

STANDARD SPECIFICATIONS FOR WATER CONSTRUCTION

**WHITE HOUSE UTILITY DISTRICT
WHITE HOUSE, TENNESSEE**

December 2005

Specifications

Division 2 - Sitework

02110	Clearing and Grubbing
02125	Erosion and Sedimentation Control
02225	Trench Excavation and Backfill
02229	Bore and Jack Casings
02575	Removing and Replacing Pavement
02665	Water Mains and Accessories
02668	Water Service Connections

Standard Detail Drawings

STD-G-01	Silt Fence Detail
STD-G-02	Concrete Encasement Detail
STD-G-03	Trench Terminology Detail
STD-G-04	Concrete Replacement Detail
STD-G-05	Asphalt Replacement Detail
STD-G-06	Pipe Bedding and Haunching Detail (Pressure Pipe)
STD-G-07	Casing Pipe Detail for Streams or Large Drainage Ditches
STD-W-01	$\frac{3}{4}$ " and 1" Short Tap Assemblies
STD-W-02	$\frac{3}{4}$ " and 1" Long Tap Assemblies
STD-W-03	2" Short Tap Assemblies
STD-W-04	2" Long Tap Assemblies
STD-W-05A	Pre-Cast Concrete Vault Meters 4" and Larger – Profile View
STD-W-05B	Pre-Cast Concrete Vault Meters 4" and Larger – Profile View
STD-W-06	Typical Blocking Detail
STD-W-07	Temporary Dead End
STD-W-08	Fire Hydrant Detail
STD-W-09	4" Blow-Off Hydrant Detail for Permanent Dead-End Mains
STD-W-10	Blow-Off Fire Hydrant
STD-W-11	Gate Valve Installation Detail
STD-W-12	Butterfly Valve Installation Detail
STD-W-13	Extension Stem Detail
STD-W-14	$\frac{3}{4}$ " and 1" Air Release Valve Assembly
STD-W-15	2" Air Release Valve Assemblies

Part 1 General

1.01 Scope

- A. Clearing and grubbing includes, but is not limited to, removing from the Project site, trees, stumps, roots, brush, structures, abandoned utilities, trash, debris and all other materials found on or near the surface of the ground in the construction area and are to be removed. Precautionary measures that prevent damage to existing features that are to remain is part of the Work.
- B. Clearing and grubbing operations shall be coordinated with temporary and permanent erosion and sedimentation control procedures.

1.02 Compliance with Law

- A. The Contractor shall comply with all applicable codes, ordinances, rules, regulations , requirements, and laws of local, municipal, state or federal authorities having jurisdiction over the Project. All required permits shall be obtained for construction operations by the Contractor.
- B. Open burning, if allowed, shall first be permitted by the governmental authority having jurisdiction. The Contractor shall notify the local fire department and abide by fire department requirements and restrictions.

1.03 Job Conditions

Location of the Work: The area to be cleared and grubbed is shown schematically on the Drawings or specified below. It includes all areas designated for construction.

Part 2 Equipment

2.01 Equipment

The Contractor shall furnish all equipment of the type normally used in clearing and grubbing operations including, but not limited to, tractors, trucks and loaders.

Part 3 Execution

3.01 Scheduling of Clearing

- A. The Contractor shall clear at each construction site only that length or area of the right-of-way or permanent or construction easement that would be required for the work to be performed during the next thirty (30) days. This area or length shall be determined from the Contractor's Progress Schedule.
- B. The Engineer may permit clearing for additional areas or lengths of the pipe line provided that erosion and sedimentation controls are in place and a satisfactory stand of grass is established. Should a satisfactory stand of grass not be possible, no

Clearing and Grubbing

additional clearing shall be permitted beyond that specified in section 3.01(A) above..

- C. A satisfactory stand of grass shall have no bare spots larger than one square yard and all bare spots combined shall not comprise more than one percent of any given area.

3.02 Clearing and Grubbing

- A. Clear and grub as required on each side of the pipeline before excavating. Remove from site all trees, growth, debris, stumps and other unsuitable as backfill material matter. Clear the construction easement or road right-of-way only as necessary.
- B. Materials to be cleared, grubbed and removed from the Project site include, but are not limited to, all trees, stumps, roots, brush, trash, organic matter, paving, miscellaneous structures, houses, debris and abandoned utilities.
- C. Grubbing shall consist of completely removing roots, stumps, trash and other debris from all graded areas so that they are free of roots and debris. Topsoil is to be left sufficiently clean so that further picking and raking will not be required.
- D. All stumps, roots, foundations and planking embedded in the ground shall be removed and properly disposed offsite. Pilings and butts of utility poles shall be removed to a minimum depth of two feet below the limits of excavation for structures, trenches and roadways or two feet below finish grade, whichever is lower.
- E. Landscape features shall include, but are not necessarily limited to, fences, cultivated trees, cultivated shrubbery, property corners, man-made improvements, subdivision and other signs within the right-of-way and easement.
The Contractor shall take extreme care in moving landscape features and promptly re-establishing these features.
- F. Surface rocks and boulders shall be grubbed from the soil and removed from the site if not suitable as rip rap, if rip rap is required by the Drawings.
- G. Where tree limbs interfere with utility wires, or where the trees to be felled are in close proximity to utility wires, the tree or its limbs shall be taken down in sections to eliminate the possibility of damage to the utility.
- H. Any work pertaining to utilities or utility poles shall comply with the requirements of the appropriate utility.
- I. All fences adjoining any excavation or embankment that, in the Contractor's opinion, may be damaged or buried, shall be carefully removed, stored and replaced. Any fencing that, in the Engineer's opinion, is significantly damaged shall be replaced with new fence material at no cost to Owner.
- J. The Contractor shall exercise special precautions for the protection and preservation of trees, cultivated shrubs, sod, fences, etc. situated within the limits of the construction area but not directly within excavation and/or fill limits. The Contractor shall be responsible for any damage the Contractor's operations cause to such property.

- K. The Contractor shall be responsible for any damage to existing improvements resulting from Contractor's operations.

3.03 Disposal of Debris

- A. The debris resulting from the clearing and grubbing operation shall be hauled to a disposal site secured by the Contractor and shall be disposed of in accordance with all applicable requirements of federal, state, county and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or in any street or alley. No debris shall be deposited upon any property except with written consent of the property owner. In no case shall any debris or unused material be left on the Project, placed onto abutting properties or buried on the Project.
- B. When approved in writing by the Engineer and authorized by the proper authorities, the Contractor may dispose of such debris by burning on the Project site, provided all permitting and other requirements set forth by the governing authorities are met. The authorization to burn shall not relieve the Contractor in any way from damages that may result from Contractor's operations. The Contractor shall not burn on the site unless written permission is secured from the property owner, in addition to authorization from the proper authorities.

END OF SECTION

Part 1 General

1.01 Scope

- A. The Work specified in this Section consists of providing, maintaining and removing erosion and sedimentation controls during construction.
- B. Temporary erosion controls, include, but are not limited to, grassing, mulching, watering and reseeded on-site surfaces and spoil and borrow area surfaces, and providing interceptor ditches at ends of berms and at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the Federal Clean Water Act of 1987, as amended. The Contractor should follow the Tennessee Erosion and Sedimentation Control Handbook.
- C. Temporary sedimentation controls include, but are not limited to, silt dams, silt fences, traps, barriers, hay bales, filter stone and appurtenance that will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the Federal Clean Water Act of 1987, as amended.
- D. Basic Principles...
 - 1. Conduct the earthwork and excavation activities in such a manner to fit the topography, soil type and conditions.
 - 2. Minimize the disturbed area and the duration of exposure to erosion elements.
 - 3. Stabilize disturbed areas immediately.
 - 4. Safely convey run-off from the site to an outlet such that erosion will not be increased off site.
 - 5. Retain sediment on site that was generated on site.
 - 6. Minimize encroachment upon waterway.
- E. Temporary Erosion and Sedimentation Control: In general, temporary erosion and sedimentation control procedures shall be directed toward:
 - 1. Preventing soil erosion at the source.
 - 2. Preventing silt and sediment from entering any waterway if soil erosion cannot be prevented.
 - 3. Preventing silt and sediment from migrating downstream in the event it cannot be prevented from entering the waterway.
- F. Permanent Erosion Control: Permanent erosion control measures shall be implemented to prevent sedimentation of the waterways and to prevent erosion of the Project site.

1.02 Quality Assurance

- A. General: Perform all work under this Section in accordance with all applicable laws, rules, regulations and requirements and these Specifications.
- B. Conflicts: Where provisions of applicable laws, rules and regulations and requirements conflict with these Specifications, the more stringent provisions shall govern.

Part 2 Products

2.01 Temporary Erosion and Sedimentation Control

- A. Silt Fence
 - 1. Silt fences shall consist of polymer type netting with a built-in cord running throughout the top edge of the fabric. Posts shall be either steel or pressure treated fir, southern pine or hemlock and shall be spaced not more than six feet on center. Silt fences shall be provided with netting to provide reinforcing when necessary. Silt fences shall have an Equivalent Opening Size (EOS) of 40 to 100. Silt fence fabric shall have a maximum permeability of 40 gallons per minute per square foot.
 - 2. Silt fence fabric shall be Mirafi 100X, Amoco 1380 or Exxon GTF-100 Series.
- B. Hay bales shall be clean, seedfree cereal hay type.
- C. Netting shall be 1/2-inch, galvanized steel, chicken wire mesh.

2.02 Stone Rip Rap

Stone rip rap should consist of sound, tough, durable stones resistant to the effects of air and water. Slabby or shaley pieces will not be acceptable. Specific gravity shall be 2.0 or greater. Rip rap shall have less than 66 percent wear when tested in accordance with AASHTO T-96. Rip rap shall be in accordance with Section 709 of the Tennessee Department of Transportation Standard Specifications.

2.03 Filter Fabric

- A. The filter fabric for use under rip rap shall be a monofilament, polypropylene woven fabric meeting the specifications as established by Task Force 25 for the Federal Highway Administration. The filter fabric shall have an equivalent opening size (EOS) of 70.
- B. Filter fabric under rip rap shall be Mirafi, Amoco or Exxon.

Part 3 Execution

3.01 General

- A. Standards: Provide all materials and promptly take all actions necessary to achieve effective erosion and sedimentation control in accordance with the Federal Clean Water Act of 1987, as amended, local enforcing agency guidelines and these Specifications.
- B. Implementation: The Contractor shall have the responsibility to actively take all steps necessary to control soil erosion and sedimentation.

3.02 Temporary Erosion and Sedimentation Control

- A. Temporary erosion and sedimentation control procedures initially should be directed toward preventing silt and sediment from entering the waterways. The preferred method is to provide an undisturbed natural buffer, extending a minimal five feet from the water, to filter the run-off. Should this buffer prove ineffective due to construction activities being too close to the water, or if the amount of sediment overwhelms the buffer, the Contractor shall place silt fences to filter the run-off and, if necessary, place permanent rip rap to stabilize the bank.
- B. Silt dams, silt fences, traps, barriers, check dams, appurtenances and other temporary measures and devices shall be installed as indicated on the approved plans and working drawings and as otherwise directed by TDEC, shall be maintained until no longer needed, and shall then be removed. Deteriorated hay bales and dislodged filter stone shall be replaced with new materials.
- C. Where permanent grassing is not appropriate, and where the Contractor's temporary erosion and sedimentation control practices are inadequate, the Engineer may direct the Contractor to provide temporary vegetative cover with fast growing seedings.
- D. All erosion and sedimentation control devices, including check dams, shall be inspected by the Contractor at least weekly and after each rainfall occurrence and cleaned out and repaired or replaced by the Contractor as necessary.
- E. Temporary erosion and sedimentation control devices shall be installed and maintained from the initial land disturbance activity until the satisfactory completion and establishment of permanent erosion control measures. At that time, temporary devices shall be removed.

3.03 Permanent Erosion Control

- A. Permanent erosion control shall include:
 - 1. Restoring the work site to its original contours, unless shown otherwise on the Drawings or directed by the Engineer.
 - 2. Permanent vegetative cover shall be performed in accordance with this Section 3.04 dealing with "Grassing".
- B. Permanent erosion control measures shall be implemented as soon as practical after

Erosion and Sedimentation Control

the completion of each segment of the Project. In no event shall implementation be postponed or delayed when no further activities related to pipe installation will impact that portion or segment of the Project. Payment requests may be withheld for those portions of the Project not complying with this requirement.

3.04 Grassing

A. General

1. All references to grassing, unless noted otherwise, shall relate to establishing permanent vegetative cover as specified herein for seeding, fertilizing, mulching, etc.
2. When final grade has been established, all bare soil, unless otherwise required by the Contract Documents, shall be seeded, fertilized and mulched in an effort to restore to a protected condition. Critical areas shall be sodded as approved or directed by the Engineer.
3. Specified permanent grassing shall be performed at the first appropriate season listed below following establishment of final grading in each section of the site.

Times of Sowing and Seed Mixtures Required	
February 1 - September 1	Group A Only
September 1 - December 1	Group B Only
December 1 - February 1	Do Not Sow Any Seeds

B. Materials

1. **Topsoil:** Shall consist of natural, fertile, agricultural soil typical of the locality, capable of sustaining vigorous plant growth, from a well drained site free of flooding, not in frozen or muddy condition, and containing not less than six percent organic matter, and pH value of 5.9 to 7.0. Free from subsoil, slag, clay, stones, lumps, live plants, roots, sticks, crabgrass, couch grass, noxious weeds, and foreign matter.
2. **Peatmoss:** Shall consist of horticultural grade Class A decomposed plant material, elastic and homogeneous. Free of decomposed colloidal residue, wood, sulphur, and iron. Peatmoss shall have a pH value of 5.9 to 7.0, 60 percent organic matter by weight, moisture content not exceeding 15 percent and water absorption capacity of not less than 300 percent by weight on oven dry basis.
3. **Sand:** Shall consist of hard, granular, natural, beach sand, washed, free of impurities, chemical, or organic matter.
4. **Fertilizer:** Shall be 6-12-12 grade Commercial type with six percent nitrogen, 12 percent P₂O₅, and 12 percent K₂O.

5. Lime: Shall be standard agricultural type containing at least 85 percent total carbonates applied at a rate of 4,000 pounds per acre (92 pounds per 1,000 square feet), or as required by the test results and recommendations as specified above. Before seeding, apply lime and fertilizer and incorporate them into the soil at least 3-inches deep by discing and harrowing, at the rates recommended above or required by the above test results.
6. Seed: Seed shall be uniform mixtures of the following kinds and properties:

Kind	Group A		Group B	
	% by Weight	Pounds/Acre	% by Weight	Pounds/Acre
Kentucky Bluegrass	25	50	25	50
Hulled Bermuda	-	-	20	40
Kentucky 31 Fescue	75	150	35	70
English Rye	-	-	20	40
Total	100	200	100	200

- C. Replant grass removed or damaged in residential or landscaped areas using the same variety of grass as was existing and at the first appropriate season. Where sod is removed or damaged, replant such areas using sod of the same species of grass at the first appropriate season. Outside of residential or landscaped areas, grass the entire area disturbed by the work on completion of work in any area. In all areas, promptly establish successful stands of grass.

3.05 Rip Rap

- A. Unless shown otherwise on the Drawings, rip rap shall be placed where ordered by the Engineer. Carefully compact backfill and place rip rap to prevent subsequent settlement and erosion.
- B. Preparation of Foundations: The ground surface upon which the rip rap is to be placed shall be brought in reasonably close conformity to the correct lines and grades before rip rap placement is commenced. Where filling of depressions is required, the fill material shall be compacted with hand or mechanical tampers.
- C. Placement of Filter Fabric: The surface to receive fabric shall be prepared to a relatively smooth condition free from obstructions, depressions and debris. The fabric shall be placed with the long dimension running up the slope and shall be placed to provide a minimum number of overlaps. The strips shall be placed to provide a minimum width of one foot of overlap for each joint. The filter fabric shall be anchored in place with securing pins of the type recommended by the fabric manufacturer. Pins shall be placed on or within 3-inches of the centerline of the overlap. The fabric shall be placed so that the upstream strip overlaps the downstream strip. The fabric shall be placed loosely so as to give, and therefore, avoid stretching and tearing during placement of the stones. The stones shall be dropped on the fabric no more than

Erosion and Sedimentation Control

three feet during construction. The fabric shall be protected at all times during construction from clogging due to clay, silts, chemicals or other contaminants. Any contaminated fabric or any fabric damaged during its installation or during placement of rip rap shall be removed and replaced with uncontaminated and undamaged fabric at no expense to the Owner.

- D. **Placement of Rip Rap:** The rip rap shall be placed on a 6-inch layer of soil, crushed stone or sand overlaying the filter fabric. This 6-inch layer shall be placed to maximize the contact between the soil beneath the filter fabric and the filter fabric. Rip rap shall be placed with its top elevation conforming with the natural slope of the stream bank and stream bottom. Stone rip rap shall be dumped into place to form a uniform surface and to the thickness specified on the Drawings. The thickness tolerance for the course shall be -6-inches and +12-inches. If the Drawings or Bid do not specify a thickness, the course shall be placed to a thickness of not less than 18-inches.
- E. **Repair of Existing Rip Rap Ditches:** The Drawings show locations where existing rip rap ditches will be disturbed in order to construct the new water main. The Contractor shall limit the amount of ditch disturbed to that which is necessary to construct the water main. Immediately after placement of the water main, the rip rap ditch shall be repaired. The Contractor, at its option, may reuse the existing rip rap provided it is free of all mud or any other deleterious matter and usable otherwise. The Engineer will determine the suitability of the material for reuse. Any shortage of materials to replace the ditch shall be filled with new material by the Contractor. All unused material, new or existing, shall be removed from the site. All new rip rap used to repair/replace the existing ditches shall meet the requirements as specified in Article 2.02 Rip Rap of this Section of the Specifications. Placement of the rip rap will be in accordance with the requirements of Article 3.05, Paragraph D of this Section of the Specifications.

END OF SECTION

Part 1 General

1.01 Scope

- A. The work under this Section consists of furnishing all labor, equipment and materials and performing all operations in connection with the trench excavation and backfill required to install the pipelines shown on the Drawings and as specified.
- B. Excavation shall include the removal of any trees, stumps, brush, debris or other obstacles that remain after the clearing and grubbing operations, which may obstruct the work, and the excavation and removal of all earth, rock or other materials to the extent necessary to install the pipe and appurtenances in conformance with the lines and grades shown on the Drawings and as specified.
- C. Backfill shall include the refilling and compaction of the fill in the trenches and excavations up to the surrounding ground surface or road grade at crossing.
- D. The pipe zone area of the trench is divided into five specific areas:
 - 1. Foundation: The area beneath the bedding, sometimes also referenced to as trench stabilization.
 - 2. Bedding: The area above the trench bottom (or foundation) and below the bottom of the barrel of the pipe.
 - 3. Haunching: The area above the bottom of the barrel of the pipe up to a specified height above the bottom of the barrel of the pipe.
 - 4. Initial Backfill: The area above the haunching material and below a plane 18-inches above the top of the barrel of the pipe.
 - 5. Final Backfill: The area above a plane 18-inches above the top of the barrel of the pipe.
- E. The choice of method, means, techniques and equipment rests with the Contractor. WHUD can limit use of trench or require trenchers as job dictates. The Contractor, except as provided herein or on the Drawing, shall select the method and equipment for trench excavation and backfill depending upon the type of material to be excavated and backfilled, the depth of excavation, the amount of space available for operation of equipment, storage of excavated material, proximity of man-made improvements to be protected, available easement or right-of-way and prevailing practice in the area. **The District shall note on approved construction drawings if specific trenching methods are required.**

1.02 Quality Assurance

- A. Density: All references to "maximum dry density" shall mean the maximum dry density defined by the "Maximum Density-Optimum Moisture Test", ASTM D 698. Determination of the density of foundation, bedding, haunching, or backfill materials in

Trench Excavation and Backfill

place shall meet with the requirements of ASTM D 1556, "Density of Soil In Place by the Sand Cone Method", ASTM D 2937, "Density of Soil In Place by the Drive-Cylinder Method" or ASTM D 2922, "Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)".

- B. Sources and Evaluation Testing: Testing of materials to certify conformance with these Specifications shall be performed by an independent testing laboratory retained by the Contractor at no cost to the Owner. The testing laboratory shall perform tests, at no cost to the Owner, upon change of material source and at sufficient intervals during the work to certify conformance of all material furnished for use on this Project.

1.03 Safety

Perform all trench excavation and backfilling activities in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596), as amended. The Contractor shall pay particular attention to the Safety and Health Regulations Part 1926, Subpart P "Excavation, Trenching & Shoring" as described in OSHA 2226.

Part 2 Products

2.01 Trench Foundation Materials

- A. Normal trench foundations shall be composed of undisturbed, firm soil or native rock with no large stones or sharp surfaces left in the ditch that could potentially damage pipe or otherwise cause uneven bearing of the installed pipe.
- B. No. 67 crushed stone or surge stone shall be utilized for trench foundation (trench stabilization) in the field where directed by the Engineer.
- C. Crushed stone shall be crushed limestone and shall meet the requirements of the Tennessee Department of Transportation Specification 903.11. Stone size shall be No. 67, as determined by the Tennessee Department of Transportation Specification 903.22.

2.02 Bedding and Haunching Materials

- A. Unless shown on the Drawings or specified otherwise, bedding and haunching materials shall be as follows:
 - 1. DIP Watermains: Earth materials as specified below. Where rock is encountered, No. 67 crushed stone shall be used for a depth of 6" measured from the trench foundation to the bottom of the pipe barrel.
- B. Bedding and haunching material shall be crushed stone under all pavement areas or where the trench is within three feet of the pavement edge.
- C. Earth materials utilized for bedding and haunching shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of

rock larger than 3-inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, earth bedding and haunching materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as bedding or haunching material, the Contractor shall provide select material conforming to the requirements of this Section at no additional cost to the Owner.

2.03 Initial Backfill

- A. Initial backfill material shall be earth materials or crushed stone as specified for bedding and haunching materials. In rocky laying conditions the initial backfill shall be No. 67 crushed stone to a point 12" above the crown of the pipe.
- B. Earth materials utilized for initial backfill shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock larger than 2-inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and is capable of meeting the specified compaction requirements. When necessary, initial backfill materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as initial backfill material, Contractor shall provide select material conforming to the requirements of this Section.
- C. Initial backfill in roadways shall be No. 67 crushed stone.

2.04 Final Backfill

- A. Final backfill material shall be general excavated earth materials and shall not contain rock larger than 3-inches at its greatest diameter, cinders, stumps, limbs, man-made wastes and other unsuitable materials. If materials excavated from the trench are not suitable for use as final backfill material, Contractor shall provide select material conforming to the requirements of this Section.
- B. Final backfill in roadways shall be crushed stone.

2.05 Select Backfill

Select backfill shall be materials that meet the requirements as specified for bedding, haunching, initial backfill or final backfill materials, including compaction requirements.

2.06 Concrete

Concrete for bedding, haunching, initial backfill or encasement shall have a compressive strength of not less than 3,500 psi, with not less than six bags of Portland cement per cubic yard and a slump between 3 and 5-inches. Ready-mixed concrete

Trench Excavation and Backfill

shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

Part 3 Execution

3.01 Trench Excavation

- A. Topsoil and grass shall be stripped a minimum of 6-inches over the trench excavation site and stockpiled separately for replacement over the finished graded areas.
- B. Trenches shall be excavated to the lines and grades shown on the Drawings with the centerlines of the trenches on the centerlines of the pipes and to the dimensions that provide the proper support and protection of the pipe and other structures and accessories. Before laying the pipe, the Contractor shall open the trench far enough ahead to reveal obstructions that may necessitate changing the line or grade of the pipeline.
- C. In all areas along State Highways where the pipeline is being laid in pavement or in the right-of-way of the road, excavation during each day shall be limited to the footage of pipe that can be laid and the trench that can be backfilled all in accordance with the applicable provisions of this section of these Specifications, so that no open ditch is left overnight in such areas.
- D. Width
 - 1. The sides of all trenches shall be vertical to a minimum of one foot above the top of the pipe. Unless otherwise indicated on the Drawings, the maximum trench width shall be equal to the sum of the outside diameter of the pipe plus 24 inches. The minimum trench width shall be that which allows the proper consolidation of the haunching and initial backfill material **when rocky conditions are not encountered**.
 - 2. Excavate the top portion of the trench to any width within the construction easement or right-of-way that will not cause unnecessary damage to adjoining structures, roadways, pavement, utilities, trees or private property. Where necessary to accomplish this, provide sheeting and shoring.
 - 3. Where rock is encountered in trenches, excavate to remove boulders and stones to provide a minimum of 12-inches clearance between the rock and any part of the pipe barrel.
 - 4. Wherever the excavation is carried beyond or below the lines and grades given by the Engineer, the Contractor, at its own expense, shall refill such excavated space with such material and in such a manner as will ensure stability of the line involved, including the use of crushed stone or class "C" concrete. The excessive trench width may be due to unstable trench walls or inadequate or improperly placed bracing and sheeting which caused sloughing, accidental over-excavation, intentional over-excavation necessitated by the size of the Contractor's tamping and compaction equipment, intentional over-excavation due

to the size of the Contractor's excavation equipment, or other reasons beyond the control of the Engineer or WHUD.

E. Depth

1. The trenches shall be excavated to the depth or elevation that allows for the placement of the pipe and bedding to the thickness shown on the Drawings.
2. Water Mains
 - a. Depth of Trenches: Excavate trenches to provide depths as shown on the Drawings. The depth of cover shall not exceed five feet without approval of the Engineer or Inspector.
 - b. Excavate trenches to provide a minimum cover not less than three feet below the surface of the ground when laid through wooded areas, fields or other such areas outside the pavement or traveled surface of highways and roadways. The minimum depth of cover shall not be less than 3-1/2 feet for pipe lines laid within the pavement, traveled surface, or shoulder of any highway and/or roadway. Any line crossing a State Highway shall have a minimum depth of cover of four feet. Depth of cover at ditches on state highway shall be 36-inches minimum. All depths of cover are measured from the top of the pipe.
 - c. Increase the depth of cover where specifically shown on the Drawings and where necessary to avoid interference with underground utilities and obstructions.
3. Where rock is encountered in trenches, excavate to a depth that will provide a minimum clearance of six inches between the undisturbed trench bottom and the pipe barrel or fittings. Remove boulders and stones to provide a minimum of six inches clearance between the rock and any part of the pipe or accessory.

F. Excavated Materials

1. Excavated materials shall be placed adjacent to the work to be used for backfilling as required and appropriate. Topsoil shall be carefully separated and placed in its original location.
2. Excavated material shall be placed sufficiently back from the edge of the excavation to prevent caving of the trench wall, to permit safe access along the trench and to not cause any drainage problems. Excavated material shall be placed so as not to damage existing landscape features or man-made improvements.

3.02 Rock Excavation

- A. Definition of Rock: Any material that cannot be excavated with conventional excavating equipment, and is removed by drilling or blasting, and occupies an original volume of at

Trench Excavation and Backfill

least one-half cubic yard. This includes the excavation of all solid rock, such as limestone or sandstone occurring in mass or ledge formation or of such character as to warrant removal by blasting, and it shall also include the removal of boulders equal to or greater than one-half cubic yard in size. In excavating for pipelines in rock, the excavation shall be carried to a depth of six inches below the bottom of the pipe.

- B. **Blasting:** The Contractor shall provide licensed, experienced workmen to perform blasting. Conduct blasting operations in accordance with all applicable laws, ordinances and regulations. Protect all buildings and structures from the effects of the blast. Repair any resulting damage. The Engineer may direct the Contractor to employ an independent blasting consultant to supervise the preparation for each blast and approve the quantity of each charge.
- C. **Removal of Rock:** Dispose off site all rock that is surplus or not suitable for use as rap or backfill.
- D. The Contractor shall notify the Engineer prior to any blasting. Additionally, the Contractor shall notify the Engineer before any charge is set.
- E. Following review by the Engineer regarding the proximity of permanent buildings and structures to the blasting site, the Engineer may direct the Contractor to employ an independent, qualified specialty sub-contractor, approved by the Engineer, to monitor the blasting by use of seismograph, identify the areas where light charges must be used, conduct pre-blast and post-blast inspections of structures, including photographs or videos, and maintain a detailed written log.

3.03 Dewatering Excavations

- A. The Contractor, at his own expense, shall provide adequate facilities for promptly removing water from all excavations. Dewater excavation continuously to maintain a water level two feet below the bottom of the trench.
- B. Control drainage in the vicinity of excavation. The ground surface should be properly sloped to prevent water running into the excavation.
- C. There shall be sufficient pumping equipment, in good working order, available at all times, to remove any water that accumulates in excavations. Where the pipe line crosses natural drainage channels, the work shall be conducted in such a manner that unnecessary damage or delays in the prosecution of the work will be prevented. Provision shall be made for the satisfactory disposal of surface water to prevent damage to public or private property.
- D. In all cases, accumulated water in the trench shall be removed before placing bedding or haunching, laying pipe or placing concrete or backfilling.
- E. Where dewatering is performed by pumping the water from a sump, crushed stone shall be used as the medium for conducting the water to the sump. Sump depth shall be at least two feet below the bottom of the trench, Pumping equipment shall be of sufficient quantity and/or capacity to maintain the water level in the sump two feet below

the bottom of the trench. Pumps shall be a type such that intermittent flows can be discharged. A standby pump shall be present and will be used in the event the operating pump or pumps clog or otherwise stop operation.

- F. Dewater by use of a well point system when pumping from sumps does not lower the water level two feet below the trench bottom. Where soil conditions dictate, the Contractor shall construct well points cased in sand wicks. The casing, 6 to 10-inches in diameter, shall be jetted into the ground, followed by the installation of the well point, filling the casing with sand and withdrawing the casing.

3.04 Trench Foundation and Stabilization

- A. The bottom of the trench shall provide a foundation to support the pipe and its specified bedding. The trench bottom shall be graded to support the pipe and bedding uniformly throughout its length and width.
- B. If, after dewatering as specified above, in the opinion of the Engineer the trench bottom is spongy, the trench bottom does not provide firm, stable footing and the material at the bottom of the trench will still not adequately support the pipe, the trench will be determined to be unsuitable and the Engineer shall then direct removal of the unsuitable material. The Engineer shall then determine which select material shall be provided at the Contractor's expense for trench stabilization.
- C. Should the undisturbed material encountered at the trench bottom constitute, in the opinion of the Engineer, an unstable foundation for the pipe, the Contractor shall be required to remove such unstable material and fill the trench to the proper subgrade with crushed stone or class "C" concrete.
- D. Where trench stabilization is provided, the trench stabilization material shall be compacted to at least 90 percent of the maximum dry density, unless shown or specified otherwise.

3.05 Bedding and Haunching

- A. Bedding material shall be placed to provide uniform support along the bottom of the pipe and to place and maintain the pipe at the proper elevation. The initial layer of bedding placed to receive the pipe shall be brought to the grade and dimensions indicated on the Drawings, and the pipe shall be placed thereon and brought to grade by tamping the bedding material or by removal of the excess amount of the bedding material under the pipe. Adjustment to grade line shall be made by scraping away or filling with bedding material. Wedging or blocking up of pipe is not permitted. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade is not permitted. Each pipe section shall have a uniform bearing on the bedding for the length of the pipe, except immediately at the joint. All bedding shall extend the full width of the trench bottom. Prior to placement of bedding material, the trench bottom shall be free of any water, loose rocks, boulders, or large dirt clods or other unsuitable material.
- B. At each joint, excavate bell holes of ample depth and width to permit the joint to be

Trench Excavation and Backfill

assembled properly and to relieve the pipe bell of any load.

- C. After the pipe section is properly placed, add the haunching material to the specified depth. The haunching material shall be shovel sliced, tamped, vigorously chinked or otherwise consolidated to provide uniform support for the pipe barrel and to fill completely the voids under the pipe, including the bell hole. Prior to placement of the haunching material, the bedding shall be clean and free of any water, loose rocks, boulders, dirt clods or other unsuitable material.
- F. Water
1. Ductile Iron Pipe
 - a. Unless otherwise shown on the Drawings or specified, utilize earth materials for bedding and haunching. Type 2, 3, 4 and 5 bedding shall be installed as detailed on the Drawings.
 - b. Unless specified or shown otherwise, bedding shall meet the requirements for Type 2 Pipe Bedding. Unless specified or shown otherwise for restrained joint pipe and fittings, bedding shall meet the requirements for Type 3 Pipe Bedding.
 - c. Where the depth of cover over the piping exceeds 15 feet, the pipe bedding shall meet the requirements of Type 4 Pipe Bedding. Where the depth of cover over the piping exceeds 28 feet, the pipe bedding shall meet the requirements of Type 5 Pipe Bedding.
 - d. Type 4 or Type 5 Pipe Bedding called for on the Drawings, specified or ordered by the Engineer, shall meet requirements for Type 4 or Type 5 Pipe Bedding, utilizing crushed stone bedding and haunching material.
 2. Polyvinyl Chloride Pipe
 - a. Utilize crushed stone for bedding and haunching.
 - b. Unless shown otherwise on the Drawings, bedding and haunching shall meet the requirements for Type 2 Pipe Bedding, as detailed on the Drawings. In areas where rock is encountered, No. 67 crushed stone shall be used for bedding and haunching.
- G. Excessive Width and Depth
1. If the trench is excavated to excess width, provide the next higher type or class of pipe bedding, but a minimum of Type 4, as detailed on the Drawings.
 3. If the trench is excavated to excessive depth, provide crushed stone to place the bedding at the proper elevation or grade.

- H. Compaction: Bedding and haunching materials under pipe, manholes and accessories shall be compacted to a minimum of 90 percent of the maximum dry density, unless shown or specified otherwise.

3.06 Initial Backfill

- A. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill and ensure the uniform distribution of the loads over the top of the pipe. Backfilling pipeline trenches shall not begin under any circumstances until pipe has been verified for proper placement in the trench by the Inspector. This includes work not done during normal business hours.
- B. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least 18-inches above the pipe barrel. Layer depths shall be a maximum of 6-inches for pipe 18-inches in diameter and smaller, and a maximum of 12-inches for pipe larger than 18-inches in diameter.
- C. Backfill on both sides of the pipe simultaneously to prevent side pressures.
- D. Compact each layer thoroughly with suitable hand tools or tamping equipment.
- E. Initial backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless shown or specified otherwise.
- F. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.
- G. In areas where the trench is cut into rock or where suitable backfill is unavailable, crushed stone shall encase the pipe. Bedding shall be six inches of crushed stone with at least twelve inches of crushed stone backfill as determined by the Inspector. Initial backfill with crushed stone shall extend the full width of the excavated trench.

3.07 Concrete Encasement

- A. Where concrete encasement is shown on the Drawings, excavate the trench to provide a minimum width and depth of 24-inches plus the diameter of the casing pipe. Lay casing and carrier pipe to line and grade on concrete blocks. In lieu of bedding, haunching and initial backfill, place concrete to the full width of the trench and to a height of not less than 18-inches above the casing pipe. Do not backfill the trench for a period of at least 24 hours after concrete is placed.
- B. For pipes under structures, provide concrete backfill as specified in Section 02200.

3.08 Final Backfill

- A. Backfill carefully to restore the ground surface to its original condition.
- B. The top 6-inches shall be topsoil obtained as specified in Article 3.01 of this Section.

Trench Excavation and Backfill

- C. Excavated material that is unsuitable for backfilling, and excess material, shall be disposed of, at no additional cost to the Owner, in a manner approved by the Engineer. Surplus soil may be neatly distributed and spread over the site, if approved by the Engineer. If such spreading is allowed, the site shall be left in a clean and slightly condition and shall not affect pre-construction drainage patterns. Surplus rock from the trenching operations shall be removed from the site.
- D. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.
- E. After initial backfill material has been placed and compacted, backfill with final backfill material. The final backfill material may be shoveled into the trench without compacting, and heaped over whenever, in the opinion of the Engineer, this method of backfilling may be used without inconvenience to the public. Where street paving or shoulders are to be repaired, the Contractor will be required to tamp or paddle all backfill as described hereinafter or may be required to backfill the entire trench with crushed stone.
- F. Settlement: If the trench settles, re-fill and grade the surface to conform to the adjacent surfaces.
- G. Final backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless specified otherwise.

3.09 Backfill Under Roads

- A.
 - 1. Where the pipe is installed under current or future roadway paved surfaces, or where otherwise required by the Engineer, crushed stone backfill shall be placed in layers not exceeding six inches and firmly tamped into place by tampers or rammers. Mechanical tamping will be required on lines where street pavement is to be replaced immediately after the backfilling is completed. The Engineer may also require paddling where, in his opinion, it is necessary for proper compaction.
 - 2. In backfilling the pipeline trench in areas where the line is laid in the paved or graveled shoulder of a State Highway, all of the above requirements shall be met, including that of placing all backfill in the trench in six inch lifts and tamping all backfill. In addition, all backfill in such areas shall be chert or crushed stone.
 - 3. Open cut crossing of State Highways or paved city or county streets will be backfilled with compacted chert or crushed stone. Chert or crushed stone backfill will not be required unless otherwise directed by the Engineer where the lines are laid within the pavement or shoulder of a city or county street and are parallel to the direction of the street.
- B. Road Crossings

1. The Contractor shall familiarize himself with the requirements of the County or State Highway Department within whose rights-of-way the Contractor is working. The District will obtain and pay for any permit it is required to obtain to place the utility within the right-of-way and the Contractor, at its expense, shall secure any permit it is required to obtain to work within the right-of-way if such a permit is required. The Contractor shall pay for any insurance or bond to the amount and extent required by the highway department involved.
2. Crossing of County Roads will be open cut with permission of the County Highway Department. Depth of cover shall be four feet as measured from the top of the pipe at the crossing. Depth of cover shall be a minimum of 36-inches at ditch lines or at the toe of slope.
3. Pipe line crossings of U.S. and State of Tennessee Highway's and where otherwise directed by the Engineer, will be made by boring or jacking with a smooth wall steel casing pipe under the roadbed and inserting the pipe in the casing. Where boring is required, holes shall be bored under the highway at least four feet below the surface with no disturbance to the surface or as otherwise directed by the Engineer.
4. If approval by the State of Tennessee is obtained, open cutting of crossings may be permitted. Installations by open-trench methods shall comply with highway department specifications.

3.10 Backfill Along Restrained Joint Pipe

Backfill along restrained joint pipe shall be compacted to a minimum 90 percent of the maximum dry density.

3.11 Testing and Inspection

- A. If, in the opinion of the Engineer, compaction has not been sufficient, soil testing will be performed by an independent testing laboratory selected by the Owner. Payment for soil testing shall be made by the Contractor.
- B. The soils testing laboratory is responsible for the following:
 1. Compaction tests in accordance with Article 1.02 of this Section.
 2. Field density tests for each two feet of lift, one test for each 2,000 feet of pipe installed or more frequently if ordered by the Engineer.
 3. Inspecting and testing stripped site, subgrades and proposed fill materials.
- C. The Contractor's duties relative to testing include:
 1. Notifying laboratory of conditions requiring testing.
 2. Coordinating with laboratory for field testing.

Trench Excavation and Backfill

3. Paying costs for additional testing performed beyond the scope of that required and for re-testing where initial tests reveal non-conformance with specified requirements.
 4. Providing excavation as necessary for laboratory personnel to conduct tests.
- D. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this section.
- E. After initial backfill material has been placed and compacted, backfill with final backfill material. The backfill material may be shoveled into the trench without compacting, and heaped over whenever, in the opinion of the Engineer, this method of backfilling may be used without inconvenience to the public. Where street paving or shoulders are to be repaired, the Contractor will be required to tamp or puddle all backfill as described hereinafter or may be required to backfill the entire trench with crushed stone.
- F. Settlement: If trench settles, re-fill and grade the surface to conform to the adjacent surfaces.
- G. Final backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless specified otherwise.

END OF SECTION

Part 1 General

1.01 Scope

- A. The work covered by this Section includes furnishing all labor, materials and equipment required to bore and jack casings and to properly complete pipeline construction as described herein and/or shown on the Drawings.
- B. Supply all materials and perform all work in accordance with applicable American Society for Testing and Materials (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI) or other recognized standards. Latest revisions of all standards are applicable. If requested by the Engineer, submit evidence that manufacturer has consistently produced products of satisfactory quality and performance over a period of at least two years.

1.02 Submittals

- A. Submit shop drawings, product data and experience in accordance with WHUD requirements.
- B. Material Submittals: The Contractor shall provide shop drawings and other pertinent specifications and product data as follows:
 - 1. Shop drawings for casing pipe showing sizes and connection details.
 - 2. Design mixes for concrete and grout.
 - 3. Casing Spacers.
- C. Experience Submittals
 - 1. Boring and jacking casings is deemed to be specialty contractor work. If the Contractor elects to perform the work, the Contractor shall provide evidence as required by the General Conditions. A minimum of five continuous years of experience in steel casing construction is required of the casing installer. Evidence of this experience must be provided with the shop drawings for review by the Engineer.

1.03 Storage And Protection

All materials shall be stored and protected in accordance with the manufacturer's recommendations and as approved by the Engineer.

Part 2 Products

2.01 Materials and Construction

A. Casing

1. The casing shall be new and unused pipe. The casing shall be made from steel plate having a minimum yield strength of 35,000 psi. The steel plate shall also meet the chemical requirements of ASTM A 36.
2. The thicknesses of casing shown in paragraph B. below are minimum thicknesses. Actual thicknesses shall be determined by the casing installer, based on an evaluation of the required forces to be exerted on the casing when jacking. Any buckling of the casing due to jacking forces shall be repaired at no additional cost to the Owner.
3. The diameters of casing shown in paragraph B. below and shown on the Drawings are minimum. Larger casings, with the Engineer's approval, may be provided at no additional cost to the Owner, for whatever reasons the Contractor may decide, whether casing size availability, line and grade tolerances, soil conditions, etc.

B. Casing Sizes

UNDER RAILROADS		
Pipe Diameter, inches	Casing Diameter, inches	Wall Thickness, inches
		Uncoated
6	14	0.282
8	18	0.375
10	20	0.375
12	22	0.375
14	24	0.407
16	30	0.469
18	30	0.469
20	32	0.501
24	36	0.532
30	42	0.563

UNDER HIGHWAYS		
Pipe Diameter, inches	Casing Diameter, inches	Wall Thickness, inches
6	12	0.250
8	16	0.375
10	16	0.375
12	18	0.375
14	22	0.375
16	24	0.375
18	30	0.375
20	30	0.375
24	36	0.375
30	42	0.375

- C. Casing Spacers: Casing spacers shall meet one of the following requirements:
1. Casing spacers shall be flanged, bolt-on style with a two-section stainless steel shell lined with a PVC liner, minimum 0.09-inch thick also having a hardness of 85-90 durometer. Runners shall be attached to stainless steel risers which shall be properly welded to the shell. The height of the runners and risers shall be manufactured such that the pipe does not float within the casing. Casing spacers shall be Cascade Waterworks Manufacturing Company or Advanced Products & Systems, Inc.
 2. Casing spacers shall be a two-section, flanged, bolt on style constructed of heat fused PVC coated steel, minimum 14 gauge band and 10 gauge risers, with 2-inch wide glass reinforced polyester insulating skids, heavy duty PVC inner liner, minimum 0.09-inch thick having a hardness of 85-90 durometer, and all stainless steel or cadmium plated hardware shall be Pipeline Seal and Insulator, Inc.
- D. Grout: Grout and brick shall be used for filling the void between the end of the casing pipe and the carrier pipe. Cement shall conform to ASTM C 150, Type I or Type II. Grout shall have a minimum compressive strength of 100 psi attained within 24 hours.
- E. Carrier Pipe: Carrier pipes shall meet requirements as specified in Section 02665, 02730, or 2731 of these Specifications.
- F. Surface Settlement Markers: Surface settlement markers within pavement areas shall be P.K. nails. Surface settlement markers within non-paved areas shall be wooden hubs.

2.02 Equipment

- A. A cutting head shall be attached to a continuous auger mounted inside the casing pipe.
- B. The steering head shall be controlled manually from the bore pit. The grade indicator shall consist of a water level attached to the casing which indicates the elevation of the front end of the casing or some other means for grade indication approved by the Engineer.

Part 3 Execution

3.01 General

- A. Interpretation of soil investigation reports and data, investigating the site and determination of the site soil conditions prior to bidding are the sole responsibility of the Contractor. Any subsurface investigation by the Bidder or Contractor must be approved by the appropriate authority having jurisdiction over the site. Rock and/or water, if encountered, shall not entitle the Contractor to additional compensation.
- B. Casing construction shall be performed so as not to interfere with, interrupt or endanger roadway surface and activity thereon, and minimize subsidence of the surface, structures, and utilities above and in the vicinity of the casing. Support the ground continuously in a manner that will prevent loss of ground and keep the perimeters and face of the casing, passages and shafts stable. The Contractor shall be responsible for all settlement resulting from casing operations and shall repair and restore damaged property to its original or better condition at no cost to the Owner.
- C. Face Protection: The face of the excavation shall be protected from the collapse of the soil into the casing.
- D. Casing Design: Design of the bore pit and required bearing to resist jacking forces are the responsibility of the Contractor. The excavation method selected shall be compatible with expected ground conditions. The lengths of the casing shown on the Drawings are the minimum lengths required. The length of the casing may be extended for the convenience of the Contractor, at no additional cost to the Owner. Due to restrictive right-of-way and construction easements, boring and jacking casing lengths less than the nominal 20 foot length may be necessary.
- E. Highway Crossings
 - 1. The Contractor shall be held responsible and accountable for the coordinating and scheduling of all construction work within the highway right-of-way.
 - 2. Work along or across the highway department rights-of-way shall be subject to inspection by such highway department.

3. All installations shall be performed to leave free flows in drainage ditches, pipes, culverts or other surface drainage facilities of the highway, street or its connections.
4. No excavated material or equipment shall be placed on the pavement or shoulders of the roadway without the express approval of the highway department.
5. In no instance will the Contractor be permitted to leave equipment (trucks, backhoes, etc.) on the pavement or shoulder overnight. Construction materials to be installed, which are placed on the right-of-way in advance of construction, shall be placed in such a manner as not to interfere with the safe operation of the roadway.
6. The Contractor shall be responsible for providing the Owner sufficient information to obtain a blasting permit in a timely manner.
7. The Contractor shall be responsible for maintaining the executed copy of the bore permit from the appropriate authority at all times.

F. Railroad Crossings

1. The Contractor shall secure permission from the Railroad to schedule work so as not to interfere with the operation of the Railroad.
2. Additional insurance is required for each railroad crossing. The Contractor shall furnish the Railroad with such additional insurance as may be needed. Cost of the insurance shall be borne by the Contractor.
3. All work on the Railroad right-of-way, including necessary support of tracks, safety of operations and other standard and incidental operation procedures, may be under the supervision of the appropriate authorized representative of the Railroad affected, and any decisions of this representative pertaining to construction and/or operations shall be final and construction must be governed by such decisions.
4. If, in the opinion of the Railroad, it becomes necessary to provide flagging protection, watchmen or the performance of any other work in order to keep the tracks safe for traffic, the Contractor shall coordinate such work and shall reimburse the Railroad, in cash, for such services, in accordance with accounting procedures agreed on by the Contractor and affected Railroad before construction is started.
5. No blasting shall be permitted within the Railroad right-of-way. The Contractor shall be responsible for maintaining an executed copy of the bore permit from the appropriate authority at all times.

3.02 Groundwater Control

- A. The Contractor shall control the groundwater throughout the construction of the casing.
- B. Methods of dewatering shall be at the option and responsibility of the Contractor. Maintain close observation to detect settlement or displacement of surface facilities due to dewatering. Should settlement or displacement be detected, notify the Engineer immediately and take such action as necessary to maintain safe conditions and prevent damage.
- C. When water is encountered, provide and maintain a dewatering system of sufficient capacity to remove water on a 24 hour basis, keeping excavations free of water until the backfill operation is in progress. Dewatering shall be performed in such a manner that removal of soil particles is held to a minimum. Dewater into a sediment trap and comply with requirements specified in Section 02125 of these Specifications.

3.03 Surface Settlement Monitoring

- A. Provide surface settlement markers, placed as specified and as directed by the Engineer. The Contractor shall place settlement markers outside of pavement area, along the centerline of the casing at 20 foot intervals and offset 10 feet each way from the centerline of the tunnel. Markers shall also be placed at each shoulder of the roadway, at each edge of pavement, at the centerline of the pavement and at 10 and 25 feet in each direction from the centerline of the casing. Tie settlement markers to bench marks and indices sufficiently removed so as not to be affected by the casing operations.
- B. Make observations of surface settlement markers, placed as required herein, at regular time intervals acceptable to the Engineer. In the event settlement or heave on any marker exceeds 1-inch, the Contractor shall immediately cease work and, using a method approved by the Engineer and the authority having jurisdiction over the project site, take immediate action to restore surface elevations to that existing prior to start of casing operations.
- C. Take readings and permanently record surface elevations prior to start of dewatering operations and/or shaft excavation. The following schedule shall be used for obtaining and recording elevation readings: all settlement markers, once a week; all settlement markers within 50 feet of the casing heading, at the beginning of each day; more frequently at the Engineer's direction if settlement is identified. Make all elevation measurements to the nearest 0.01 foot.
- D. The Contractor shall cooperate fully with jurisdictional personnel. Any settlement shall be corrected by, and at the expense of, the Contractor.
- E. Promptly report any settlement and horizontal movement immediately to the Engineer and take immediate remedial action.

3.04 Boring and Jacking

A. Shaft

1. Conduct boring and jacking operations from a shaft excavated at one end of the section to be bored. Where conditions and accessibility are suitable, place the shaft on the downstream end of the bore.
2. The shaft shall be rectangular and excavated to a width and length required for ample working space. If necessary, sheet and shore shaft properly on all sides. Shaft sheeting shall be timber or steel piling of ample strength to safely withstand all structural loadings of whatever nature due to site and soil conditions. Keep preparations dry during all operations. Perform pumping operations as necessary.
3. The bottom of the shaft shall be firm and unyielding to form an adequate foundation upon which to work. In the event the shaft bottom is not stable, excavate to such additional depth as required and place a gravel sub-base or a concrete sub-base if directed by the Engineer due to soil conditions.

B. Jacking Rails and Frame

1. Set jacking rails to proper line and grade within the shaft. Secure rails in place to prevent settlement or movement during operations. The jacking rails shall cradle and hold the casing pipe on true line and grade during the progress of installing the casing.
2. Place backing between the heels of jacking rails and the rear of the shaft. The backing shall be adequate to withstand all jacking forces and loads.
3. The jacking frame shall be of adequate design for the magnitude of the job. Apply thrust to the end of the pipe in such a manner to impart a uniformly balanced load to the pipe barrel without damaging the joint ends of the pipe.

C. Boring and jacking of casing pipes shall be accomplished by the dry auger boring method without jetting, sluicing or wetboring.

D. Auger the hole and jack the casing through the soil simultaneously.

E. Bored installations shall have a bored-hole diameter essentially the same as the outside diameter of the casing pipe to be installed.

F. Execute boring ahead of the casing pipe with extreme care, commensurate with the rate of casing pipe penetration. Boring may proceed slightly in advance of the penetrating pipe and shall be made in such a manner to prevent any voids in the earth around the outside perimeter of the pipe. Make all investigations and determine if the soil conditions are such as to require the use of a shield.

G. As the casing is installed, check the horizontal and vertical alignment frequently. Make corrections prior to continuing operation. [For casing pipe installations over 100 feet in length, the auger shall be removed and the alignment and grade checked at minimum

Bore and Jack Casings

intervals of 60 feet.

- H. Any casing pipe damaged in jacking operations shall be repaired, if approved by the Engineer, or removed and replaced at Contractor's own expense.
- I. Lengths of casing pipe, as long as practical, shall be used, except as restricted otherwise. Joints between casing pipe sections shall be butt joints with complete joint penetration, single groove welds, for the entire joint circumference, in accordance with AWS recommended procedures. Prior to welding the joints, the Contractor shall ensure that both ends of the casing sections being welded are square.
- J. The Contractor shall prepare a contingency plan which will allow the use of a casing lubricant, such as bentonite, in the event excessive frictional forces jeopardize the successful completion of the casing installation.
- K. Once the jacking procedure has begun, it should be continued without stopping until completed, subject to weather and conditions beyond the control of the Contractor.
- L. Care shall be taken to ensure that casing pipe installed by boring and jacking method will be at the proper alignment and grade.
- M. The Contractor shall maintain and operate pumps and other necessary drainage system equipment to keep work dewatered at all times.
- N. Adequate sheeting, shoring and bracing for embankments, operating pits and other appurtenances shall be placed and maintained to ensure that work proceeds safely and expeditiously. Upon completion of the required work, the sheeting, shoring and bracing shall be left in place, cut off or removed, as designated by the Engineer.
- O. Trench excavation, all classes and type of excavation, the removal of rock, muck, debris, the excavation of all working pits and backfill requirements of Section 02225 are included under this Section.
- P. All surplus material shall be removed from the right-of-way and the excavation finished flush with the surrounding ground.
- Q. Grout backfill shall be used for unused holes or abandoned pipes.
- R. Any replacement of carrier pipe in an existing casing shall be considered a new installation, subject to the applicable requirements of these Specifications.

3.05 Ventilation and Air Quality

Provide, operate and maintain for the duration of casing project a ventilation system to meet all applicable safety and OSHA requirements.

3.06 Rock Excavation

- A. In the event that rock is encountered during the installation of the casing pipe which, in the opinion of the Engineer, cannot be removed through the casing, the Engineer may authorize the Contractor to complete the crossing using an alternate method at no additional cost to the Owner.
- B. At the Contractor's option, the Contractor may continue to install the casing and remove the rock through the casing at no additional cost to the Owner.

3.07 Installation of Pipe

- A. After construction of the casing is complete, and has been accepted by the Engineer, install the pipeline in accordance with the Drawings and Specifications.
- B. Check the alignment and grade of the casing and prepare a plan to set the pipe at proper alignment, grade and elevation, without any sags or high spots.
- C. The carrier pipe shall be held in the casing pipe by the following method:
 - 1. The pipe shall be supported within the casing by use of casing spacers sized to limit radial movement to a maximum of 1-inch. Provide a minimum of two casing spacers per nominal length of pipe with an interval no greater than seven linear feet between spacers. Casing spacers shall be attached to the pipe per the manufacturer's instructions.
- D. Carrier pipe shall be installed using locking gaskets as noted in Section 02665 Part 2.01 A.4 of these specifications.
- E. Close the ends of the casing with grout and brick.

3.08 Sheeting Removal

Remove sheeting used for shoring from the shaft and off the job site. The removal of sheeting, shoring and bracing shall be done in such a manner as not to endanger or damage either new or existing structures, private or public properties and also to avoid cave-ins or sliding in the banks.

3.09 Interstate Restoration

When boring and jacking operations encroach upon the right-of-ways of the federal interstate system, the Contractor shall restore all screening trees with seedlings of like species.

END OF SECTION

Removing and Replacing Pavement

Part 1 General

1.01 Scope

The work to be performed under this Section shall consist of removing and replacing existing pavement, sidewalks and curbs in paved areas where such have been removed for construction of water mains, fire hydrants, sewers, manholes, or any other water and sewer and utility appurtenances and structures.

1.02 Submittals

- A. Certificates: Provide certificates stating that materials supplied comply with Specifications. Certificates shall be signed by the asphalt producer and the Contractor.

1.03 Conditions

A. Weather Limitations

1. Do not conduct paving operations when surface is wet or contains excess moisture which would prevent uniform distribution and required penetration.
2. Construct prime and tack coats and asphaltic courses only when atmospheric temperature in the shade is above 50 degrees F, the underlying base is dry, and weather is not rainy.
3. Place base course when air temperature is above 35 degrees F and rising.

- B. Grade Control: Establish and maintain the required lines and grades for each course during construction operations.

Part 2 Products

2.01 Materials

- A. Mineral Aggregate Base Course: Mineral aggregate base course shall conform to the requirements of the Tennessee Department of Transportation Bureau of Highways Standard Specifications for Road and Bridge Construction, Section 303, Type A base.
- B. Bituminous Plant Mix Base (Hot Mix): The base of all paved roadways shall conform to the requirements of Section 307 of the Tennessee Department of Transportation Bureau of Highways Standard Specifications for Road and Bridge Construction.
- C. Bituminous Sand-Gravel Binder Course: The binder course of all paved roadways shall conform to the requirements of Section 409 of the Tennessee Department of Transportation Bureau of Highways Standard Specifications for Road and Bridge Construction.
- D. Asphaltic Concrete Surface (Hot Mix): The surface course for all pavement shall conform to the requirements of the Tennessee Department of Transportation Bureau of

Removing and Replacing Pavement

Highways Standard Specifications for Road and Bridge Construction, Section 411, Grading "E".

- E. Double Bituminous Surface Treatment: The surface for all pavements shall conform to the requirements of the Tennessee Department of Transportation Bureau of Highways Standard Specifications for Road and Bridge Construction, Section 404.
- F. Concrete: Provide concrete and reinforcing for concrete pavement or base courses in accordance with the requirements of the Tennessee Department of Transportation Bureau of Highways Standard Specifications for Road and Bridge Construction, Section 501.
- G. Special Surfaces: Where driveways or roadways are disturbed or damaged which are constructed of specialty type surfaces, e.g. brick or stone, these driveways and roadways shall be restored utilizing similar, if not original, materials. Where the nature of these surfaces dictate, a specialty contractor shall be used to restore the surfaces to their previous or better condition. Special surfaces shall be removed and replaced to the nearest construction joint.

2.02 Types of Pavements

- A. General: All existing pavement removed, destroyed or damaged by construction shall be replaced with the same type and thickness of pavement as that existing prior to construction, unless otherwise directed by the Engineer. Materials, equipment and construction methods used for paving work shall conform to the Tennessee Department of Transportation Bureau of Highways specifications applicable to the particular type required for replacement, repair or new pavements.
- B. Aggregate Base: Aggregate base shall be constructed in accordance with the requirements of Section 303, Type A base of the Tennessee Department of Transportation Bureau of Highways Standard Specifications for Road and Bridge Construction. Material shall be mixed and placed by the stationary plant method. If the finished compacted base course depth is 6-inches or more, the course shall be constructed in two or more layers of approximately equal thickness.
- C. Concrete Pavement: Concrete pavement or base courses shall be replaced with concrete. The surface finish of the replaced concrete pavement shall conform to that of the existing pavement. The surface of the replaced concrete base course shall be left rough. The slab depth shall be equivalent to the existing concrete pavement or base course, but in no case less than 6-inches thick. Transverse and longitudinal joints removed from concrete pavement shall be replaced at the same locations and to the same types and dimensions as those removed. Concrete pavements or concrete base courses shall be reinforced and shall conform to the Tennessee Department of Transportation Bureau of Highways Standard Specifications, Section 501.
- D. Asphalt Concrete Base, Binder and Surface Course: Asphalt concrete base, binder and surface course construction shall conform to the Tennessee Department of Transportation Bureau of Highways Standard Specifications, Section 307 for bituminous plant mix base course, Section 409 for bituminous sand-gravel binder course and Section 411, Grading "E" for asphalt concrete surface course. The

pavement mixture shall not be spread until the designated surface has been previously cleaned and prepared, is intact, compacted as specified herein, properly cured and dry, and the prime and/or tack coat has been applied. Apply and compact the asphalt concrete in maximum layer thickness by asphalt spreader equipment of design and operation approved by the Engineer. After compaction, the asphalt concrete shall be smooth and true to established profiles and sections. Immediately correct any high, low or defective areas by cutting out the course, replacing with fresh hot mix, and immediately compacting to conform and thoroughly bond to the surrounding area.

- E. Double Bituminous Surface Treatment: Double bituminous surface treatment shall be replaced with a minimum thickness of 1-inch conforming to Section 404 of the Tennessee Department of Transportation Bureau of Highways Standard Specifications. No bituminous surface shall be installed between October 15 and April 15, and only when the air and pavement temperatures in the shade are above 60 degrees F.
- F. Gravel Surfaces: Existing gravel road, drive and parking area replacement shall meet the requirements of aggregate base course. This surfacing may be authorized by the Engineer as a temporary surface for paved streets until replacement of hard surfaced pavement is authorized.
- G. Temporary Measures: During the time period between pavement removal and complete replacement of permanent pavement, maintain highways, streets and roadways by the use of steel running plates anchored to prevent movement. The backfill above the pipe shall be compacted, as specified elsewhere in these Specifications, up to the existing pavement surface to provide support for the steel running plates. All pavement shall be replaced within seven calendar days of its removal.

Part 3 Execution

3.01 Removing Pavement

- A. General: Remove existing pavement as necessary for installing the pipe line and appurtenances.
- B. Marking: Before removing any pavement, neatly mark the pavement paralleling pipe lines and existing street lines. Space the marks the width of the trench.
- C. Breaking: Break asphalt pavement along the marks using pavement shearing equipment, jack hammers or other suitable tools. Break concrete pavement along the marks by scoring with a rotary saw and breaking below the score by the use of jack hammers or other suitable tools.
- D. Machine Pulling: Do not pull pavement with machines until the pavement is completely broken and separated from pavement to remain.
- E. Damage to Adjacent Pavement: Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.

Removing and Replacing Pavement

- F. Damage to Traffic Signal Loops: Any pavement removal which will include removal of traffic signal loops embedded in the pavement shall be coordinated with the Traffic Engineering Department having jurisdiction over the traffic signal five days prior to pavement removal.
- G. Sidewalk: Remove and replace any sidewalks disturbed by construction for their full width and to the nearest undisturbed joint.
- H. Curbs: Tunnel under or remove and replace any curb disturbed by construction to the nearest undisturbed joint.

3.02 Replacing Pavement

- A. Preparation of Subgrade: During backfilling and compaction of the backfill, arrange to have the compaction tested by an independent testing laboratory. After compaction testing has been satisfactorily completed, replace all pavements, sidewalks and curbs removed.
 - 1. The existing street pavement or surface shall be removed along the lines of the work for the allowable width specified for the trench or structure. After the installation of the sewage or water works facilities and after the backfill has been compacted suitably, the additional width of pavement to be removed, as shown on the Drawings, shall be done immediately prior to replacing the pavement.
 - 2. Trench backfill shall be compacted for the full depth of the trench as specified in Section 02225 of these Specifications.
 - 3. Temporary trench backfill along streets and driveways shall include 6-inches of crushed stone or cherty clay as a temporary surfacing of the trenches. This temporary surface shall be maintained carefully at grade and dust-free by the Contractor until the backfill of the trench has thoroughly compacted in the opinion of the Engineer and permission is granted to replace the street pavement.
 - 4. When temporary crushed stone or chert surface is considered by the Engineer to be sufficient surface for gravel pavement, the surface shall be graded smooth and to an elevation that will make the final permanent surfacing level with the adjacent surfacing that was undisturbed.
- B. Pavement Replacement
 - 1. Prior to replacing pavement, make a final cut in concrete pavement 12-inches back from the edge of the damaged pavement with a concrete saw. Remove asphalt pavement 12-inches back from the edge of the damaged pavement, using pavement shearing equipment, jack hammers or other suitable tools.
 - 2. Replace all street and roadway pavement as shown on the Drawings. Replace driveways, sidewalks and curbs with the same material, to nearest existing undisturbed construction joint and to the same dimensions as those existing.

Removing and Replacing Pavement

3. If the temporary crushed stone or chert surface is to be replaced, the top 6-inches shall be removed and the crushed stone surfacing for unpaved streets or the base for the bituminous surface shall be placed.
 4. Following this preparation, the chert or crushed stone base shall be primed with a suitable bituminous material and surfaced with the proper type of bituminous surface treatment.
 5. Where the paved surface is to be replaced with asphaltic concrete pavement, concrete pavement or with a concrete base and a surface course, the temporary chert or crushed stone surface and any necessary backfill material, additional existing paving and new excavation shall be removed to the depth and width shown on the Drawings. All edges of the existing pavement shall be cut to a straight, vertical edge. Care shall be used to get a smooth joint between the old and new pavement and to produce an even surface on the completed street. Expansion joints, where applicable, shall be replaced in a manner equal to the original joint.
 6. Where driveways or roadways, constructed of specialty type surfaces, e.g. brick or stone, are disturbed or damaged, these driveways and roadways shall be restored utilizing similar materials. Where the nature of these surfaces dictate, a specialty contractor shall be used to restore the surfaces to their previous or better condition. Special surfaces shall be removed and replaced to the limits to which they were disturbed.
- C. Pavement Resurfacing
1. Certain areas to be resurfaced are specified or noted on the Drawings. Where pavement to be resurfaced has been damaged with potholes, the Contractor shall remove all existing loose pavement material and fill the hole with Bituminous Plant Mix Base, as specified, to the level of the existing pavement. After all pipe line installations are complete and existing pavement has been removed and replaced along the trench route, apply tack coat and surface course as specified.
 2. Resurfacing limits shall be perpendicular to the road centerline. The limits of resurfacing shall be 10 feet beyond the edge of the pavement replacement on the main road being resurfaced, and to the point of tangency of the pavement on the side streets.
- D. Pavement Striping: Pavement striping removed or paved over shall be replaced with the same type, dimension and material as original, unless directed otherwise by the Engineer.
- E. Traffic Signal Loops: The replacement or repair of all traffic signal loops removed or damaged during the removal and replacement of pavement shall be coordinated by the Contractor with the Traffic Engineering Department having jurisdiction over each traffic signal. The Contractor shall be responsible for payment of all fees associated with replacement or repair of traffic signal loops.

3.03 Sidewalk and Curb Replacement

A. Construction

1. Whenever sidewalks are removed or disturbed in connection with construction work, they shall be replaced to the original lines and grades in fully as good or better condition than which existed prior to the Contractor's operations. All concrete sidewalks and curbs shall be replaced with class "A" concrete. Other types of sidewalks, such as brick, stone, etc., shall be replaced with material removed during the progress of the work, in equally as good or better condition as the original.
2. Preformed joints shall be 1/2-inch thick, conforming to the latest edition of AASHTO M 59 for sidewalks and AASHTO M 123 for curbs.
3. Forms for sidewalks shall be of wood or metal, shall be straight and free from warp, and shall be of sufficient strength, when in place, to hold the concrete true to line and grade without springing or distorting.
4. Forms for curbs shall be metal and of an approved section. They shall be straight and free from distortions, showing no vertical variation greater than 1/8-inch in 10 feet and no lateral variation greater than 1/4-inch in 10 feet from the true plain surface on the vertical face of the form. Forms shall be of the full depth of the structure and constructed such to permit the inside forms to be securely fastened to the outside forms.
5. Securely hold forms in place true to the lines and grades indicated on the Drawings.
6. Wood forms may be used on sharp turns and for special sections, as approved by the Engineer. Where wooden forms are used, they shall be free from warp and shall be the nominal depth of the structure.
7. All mortar and dirt shall be removed from forms and all forms shall be thoroughly oiled or wetted before any concrete is deposited.

B. When a section is removed, the existing sidewalk or curb shall be cut to a neat line, perpendicular to both the centerline and the surface of the concrete slab. Existing concrete shall be cut along the nearest existing construction joints; if such joints do not exist, the cut shall be made at minimum distances shown on the Drawings.

C. Existing concrete sidewalks and curbs that have been cut and removed for construction purposes shall be replaced with the same width and surface as the portion removed. Sidewalks shall have a minimum uniform thickness of 4-1/2-inches. The new work shall be neatly jointed to the existing concrete so that the surface of the new work shall form an even, unbroken plane with the existing surfaces.

D. The subgrade shall be formed by excavating to a depth equal to the thickness of the concrete, plus 3-inches. Subgrade shall be of such width as to permit the proper installation and bracing of the forms. Subgrades shall be compacted by hand tamping

or rolling. Soft, yielding or unstable material shall be removed and backfilled with satisfactory material. Place 3-inches of porous crushed stone under all sidewalks and curbs and compact thoroughly, then finish to a smooth, unyielding surface at proper line, grade and cross section. Immediately prior to pouring concrete, the stone shall be thoroughly wetted, or the concrete shall be poured on a layer of heavy building paper.

E. Joint for Curbs

1. Joints shall be constructed as indicated on the Drawings and as specified. Construct joints true to line with their faces perpendicular to the surface of the structure and within 1/4-inch of their designated position.
2. Thoroughly spade and compact the concrete at the faces of all joints filling all voids.
3. Install expansion joint materials at the point of curve at all street returns. Install expansion joint material behind the curb at abutment to sidewalks and adjacent structures.
4. Place contraction joints every 10 feet along the length of the curbs and gutters. Form contraction joints using steel templates or division plates which conform to the cross section of the structure. Leave the templates in place until the concrete has set sufficiently to hold its shape, but remove them while the forms are still in place. Contraction joint templates or plates shall not extend below the top of the steel reinforcement or they shall be notched to permit the reinforcement to be continuous through the joint. Contraction joints shall be a minimum of 1-1/2-inches deep.

F. Expansion joints shall be required to replace any removed expansion joints or in new construction wherever shown on the Drawings. Expansion joints shall be true and even, shall present a satisfactory appearance, and shall extend to within 1/2-inch of the top of finished concrete surface.

G. Finishing

1. Strike off the surface with a template and finish the surface with a wood float using heavy pressure, after which, contraction joints shall be made and the surface finished with a wood float or steel trowel.
2. Finish the face of the curbs at the top and bottom with an approved finishing tool of the radius indicated on the Drawings.
3. Finish edges with an approved finishing tool having a 1/4-inch radius.
4. Provide a final broom finish by lightly combing with a stiff broom after troweling is complete.
5. The finished surface shall not vary more than 1/8-inch in 10 feet from the established grade.

Removing and Replacing Pavement

- H. Driveway and Sidewalk Ramp Openings
 - 1. Provide driveway openings of the widths and at the locations indicated on the Drawings and as directed by the Engineer.
 - 2. Provide sidewalk ramp openings as indicated on the Drawings, in conformance with the applicable regulations and as directed by the Engineer.
- I. Concrete shall be suitably protected from freezing and excessive heat. It shall be kept covered with burlap or other suitable material and kept wet until cured. Provide necessary barricades to protect the work. All damage caused by people, vehicles, animals, rain, the Contractor's operations and the like shall be repaired by the Contractor, at no additional expense to the Owner.

3.04 Maintenance

The Contractor shall maintain the surfaces of roadways built and pavements replaced until the acceptance of the Project. Maintenance shall include replacement, scraping, reshaping, wetting and rerolling as necessary to prevent raveling of the road material, the preservation of reasonably smooth surfaces and the repair of damaged or unsatisfactory surfaces, all to the satisfaction of the Engineer. Maintenance shall include sprinkling as may be necessary to abate dust from the gravel surfaces.

3.05 Supervision and Approval

- A. Pavement restoration shall meet the requirements of the regulatory agency responsible for the pavement. Obtain agency approval of pavement restorations before requesting final payment.
- B. Obtain the Engineer's approval of restoration of pavement, such as private roads and drives, that are not the responsibility of a regulatory agency.
- C. Complete pavement restoration as soon as possible after backfilling.
- D. Failure of Pavement: Should any pavement restoration or repairs fail or settle during the life of the Contract, including the bonded period, promptly restore or repair defects.

3.06 Cleaning

The Contractor shall remove all surplus excavation materials and debris from the street surfaces and rights-of-way and shall restore street, roadway or sidewalk surfacing to its original condition.

END OF SECTION

Part 1 General

1.01 Scope

- A. This Section describes products to be incorporated into the water mains and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.
- B. General: Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. Latest revisions of all standards are applicable.

1.02 Qualifications

If requested by the Engineer, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.

1.03 Submittals

Complete shop drawings and engineering data for all products shall be submitted to the Engineer a minimum of five working days prior to the pre-construction conference. A minimum of six full sets of manufacturer's data calling out make, model numbers, sizes and intended applications for the materials shall be delivered to the White House Utility District Offices for approval. An approved set of submittals will be returned to the Contractor and developer if requested at or prior to the preconstruction conference.

1.04 Transportation and Handling

- A. Unloading: Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification. Pipe handled on skids shall not be rolled or skidded against the pipe on the ground.
- B. Handling: Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front end loader. Do not use material damaged in handling. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior coatings or internal lining of the pipe.

1.05 Storage and Protection

- A. Store all pipe that cannot be distributed along the route. Make arrangements for the use of suitable storage areas.
- B. Stored materials shall be kept safe from damage. The interior of all pipe, fittings and

Water Mains and Accessories

other appurtenances shall be kept free from dirt or foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.

- C. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tier shall be kept off the ground on timbers, rails or concrete. Pipe in tiers shall be alternated: bell, plain end; bell, plain end. At least two rows of timbers shall be placed between tiers and chocks, affixed to each other in order to prevent movement. The timbers shall be large enough to prevent contact between the pipe in adjacent tiers.
- D. Stored mechanical and push-on joint gaskets shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.
- E. Mechanical-joint bolts shall be handled and stored in such a manner that will ensure proper use with respect to types and sizes.

1.06 Quality Assurance

- A. The manufacturer shall provide written certification to the Engineer that all products furnished comply with all applicable requirements of these Specifications.
- B. If ordered by the Engineer, each pipe manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe. This service will be furnished for a minimum of five days during initial pipe installation.

Part 2 Products

2.01 Piping Materials and Accessories

- A. Ductile Iron Pipe (DIP)
 - 1. Ductile iron pipe shall be manufactured in the U.S.A. in accordance with AWWA C151. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes will be as shown on the Drawings. All pipe shall have a minimum 350 psi rated working pressure, unless otherwise noted. Each pipe shall be subjected to a hydrostatic pressure test of at least 500 psi at the point of manufacture. The class or nominal thickness, net weight without lining, and casting period shall be clearly marked on each length of pipe. Additionally, the manufacturer's mark, country where cast, year in which the pipe was produced, and the letters "DI" or "Ductile" shall be cast or stamped on the pipe.
 - 2. Pipe shall be cement lined in accordance with AWWA C104. Pipe and fittings shall be furnished with a bituminous outside coating. Mechanical joint fittings may also be supplied with a fusion bonded epoxy coating. The epoxy coating shall be non-toxic, impart no taste to the water and conform to AWWA C550, latest revision.

3. Fittings shall be ductile iron mechanical joint conforming to ANSI/AWWA C153. Fittings shall have a working pressure rating of at least 350 psi and meet the current requirements for the manufacturer's standards. Fittings shown on the plans are intended to convey the general configuration, but the Contractor shall furnish all fittings required. All fittings shall be furnished with bituminous outside coating and the coating inside shall be cement lined in accordance with AWWA C104 or fusion bonded epoxy coating.
4. Joints
 - a. Unless shown or specified otherwise, joints shall be push-on or restrained joint type. Push-on joints shall conform to AWWA C111. Restrained pipe joints shall be made with locking gaskets using American "Fast-Grip" or an approved equal gasket, unless other products for restraint are mentioned in approved plans and specifications.
5. Flexible, restrained joint pipe shall have a wall thickness in accordance with Special Thickness Class 56. Joints shall be ball and socket type providing restraint and leaktight connections for up to 15 degrees of joint deflection. Flexible, restrained joint pipe shall be equal to American "FLEX-LOK", U.S. Pipe "USIFLEX", or Clow F-141. Appropriate transition pieces shall be utilized on each end of run of flexible joint pipe. All joint material required for proper installation shall be furnished by the pipe manufacturer.
6. Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

2.02 Valves

A. Gate Valves (GV)

1. 2-Inches in Diameter: Gate valves shall be iron bodied, heavy duty, non-rising stem, resilient wedge type. Valve ends shall be threaded. Valves shall have a minimum 200 psi working pressure for water (125 psi working pressure for steam). Valves shall be made in the U.S.A. Gate valves shall be equal to M & H, Mueller, American Flow Control, or U.S. Pipe.
2. 4-Inches Through 16-Inches in Diameter: Gate valves 4-inches through 12-inches shall be resilient wedge type conforming to the requirements of AWWA C515 rated for 200 psi working pressure.
 - a. Valves shall be provided with two O-ring stem seals with one O-ring located above and one O-ring below the stem collar. The area between the O-rings shall be filled with lubricant to provide lubrication to the thrust collar bearing surfaces each time the valve is operated. At least one anti-friction washer shall be utilized to further minimize operating torque. All seals between valve parts, such as body and bonnet, bonnet and

bonnet cover, shall be flat gaskets or O-rings.

- b. The valve gate shall be made of cast iron or ductile iron having a vulcanized, synthetic rubber coating, or a seat ring attached to the disc with retaining screws. Sliding of the rubber on the seating surfaces to compress the rubber will not be allowed. The design shall be such that compression-set of the rubber shall not affect the ability of the valve to seal when pressure is applied to either side of the gate. The sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.
- c. All internal ferrous surfaces shall be coated with fusion bonded epoxy to a minimum thickness of 4 mils. The epoxy shall be non-toxic, impart no taste to the water and shall conform to AWWA C550, latest revision.
- d. Gate valves 4 through 16-inches shall be manufactured by Mueller, M & H Valve, American Flow Control, or U.S. Pipe.

B. Butterfly Valves (BV)

1. Butterfly valves shall be resilient seated, short body design, and shall be designed, manufactured, and tested in accordance with all requirements of AWWA C504 for Class 150B.
2. Where butterfly valves are indicated on the Drawings to be 250 pound valves, butterfly valves shall be resilient seated, short body design, and shall be designed, manufactured, and tested in accordance with all requirements of AWWA C504, and as modified below. Valves shall be designed for a rated working pressure of 250 psi. Class B, AWWA C504 Section 5.2 testing requirements are modified as follows:
 - a. the leakage test shall be performed at a pressure of 250 psi;
 - b. the hydrostatic test shall be performed at a pressure of 500 psi; and
 - c. proof of design tests shall be performed and certification of such proof of design test shall be provided to the Engineer.
3. Valve bodies shall be ductile iron conforming to ASTM A 536, Grade 65-45-12 or ASTM A 126, Grade B cast iron. Shafts shall be ASTM A 276, Type 304 stainless steel, machined and polished. Valve discs shall be ductile iron, ASTM A 536, Grade 65-45-12 or ASTM A 126, Grade B cast iron. The resilient valve seat shall be located in the valve body and shall be fully field adjustable and field replaceable.
4. Where butterfly valves are indicated on the Drawings to be 250 pound valves, bodies shall be ductile iron conforming to ASTM A 536, Grade 65-45-12 or ASTM A 126, Grade B cast iron. Shafts and shaft hardware shall be ASTM A 564, Type 630 stainless steel, machined and polished. Valve discs shall be ductile iron,

ASTM A 536, Grade 65-45-12. The valve shall have a resilient seat as noted above.

5. Valves shall be installed with the valve shafts horizontal. Valves and actuators shall have seals on all shafts and gaskets on valve actuator covers to prevent the entry of water. Actuator mounting brackets shall be totally enclosed and shall have gasket seals.
6. Actuators
 - a. Valves shall be equipped with traveling nut, self-locking type actuators designed, manufactured and tested in accordance with AWWA C504. Actuators shall be capable of holding the disc in any position between full open and full closed without any movement or fluttering of the disc.
 - b. Actuators shall be furnished with fully adjustable mechanical stop-limiting devices. Actuators that utilize the sides of the actuator housing to limit disc travel are unacceptable.
 - c. Valve actuators shall be capable of withstanding a minimum of 450 foot pounds of input torque in either the open or closed position without damage.
7. Operators: Valves for buried service shall have a nut type operator and shall be equipped with a valve box and stem extension, as required.
8. Valve ends shall be mechanical joint type, except where flanged or restrained joint ends are shown. Flange joints shall meet the requirements of ANSI B16.1, class 125.
9. Butterfly valves shall be manufactured by Pratt or equal.

2.03 Fire Hydrants

- A. All fire hydrants shall conform to the requirements of AWWA C502 for 150 psi working pressure. Hydrants shall be the compression type, closing with line pressure. The valve opening shall not be less than 4-1/2-inches.
- B. In the event of a traffic accident, the hydrant barrel shall break away from the standpipe at a point above grade and in a manner that will prevent damage to the barrel and stem, preclude opening of the valve, and permit rapid and inexpensive restoration without digging or cutting off the water.
- C. The means for attaching the barrel to the standpipe shall permit facing the hydrant a minimum of eight different directions.
- D. Hydrants shall be fully bronze mounted with all working parts of bronze. Valve seat ring shall be bronze and shall screw into a bronze retainer.

Water Mains and Accessories

- E. All working parts, including the seat ring, shall be removable through the top without disturbing the barrel of the hydrant.
- F. The operating nut shall be 1-1/2-inch pentagon shaped. Hydrants shall open counterclockwise. The operating threads shall be totally enclosed in an operating chamber, separated from the hydrant barrel by a rubber O-ring stem seal and lubricated by a grease or an oil reservoir. All hydrants shall be furnished with a McGard brand Intimidator Hydrant Lock for the operating nut.
- G. Hydrant shall be a non-freezing design and be provided with a simple, positive, and automatic drain which shall be fully closed whenever the main valve is opened.
- H. Hose and pumper connections shall be breech-locked, pinned, or threaded and pinned to seal them into the hydrant barrel. Each hydrant shall have two 2-1/2-inch hose connections and one 4-1/2-inch pumper connection, all with National Standard threads and each equipped with cap and non-kinking chain.
- I. Hydrants shall be furnished with a mechanical joint connection to the spigot of the 6-inch hydrant lead.
- J. Minimum depth of bury shall be 3.5 feet. Provide extension section where necessary for proper vertical installation and in accordance with manufacturer's recommendations.
- K. All outside surfaces of the barrel above grade shall be painted with enamel equal to Koppers Glamortex 501 "Fire Hydrant Red".
- L. Hydrants shall be traffic model and shall be Mueller A-421 or M & H Valve 129.

2.04 Valve Boxes and Extension Stems

- A. All valves shall be equipped with valve boxes. The valve boxes shall be cast iron two-piece screw type with drop covers. Valve boxes shall have a 5.25-inch inside diameter. Valve box covers shall weigh a minimum of 13 pounds. The valve boxes shall be adjustable to 24-inches up or down from the nominal required cover over the pipe. Valve boxes shall be of sufficient length so that bottom flange of the lower belled portion of the box is below the valve operating nut. Ductile or cast iron extensions shall be provided as necessary. Covers shall have "WATER VALVE" or "WATER" cast into them.
- B. All valves shall be furnished with extension stems, as necessary, to bring the operating nut to within 30-inches of the top of the valve box. Connection to the valve shall be with a wrench nut coupling and a set screw to secure the coupling to the valve's operating nut. The coupling and square wrench nut shall be welded to the extension stem. Extension stems shall be equal to Mueller A-26441 or M & H Valve Style 3801.

2.05 Valve Markers (Vm)

Valve markers will be required on an as needed basis and will be shown on the

Drawings.

2.06 Tapping Sleeves and Valves (TS&V)

- A. Tapping Sleeves of fabricated carbon steel manufacture, such as the Ford FTS model or equal and mechanical joint tapping sleeves that are epoxy coated, are acceptable for tapping pipes of all diameters. For pipe diameters 10" and smaller, tapping sleeves may be the stainless steel wrap around type with a carbon steel flange, unless otherwise noted on drawings. Acceptable models for stainless steel wrap type around are the Ford Fast or equal. The Contractor shall be responsible for determining the outside diameter and type of the pipe to be connected to prior to ordering the sleeve.
- B. Valves shall be true tapping valves made for tapping sleeves. Ordinary flange by mechanical joint valves will not be accepted. Sleeve and valve must be air pressure tested before tap is made. Valves shall be gate valves furnished in accordance with the specifications shown above, with flanged connection to the tapping sleeve and mechanical joint connection to the branch pipe.
- C. The tapping valve is to be supplied with a three piece valve box and two inch square operating nut.

2.07 Corporation Cocks and Curb Stops

Corporation cocks and curb stops shall be ground key type, shall be made of bronze conforming to ASTM B 61 or B 62, and shall be suitable for the working pressure of the system. Ends shall be suitable for grip type joint. Threaded ends for inlet and outlet of corporation cocks shall conform to AWWA C800. Corporation cocks and curb stops shall be manufactured by Mueller, Ford, and McDonald.

2.08 Air Valves

- A. Air release valves shall be Model S-050 for 1" and ¾" or D-040 for 2" as manufactured by ARI Flow Control Accessories. The valve inlet diameter shall be specified in the plans. The valve shall be suitable for use in lines having a maximum water pressure of 200 psig.

2.09 Blowoff Hydrants

- A. Blow Off Hydrant: Blow-off hydrant shall be the Model #7500 Mainguard Hydrant manufactured by the Kupferle Foundry Company or approved equal.
- B. Where required, auto-flushing hydrants shall be manufactured by Hydro-Guard.

2.10 Precast Concrete Products (Meter Vaults only)

Water Mains and Accessories

- A. Provide precast concrete products in accordance with the following:
1. Precast Concrete Sections
 - a. Precast concrete sections shall meet the requirements of ASTM C 478. The minimum compressive strength of the concrete in precast sections shall be 4,000 psi. The minimum wall thickness shall be one-twelfth of the inside diameter of the base, riser or the largest cone diameter.
 - b. Transition slabs which convert bases larger than four feet in diameter to four foot diameter risers shall be designed by the precast concrete manufacturer to carry the live and dead loads exerted on the slab.
 - c. Seal joints between precast sections by means of rubber O-ring gaskets or flexible butyl rubber sealant. Butyl rubber sealants shall meet the requirements of AASHTO M-198. Sealant shall be pre-formed type with a minimum nominal diameter of 1-inch.
 - d. Butyl rubber sealant shall be equal to Kent Seal No. 2 or Concrete Sealants CS 202.
 2. Iron Castings
 - a. Cast iron manhole frames, covers and steps shall meet the requirements of ASTM A 48 for Class 30 gray iron and all applicable local standards. All castings shall be tough, close grained, smooth and free from blow holes, blisters, shrinkage, strains, cracks, cold shots and other imperfections. No casting will be accepted that weighs less than 95 percent of the design weight. Shop drawings must indicate the design weight and provide sufficient dimensions to permit checking. All castings shall be thoroughly cleaned in the shop and given two coats of approved bituminous paint before rusting begins.
 3. Plastic Steps: Manhole steps of polypropylene, molded around a steel rod, equal to products of M.A. Industries may be used.
 4. Floor Door
 - a. Door shall be single or double leaf type as shown on the Drawings.
 - b. The frame shall be ¼-inch extruded aluminum alloy 6063-T6, with built-in neoprene cushion and with strap anchors bolted to the exterior. Door leaf shall be ¼-inch aluminum diamond plate, alloy 6061-T6, reinforced with aluminum stiffeners as required. Stainless steel hinges shall be bolted to the underside and pivot on torsion bars that counterbalance the door for easy operation. The door shall open to 90 degrees and lock automatically in that position. A vinyl grip handle shall be provided to release the cover for closing. The door shall be built to withstand a live load of 300 pounds per square foot, and shall be equipped with a snap lock and removable handle. Bituminous coating shall be applied to exterior of frame by the

manufacturer. The door shall also be provided with a hasp in addition to the built-in locking mechanism.

- c. The floor door shall be by The Bilco Company or Thompson Fabricating LLC or approved equal.

2.11 Mechanical Joint Restraint

All mechanical joint fittings, valves and hydrants shall include mechanical joint restraints. Additionally, all mechanical joint fittings subject to thrust shall be restrained with concrete thrust blocks as shown in Drawing STD-W-06. Mechanical joint restraints shall be Megalug Series 1100, as manufactured by EBAA Iron, Uni-Flange Series 1400, as manufactured by Ford Meter Box Company, or Sigma.

2.12 Concrete

Concrete shall have a compressive strength of not less than 3500 psi, with not less than six bags of Portland cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the Engineer. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

Part 3 Execution

3.01 Existing Utilities and Obstructions

- A. The Drawings indicate utilities or obstructions that are known to exist according to the best information available to the Owner. The Contractor shall call the Tennessee One Call System, Inc. (1-800-351-1111) as required by the Tennessee Law "Underground Utility Damage Prevention Act" (Code Section 65-31-106) and all utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site at least 72 hours or three business days whichever is longer prior to construction to verify the location of the existing utilities.
 - 1. The exact location of existing water lines shown on any White House Utility drawings or any other plans is not guaranteed and White House Utility District is not responsible for any inaccuracies. Arrangements must be made through Tennessee One Call to have water lines marked. It may at some times be necessary to excavate in order to determine exact line locations. Arrangements should be made through the Inspector to have this done by District employees. Please allow as much time as possible for this work to be scheduled.
- B. Existing Utility Location: The following steps shall be exercised to avoid interruption of existing utility service.

Water Mains and Accessories

1. Provide the required notice to the utility owners and allow them to locate their facilities according to Tennessee law. Field utility locations are valid for only 10 days after original notice. The Contractor shall ensure, at the time of any excavation, that a valid utility location exists at the point of excavation.
 2. Expose the facility, for a distance of at least 200 feet in advance of pipeline construction, to verify its true location and grade. Repair, or have repaired, any damage to utilities resulting from locating or exposing their true location.
 3. Avoid utility damage and interruption by protection with means and methods recommended by the utility owner.
 4. Maintain a log identifying when phone calls were made, who was called, area for which utility relocation was requested and work order number issued, if any. The Contractor shall provide the Engineer an updated copy of the log bi-weekly, or more frequently if required.
- C. Conflict with Existing Utilities
1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed water main does not permit safe installation of the water main by the use of sheeting, shoring, tying-back, supporting, or temporarily suspending service of the parallel or crossing facility. The Contractor may change the proposed alignment of the water main to avoid horizontal conflicts if the new alignment remains within the available right-of-way or easement, complies with regulatory agency requirements and after a written request to and subsequent approval by the Engineer. Where such relocation of the water main is denied by the Engineer, the Contractor shall arrange to have the utility, main, or service relocated.
 2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed water main does not permit the crossing without immediate or potential future damage to the utility, main, service, or the water main. The Contractor may change the proposed grade of the water main to avoid vertical conflicts if the changed grade maintains adequate cover and complies with regulatory agencies requirements after written request to and subsequent approval by the Engineer. Where such relocation of the water main is denied by the Engineer, the Contractor shall arrange to have the utility, main, or service relocated.
- D. Electronic Locator: Have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipe lines or other obstructions.
- E. Water and Sewer Separation

Waterlines should maintain a minimum ten foot edge-to-edge separation from sewer lines. Where the water main crosses a sewer, an 18-inch vertical separation shall be maintained where possible. Where possible, a full joint of water pipe shall be centered

over the sewer line. Any deviation shall be requested in writing in advance by the Engineer.

3.02 Construction Along Highways, Streets and Roadways

- A. Install pipe lines and appurtenances along highways, streets and roadways in accordance with the applicable regulations of, and permits issued by, the applicable agency.
- B. Traffic Control
 1. The Contractor shall at his own expense provide, erect and maintain all necessary barricades, suitable and sufficient lights and other traffic control devices; provide qualified flagmen where necessary to direct traffic and take all necessary precautions for the protection of the work and the safety of the public.
 2. Construction traffic control devices and their installation shall be in accordance with the current Manual On Uniform Traffic Control Devices for Streets and Highways published by the US Department of Transportation, Federal Highway Administration.
 3. Placement and removal of construction traffic control devices shall be coordinated with the applicable regulatory agencies at least 48 hours in advance of the activity.
 4. Placement of construction traffic control devices shall be scheduled ahead of associated construction activities. Construction in street right-of-way shall be conducted to minimize the length of time traffic is disrupted. Construction traffic control devices shall be removed immediately following their useful purpose. Traffic control devices used intermittently, such as "Flagmen Ahead", shall be removed and replaced when needed.
 5. Existing traffic control devices within the construction work zone shall be protected from damage. Traffic control devices requiring temporary relocation shall be located as near as possible to their original vertical and horizontal locations. Original locations shall be measured from reference points and recorded in a log prior to relocation. Temporary locations shall provide the same visibility to affected traffic as the original location. Relocated traffic control devices shall be reinstalled in their original locations as soon as practical following construction.
 6. Construction traffic control devices shall be maintained in good repair and shall be clean and visible to affected traffic for daytime and nighttime operation. Traffic control devices affected by the construction work zone shall be inspected daily.
 7. Construction warning signs shall be black legend on an orange background. Regulatory signs shall be black legend on a white background. Construction sign panels shall meet the minimum reflective requirements of the Department of Transportation and the County. Sign panels shall be of durable materials

Water Mains and Accessories

capable of maintaining their color, reflective character and legibility during the period of construction.

8. Channelization devices shall be positioned preceding an obstruction at a taper length as required by the current Manual On Uniform Traffic Control Devices for Streets and Highways, and as appropriate for the speed limit at that location. Channelization devices shall be patrolled to insure that they are maintained in the proper position throughout their period of use.

C. Construction Operations

1. Perform all work along highways, streets and roadways in a manner to minimize interference with traffic.
2. Stripping: Where the pipe line is laid along road right-of-way, strip and stockpile all sod, topsoil and other material suitable for right-of-way restoration.
3. Trenching, Laying and Backfilling: Do not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day.
4. Shaping: Reshape damaged slopes, side ditches, and ditch lines immediately after completing backfilling operations. Replace topsoil, sod and any other materials removed from shoulders.

- D. Excavated Materials: Do not place excavated material along highways, streets and roadways in a manner that obstructs traffic. Sweep all scattered excavated material off of the pavement in a timely manner.

- E. Drainage Structures: Keep all side ditches, culverts, cross drains, and other drainage structures clear of excavated material. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.

- F. Landscaping Features: Landscaping features shall include, but are not necessarily limited to: fences; property corners; cultivated trees and shrubbery; manmade improvements; subdivision and other signs within the right-of-way and easement. The Contractor shall take extreme care in moving landscape features and promptly re-establishing these features.

G. Maintaining Highways, Streets, Roadways and Driveways

1. Maintain streets, highways, roadways and driveways in suitable condition for movement of traffic until completion and final acceptance of the Work.
2. During the time period between pavement removal and completing permanent pavement replacement, maintain highways, streets and roadways by the use of steel running plates. Running plate edges shall have asphalt placed around their periphery to minimize vehicular impact. The backfill above the pipe shall be

compacted as specified elsewhere herein up to the existing pavement surface to provide support for the steel running plates.

3. Furnish a road grader or front-end loader for maintaining highways, streets, and roadways. The grader or front-end loader shall be available at all times.
4. Immediately repair all driveways that are cut or damaged. Maintain them in a suitable condition for use until completion and final acceptance of the Work.

3.03 Pipe Distribution

- A. Pipe shall be distributed and placed in such a manner as will not interfere with traffic.
- B. No pipe shall be strung further along the route than 500 feet beyond the area in which the Contractor is actually working without, written permission from the Owner. The Owner reserves the right to reduce this distance to a maximum distance of 200 feet in residential and commercial areas based on the effects of the distribution to the adjacent property owners.
- C. No street or roadway may be closed for unloading of pipe without first obtaining permission from the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along highways, streets and roadways upon which pipe is distributed.
- D. No distributed pipe shall be placed inside drainage ditches.
- E. Distributed pipe shall be placed as far as possible from the roadway pavement, but no closer than five feet from the roadway pavement, as measured edge-to-edge.

3.04 Location and Grade

- A. The Drawings show the alignment of the water main and the location of valves, hydrants and other appurtenances.
- B. Construction Staking
 1. The base lines for locating the principal components of the work and a bench mark adjacent to the work are shown on the Drawings. Base lines shall be defined as the line to which the location of the water main is referenced, i.e., edge of pavement, road centerline, property line, right-of-way or survey line. The Contractor shall be responsible for performing all survey work required for constructing the water main, including the establishment of base lines and any detail surveys needed for construction. This work shall include the staking out of permanent and temporary easements to insure that the Contractor is not deviating from the designated easements.
 2. The level of detail of survey required shall be that which the correct location of the water main can be established for construction and verified by the Engineer. Where the location of components of the water main, e.g. tunnels and fittings, are

Water Mains and Accessories

not dimensioned, the establishment on the location of these components shall be based upon scaling these locations from the Drawings with relation to readily identifiable land marks, e.g., survey reference points, power poles, manholes, etc.

C. Reference Points

1. The Contractor shall take all precautions necessary, which includes, but is not necessarily limited to, installing reference points, in order to protect and preserve the centerline or baseline established by the Engineer.
2. Reference points shall be placed, at or no more than three feet, from the outside of the construction easement or right-of-way. The location of the reference points shall be recorded in a log with a copy provided to the Engineer for use, prior to verifying reference point locations. Distances between reference points and the manhole centerlines shall be accurately measured to 0.01 foot.
3. The Contractor shall give the Engineer reasonable notice that reference points are set. The reference point locations must be verified by the Engineer prior to commencing clearing and grubbing operations.

D. After the Contractor locates and marks the water main centerline or baseline, the Contractor shall perform clearing and grubbing.

E. Construction shall begin at a connection location and proceed without interruption. Multiple construction sites shall not be permitted without written authorization from the Engineer for each site.

F. The Contractor shall be responsible for any damage done to reference points, base lines, center lines and temporary bench marks, and shall be responsible for the cost of re-establishment of reference points, base lines, center lines and temporary bench marks as a result of the operations.

3.05 Laying and Jointing Pipe and Accessories

A. Lay all pipe and fittings to accurately conform to the lines and grades established by the Engineer.

B. Pipe Installation

1. Proper implements, tools and facilities shall be provided for the safe performance of the Work. All pipe, fittings, valves and hydrants shall be lowered carefully into the trench by means of slings, ropes or other suitable tools or equipment in such a manner as to prevent damage to water main materials and protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench.
2. All pipe, fittings, valves, hydrants and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective

materials shall be marked and held for inspection by the Engineer, who may prescribe corrective repairs or reject the materials.

3. All lumps, blisters and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit and any foreign materials before the pipe is laid. No pipe containing dirt shall be laid.
4. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing or other materials shall be placed in the pipe at any time.
5. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.
6. It is not mandatory to lay pipe with the bells facing the direction in which work is progressing.
7. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted.
8. Unless specifically directed otherwise by the Engineer or unless required to uncover or determine the presence of underground obstructions, not more than three hundred feet of trench shall be opened ahead of the pipe laying, and no more than four hundred feet of open ditch shall be left behind the pipe laying.

C. Alignment and Gradient

1. Lay pipe straight in alignment and gradient or follow true curves as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer or 3 degrees, whichever is the least angle.
2. Maintain a transit, level and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.

- D. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill the end of an uncompleted pipe or accessory, close the end with a suitable plug. (either push-on, mechanical joint, restrained joint or as approved by the Engineer) All open ends of unfinished pipe lines shall be securely plugged or closed with a plug or cap, manufactured for such an application, at the end of each work day or when a line is to be left open for an extended time.

E. Joint Assembly

1. Push-on, mechanical, flange and restrained type joints shall be assembled in accordance with the manufacturer's recommendations.

Water Mains and Accessories

2. The Contractor shall inspect each pipe joint within 1,000 feet on either side of main line valves to insure 100 percent seating of the pipe spigot, except as noted otherwise.
 3. Each restrained joint shall be inspected by the Contractor to ensure that it has been "homed" 100 percent.
 4. The Contractor shall internally inspect each pipe joint to insure proper assembly for pipe 24-inches in diameter and larger after the pipe has been brought to final alignment.
- F. Cutting Pipe: Cut ductile iron pipe using an abrasive wheel saw. Remove all burrs and smooth the end before jointing. The Contractor shall cut the pipe the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, valves, accessories and closure pieces in the correct location. Only push-on or mechanical joint pipe shall be cut.
- G. Valve and Fitting Installation
1. Prior to installation, valves shall be inspected for direction of opening, number of turns to open, freedom of operation, tightness of pressure-containing bolting and test plugs, cleanliness of valve ports and, especially, seating surfaces, and handling damage and cracks. Defective valves shall be corrected or held for inspection by the Engineer. Valves shall be closed before being installed.
 2. Valves, fittings, plugs and caps shall be set and joined to the pipe in the manner specified in this Section for cleaning, laying and joining pipe, except that 12-inch and larger valves shall be provided with special support, such as treated timbers, crushed stone, concrete pads or a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve. Valves shall be installed in the closed position.
 3. A valve box shall be provided on each underground valve. They shall be carefully set, centered exactly over the operating nut and truly plumbed. The valve box shall not transmit shock or stress to the valve. The bottom flange of the lower belled portion of the box shall be placed below the valve operating nut. This flange shall be set on brick, so arranged that the weight of the valve box and superimposed loads will bear on the base and not on the valve or pipe. Extension stems shall be installed where depth of burial places the operating nut in excess of 30-inches beneath finished grade so as to set the top of the operating nut 30-inches below finished grade. The valve box cover shall be flush with the surface of the finished area or such other level as directed by the Engineer. The valve box shall be set vertically and properly adjusted so that the cover shall be in the same plane as the finished surface of the ground or street. Valve box must permit easy operation of the valve with a standard valve wrench. Care should be taken to keep valve box free of gravel, dirt and debris and to avoid deflection of valve box. An 18-inch by 18-inch pad of Class "C" concrete four inches thick shall be poured around the valve box flush with its top.

4. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.
5. In no case shall valves be installed in a roadway.

H. Hydrant Installation

1. Prior to installation, inspect all hydrants for direction of opening, nozzle threading, operating nut and cap nut dimensions, tightness of pressure-containing bolting, cleanliness of inlet elbow, handling damage and cracks. Defective hydrants shall be corrected or held by Contractor for inspection by the Engineer.
2. All hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the roadway, with pumper nozzle facing the roadway, except that hydrants having two-hose nozzles 90 degrees apart shall be set with each nozzle facing the roadway at an angle of 45 degrees.
3. Hydrants shall be set to the established grade, with the centerline of the lowest nozzle at least 12-inches above the ground or as directed by the Engineer.
4. Each hydrant shall be connected to the main with a 6-inch branch controlled by an independent 6-inch valve. When a hydrant is set in soil that is pervious, drainage shall be provided at the base of the hydrant by placing coarse gravel or crushed stone mixed with coarse sand from the bottom of the trench to at least 6-inches above the drain port opening in the hydrant to a distance of 12-inches around the elbow.
5. When a hydrant is set in clay or other impervious soil, a drainage pit 2 x 2 x 2 feet shall be excavated below each hydrant and filled with coarse gravel or crushed stone mixed with coarse sand under and around the elbow of the hydrant and to a level of 6-inches above the drain port.
6. Hydrant, valve and tee shall be restrained using mechanical joint restraints. Hydrants shall be additionally restrained with a concrete thrust block behind the shoe.
7. Hydrants shall be located as shown on the Drawings or as directed by the Engineer. In the case of hydrants that are intended to fail at the ground-line joint upon vehicle impact, specific care must be taken to provide adequate soil resistance to avoid transmitting shock moment to the lower barrel and inlet connection. In loose or poor load bearing soil, this may be accomplished by pouring a concrete collar approximately 6-inches thick to a diameter of 24-inches at or near the ground line around the hydrant barrel.

I. Air Valve Vaults

Air release valves and vaults shall be installed on water lines at all high points as shown on the Drawings. The exact location of air release valves shall be determined in the field by the Engineer or the WHUD Inspector. Pits shall be as shown on the

Water Mains and Accessories

plans complete with box or vault, connecting brass piping, cutoffs, blow-offs and all accessories.

J. **Blow-off and Auto-Flushing Hydrant Installation**

1. Construct blow-off and Auto-Flushing hydrant as detailed on the Drawings.

3.06 Connections to Water Mains

A. Make connections to existing pipe lines with tapping sleeves and valves or saddle, unless specifically shown otherwise on the Drawings.

B. Location: Before laying pipe, locate the points of connection to existing water mains and uncover as necessary for the Engineer to confirm the nature of the connection to be made.

C. Interruption of Service: Make connections to existing water mains only when system operations permit.

D. **Tapping Saddles and Tapping Sleeves**

1. Holes in the new pipe shall be machine cut, either in the field or at the factory. No torch cutting of holes shall be permitted.
2. Prior to attaching the saddle or sleeve, the pipe shall be thoroughly cleaned, utilizing a brush and rag, as required.
3. Before performing field machine cut, the watertightness of the saddle or sleeve assembly shall be pressure tested. A compressed air supply shall be attached, which will induce a test pressure to be determined at the preconstruction conference. No leakage shall be permitted for a period of five minutes.
4. After attaching the saddle or sleeve to an existing main, but prior to making the tap, the interior of the assembly shall be disinfected. All surfaces to be exposed to potable water shall be swabbed or sprayed with a one percent hypochlorite solution.

3.07 Thrust Restraint

A. Provide restraint at all points where hydraulic thrust may develop. All tees, valves, angles or bends in the pipe lines, either vertical or horizontal, shall be satisfactorily restrained and anchored against the tendency of movement with mechanical joint restraints and concrete thrust blocks. Additional means of restraint may be shown on the approved plans or required in the field by the inspector.

B. Mechanical Joint Restraint: Provide mechanical joint restraint on fire hydrants and all associated fittings, valves and related piping. Retainer glands shall be installed in accordance with the manufacturer's recommendations, particularly, the required torque of the set screws that seat the wedges. The Contractor shall furnish a torque wrench to

verify the torque on all set screws that do not have inherent torque indicators.

C. Harnessing

1. Provide harness rods only where specifically shown on the Drawings or directed by the Engineer.
2. Harness rods shall be manufactured in accordance with ASTM A 36 and shall have an allowable tensile stress of no less than 22,000 psi. Harness rods shall be hot dip galvanized or field coated with bitumastic before backfilling.
3. Where possible, harness rods shall be installed through the mechanical joint bolt holes. Where it is not possible, provide 90 degree bend eye bolts.
4. Eye bolts shall be of the same diameter as specified in AWWA C111 for that pipe size. The eye shall be welded closed. Where eye bolts are used in conjunction with harness rods, an appropriate size washer shall be utilized with a nut on each end of the harness rod. Eye bolts shall be of the same material and coating as the harness rods.

D. Hydrants: Hydrant valves may be attached to the water main by the following methods:

1. For all new mains, the isolation valve shall be attached to the main by connecting the valve to the hydrant tee.
2. For all existing mains, the isolation valve shall be attached to the main by providing an anchor coupling between the valve and tapping sleeve.
3. The isolation valve shall be attached to the hydrant by providing an anchor coupling between the valve and hydrant.

E. Thrust Collars: Collars shall be constructed as shown on the Drawings. Concrete and reinforcing steel shall meet the requirements as specified in this Section. The welded-on collar shall be designed to meet the minimum allowable load shown on the Drawings. The welded-on collar shall be attached to the pipe by the pipe manufacturer.

F. Concrete Blocking

1. Provide concrete blocking for all bends, tees, valves, and other points where thrust may develop, except where other exclusive means of thrust restraint are specifically shown on the Drawings.
2. Concrete shall be as specified in this Section.
3. Form and pour concrete blocking at fittings as shown on the Drawings and as

Water Mains and Accessories

directed by the Engineer. Pour blocking against undisturbed earth. Increase dimensions when required by over excavation. Concrete placed outside the specified limits or without written authorization from the Engineer will not be paid for.

3.08 Inspection and Testing

A. Inspection of Lines

1. All water lines installed in the White House Utility District service area, regardless of length, shall be inspected, pressure tested, have disinfection samples taken, and have as-built drawings submitted to and accepted by an Inspector of the White House Utility District. **As-built drawings must be submitted by the water line designer and accepted by the Inspector prior to disinfection samples being collected.**
2. The District shall be notified a minimum of three business days prior to construction to arrange for an Inspector to be present. From that time forward, the Contractor must make arrangements with the District Inspector for daily inspection. The Inspector shall have the right to inspect pipe and fittings stored on the job site as well as observe all aspects of line laying and testing procedures. Contractor shall only lay pipe during Inspector's working hours. Any extended daily or weekend hours shall be subject to approval by WHUD a minimum of one week in advance.
3. Record type, size, and location of all valves, hydrants, and fittings on as-built drawings. As-builts shall be in the form of a digital file that can be opened in AutoCAD and must be to scale. Valve locations shall be referenced to two permanent, conspicuous land marks.

B. Pressure and Leakage Test

1. All sections of the water main, **including service lines** and meter setters, shall be subjected to an internal pressure of 200 psi for three hours. A section of main will be considered ready for testing after all appurtenances have been installed and backfilled, and air has been removed from the lines.
2. Each segment of water main between main valves shall be tested individually. Where practical, pipelines shall be tested in lengths between line valves or plugs of no more than 2,500 feet.
3. Test Preparation
 - a. For water mains less than 24-inches in diameter, flush sections thoroughly at flow velocities, greater than 2.5 feet per second, adequate to remove debris from pipe and valve seats. For water mains 24-inches in diameter and larger, the main shall be carefully swept clean, and mopped if directed by the Engineer. Partially open valves to allow the water to flush the valve seat.

- b. Partially operate valves and hydrants to clean out seats.
 - c. Provide temporary blocking, bulkheads, flanges and plugs, as necessary, to assure all new pipe, valves and appurtenances will be pressure tested.
 - d. Before applying test pressure, air shall be completely expelled from the pipeline and all appurtenances. Insert corporation cocks at high points to expel air as the main is filled with water, as necessary, to supplement automatic air valves. Corporation stops shall be constructed as detailed on the Drawings with a meter box.
 - e. Fill pipeline slowly with water. Provide a suitable pump with an accurate water meter to pump the line to the specified pressure.
 - f. The differential pressure across a valve or hydrant shall equal the maximum possible, but not exceed the rated working pressure. Where necessary, provide temporary backpressure to meet the differential pressure restrictions.
 - g. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure.
4. Test Pressure: Test the pipeline at 200 psi measured at the highest point for at least three hours. Should the pressure drop at any time during the test period, the pressure shall be restored to the specified test pressure and the source of the pressure drop identified and repaired. Provide an accurate pressure gauge with graduations not greater than 2 psi, and gauge must be filled with glycerin. Pressure testing must be done in the presence of the Inspector. The Contractor shall furnish all pumps, gauges, meters and other equipment required and shall maintain said equipment in a condition suitable for accurate testing as determined by the Engineer. No test shall be performed when the outside temperature is at freezing (32° F) or below.
 5. Leakage: No leakage shall be allowed.
 6. Completion: After a pipeline section has been tested, relieve test pressure.

3.09 Disinfecting Pipeline

- A. After successfully pressure testing each pipeline section, disinfect in accordance with AWWA C651 for the continuous-feed method and these Specifications.
- B. The new water lines shall not be placed in service, either temporarily or permanently, until they have been thoroughly disinfected in accordance with the following requirements and to the satisfaction of the Engineer.
- C. Chlorination

Water Mains and Accessories

1. After pressure testing, if a form of chlorine has not already been introduced into the section of line being disinfected, a solution of HTH or equal shall be introduced into the section of the lines being disinfected sufficient to insure a chlorine dose of at least 50 ppm. Following is a table containing pounds of HTH per 100 feet of various size lines required to produce a 50 ppm free chlorine concentration:

Line Size	Pounds HTH Required Per 100 Feet of Line for a 50 ppm Free Chlorine Residual
2"	¼ oz.
4"	¾ oz.
6"	1-½ oz
8"	2-¾ oz
10"	4-¼ oz
12"	6-¼ oz
16"	11 oz
18"	1 lb.
20"	1-¼ lbs.
24"	1.5 lbs.

2. While the solution is being applied, water shall be allowed to escape at the end of the line until tests indicate that a dose of at least 50 ppm has been obtained throughout the pipe. The chlorinated water shall be allowed to remain in the pipe for 24 hours. A residual of at least 25 ppm free chlorine should be present in the line at the end of the 24-hour period. After the chlorinated water has remained in the line for 24 hours, the line shall be thoroughly flushed and filled with water from the District's system. Bacteriological samples will then be taken by a water quality representative of WHUD for analysis. If a negative sample is obtained, the line shall be thoroughly flushed and then may be connected to the system. If the sample is positive for bacteria, the disinfection procedure must be repeated until a negative sample is obtained. The cost of the bacteriological test will be borne by the Developer or Contractor. The District will supply the required city water and bill the Developer or Contractor.

- D. Disposal of Chlorinated Water: Reduce chlorine residual of disinfection water to a level that complies with current state regulations.

3.10 Protection and Restoration of Work Area

- A. General: Return all items and all areas disturbed, directly or indirectly, by work under these Specifications to their original condition or better, as quickly as possible after work is started.
 1. The Contractor shall plan, coordinate, and prosecute the work such that disruption to personal property and business is held to a practical minimum.
 2. All construction areas abutting lawns and yards of residential or commercial property shall be restored promptly. Backfilling of underground facilities, ditches, and disturbed areas shall be accomplished on a daily basis as work is completed.

Finishing, dressing, and grassing shall be accomplished immediately thereafter, as a continuous operation within each area being constructed and with emphasis placed on completing each individual yard or business frontage. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.

3. Handwork, including raking and smoothing, shall be required to ensure the removal of roots, sticks, rocks, and other debris in order to provide a neat and pleasing appearance.
 4. The Department of Transportation's engineer or WHUD Inspector shall be authorized to stop all work by the Contractor when restoration and cleanup are unsatisfactory and to require appropriate remedial measures.
- B. Man-Made Improvements: Protect, or remove and replace with the Engineer's approval, all fences, walkways, mail boxes, pipe lines, drain culverts, power and telephone lines and cables, property pins and other improvements that may be encountered in the work.
- C. Cultivated Growth: Do not disturb cultivated trees or shrubbery unless approved by the Engineer. Any such trees or shrubbery that must be removed shall be heeled in and replanted under the direction of an experienced nurseryman.
- D. Cutting of Trees: Do not cut trees for the performance of the work except as absolutely necessary. Protect trees that remain in the vicinity of the work from damage from equipment. Do not store spoil from excavation against the trunks. Remove excavated material stored over the root system of trees within 30 days to allow proper natural watering of the root system. Repair any damaged tree over 3-inches in diameter, and not to be removed, under the direction of an experienced nurseryman. All trees and brush that require removal shall be promptly and completely removed from the work area and disposed of by the Contractor. No stumps, wood piles, or trash piles will be permitted on the work site.
- E. Disposal of Rubbish: Dispose of all materials cleared and grubbed during the construction of the Project in accordance with the applicable laws, codes, rules and requirements of the appropriate county, state and federal regulatory agencies.

3.11 Abandoning Existing Water Mains

- A. General: Abandon in place all existing water main segments indicated on the Drawings to be abandoned. Perform abandonment after the new water main has been placed in service and all water main services have been changed over to the new main. Salvage for WHUD, existing fire hydrants, valve boxes, valve markers, and other materials indicated on the Drawings or located on water mains abandoned.
- B. Capping and Plugging: Disconnect by sawing or cutting and removing a segment of existing pipe where cutting and capping or plugging is shown on the Drawings or directed by the Engineer. Provide a watertight pipe cap or plug and concrete blocking for restraint to seal off existing mains indicated to remain in service. Seal ends of existing mains to be abandoned with a pipe cap or plug or with a masonry plug and

Water Mains and Accessories

minimum 6-inch cover of concrete on all sides around the end of the pipe. The Contractor shall be responsible for uncovering and verifying the size and material of the existing main to be capped or plugged.

- C. Salvaging Materials: Salvage existing fire hydrants, valve boxes, valve markers and other materials as indicated on the Drawings and deliver salvaged items in good condition to WHUD's storage yard. Coordinate delivery and placement of salvaged materials in advance with the Owner.
- D. Blow-Off Piping: Remove existing blow-off piping, located on segments of water mains to be abandoned, to a minimum of two feet below finished grade. Seal the end of remaining piping as specified above in paragraph B. Blow-off piping removed becomes the property of the Contractor.
- E. Pavement Removal and Replacement: Perform any necessary pavement removal and replacement in accordance with the details on the Drawings and Section 02575 of these Specifications.

END OF SECTION

Part 1 General

1.01 Scope

- A. The work covered by this Section includes furnishing all materials and equipment, providing all required labor and installing water service connections and all appurtenant work according to these Specifications and/or to the Water Connection Details as shown schematically on the Drawings.
- B. Water meters will be installed by WHUD.

1.02 Locations

Locations shall be directed by the Engineer along the route of the water mains.

1.03 Service Compatibility

It is the intent of these Specifications that the water service connections shall duplicate those presently being provided by the WHUD in order to be compatible with their service maintenance procedures.

1.04 Quality Control

All materials installed under this Section shall have the approval of the NSF for water services.

1.05 Submittals

- A. Material Submittals: The Contractor shall provide shop drawings and other pertinent specifications and product data to the Engineer for review.

Part 2 Products

2.01 Materials and Construction

- A. Service Line
 - 1. Polyethylene (PE) Tubing: The water service line shall be copper tube size polyethylene tubing conforming to or exceeding the requirements of ASTM D 2737. Working pressure rating shall be minimum of 160 psi with minimum burst pressure of 630 psi at 73.4 degrees F. Color shall be blue. **This material shall be used for temporary services only.**
 - 2. Copper Tubing: Tubing shall be ASTM B 88, Type K. Fittings shall be brass with compression connection inlets and outlets, ANSI B16.26. Where required, adapters shall be brass ANSI B16.18. Unions shall be cast bronze. Joints shall

Water Service Connections

be compression type. All fittings shall be of bronze construction with compression type connection.

- 3 All brass fittings shall be made of brass consisting of eighty-five percent copper, five percent lead and five percent zinc. All fittings shall be standard copper tubing size. Compression nuts shall be the Ford Q Nut type, Mueller 110, or Equal. The pack joint will not be accepted. Flared fittings will not be accepted. All threaded brass fittings (nipples, 90's, etc.) must be domestic brass. No galvanized or plastic fittings will be accepted.

B. Meter Box

1. Meter boxes shall be plastic. Material shall meet or exceed the following:
 - a. Tensile Strength: 3,400 psi (ASTM D 638).
 - b. Flexural Modulus: 191,000 psi (ASTM D 790).
 - c. Impact Strength, Izod: 0.6-feet 16/inch (ASTM D 256).
 - d. Deflection Temperatures: 200 degrees F (ASTM D 648).
2. Plastic meter boxes shall be Mid States 1015-18 for ¾-inch and 1-inch services.
3. Meter boxes for two-inch services shall be Mid States MSBC-1730-18 or approved equal.
4. Meter boxes shall be fitted with a cast iron cover and reader lid.
5. Minimum depth shall be 18-inches deep. Meter box to be installed with top of lid flush with the finished grade.

- C. Meter Setter: ¾-inch and 1-inch meter setters shall be the straight-line type with compression by compression ends. Setters shall have a ball valve cut-off with lock wings. ¾-inch line setters shall be Ford LSVB44-233WQ or approved equal. The 2-inch setter must be the custom setter type, 12-inch rise with ball valves on each side. 2-inch custom setters shall be Ford VBB77-12-11-77 or approved equal. A minimum of 3-inches crushed stone must be laid under the setter. The valve on the setter shall remain in the closed position after installation.

D. Valves and Accessories

1. 2" Valves: Gate valves shall be iron, heavy duty, non-rising stem, wedge type. Valve ends shall be threaded. Valves shall have a minimum 200 psi working pressure for water (125 psi working pressure for steam). Valves shall be made in the U.S.A. Gate valves shall be equal to M & H, Mueller, American Flow Control, or U.S. Pipe.
2. Corporation Cocks and Curb Stops

- a. Corporation cocks and curb stops shall be ground key type, shall be made of bronze conforming to ASTM B61 or B62 and shall be suitable for the working pressure of the system. Ends shall be suitable for compression type joint. Threaded ends for inlet and outlet of corporation cocks shall conform to AWWA C800.
 - b. Corporation cocks and curb stops shall be equal to Ford F-1000Q.
3. Saddles
- a. Saddles shall be ductile iron, double bail carbon steel strap saddles.
 - b. Brass saddles can be used on 2-inch PVC only.
 - c. Saddles shall be Smith Blair or approved equal.
- E. Connections to Water Mains
1. Connections to water mains for $\frac{3}{4}$ -inch and 1-inch services shall with a saddle and corporation stop, as detailed on the Drawings in full accordance with AWWA requirements. 2-inch connections shall have a saddle with a 2-inch threaded iron bodied gate valve. The corporation stop and gate valve are be left in the open position after tap has been made and setter installed.
 2. Pressure ratings shall be as required for the installation.

Part 3 Execution

3.01 Installation

A. Water Service Connections

1. Water service connections shall be installed to the properties adjacent to the water transmission mains both to the same side of the roadway (Short Side Service) and to the opposite side of the roadway (Long Side Service) as directed by the Engineer.
2. Water service connections installed under roadway shall be pulled through a SDR21 or Schedule 40 PVC casing. Casings shall be installed in an open trench. $\frac{3}{4}$ -inch and 1-inch service lines require 2-inch minimum casing pipe. 2-inch service lines require 4-inch minimum casing pipe. Minimum cover under roadway shall be three feet. At other locations, minimum cover shall be two feet.
3. Installation shall conform to the details for water service connections appearing schematically on the Drawings. Contractor shall provide any and all appurtenant work required to provide the intended water service connections.

B. Permanent Water Services

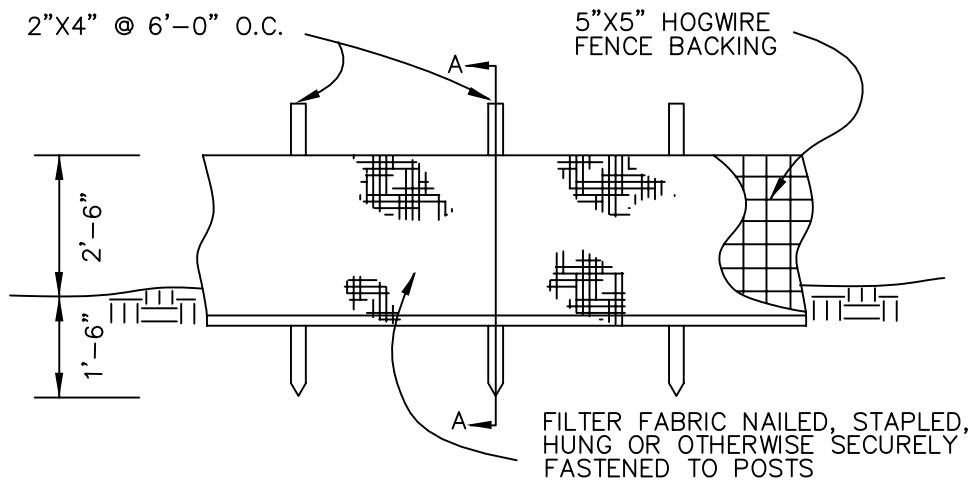
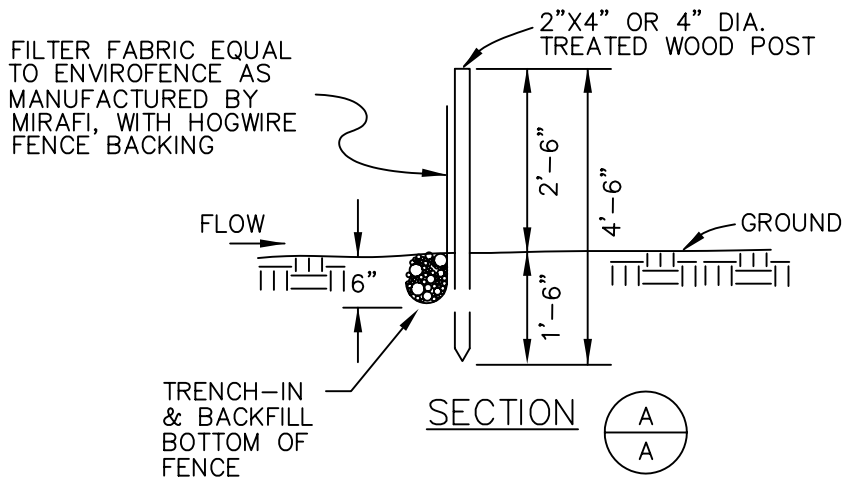
Water Service Connections

1. Each new service line (3/4" or 1") shall be tapped into the main through a corporation stop, and service clamp, as detailed on the Drawings. The tap shall be located at the 10 or 2 o'clock position on the top of the main. A new service line shall be provided to the meter as shown on the Drawings. Except for 2" taps are to be made with a threaded iron body gate valves.
 2. A corporation cock or gate valve shall be provided in the water main for each service line.
 3. Service connection piping shall be 3/4-inch, one inch or two inch Type "K" copper rated for at least 200 psig, meet current commercial standards as published by the U.S. Department of Commerce and acceptable to the National Sanitation Foundation and be of the length necessary to run a direct line from the main to the site of the meter at the property line with no joints in between. Special care should be taken to protect the service piping with earthen material from sharp and hard objects. Cover is to be at least 24 inches at all points. Under no circumstances shall water service lines and sewer lines or sewer service lines be laid in the same ditch.
 4. The openings and meter nut of the meter setters shall be wrapped in duct tape to prevent contamination. The contractor shall place locks on the meter setters. The locks shall be provided by WHUD.
- C. Temporary Water Services: Temporary services shall consist of relocating an existing water meter to just outside the construction limits to clear proposed grading changes. Temporary services shall include connecting the relocated meter to the existing or new water main, as appropriate, by means of a new polyethylene service line and any additional depth service line installation required to clear proposed grading work.
- D. Relocation of Service Lines
1. Relocate the existing meter to the new right-of-way limits and reconnect to the house service. Existing meters already located at the new right-of-way limits will not need relocating.
 2. Before disconnecting the existing meter, the existing corporation in the main shall be closed. All existing meters and meter boxes shall be removed, if not already located at the right-of-way, reinstalled and reconnected as indicated on the Drawings.
 3. Existing service lines shall be field-located by the Contractor. The Contractor shall be responsible for locating existing water meters, relocating the meters and meter boxes as necessary, and determining the existing size service line to reconnect the meters to the new water mains. All service lines installed under existing pavement, including streets, driveways and sidewalks, shall be installed by boring.
 4. The Contractor shall be prepared to make emergency repairs to the water system, if necessary, due to damage by others working in the area. In

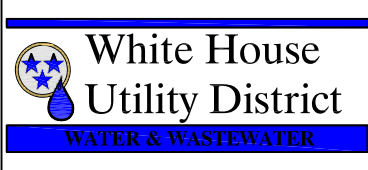
conjunction with this requirement, the Contractor shall furnish and have available at all times a tapping machine, for the purpose of making temporary water service taps or emergency repairs to damaged water services.

- E. Transfer of Service: Immediately before connecting to the relocated or existing meter, all service lines shall be flushed to remove any foreign matter. Any special fittings required to reconnect the existing meter to the new copper service line, or the existing private service line, shall be provided by the Contractor. To minimize out of service time, the Contractor shall determine the connections to be made and have all the required pipe and fittings on hand before shutting off the existing service. After completing the connection, the new corporation stop shall be opened and all visible leaks shall be repaired.

END OF SECTION



SILT FENCE DETAIL

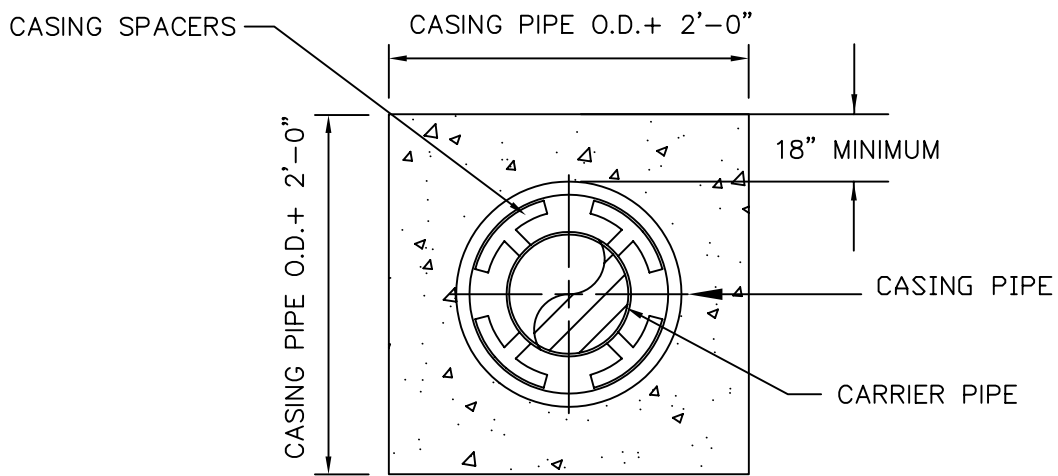


WHITE HOUSE UTILITY DISTRICT


DATE : APRIL 2003
SCALE : N.T.S.

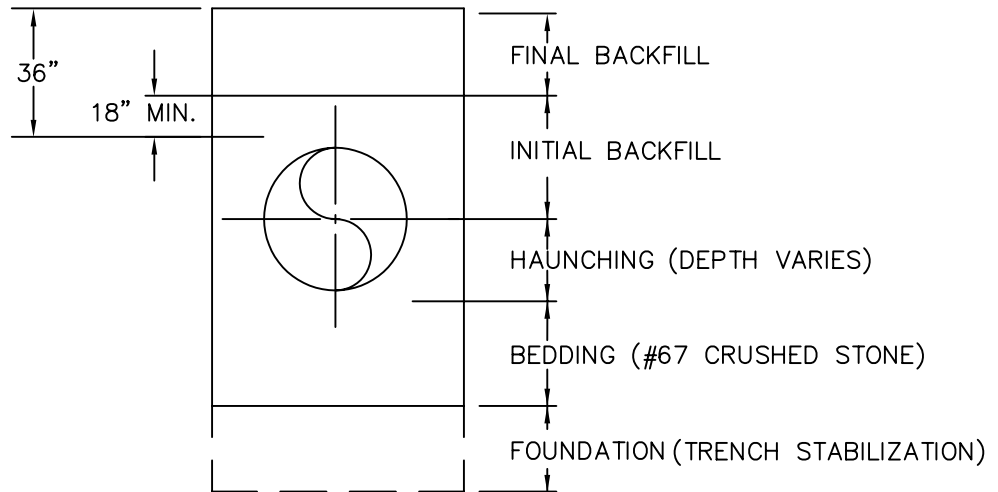
STANDARD DETAILS

STD-G-01



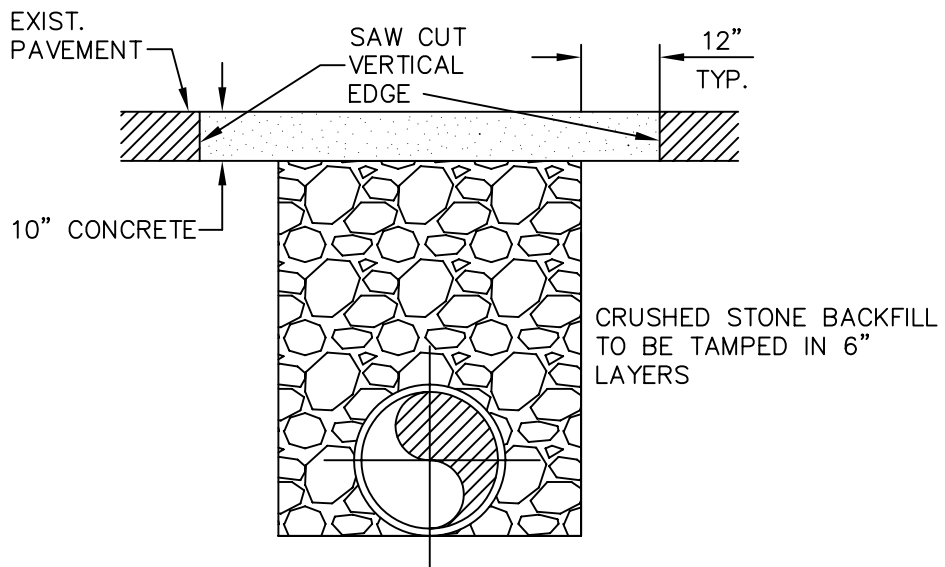
CONCRETE ENCASEMENT DETAIL

 <p>White House Utility District WATER & WASTEWATER</p>	WHITE HOUSE UTILITY DISTRICT	DATE : APRIL 2003 SCALE : N.T.S.
	STANDARD DETAILS	STD-G-02

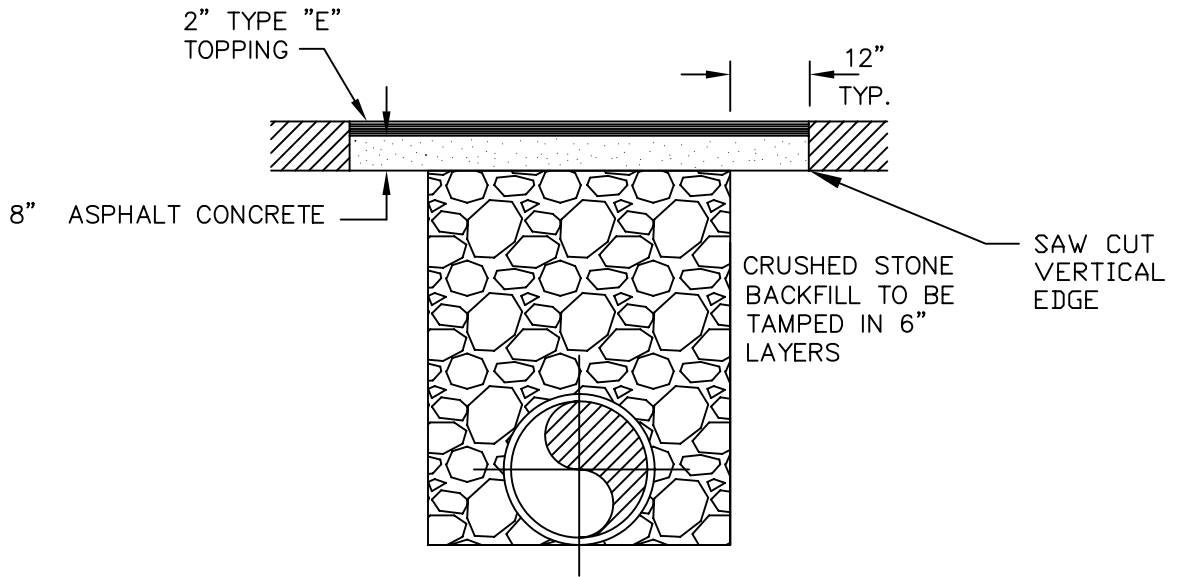


NOTE: SEE SPECIFICATIONS AND PIPE
BEDDING AND HAUNCHING DETAILS
FOR DIMENSIONS AND MATERIALS

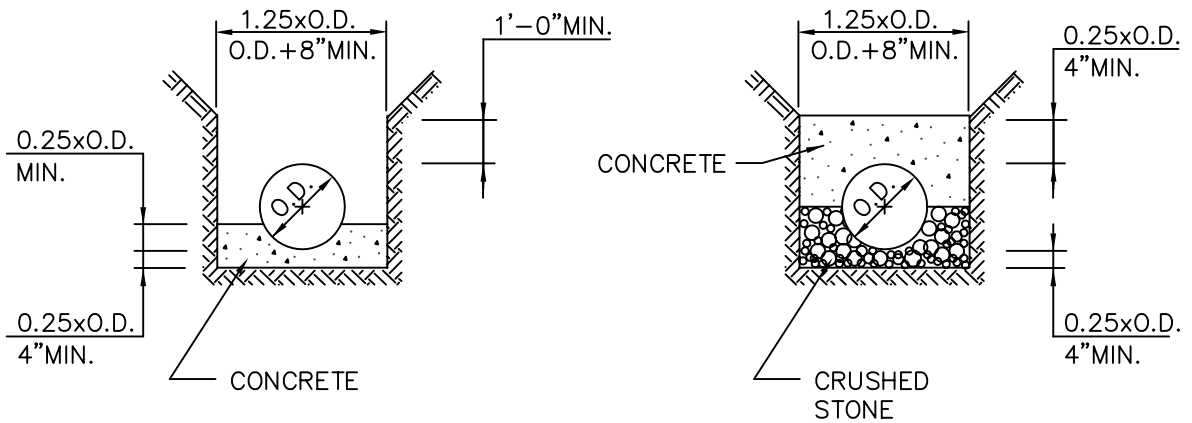
TRENCH TERMINOLOGY DETAIL



CONCRETE REPLACEMENT
DETAIL



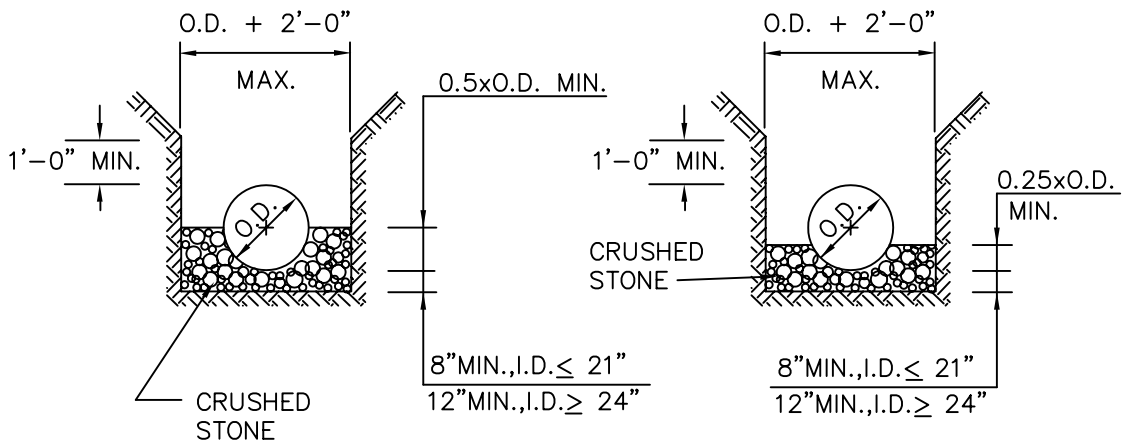
ASPHALT REPLACEMENT
DETAIL



CONCRETE CRADLE

CONCRETE ARCH.

CLASS "A"



CLASS "B"

CLASS "C"

PIPE BEDDING AND HAUNCHING DETAILS



**White House
Utility District**
WATER & WASTEWATER

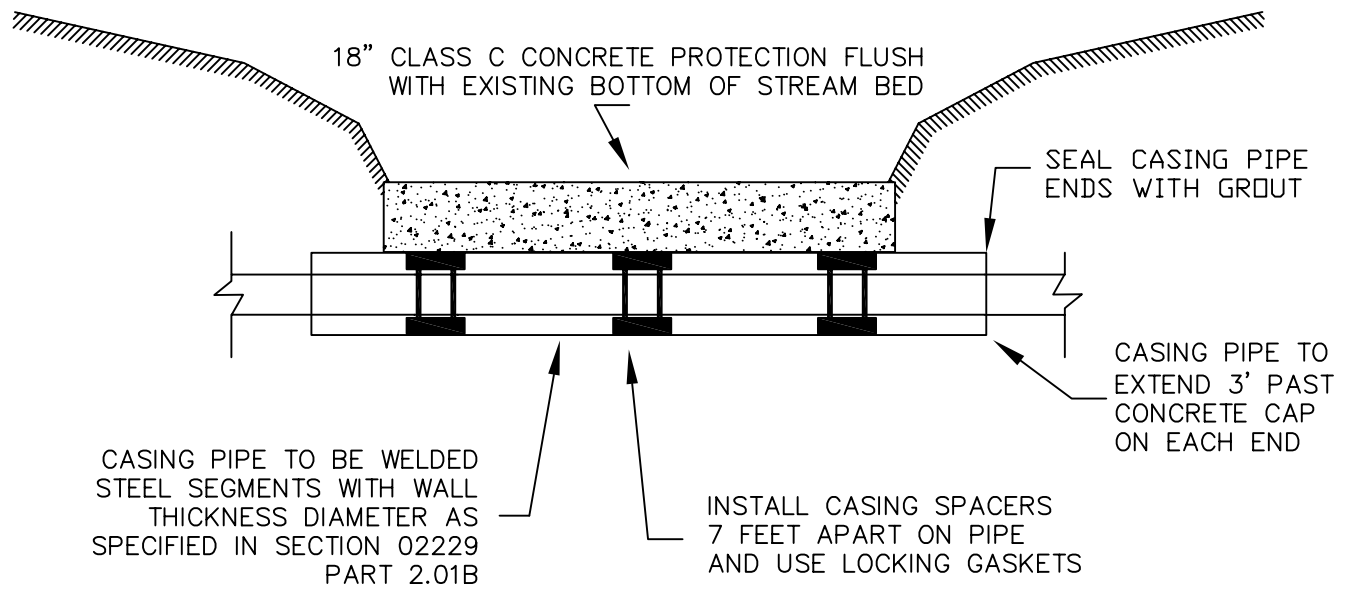
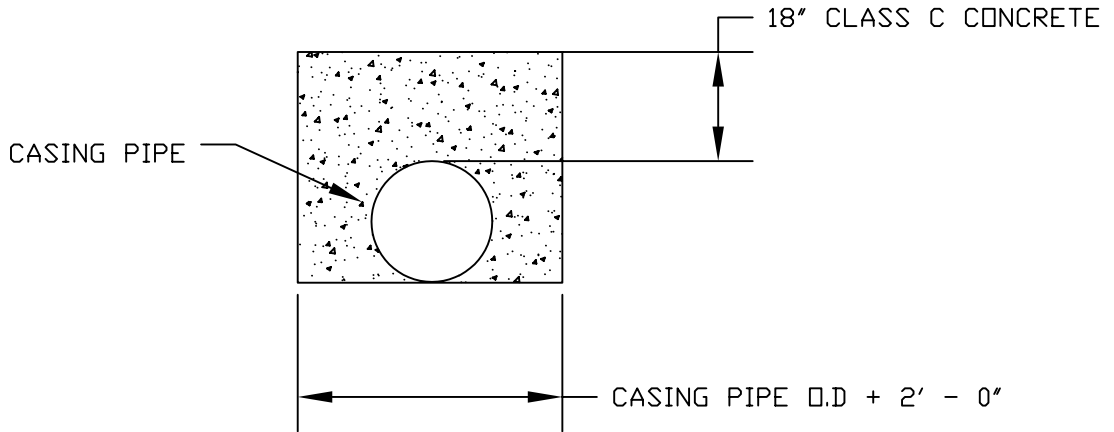
WHITE HOUSE UTILITY DISTRICT

STANDARD DETAILS


DATE : APRIL 2003
SCALE : N.T.S.

STD-G-06

END VIEW



CASING PIPE AND CONCRETE PROTECTION DETAIL FOR STREAMS OR LARGE DRAINAGE CHANNELS

 <p>White House Utility District WATER & WASTEWATER</p>	WHITE HOUSE UTILITY DISTRICT	DATE : APRIL 2003 SCALE : N.T.S.
	STANDARD DETAILS	STD-G-07

NOTE: 3/4" AND 1" METERS FURNISHED BY WHUD

MIDSTATES 1015-18 METER BOX WITH SOLIOCAST IRON LID WITH READER LID INSTALLED FLUSH WITH FINISHED GRADE

SEAMLESS TYPE "K" COPPER PIG TAIL OF SERVICE SIZE TO EXTEND MINIMUM OF THREE FEET PAST METER AND MINIMUM OF TWO FEET ABOVE FINISHED GRADE

END OF PIGTAIL, SETTER NUTS AND SETTER OPENINGS SHALL BE COVERED WITH DUCT TAPE

FINISHED GRADE

18" MINIMUM COVER

SEAMLESS TYPE "K" COPPER TUBING

LINE SETTER TO BE 3/4" FORD LSVB44-233WQ BEDDED WITH A MINIMUM OF THREE INCHES OF NO. 67 CRUSED STONE

TAP MADE AT 10 O' CLOCK OR 2 O' CLOCK WITH DOUBLE STRAP SADDLE: SMITH BLAIR 313 SERIES OR EQUAL CORPORATION STOP: FORD F-1000Q OR EQUAL

3/4" AND 1" SHORT TAP ASSEMBLIES



White House
Utility District

WHITE HOUSE UTILITY DISTRICT

STANDARD DETAILS

DATE : APRIL 2003
SCALE : N.T.S.

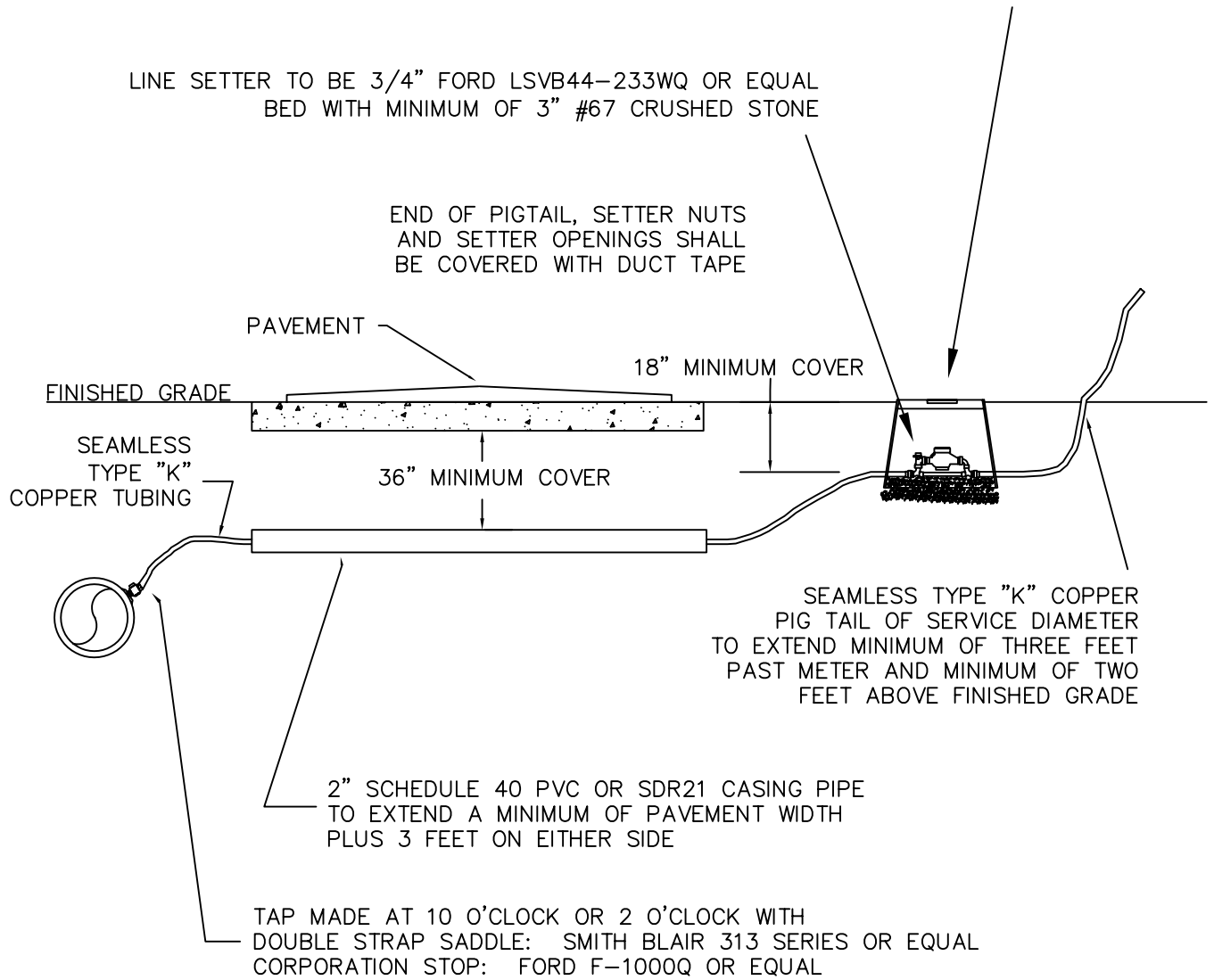
STD-W-01

NOTE: 3/4" AND 1" METERS FURNISHED BY WHUD

MIDSTATES MODEL 1015-18 METER BOX WITH CAST IRON READER
LID INSTALLED FLUSH WITH FINISHED GRADE

LINE SETTER TO BE 3/4" FORD LSVB44-233WQ OR EQUAL
BED WITH MINIMUM OF 3" #67 CRUSHED STONE

END OF PIGTAIL, SETTER NUTS
AND SETTER OPENINGS SHALL
BE COVERED WITH DUCT TAPE



3/4" AND 1" LONG TAP ASSEMBLIES



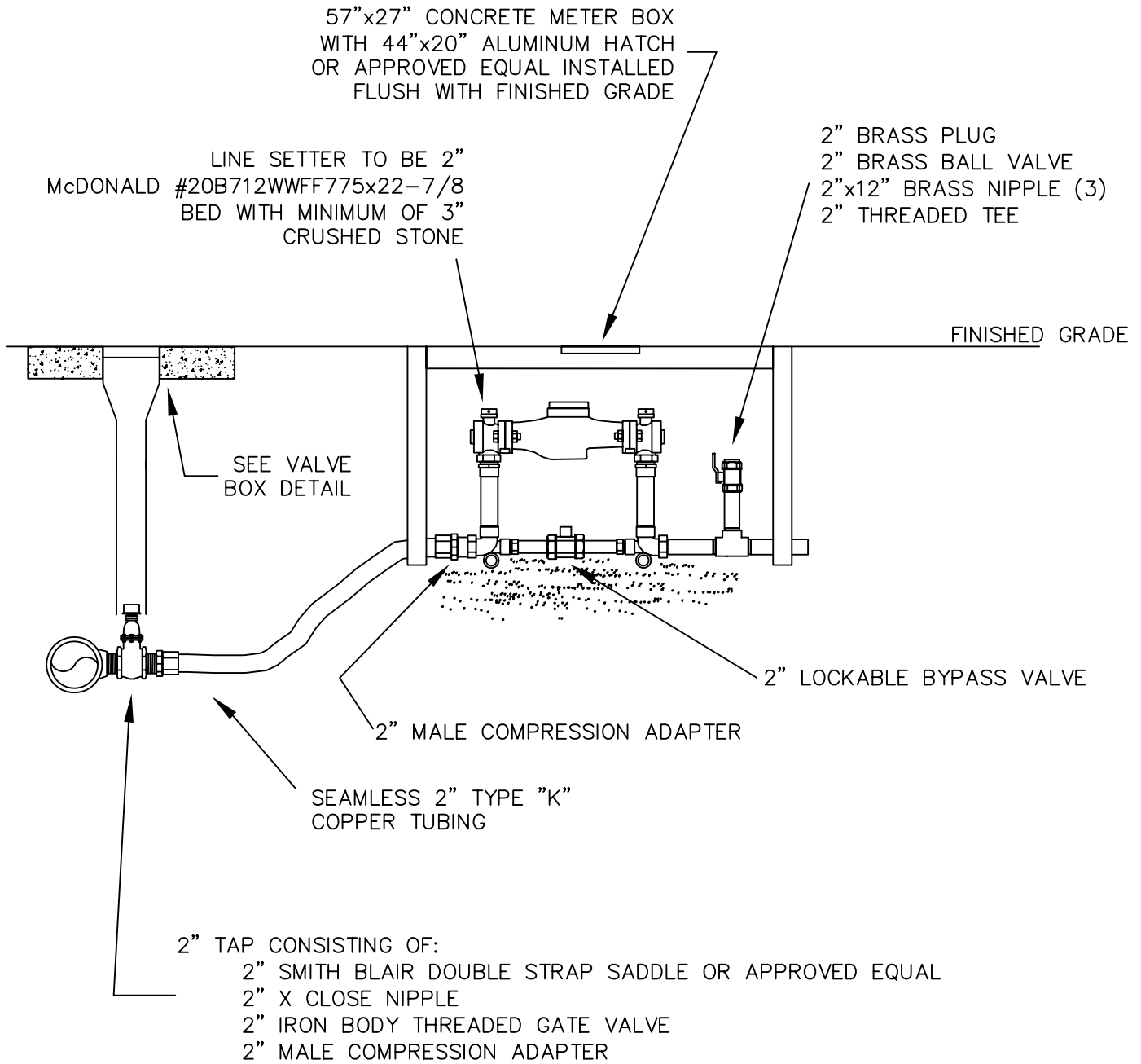
WHITE HOUSE UTILITY DISTRICT

DATE : APRIL 2003
SCALE : N.T.S.

STANDARD DETAILS


STD-W-02

2" DUAL BODY COMPOUND METER WITH DIALOG REGISTER

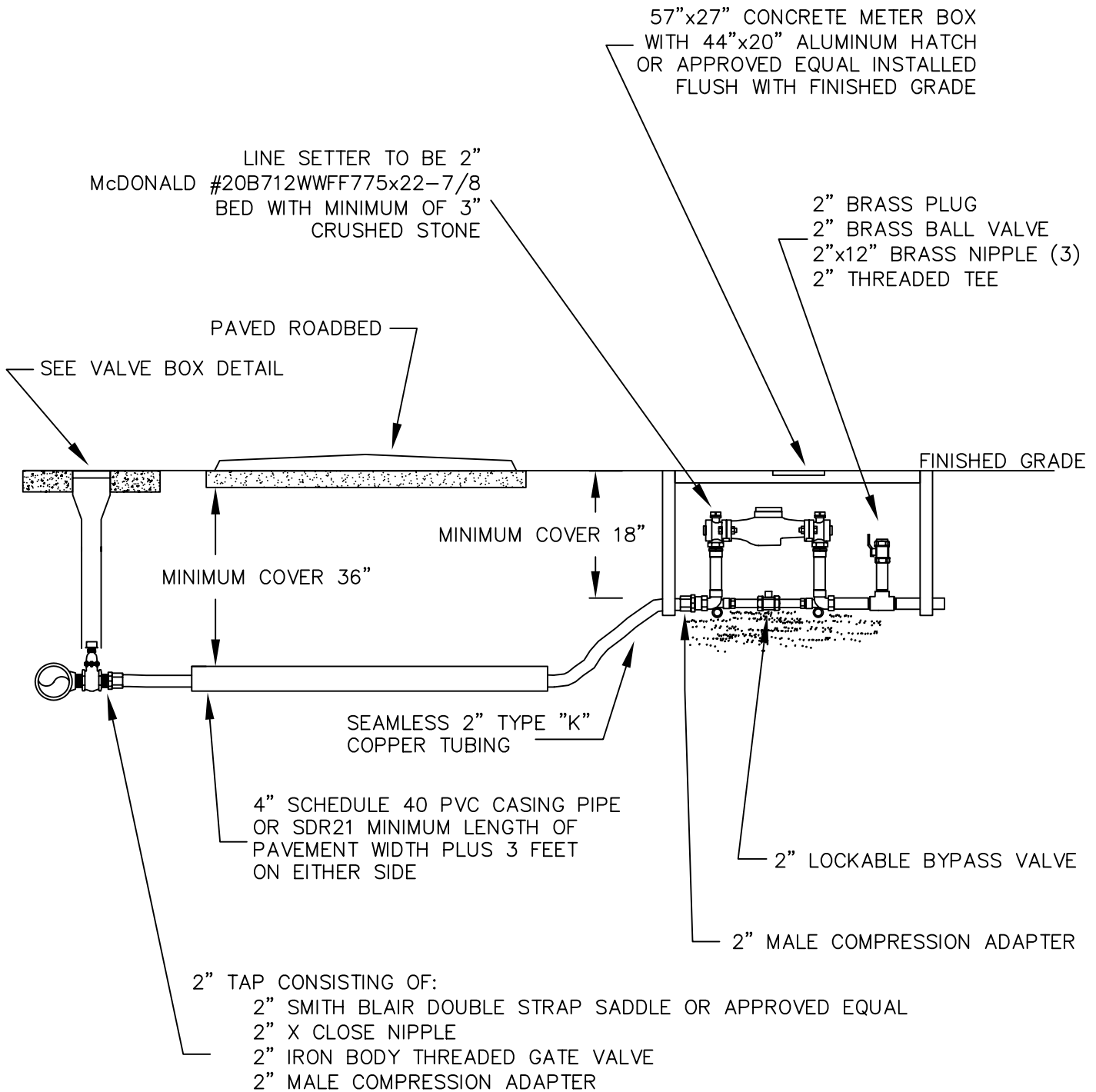


2" SHORT TAP ASSEMBLIES

* NOTE: CONTRACTOR TO PROVIDE ALL LABOR AND MATERIALS INCLUDING MAKING THE 2" MAIN TAP. WHUD PROVIDES THE METER.

 White House Utility District	WHITE HOUSE UTILITY DISTRICT	DATE : OCT 2005 SCALE : N.T.S.
	STANDARD DETAILS	STD-W-03

2" DUAL BODY COMPOUND METER WITH DIALOG REGISTER



2" LONG TAP ASSEMBLIES

* NOTE: CONTRACTOR TO PROVIDE ALL LABOR AND MATERIALS INCLUDING MAKING THE 2" MAIN TAP. WHUD PROVIDES THE METER.

WHITE HOUSE UTILITY DISTRICT

DATE : OCT 2005

SCALE : N.T.S.

STANDARD DETAILS

STD-W-04



PRE-CAST CONCRETE VAULT
METERS 4" AND LARGER
PROFILE VIEW

INSTALL TOUCHREAD PADS IN HATCH
 NEAR HINGES AND PROVIDE CABLE SLACK
 SUFFICIENT TO OPEN/CLOSE HATCH

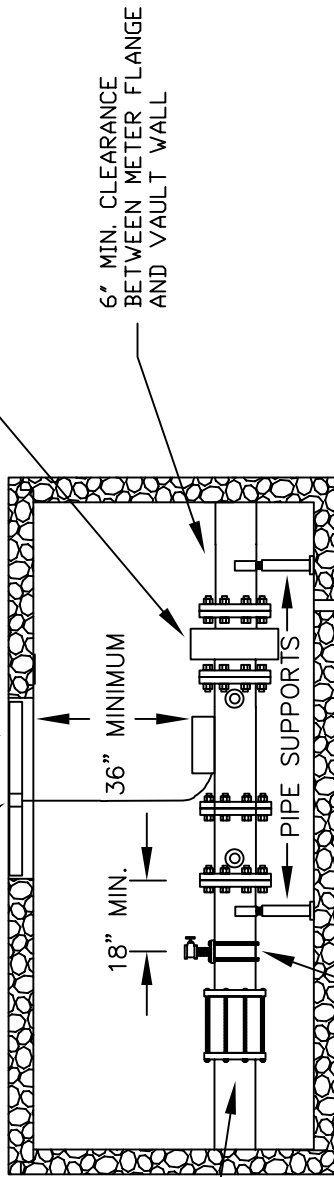
PRECAST CONCRETE VAULT WALL
 MIN. THICKNESS 6" WITH
 REINFORCING STEEL AS
 NECESSARY

MASTER METER BRAND FIRE LINE METER
 WITH METER DIAMETER STRAINER

6" MIN. CLEARANCE
 BETWEEN METER FLANGE
 AND VAULT WALL

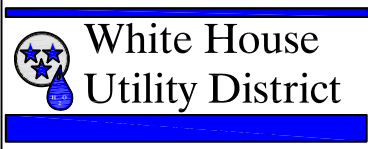
4" FLOOR DRAIN TO LOWER
 ELEVATION WHERE AVAILABLE
 INCLUDE VARMINIT SCREEN ON
 DOWNSTREAM OUTLET. PROVIDE
 SUMP PUMP IF NOTED ON APPROVED
 PLANS

FLOW



DRESSER COUPLING ALLOWING
 3" GAP BETWEEN PLAIN END
 PIECES OF PIPE. 6" MIN.
 CLEARANCE BETWEEN COUPLING
 AND VAULT WALL

*NOTE: ONLY PRECAST CONCRETE VAULTS WILL BE ACCEPTED.
 POURED IN PLACE STRUCTURES ARE NOT ACCEPTABLE.
 ALL EXTERIOR MECHANICAL JOINT FITTINGS SUBJECT
 TO THRUST SHALL BE RESTRAINED WITH MECHANICAL
 JOINT RESTRAINTS. SEE WHUD FOR METER SIZING AND
 SPECIFICATIONS. PROVIDE A MINIMUM OF 12 INCHES OF
 NO. 67 CRUSHED STONE BEDDING UNDER VAULT.



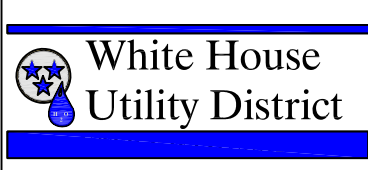
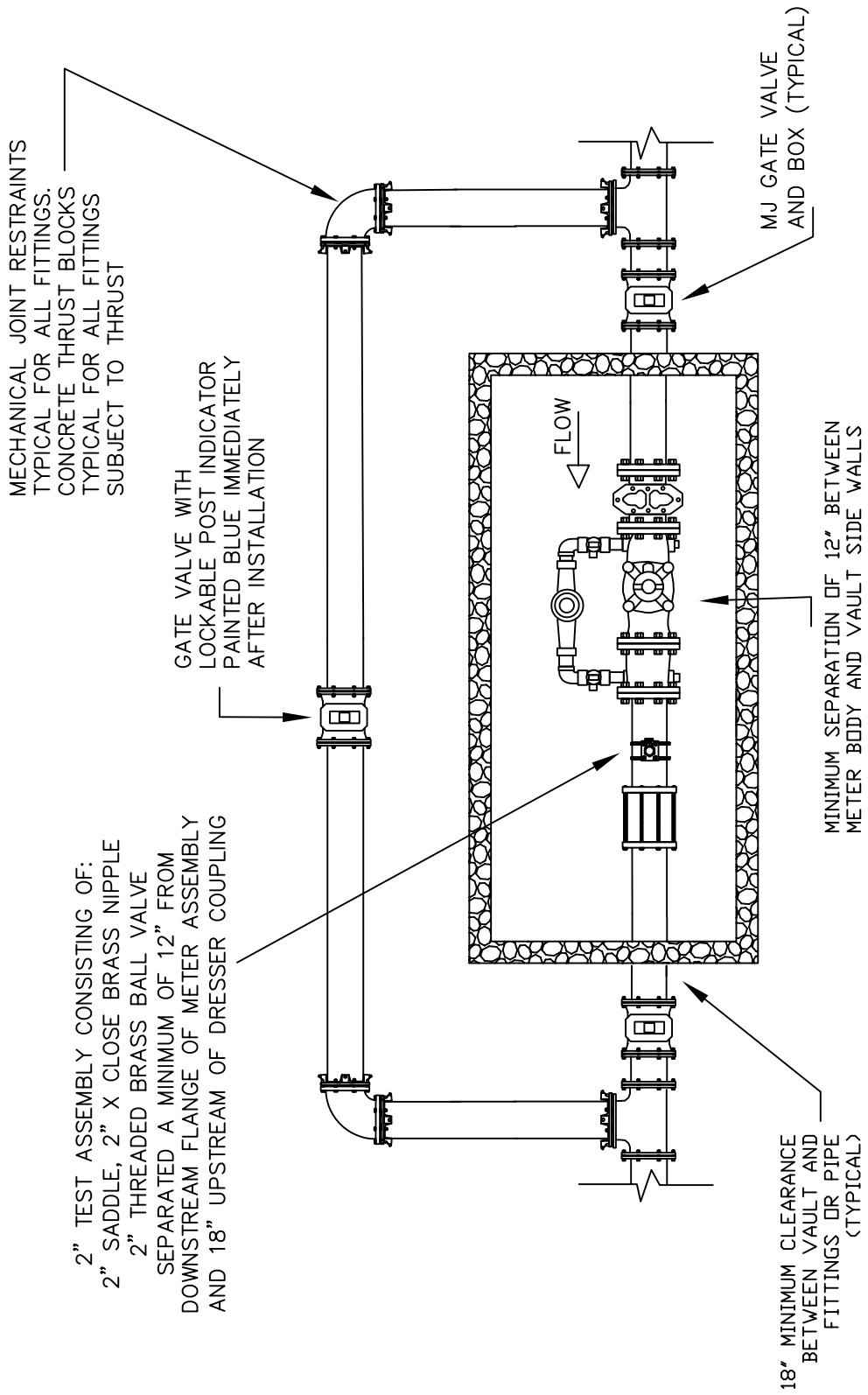
WHITE HOUSE UTILITY DISTRICT

STANDARD DETAILS

DATE : APRIL 2003
 SCALE : N.T.S.

STD-W-05A

PRE-CAST CONCRETE VAULT
METERS 4" AND LARGER
PLAN VIEW – LID NOT SHOWN FOR CLARITY

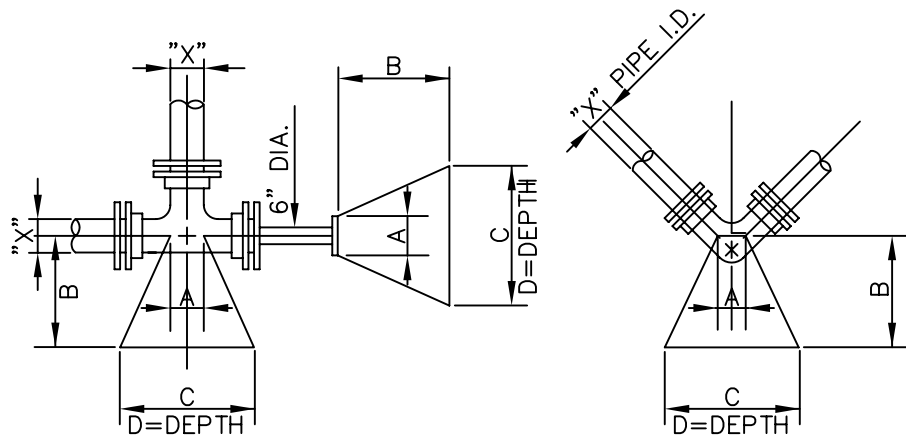


WHITE HOUSE UTILITY DISTRICT

STANDARD DETAILS

DATE : APRIL 2003
 SCALE : N.T.S.

STD-W-05B



200 PSI TEST PRESSURE
2000 PSF SOIL BEARING

		BLOCKING DIMENSIONS				
DEAD END & TEES	X*	A	B	C	D	
		10"	1'-0"	2'-6"	4'-0"	2'-6"
	8"	0'-10"	2'-3"	3'-3"	2'-0"	
	6"	0'-8"	1'-6"	2'-6"	1'-6"	
BENDS	90°	10"	1'-0"	3'-6"	5'-0"	2'-9"
		8"	0'-10"	2'-9"	4'-0"	2'-3"
		6"	0'-8"	2'-0"	3'-0"	1'-9"
	45°	10"	1'-0"	1'-9"	3'-0"	2'-6"
		8"	0'-10"	1'-6"	2'-6"	2'-0"
		6"	0'-8"	1'-3"	2'-0"	1'-6"
	1/2"	10"	1'-0"	1'-4"	2'-6"	1'-6"
		8"	0'-10"	1'-0"	2'-0"	1'-3"
		6"	0'-8"	0'-9"	1'-6"	1'-0"
		10"	1'-0"	0'-6"	1'-6"	1'-3"
		8"	0'-10"	0'-6"	1'-4"	1'-0"
		6"	0'-8"	0'-6"	1'-0"	0'-9"

X* = DIAMETER OF PIPE TO BE BLOCKED

TYPICAL BLOCKING DETAIL



White House
Utility District

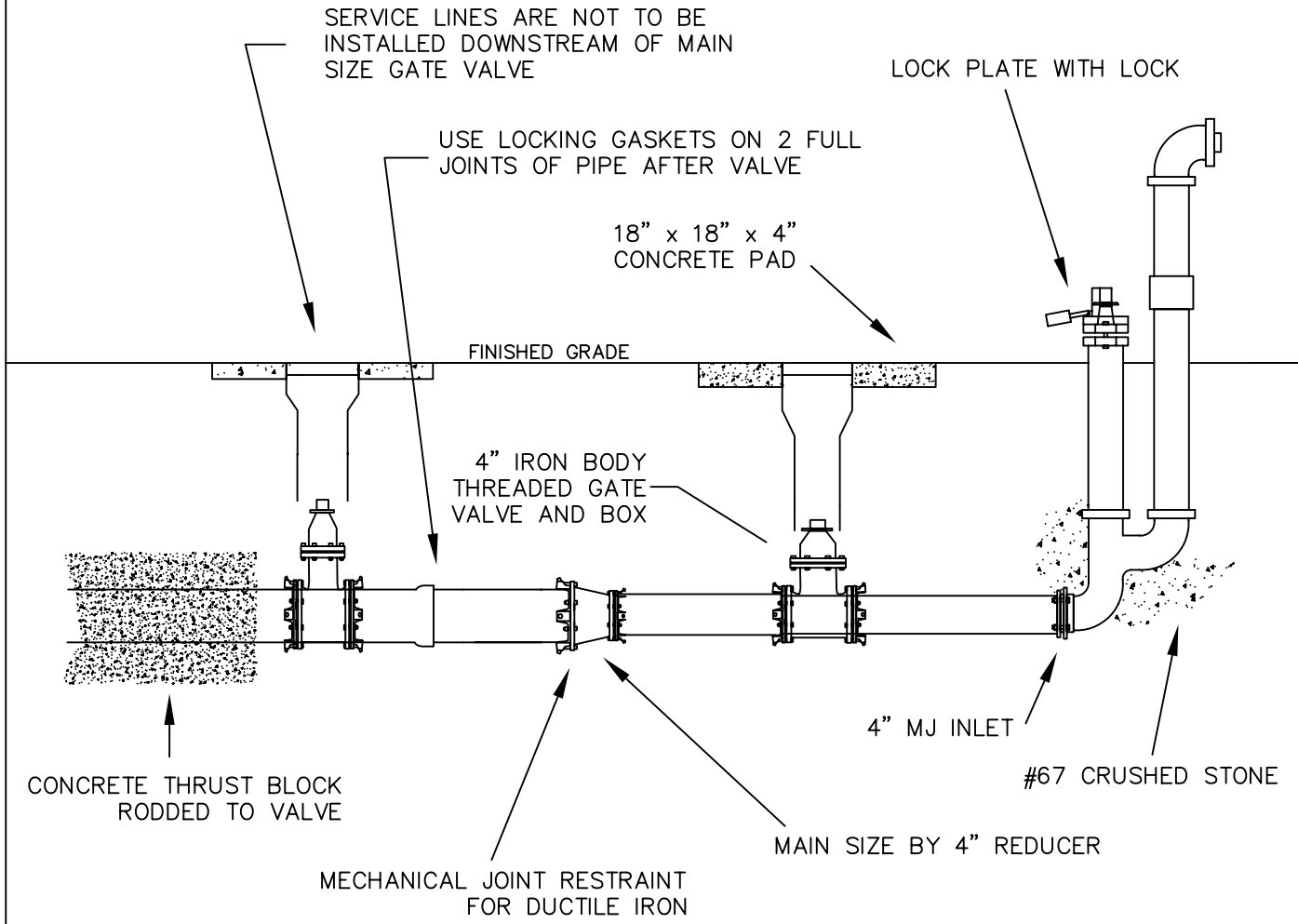
WHITE HOUSE UTILITY DISTRICT

STANDARD DETAILS


DATE : APRIL 2003
SCALE : N.T.S.

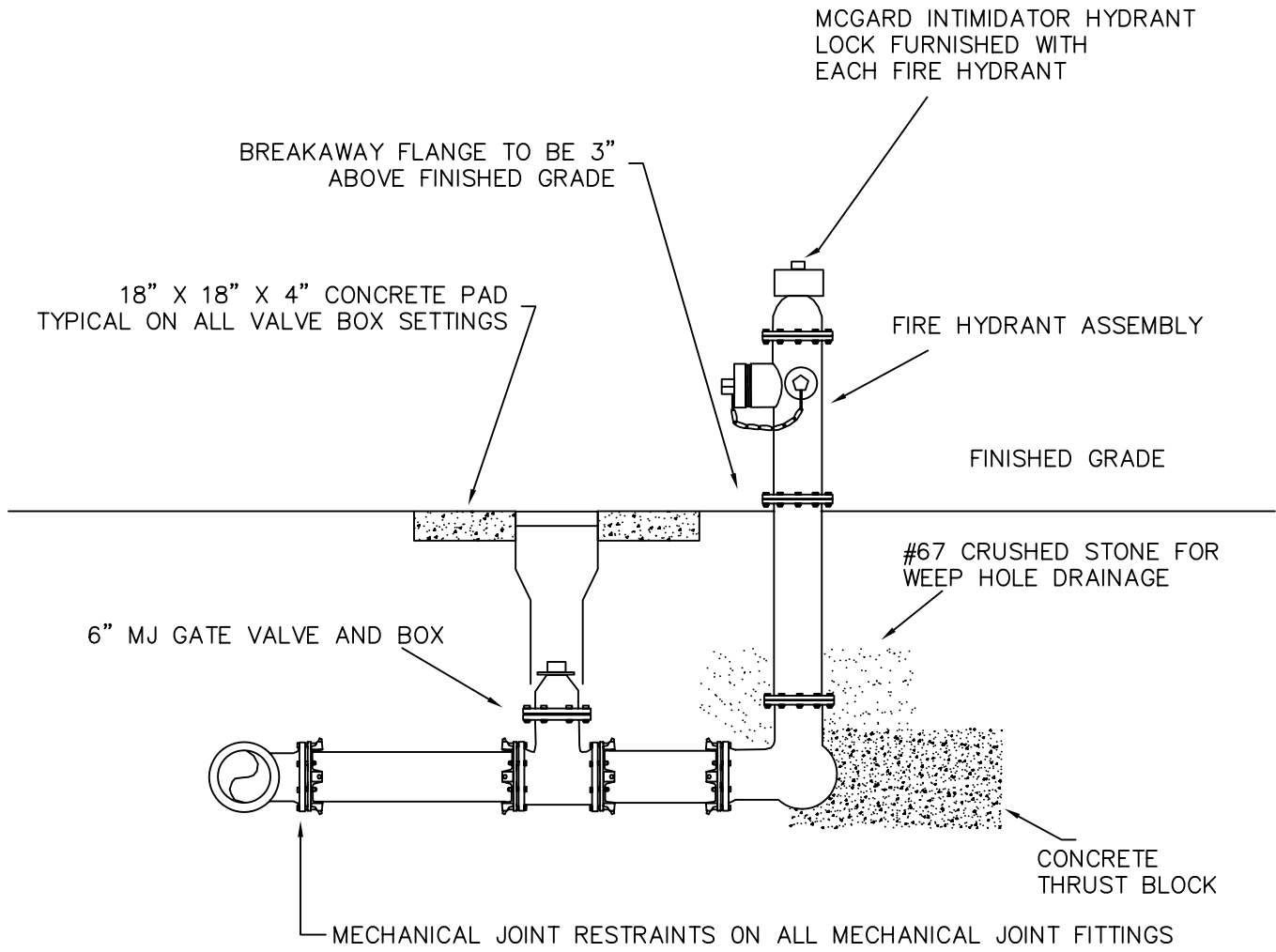
STD-W-06

KUPFERLE FOUNDRY MAINGUARD MODEL 7500 BLOWOFF HYDRANT




4" TEMPORARY DEAD END DETAIL

 White House Utility District	WHITE HOUSE UTILITY DISTRICT	DATE : FEB 2005 SCALE : N.T.S.
	STANDARD DETAILS	STD-W-07

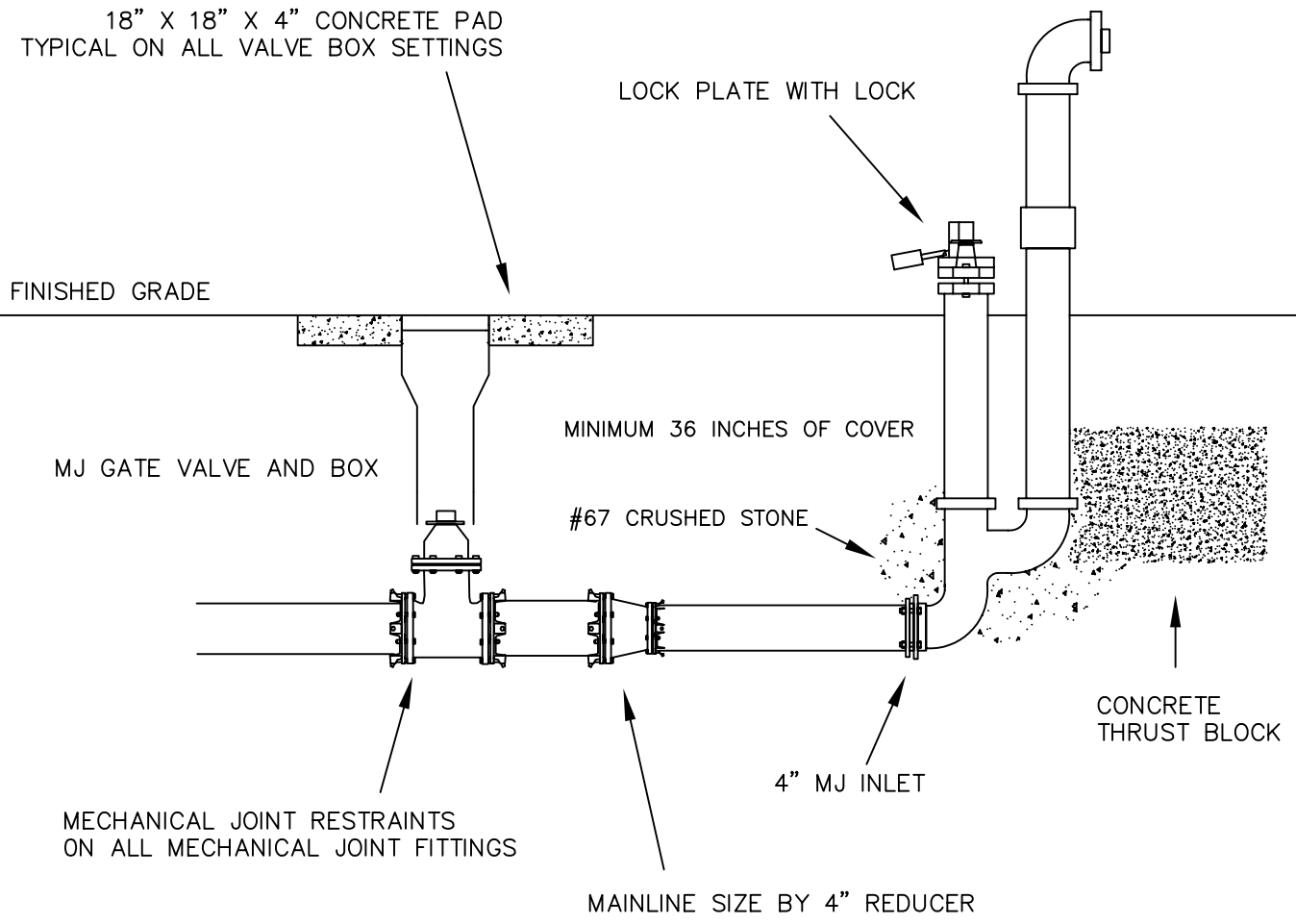


*NOTE: VALVE MAY BE ATTACHED TO AN ANCHOR (HYDRANT) TEE


FIRE HYDRANT DETAIL

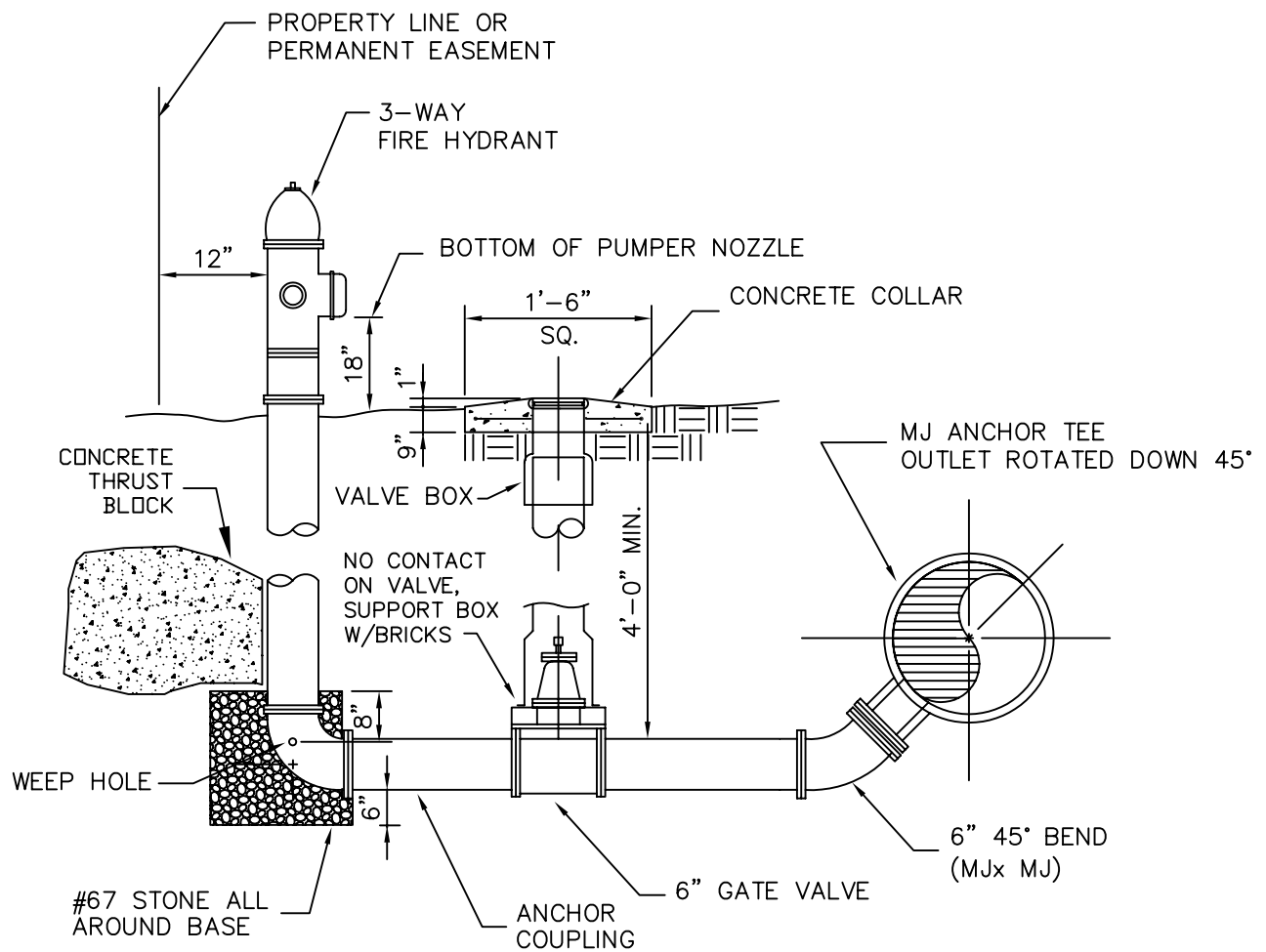
 <p>White House Utility District</p>	WHITE HOUSE UTILITY DISTRICT	DATE : APRIL 2003
	STANDARD DETAILS	SCALE : N.T.S.
		STD-W-08

KUPFERLE FOUNDRY MAINGUARD MODEL 7500 BLOWOFF HYDRANT



4" PERMANENT DEAD-END DETAIL

 <p>White House Utility District</p>	WHITE HOUSE UTILITY DISTRICT	DATE : FEB 2005
	STANDARD DETAILS	SCALE : N.T.S.
		STD-W-09



NOTE: USE RETAINER GLANDS ON ALL MJ FITTINGS NOT RESTRAINED BY ANCHOR FITTINGS

BLOW-OFF FIRE HYDRANT



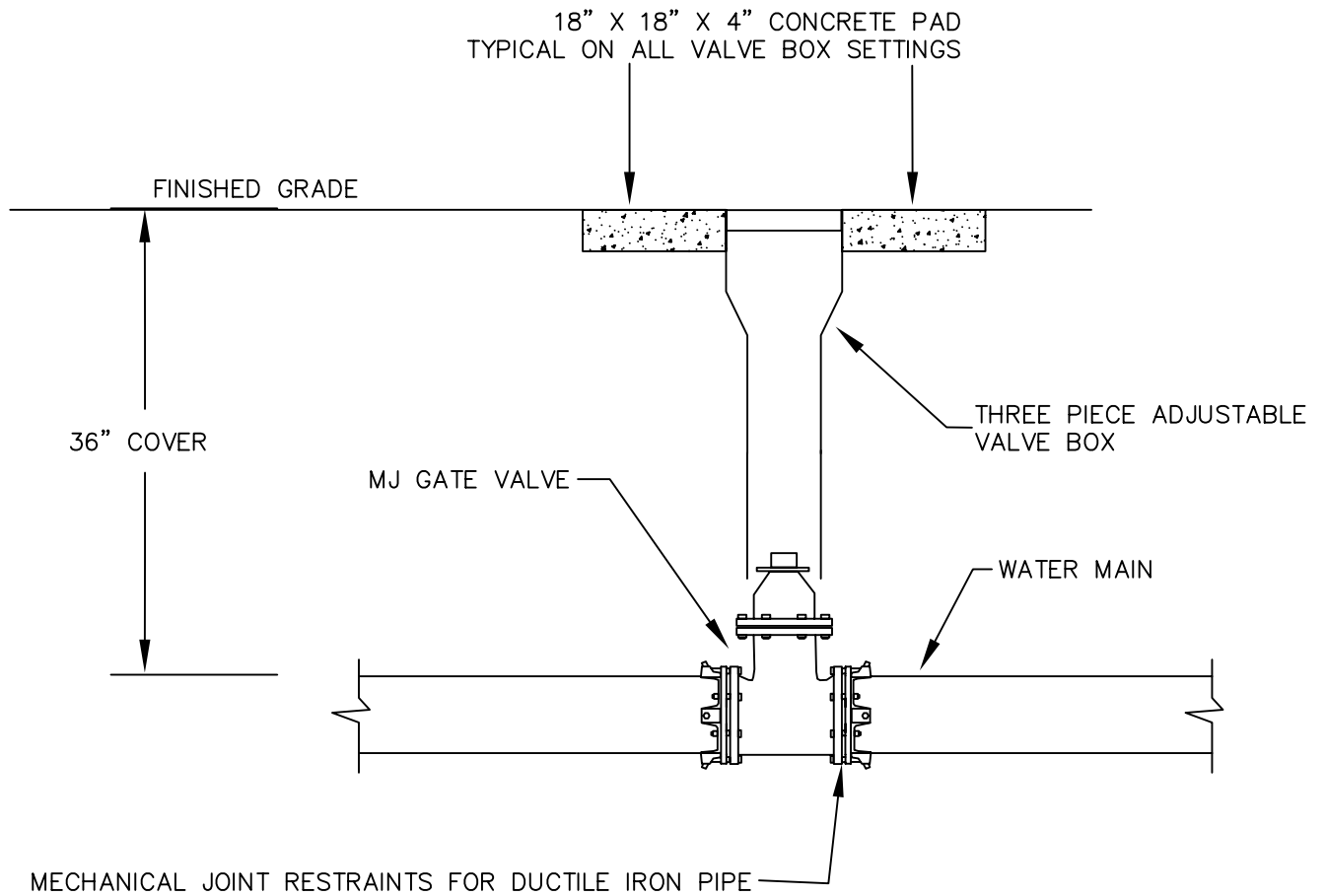
White House
Utility District

WHITE HOUSE UTILITY DISTRICT

STANDARD DETAILS

DATE : APRIL 2003
SCALE : N.T.S.

STD-W-10



NOTE: PROVIDE VALVE STEM AND BOX EXTENSIONS AS NECESSARY TO COMPLY WITH SEC. 2.04B

GATE VALVE INSTALLATION DETAIL

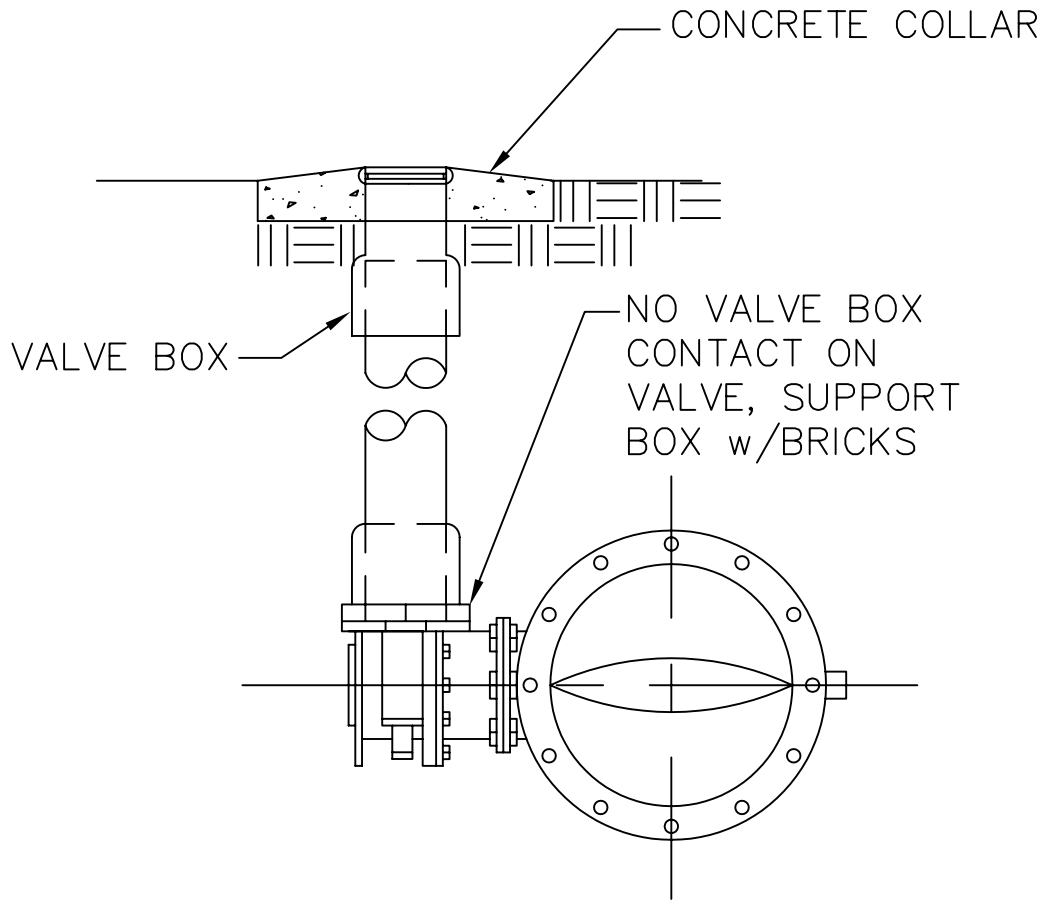


WHITE HOUSE UTILITY DISTRICT

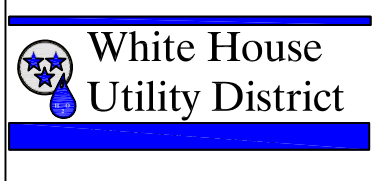
STANDARD DETAILS

DATE : APRIL 2003
SCALE : N.T.S.

STD-W-11



BUTTERFLY VALVE
INSTALLATION DETAIL

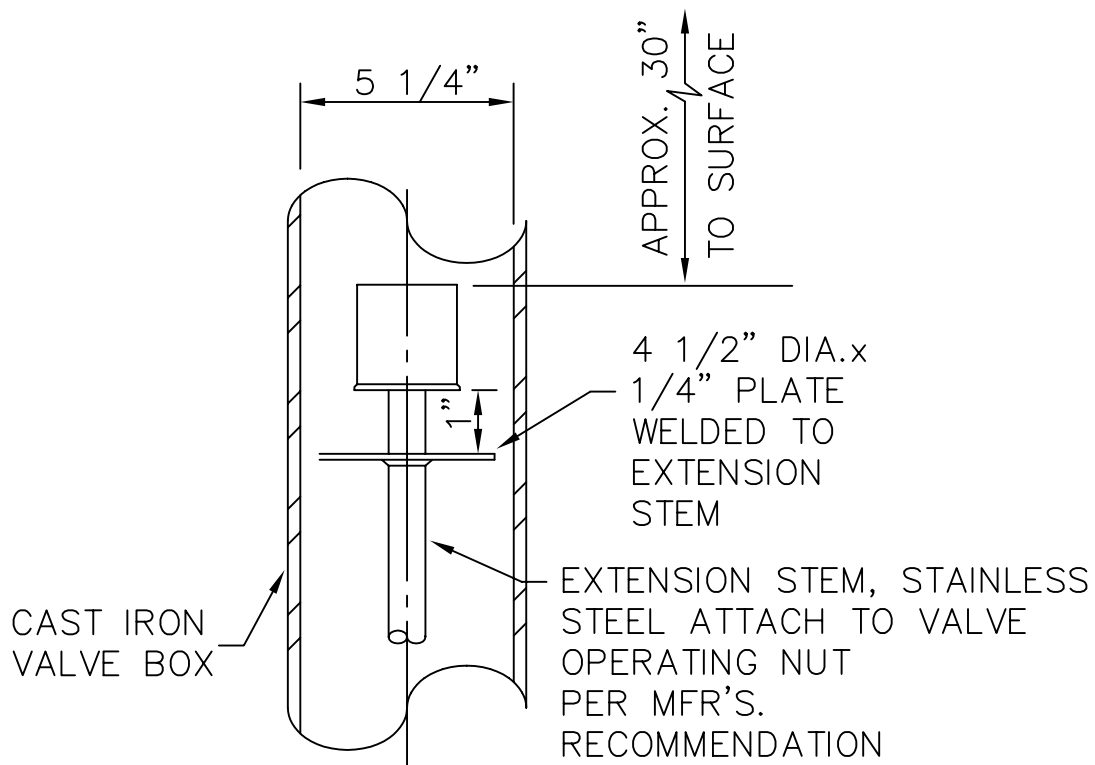


WHITE HOUSE UTILITY DISTRICT


DATE : APRIL 2003
SCALE : N.T.S.

STANDARD DETAILS

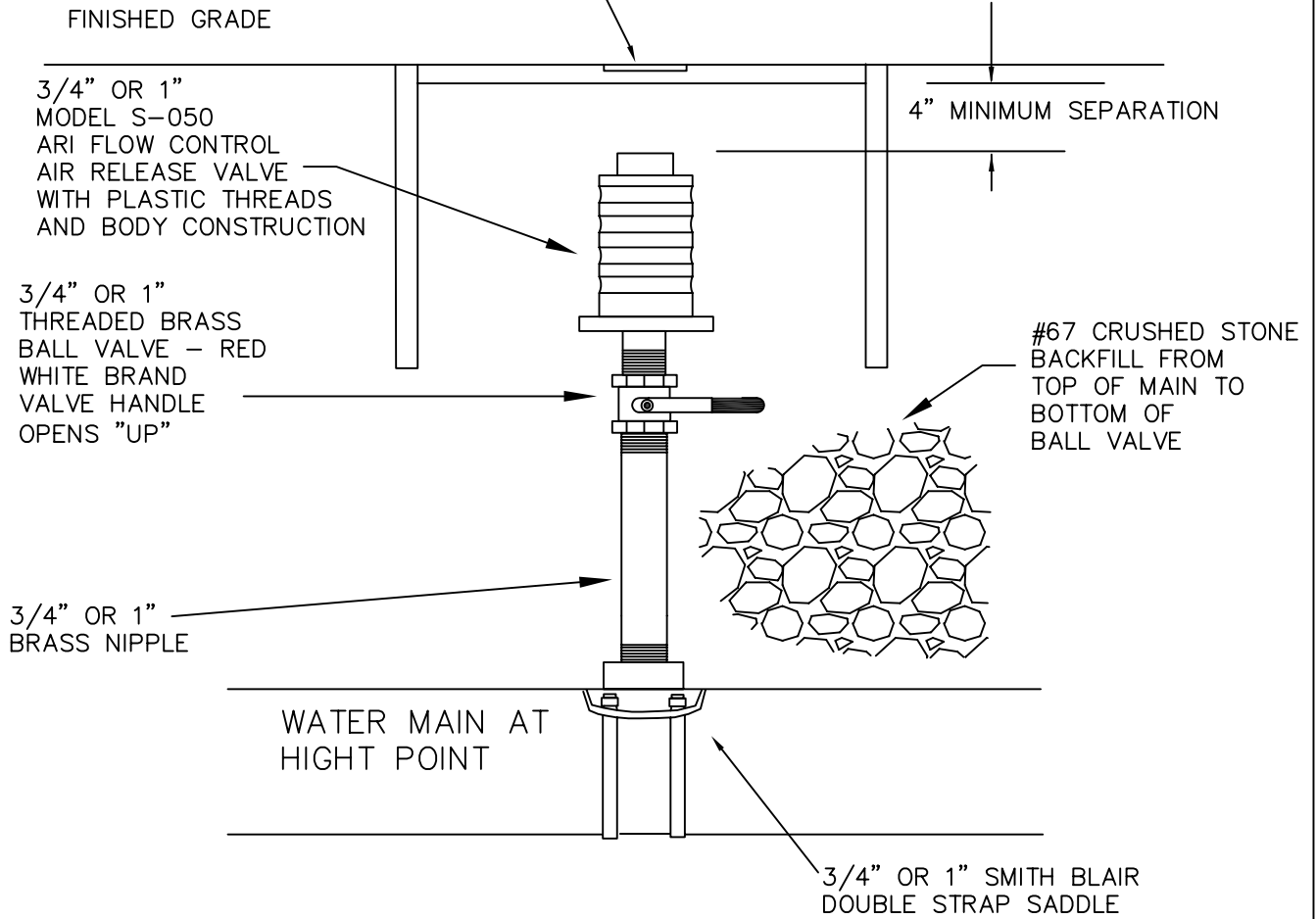
STD-W-12




EXTENSION STEM
DETAIL

 White House Utility District	WHITE HOUSE UTILITY DISTRICT	DATE : APRIL 2003 SCALE : N.T.S.
	STANDARD DETAILS	STD-W-13

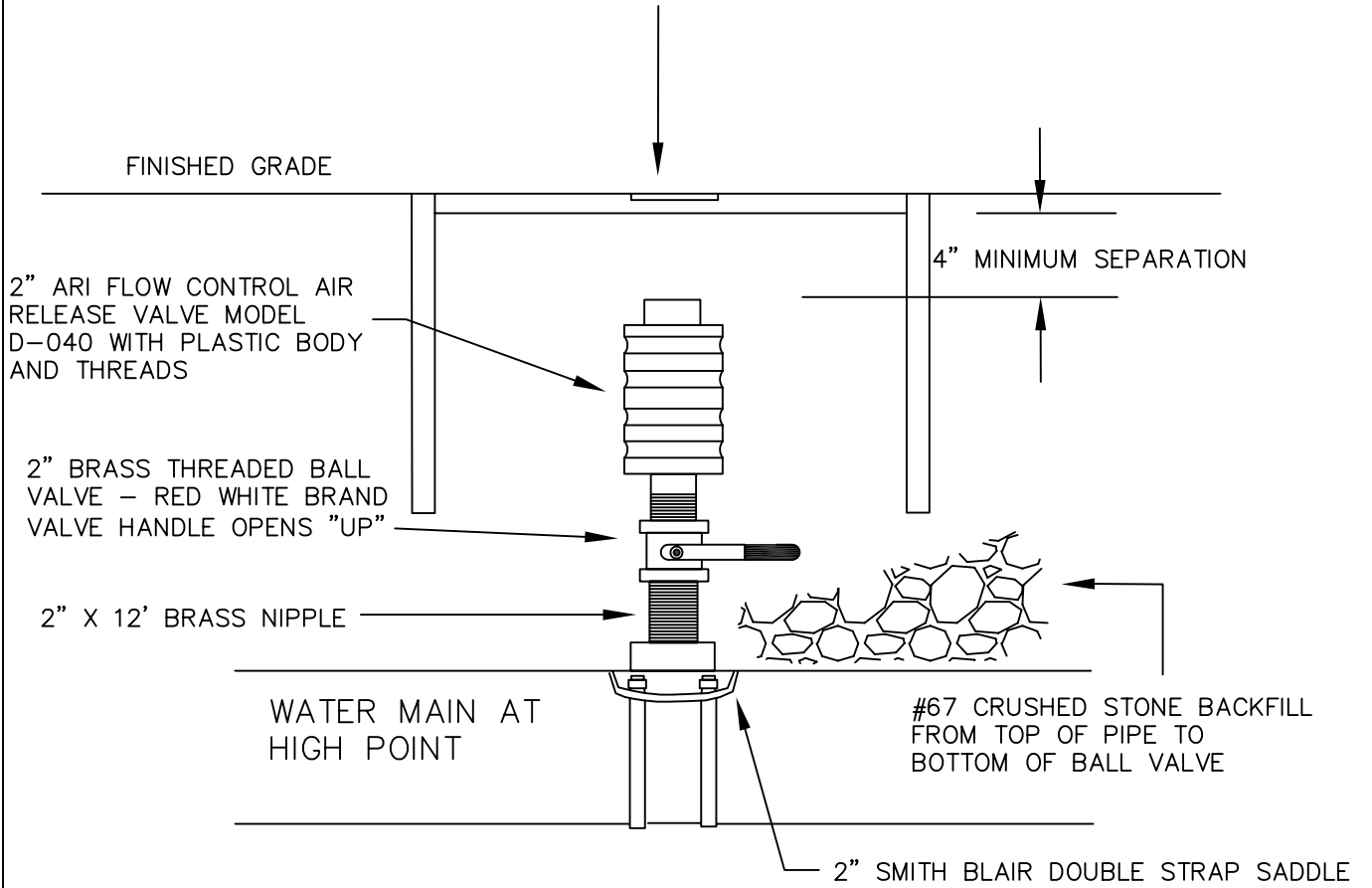
MID STATES MODEL MSBC-1730-18 METER
BOX WITH CAST IRON READER LID
INSTALLED FLUSH WITH FINISHED GRADE



3/4" AND 1" AIR RELEASE VALVE ASSEMBLY

 White House Utility District	WHITE HOUSE UTILITY DISTRICT	DATE : APRIL 2003 SCALE : N.T.S.
	STANDARD DETAILS	STD-W-14

MID STATES MODEL MSBC-1730-18 METER BOX WITH CAST IRON READER LID
 INSTALLED FLUSH WITH FINISHED GRADE



2" AIR RELEASE VALVE ASSEMBLIES



WHITE HOUSE UTILITY DISTRICT

STANDARD DETAILS

DATE : APRIL 2003
 SCALE : N.T.S.

STD-W-15