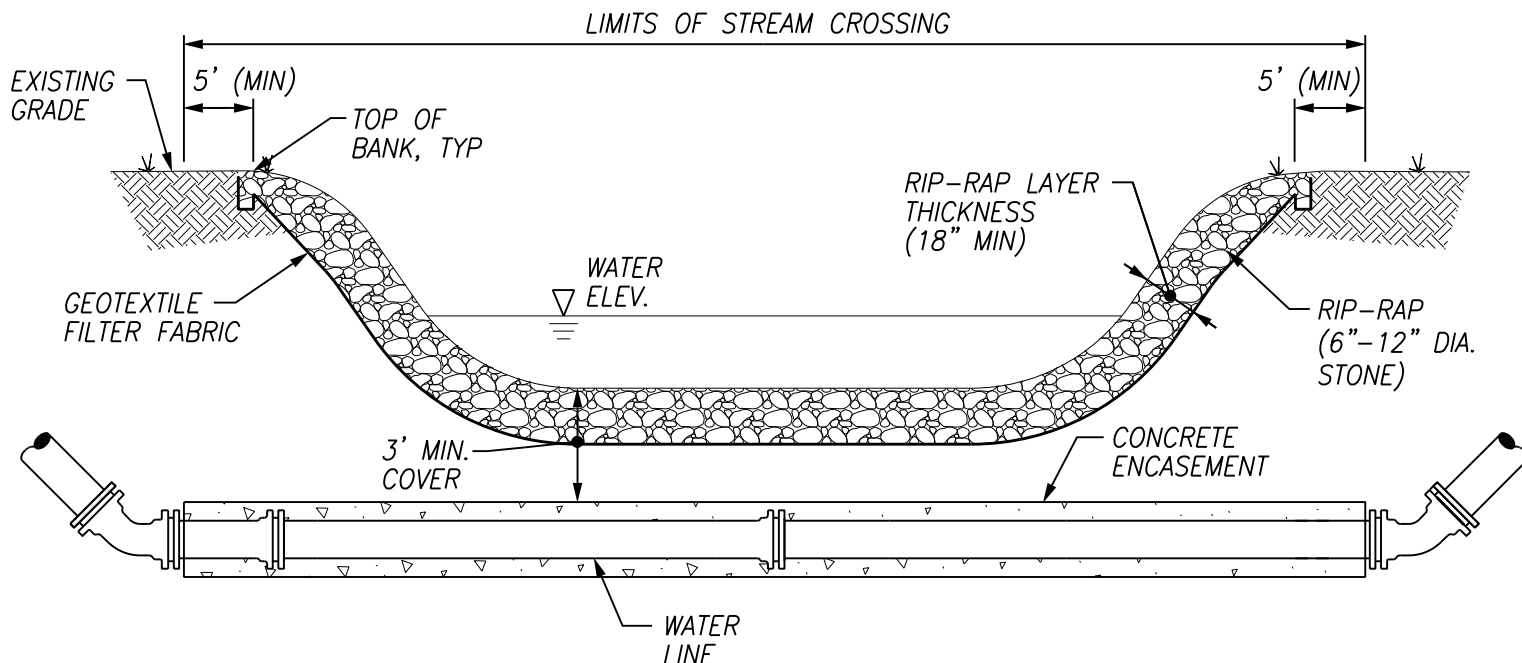
NOTES:

1. CASING DIAMETER AND THICKNESS SHALL MEET LCUB REQUIREMENTS AS WELL AS TDOT OR RAILROAD REQUIREMENTS AS APPROPRIATE.
2. CARRIER PIPE SHALL BE DIP OR HDPE AS APPROVED BY OWNER.
3. ALL DIP CARRIER PIPE JOINTS INSIDE CASING SHALL BE RESTRAINED.
4. RESTRAINING GASKETS FOR DI PUSH ON JOINT PIPE SHALL BE "FIELD LOK 350" AS MANUFACTURED BY U.S. PIPE OR APPROVED EQUAL.
5. SEE SPECIFICATION SECTION 02545.



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APPROVED BY:	LCUB	DRAWN BY:	FMA	Scale:	NTS
STEEL CASING PIPE DETAIL				Date:	07/12/19
				DRAWING NUMBER:	W12



NOTES:

1. ALL PIPE AND FITTINGS SHALL BE RESTRAINED JOINT DUCTILE IRON WITHIN LIMITS OF THE STREAM CROSSING. RESTRAINING GASKETS SHALL BE "FIELD LOK 350" AS MANUFACTURED BY U.S. PIPE OR APPROVED EQUAL. MJ RESTRAINTS SHALL BE MEGALUG BY EBAA IRON, ROMAC INDUSTRIES, INC GRIPRING, OR APPROVED EQUAL.
2. CONTRACTOR SHALL PERFORM PROPOSED WATER LINE CROSSING OF STREAMS IN STRICT ACCORDANCE WITH THE TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION AQUATIC RESOURCE ALTERATION (GENERAL) PERMIT FOR UTILITY LINE CROSSINGS OF STREAMS
3. CONTRACTOR TO INSTALL SAND BAG BERM (OR OTHER METHOD TO DIVERT STREAM FLOW AS APPROVED BY THE TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION) FOR OPEN CUT INSTALLATION OF PROPOSED WATER LINE ACROSS STREAMS AS SHOWN ON THE PROJECT PLANS. PERFORM ONE-HALF OF CREEK CROSSING, BACKFILL, THEN RE-LOCATE SAND BAG BERM TO OPPOSITE SIDE OF CREEK AND REPEAT
4. TRENCH BACKFILL SHALL BE CLEAN #57 OR #67 CRUSHED STONE UP TO WITHIN EIGHTEEN (18") INCHES OF CREEK BOTTOM. THE TOP EIGHTEEN (18") INCHES SHALL BE 6-12 INCH NOMINAL SIZE RIP-RAP OR RIVER ROCK.
5. ANY EXCAVATION OF THE STREAM CHANNEL AREA SHALL BE SEPARATED FROM FLOWING WATER, AND ACCOMPLISHED DURING LOW FLOW CONDITIONS. THIS SHALL BE ACCOMPLISHED BY THE USE OF FLUMES, LINED DIVERSION CHANNEL WITH SAND BAG BERM, DIVERSION PIPE INLET, OR IN SOME CASES, COFFER DAMS. COST TO BE INCLUDED IN OTHER ITEMS OF CONSTRUCTION.
6. GEOTEXTILE FILTER FABRIC SHALL BE SYNTHETIC INDUSTRIES EROSION XV OR EQUAL. INSTALL PER WRITTEN MANUFACTURER'S SPECIFICATIONS.
7. ALL RIP-RAP SHALL BE HAND PLACED IN A MANNER TO MINIMIZE VOIDS.



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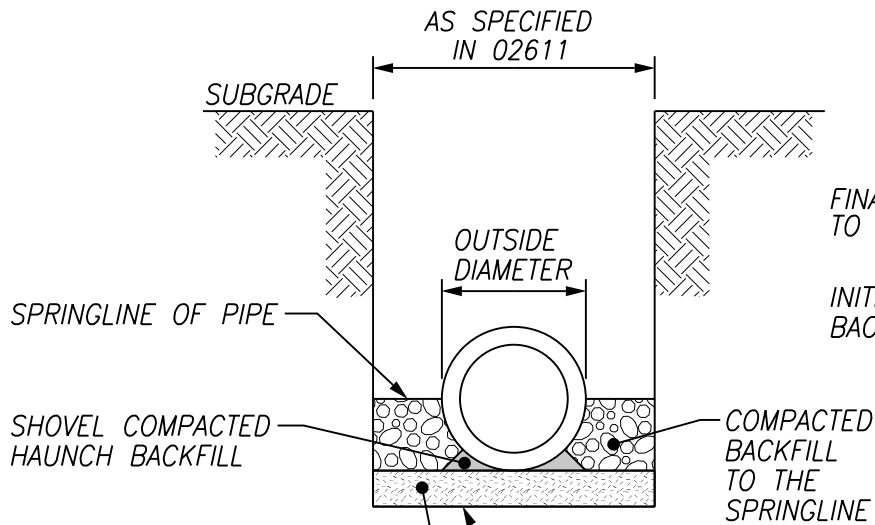
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**TYPICAL OPEN CUT
STREAM CROSSING**

Date: 07/12/19

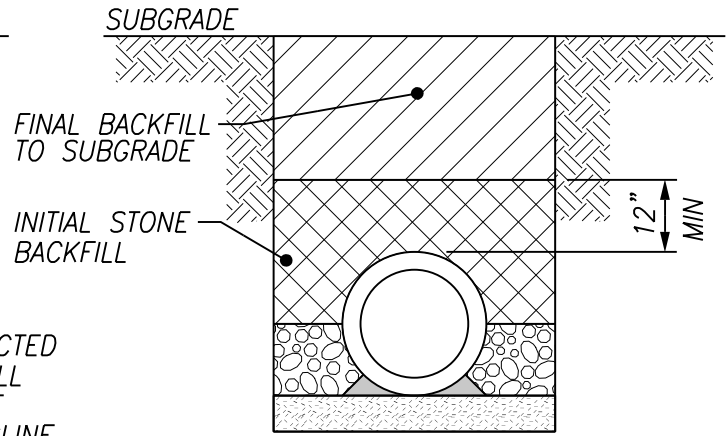
DRAWING NUMBER:

W13



COMPACTED BEDDING MATERIAL,
4" DEEP FOR $\leq 15"$ DIAMETER
6" DEEP FOR $> 15"$ & $\leq 36"$ DIAMETER
8" DEEP FOR $> 36"$ DIAMETER

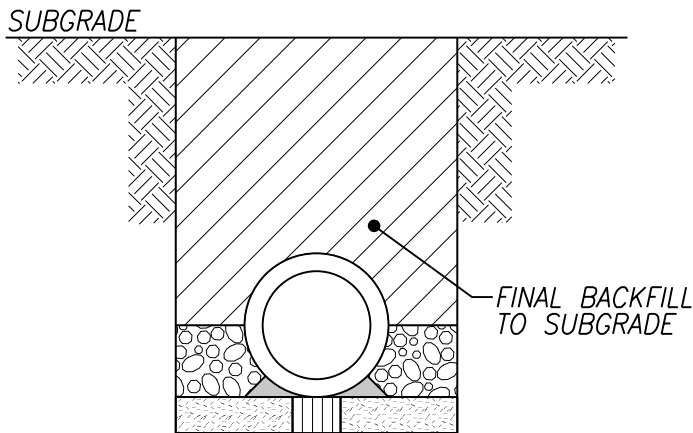
SMOOTH COMPACTED BOTTOM
FREE OF LOOSE SOIL AND
DEBRIS



BACKFILL FOR FLEXIBLE PIPE

NOTES:

1. TRENCH DESIGN AND SAFETY FOR PIPELINE CONSTRUCTION IS SOLELY THE RESPONSIBILITY OF THE CONTRACTOR AND SHALL CONFORM WITH ALL APPLICABLE LOCAL, STATE, AND OSHA REGULATIONS.
2. BEDDING MATERIAL AND BACKFILL MATERIAL UP TO THE SPRINGLINE SHALL BE #57 OR #67 STONE.
3. REGARDLESS OF BACKFILL MATERIAL OR PIPE MATERIAL, PLACE BACKFILL IN 8" LOOSE LIFTS AND COMPACT STONE TO 100% OF THE STANDARD PROCTOR DENSITY AT 2% LESS THAN THE OPTIMUM MOISTURE CONTENT AS DETERMINED BY AASHTO T99 METHOD D. INITIAL BACKFILL SHALL BE #57 OR #67 STONE.
4. FINAL BACKFILL SHALL BE #57 OR #67 STONE UNDER PAVEMENTS & WITHIN 3' OF PAVEMENT.
5. FINAL BACKFILL BEYOND 3' OF PAVEMENT SHALL BE STRUCTURAL SOIL BACKFILL.



BACKFILL FOR RIGID PIPE



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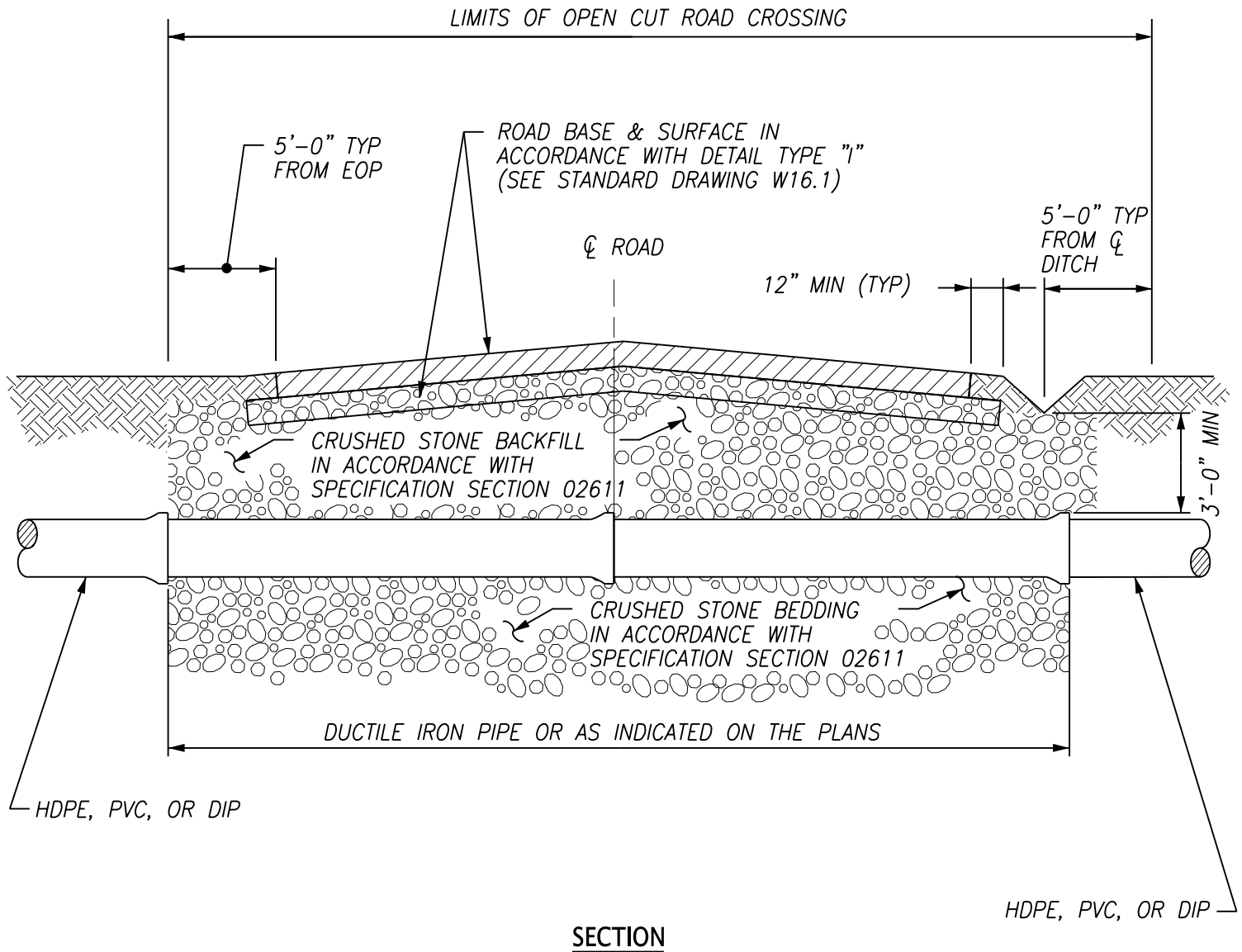
DRAWN BY: FMA

Scale: NTS

PIPE BEDDING AND BACKFILL

Date: 07/30/21

DRAWING NUMBER:
W14



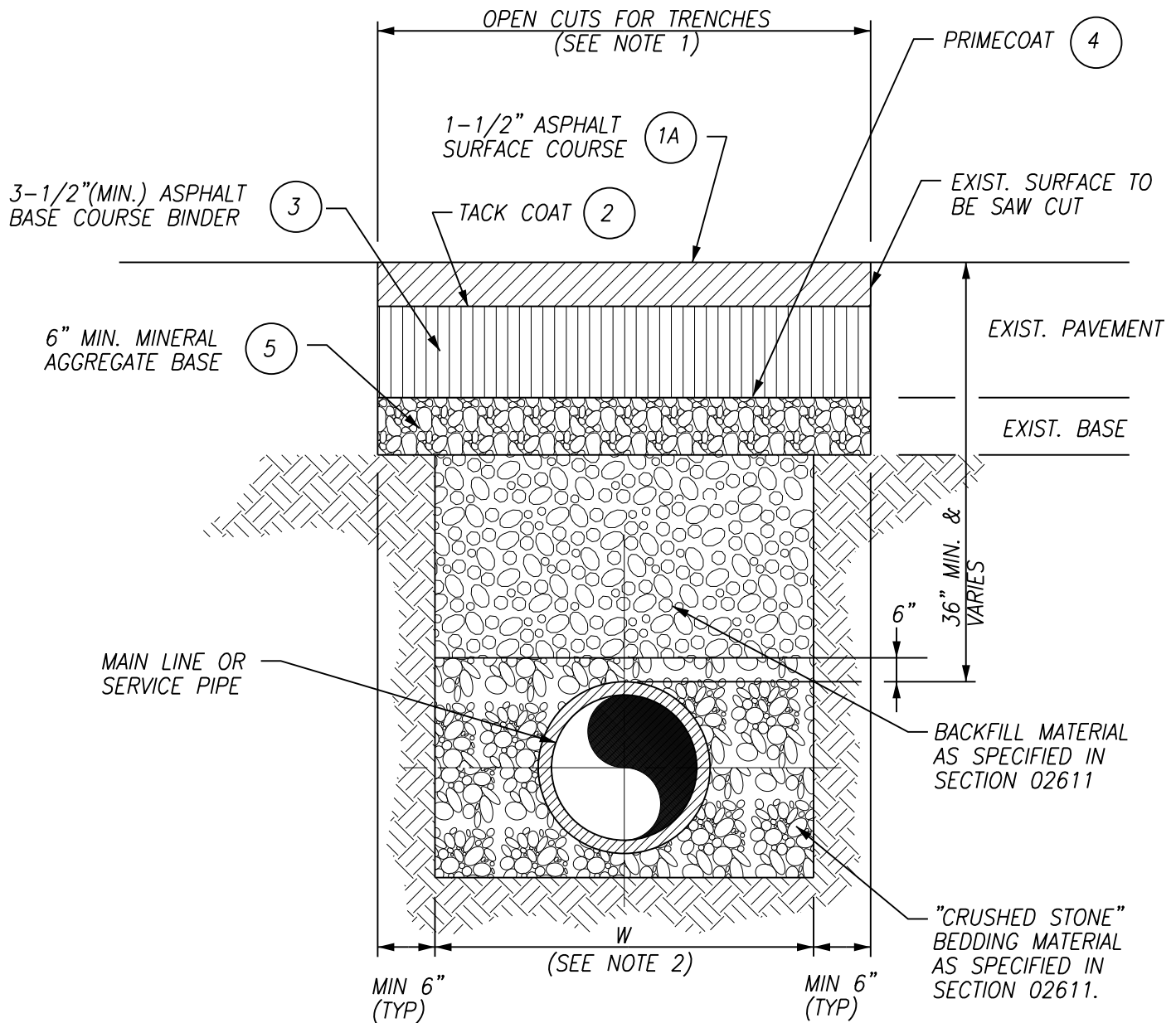
NOTES:

1. ALL PIPING WITHIN THE LIMITS OF THE OPEN CUT ROAD CROSSING SHALL BE DIP TO MATCH THE SIZE OF PIPING SHOWN ON THE PLANS.



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APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
TYPICAL OPEN CUT ROAD CROSSING		Date: 07/12/19
		DRAWING NUMBER: W15



NOTES:

1. AT THE DISCRETION OF THE OWNER, WHEN TRENCH PARALLELS CENTERLINE OF ROADWAY AND WIDTH IS EQUAL TO OR GREATER THAN HALF THE LANE WIDTH, THEN THE PAVEMENT WIDTH FOR THE SURFACE COURSE SHALL BE FOR AN OVERLAY OF THE ROADWAY ENTIRE LANE WIDTH.
2. FOR PATCH SIZES, TRENCH WIDTHS AND PAVEMENT WIDTHS, SEE PAVEMENT WIDTH SCHEDULE ON STANDARD DRAWING W16.3.
3. PAVEMENT REPAIRS/REPLACEMENT SHALL BE THERMALLY BONDED WITH THE EXISTING ASPHALT EDGES.



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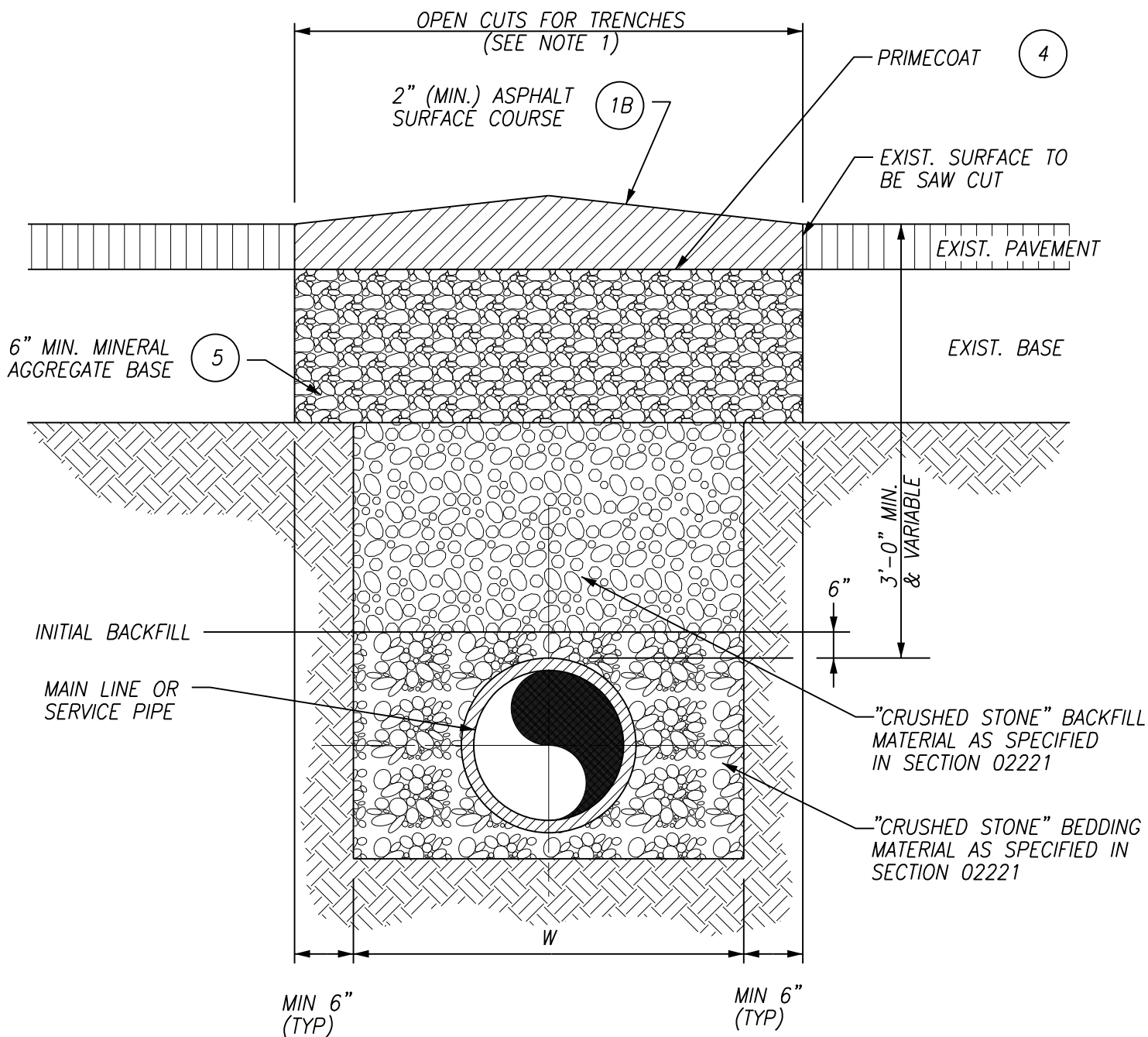
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**TYPICAL ASPHALT PAVEMENT
REPLACEMENT TYPE "I"
LENOIR CITY STREETS &
STATE HIGHWAYS**

Date: 07/12/19

DRAWING NUMBER:
W16.1



NOTES:

1. AT THE DISCRETION OF THE OWNER, WHEN TRENCH PARALLELS CENTERLINE OF ROADWAY AND WIDTH IS EQUAL TO OR GREATER THAN HALF THE LANE OR ROADWAY WIDTH, THEN THE PAVEMENT WIDTH SHALL BE FOR AN OVERLAY OF THE ENTIRE LANE OR ROADWAY WIDTH.
2. FOR PATCH SIZES, TRENCH WIDTHS AND PAVEMENT WIDTHS, SEE PAVEMENT WIDTH SCHEDULE ON STANDARD DRAWING W16.3.
3. PAVEMENT REPAIRS/REPLACEMENT SHALL BE THERMALLY BONDED WITH THE EXISTING ASPHALT EDGES.



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Scale: NTS

**TYPICAL ASPHALT PAVEMENT
REPLACEMENT TYPE "II"
OPEN CUT PARKING AREAS
& DRIVEWAY CROSSING**

Date: 07/12/19

DRAWING NUMBER:

W16.2

PAVEMENT SCHEDULE

1. BITUMINOUS SURFACING COURSE (ROADWAY) – SEE TECHNICAL SPECIFICATIONS
A. 411E (MODIFIED)
B. 411E (T.D.O.T. STD. OR MODIFIED)
2. BITUMINOUS MATERIAL FOR TACK COAT (TC) (RATE – 0.02 GAL./SQ. YARD)
3. BITUMINOUS BINDER COURSE (ROADWAY) @ MIN. 3-1/2" THICK – 307 B – SEE TECHNICAL SPECIFICATIONS
4. BITUMINOUS MATERIAL FOR PRIME COAT (PC) (RATE – 0.35 GAL./SQ. YARD)
5. MINERAL AGGREGATE BASE @ MIN. 6" DEEP TYPE "A" BASE, GRADING "D"

PAVEMENT WIDTH SCHEDULE

DEPTH FROM SURFACE TO INVERT (FEET)	WIDTH OF TRENCH (INCHES)	PAVEMENT PATCH WIDTH (INCHES)	MANHOLES SIZE OF PATCH (FEET)
4.0	PIPE DIAMETER + 18"	WIDTH + 12"	12 X 12
4.1 TO 8.0	PIPE DIAMETER + 36"	WIDTH + 12"	14 X 14
8.1 TO 12.0	PIPE DIAMETER + 42"	WIDTH + 12"	16 X 16
12.1 AND UP	PIPE DIAMETER + 42"	WIDTH + 12" (A)	16 X 16 (A)

(A) MAXIMUM PAVEMENT WIDTH AND/OR SIZE FOR ANY DEPTH OF TRENCH.

(B) PAVEMENT REPAIRS SHALL BE MADE IN STRICT ACCORDANCE WITH SECTION 02575.

NOTES:

1. PAVEMENT DEPTHS SHOWN IN THE DETAILS ARE MINIMUM FOR THIS PROJECT, BUT MAY BE INCREASED AT THE DIRECTION OF THE ENGINEER/OWNER.
2. ROADWAYS AND HIGHWAYS SHALL HAVE SURFACE COURSE PLACED AND THERMALLY BONDED AND SEALED TO EXISTING PAVEMENT TO PRODUCE A SMOOTH/SEALED SURFACE. MEANS, METHODS AND EQUIPMENT SHALL BE SUBMITTED AND APPROVED BY THE ENGINEER/OWNER PRIOR TO BEGINNING WORK ON THE PROJECT.



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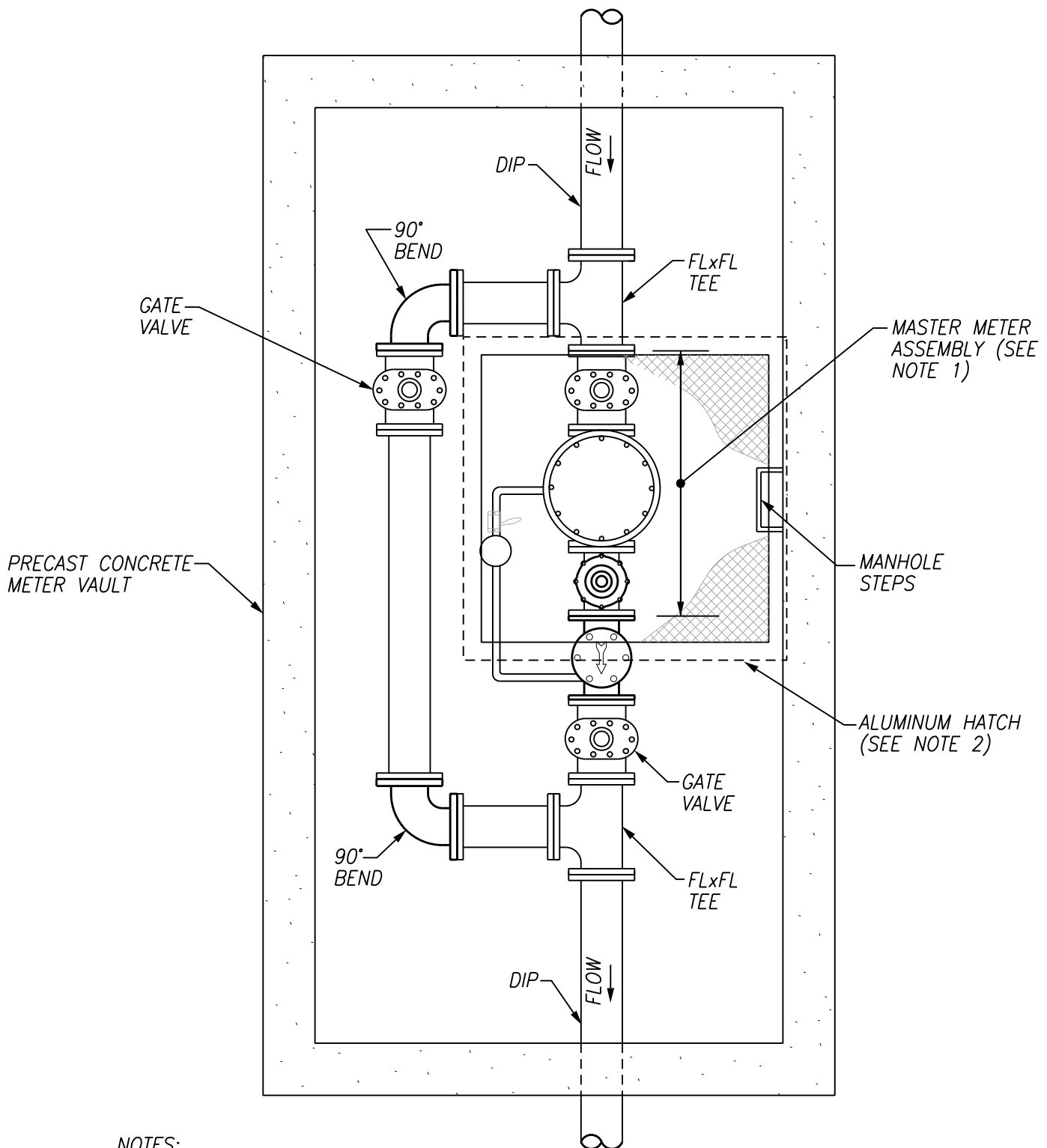
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**PAVEMENT SCHEDULE AND
PAVEMENT
WIDTH SCHEDULE**

Date: 07/12/19

DRAWING NUMBER:
W16.3



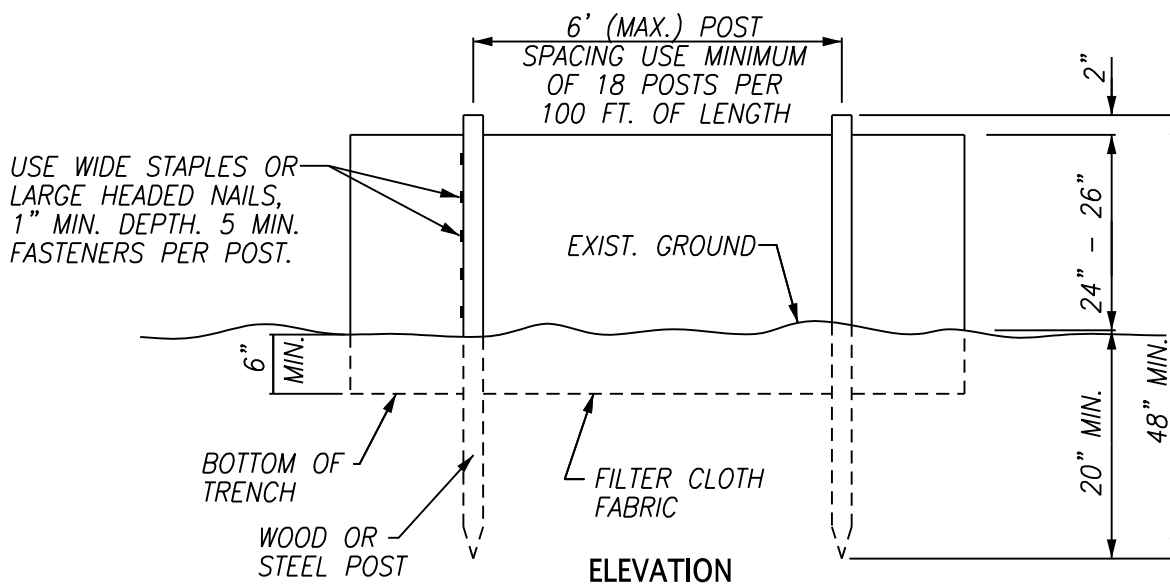
NOTES:

1. MASTER METER SHALL BE RECORDALL FIRE SERIES ASSEMBLY (FSAA) COLD WATER METER AND STRAINER WITH DISC BYPASS AS MANUFACTURED BY "BADGER METER" OR APPROVED EQUAL.
2. ALUMINUM HATCH SHALL BE DOUBLE-LEAF ACCESS DOOR AS MANUFACTURED BY "HALLIDAY" OR APPROVED EQUAL, AND SHALL INCLUDE 1/4" ALUMINUM DIAMOND PATTERN COVER, 1/4" ALUMINUM CHANNEL WITH RECESSED ANCHORS, STAINLESS STEEL HARDWARE, STAINLESS STEEL LIFTING SPRING MECHANISM, AND REMOVABLE SQUARE KEY WRENCH. WETWELL HATCH SHALL INCLUDE PROTECTIVE FALL/SAFETY GRATING (RETRO-GRATE SERIES X OR APPROVED EQUAL).



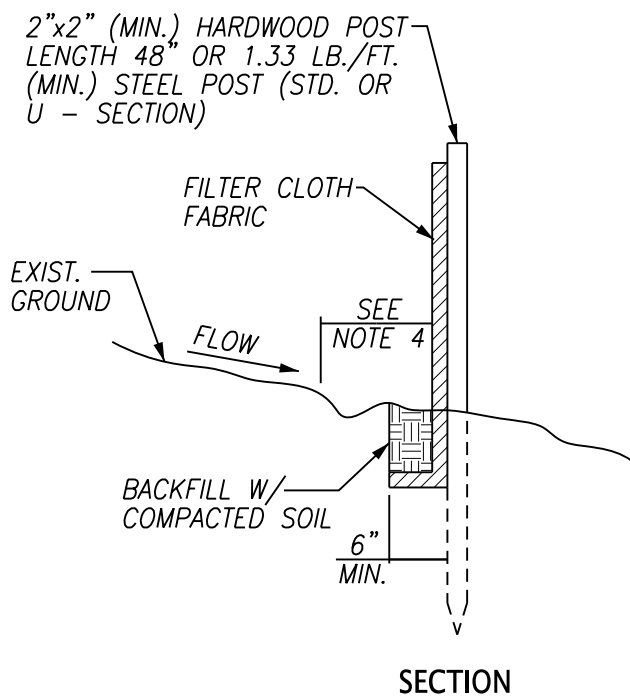
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APPROVED BY:	LCUB	DRAWN BY:	FMA	Scale:	NTS
TYPICAL MASTER METER DETAIL				Date:	07/30/21
				DRAWING NUMBER:	W17



NOTES:

1. SILT FENCE SHALL BE PRE-ASSEMBLED AND INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS SPECIFICATIONS.
2. SILT FENCE SHALL HAVE AN APPROVED BACKING OR A BUILT-IN REINFORCED STRUCTURE AS RECOMMENDED BY THE MANUFACTURER TO SUPPORT THE GEOTEXTILE FABRIC.
3. ONCE PERMANENT VEGETATION IS ESTABLISHED, REMOVE THE SILT FENCE, BACKFILL TRENCH WITH TOPSOIL, AND APPLY SEED AND MULCH TO ALL DISTURBED AREAS. LEGALLY DISPOSE OF REMOVED FENCE OFF-SITE.
4. PLACE SILT FENCE AT LEAST 5 TO 7 FEET AWAY FROM STEEP OR LONG SLOPES TO IMPOUND STORMWATER RUNOFF.
5. POST SPACING SHALL BE 4 FEET MAXIMUM WITHIN A DRAINAGE CHANNEL.
6. TURN LAST 7 TO 10 FEET OF SILT FENCE UPHILL.



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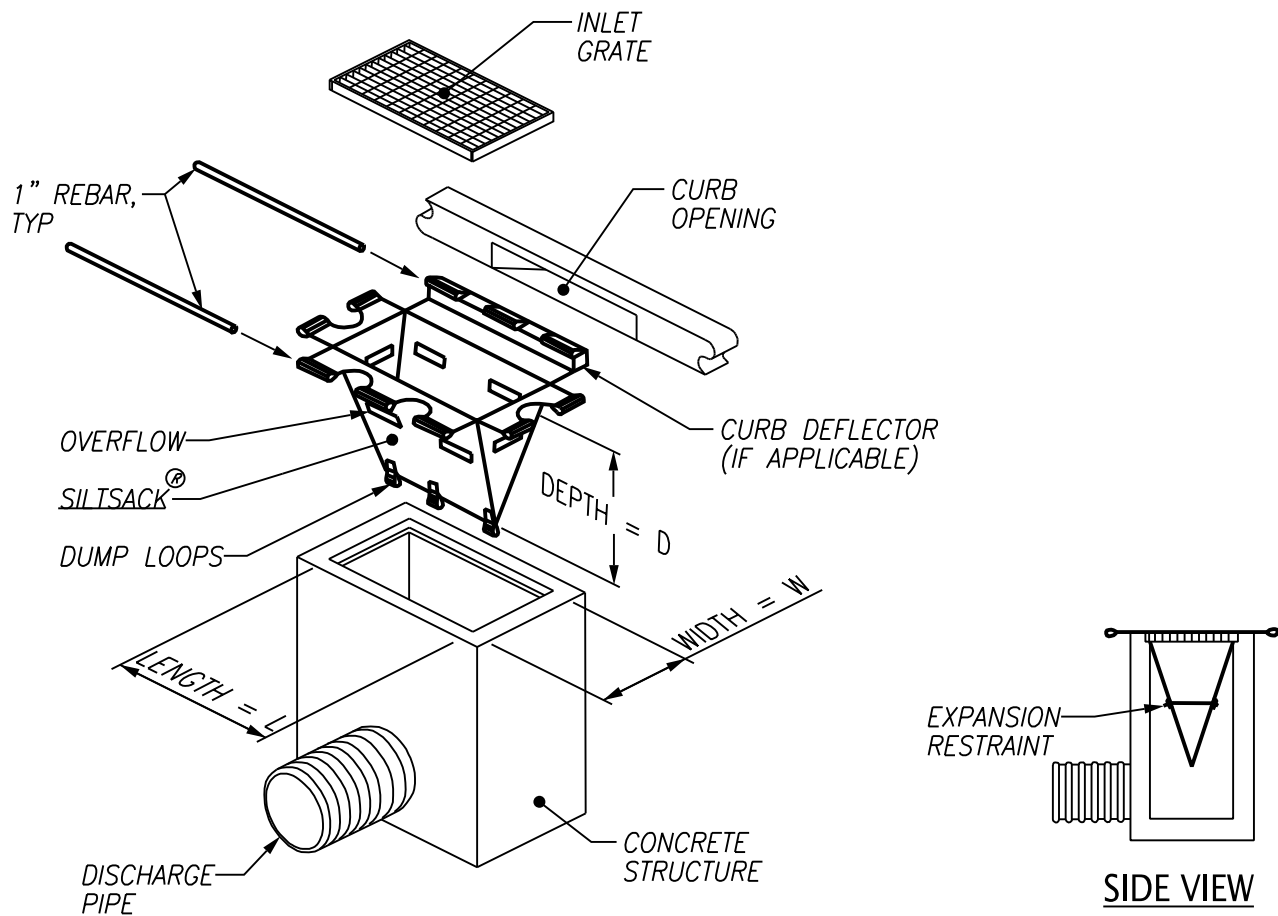
Date:

07/30/21

DRAWING NUMBER:

W18

SILT FENCE



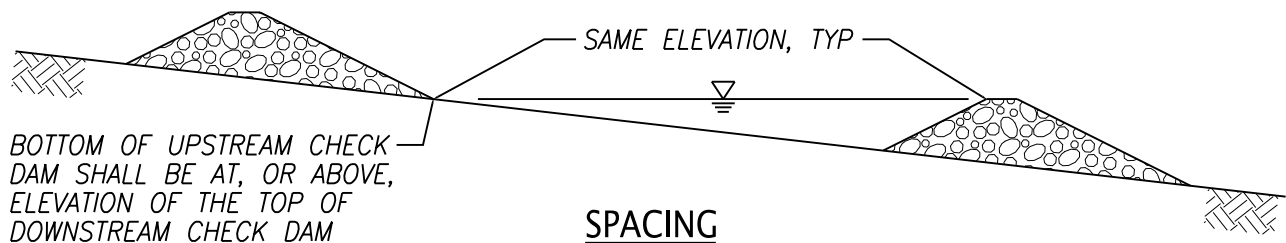
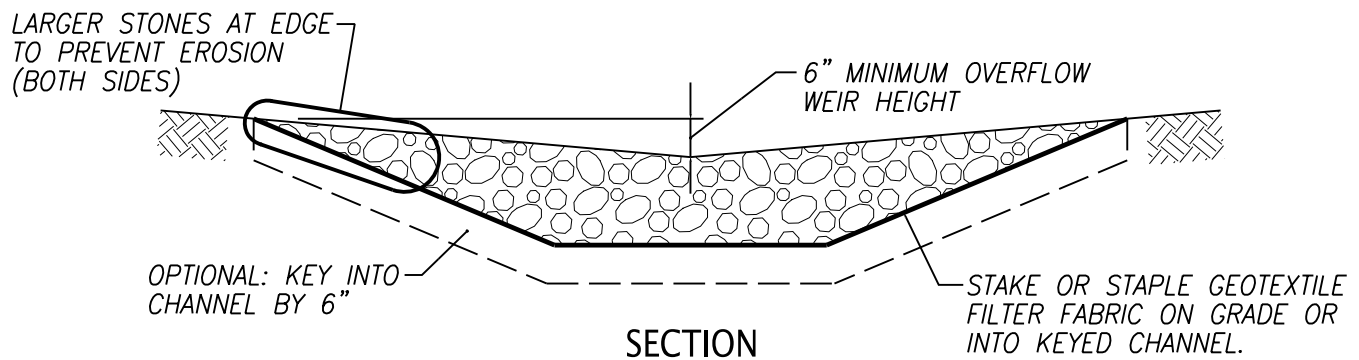
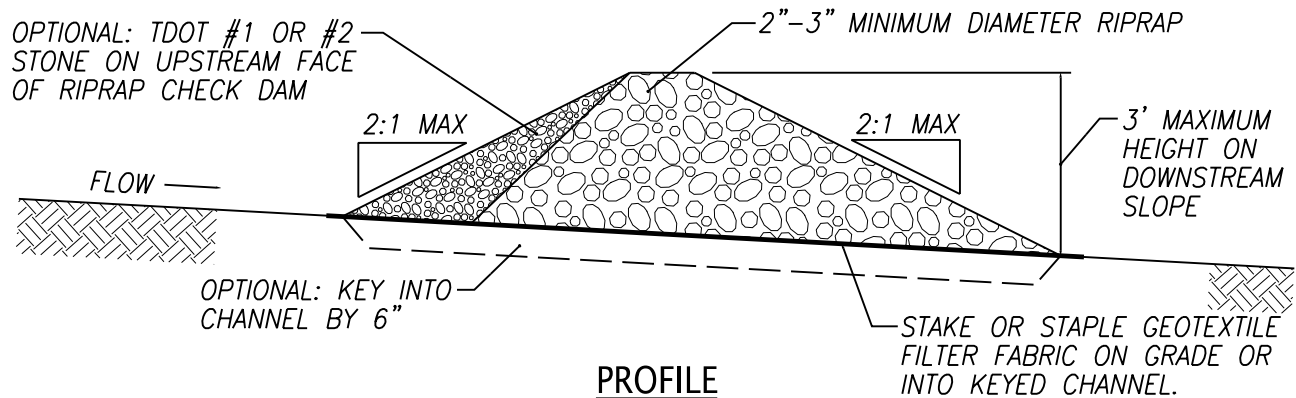
NOTES:

1. THE INLET SEDIMENT CONTROL DEVICE SHALL BE SILTSACK[®] OR EQUIVALENT, FOR USE ON STORM STRUCTURES LOCATED IN PAVED AREAS WHERE THERE IS A POTENTIAL FOR RECEIVING SEDIMENT LADEN RUNOFF.
2. REMOVE ONCE PERMANENT VEGETATION IS ESTABLISHED.



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APPROVED BY:	LCUB	DRAWN BY:	FMA	Scale:	NTS
INLET SEDIMENT CONTROL DEVICE				Date:	07/30/21
				DRAWING NUMBER:	W19



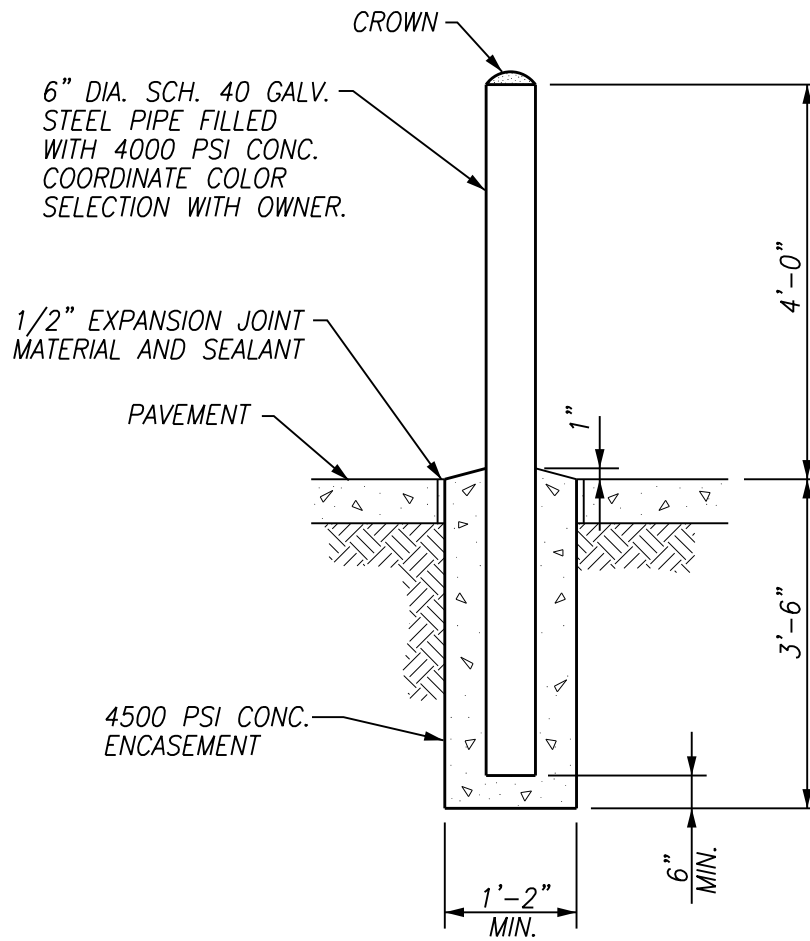
NOTES:

1. GEOTEXTILE SEPARATION FABRIC SHALL BE GEOTEX 801 (8 OUNCE NON-WOVEN) BY PROPEX OR EQUAL.
2. CONSTRUCT, MAINTAIN, AND REMOVE IN ACCORDANCE WITH THE TENNESSEE EROSION & SEDIMENT CONTROL HANDBOOK.



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APPROVED BY:	LCUB	DRAWN BY:	FMA	Scale:	NTS
TEMPORARY ROCK CHECK DAM				Date:	07/30/21
				DRAWING NUMBER:	W20



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APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
BOLLARD		Date: 07/30/21
		DRAWING NUMBER: W21

NOTES:

1. ALL WORK TO BE PERFORMED WILL BE IN ACCORDANCE WITH THE LENOIR CITY UTILITIES BOARD WATER DEPARTMENT (CURRENT EDITION) SPECIFICATIONS AND DETAILS.
2. PRE-CONSTRUCTION CONFERENCE SHALL BE CONDUCTED WITH THE LENOIR CITY UTILITIES BOARD REPRESENTATIVES, DESIGN ENGINEER, AND UTILITY CONTRACTOR PRIOR TO ANY UTILITIES CONSTRUCTION ACTIVITIES BEGINNING.
3. WATER LINE MATERIALS, INSTALLATION, TESTING AND DISINFECTION PER LENOIR CITY UTILITIES BOARD WATER DEPARTMENT STANDARDS (CURRENT EDITION).
4. CONTRACTOR TO INSTALL ALL WATER SERVICES. SERVICE LINES FOR SINGLE WATER METERS SHALL BE 3/4-INCH DIAMETER AND SERVICE LINES FOR DOUBLE WATER METERS SHALL BE 1-INCH DIAMETER. MATERIALS AND FITTINGS SHALL BE INSTALLED IN ACCORDANCE WITH THE SPECIFICATIONS AND TYPICAL DETAIL W7.
5. ALL CONSTRUCTION AND TESTING ACTIVITIES MUST BE OBSERVED BY A RESIDENT PROJECT REPRESENTATIVE (RPR) AS DESIGNATED BY LCUB. WORK PERFORMED WITHOUT DESIGNATED RPR OVERSIGHT AND APPROVAL SHALL NOT BE ACCEPTED BY LCUB.
6. ALL COSTS INCURRED BY LCUB FOR PROJECT-RELATED RPR AND GENERAL ENGINEERING SERVICES DURING CONSTRUCTION SHALL BE REIMBURSED BY THE PROPERTY OWNER/DEVELOPER.
7. ALL PROJECT CLOSEOUT DOCUMENTS MUST BE PROVIDED BY THE OWNER/DEVELOPER PRIOR TO LCUB ACCEPTING OWNERSHIP OF NEW FACILITIES AS FOLLOWS:
 - A. RECORD DRAWINGS WITH APPROVED MODIFICATIONS TO DESIGN DRAWINGS IN RED
 - B. RPR DAILY REPORTS
 - C. CONSTRUCTION PHOTOS
 - D. RPR TESTING REPORTS
 - E. PRE-CONSTRUCTION AND CONSTRUCTION PHOTOGRAPHS
 - F. VERIFIED GIS DATA COLLECTED BY LCUB-APPROVED STAFF
 - G. ASSOCIATED EASEMENT DOCUMENTS
 - H. FLUSHING / WATER LOSS REPORTS / BACTERIOLOGICAL RESULTS
8. CONTRACTOR SHALL PROVIDE EROSION AND SEDIMENT CONTROL FOR ALL EXCAVATIONS.
9. CONTRACTOR SHALL PERFORM ALL WATER LINE TAPS REQUIRED.
10. FIRE HYDRANTS SHALL BE MUELLER SUPER CENTURION #250 (FACTORY POWDER COATED YELLOW-OPEN COUNTERCLOCKWISE), WITH 5 1/4" OPENING VALVE. HYDRANTS SHALL BE PAINTED AS SHOWN BELOW, IN ACCORDANCE WITH THE LATEST NFPA CODE FOR MARKING HYDRANTS, AND/OR IN ACCORDANCE WITH THE LENOIR CITY FIRE DEPARTMENT STANDARDS.

RED	LESS THAN 500 GAL./MIN.
ORANGE	500 999 GAL./MIN.
GREEN	1000 1499 GAL./MIN.
LIGHT BLUE	1500 GAL./MIN. OR GREATER
11. MAXIMUM ALLOWABLE DEFLECTION OF AWWA C111 DUCTILE IRON PIPE PUSH ON JOINTS IS FIVE DEGREES PER JOINT. A DEFLECTION GREATER THAN THIS WILL REQUIRE ADEQUATE FITTINGS TO DEFLECT THE PIPE.
12. BLASTING NOT PERMITTED.
13. CONTRACTOR IS RESPONSIBLE FOR EMPLOYING ALL TRAFFIC CONTROL MEASURES AS NECESSARY IN ACCORDANCE WITH PROJECT SPECIFICATIONS SECTION 01570-TRAFFIC REGULATIONS, AND MUTCD.
14. DEVELOPER (OWNER) AND/OR CONTRACTOR SHALL BE RESPONSIBLE FOR ANY EXISTING WATER DISTRIBUTION IMPROVEMENTS REQUIRED TO PROVIDE ADEQUATE WATER PRESSURE AND FIRE FLOW TO THE NEW DEVELOPMENT AND MAINTAIN EXISTING DISTRIBUTION SYSTEM PRESSURES.
15. DEVELOPER (OWNER) AND/OR CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING ALL WATER TAPS, SERVICE LINES, METER YOLKS, AND CASINGS PER LCUB STANDARD SPECIFICATIONS FOR THE NEW DEVELOPMENT.
16. DEVELOPER (OWNER) AND/OR CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING ALL FIRE HYDRANTS AND APPURTENANCES PER LCUB STANDARD SPECIFICATIONS FOR THE NEW DEVELOPMENT. SPACING BETWEEN FIRE HYDRANTS SHALL NOT EXCEED 600 FEET AND HOSE PULL LENGTH (AS MEASURED FROM THE BACK OF THE FURTHEST PROPOSED STRUCTURE TO THE CLOSEST FIRE HYDRANT ALONG THE ROADWAY) SHALL NOT EXCEED 500 FEET. TYPICAL REQUESTED FIRE HYDRANT LOCATIONS ARE AT ROAD INTERSECTIONS.
17. ASSOCIATED WATER FEES FOR DEVELOPMENT PROJECTS SHALL INCLUDE, BUT NOT LIMITED TO, TAPS, CAPITAL RESERVE, SPECIAL ASSESSMENT, ETC. AND SHALL BE BILLED AT THE END OF EACH PROJECT PHASE AND PAYMENT SHALL BE DUE FROM DEVELOPER AT THAT TIME. WATER SERVICE SHALL NOT BE MADE LIVE UNTIL PAYMENT IS RECEIVED IN FULL.
18. LCUB HAS THE RIGHT TO REQUIRE A LARGER DIAMETER PIPE SIZE OR DUCTILE IRON PIPE BASED UPON HYDRAULIC ANALYSIS, DEPTH, SOIL, AND FUTURE CONDITIONS.
19. WATER DISTRIBUTION SYSTEM SHALL BE MINIMUM SIX (6) INCH C900 PVC, HDPE (SDR 11), OR DUCTILE IRON PIPE (NO EXCEPTIONS). UPON REVIEW OF PLANS, LCUB HAS THE RIGHT TO REQUIRE THE WATER DISTRIBUTION SYSTEM TO BE EIGHT (8) INCH PIPE IN LIEU OF SIX (6) INCH.
20. RIGHT-OF-WAYS AND EASEMENTS NEEDED FOR THE WATER LINE THAT FALLS INSIDE/OUTSIDE OF THE PROPERTY SHALL BE SIGNED AND FURNISHED PRIOR TO START OF PROJECT
21. CONTRACTOR SHALL FIELD VERIFY AND POTHOLE ALL UTILITIES AS INDICATED BY DRAWING, GIS, TENNESSEE ONE-CALL, ETC.
22. ALL CONTRACTORS SHALL BE LICENSED CONTRACTORS WITH "MU" CLASSIFICATION IN THE STATE OF TENNESSEE AS REQUIRED BY THE CONTRACTOR'S LICENSING ACT OF 1994 AND RELATED AMENDMENTS THERETO.
23. DEVELOPMENT PHASING SHALL BE APPROVED ONLY BEFORE P.E., LCUB, AND TDEC STAMPS ARE APPLIED AT THE BEGINNING OF THE PROJECT. NO RE-PHASING WILL BE ALLOWED OR APPROVED AFTER CONSTRUCTION OF A PROJECT HAS BEGUN.



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APPROVED BY: RWSG

DRAWN BY: FMA

Scale: NTS

Date: 04/11/23

GENERAL WATER NOTES

DRAWING NUMBER:

W22