OFFICE OF DRINKING WATER
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WCSA General Water Line Specifications

COMMONWEALTH OF VIRGINIA
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GUIDE TO THE USE OF THESE SPECIFICATIONS

1.0 General

These specifications have been prepared by the Washington County Service Authority (WCSA). They are intended for use by WCSA and those who are constructing water distribution system improvements which will come under ownership of WCSA. The use of these specifications by other entities shall be approved by WCSA. These specifications are a presentation of the minimum technical requirements of WCSA for the installation of water lines. Specifically, these specifications address technical issues relating to water line construction and they do not address technical requirements for pump stations, water storage facilities or other drinking water related structures. In addition, these specifications do not address contractual procedures nor are they intended to address a comprehensive description of regulatory requirements such as approvals, permits, etc. It must be recognized that these specifications should be interpreted differently depending upon whether they are used by private developers constructing improvements whose ownership will be transferred to WCSA for operation and maintenance or by contractors in the employ of WCSA.

2.0 Private Development Use

With respect to private development, the private developer is the Owner of the facilities until they are completed and accepted by WCSA for ownership, operation and maintenance. Therefore, for private development projects, all references in these specifications referring to “Owner” may be read as “Private Developer. Furthermore, it is the responsibility of the Owner to acquire an appropriately licensed design professional (generally and engineer, but may be a land surveyor in some limited cases), licensed to practice in the State of Virginia who will design the system. This design professional is generally responsible for acquiring the necessary approvals, including that of WCSA, supervising construction and insuring compliance with applicable permits and other requirements through inspections and after successful construction certifying the project as being completed in accordance with approved plans and specifications. WCSA will not accept ownership of the constructed improvements system, nor operate or maintain it until this certification has been made in writing to WCSA and other regulatory agencies requiring it.

For private development projects, the term “Engineer” as it is referred to by these specifications is the engineer (or other appropriately licensed design professional) in the employ of the private developer. Unless specifically stated in writing, WCSA does not and will not accept any of the responsibilities of the Engineer for private development projects. For your information a copy of the Virginia Registration Law governing the practice of Engineering in the State of the Virginia is included as an Appendix to these specifications.

For private development projects, the term “Contractor” as it is referred to by these specifications is the contractor in the employ of the private developer. WCSA has no direct authority over the Contractor (s) in the employ of the private developer. These specifications do not and are not intended to define the relationship (financial or otherwise) between the Contractor and the Owner or between the Contractor and the Engineer. It is the responsibility of the Engineer and the Owner to establish the protocol for oversight of the Contractor. As noted above, it is the responsibility for the Engineer (by convention and by stature) to perform or have performed under his supervision, inspections of the work to the degree necessary for him to certify in writing completion of the project (in accordance with plans, specifications, etc.) when it has occurred. WCSA will perform the inspections it feels necessary to protect its own interests. However, WCSA will rely upon the certification of completion statement by the design professional, as evidence that compliance with the requirements of these specifications have been attained. If in the course of the work, inspectors from WCSA find conditions, workmanship, equipment, etc. not complying with these specifications, WCSA will notify the Engineer and/or Owner of these problems. However, WCSA assumes none of the responsibility for project inspection that is reserved, by convention and stature, to the due diligence of the Engineer.

References to WCSA in these specifications generally refer to an issue which WCSA reserves the right, as the future Owner of the system, to have input on. In reference to these issues WCSA is the final authority and ill act to protect its own interests.

3.0 WCSA Contracted Projects

For projects funded by WCSA the following definitions apply. The “Owner” is WCSA, the “Engineer” is the Chief Engineer of WCSA or his designated agent and the “Contractor” is the entity under contract to WCSA to perform the work.

DIVISION II

SECTION 02005—EROSION AND SEDIMENT CONTROL

1.0 General

1.1 Requirements Included

(a) Measures required to control erosion and sediment on the project site and on areas beyond the project limits, affected by the project.

(b) If required by local authorities, the Owner shall be responsible for submitting and gaining approval of a formal Erosion and Sediment Control Plan.

(c) For private development projects, WCSA accepts no responsibility for submission of E&S control plans or storm water management plans. Compliance with requirements is solely the responsibility of the developer.

1.2 References

(a) Virginia Erosion and Sediment Control Handbook, Latest Edition.

(b) Virginia Department of Transportation (VDOT) Road and Bridge Specifications, latest edition and latest revisions

1.3 Related Sections

(a) Section 02010 - Site Clearing

(b) Section 02200 - Earthwork

(c) Section 02070 – Seeding

2.0 Materials

2.1 Materials. Shall be in accordance with the Virginia Erosion and Sediment Control Handbook, VDOT requirements and local ordinances as appropriate.

3.0 Execution

3.1 General

(a) The erosion and sediment control measures shall protect adjacent properties, shall be in accordance with the Virginia Erosion and Sediment Control Handbook and local ordinances, and shall be approved by the Engineer. All measures shall be sized and designed in accordance with the criteria specified in the handbook. All erosion control measures shall be placed prior to commencement of grading.

(b) Temporary measures shall be applied throughout the construction of the project to control erosion and to minimize siltation of drainage ditches, storm drains and waterways. The Contractor, as a minimum, shall employ all erosion control measures indicated on the drawings and specified herein.

(c) Grading shall be limited to areas of workable size so as to limit the duration of exposure of disturbed and unprotected area. All appropriate conservation practices should be applied in sequence of work. Disturbed areas that are to be left unfinished for more than 30 days shall be seeded temporarily.

(d) Protect stockpiled material with mulch, temporary vegetation, or sediment barrier at base. Slopes of stockpiled material shall not exceed 2 to 1.

(e) Stabilize all streets and parking areas, within 15 days of final grading, with basecoarse-crushed stone.

(f) Allow no water to enter storm drainage systems prior to settlement or screening of excess siltation.

(g) Synthetic filter fabric fencing shall be used for sediment control when land disturbing activities are within 25 feet of flowing creeks or streams or drainage ways which have the potential to carry surface water prior to restoration.

(h) No more than 500 feet of trench shall be open at any one time.

(i) No excavated material shall be placed in stream beds.

(j) On disturbed short, steep slopes, where erosion hazard is high or in vegetated channels or ditches, the Contractor shall provide soil stabilization blankets and matting as directed as needed.

3.2 Minimum Required Measures. The following measures may need to be employed to accomplish effective E&S control. The numbers in parenthesis refer to standards and specifications in the Virginia Erosion and Sediment Control Handbook.

(a) Straw Bale Barrier (3.04)

(b) Silt Fence (3.05)

(c) Storm Drain Inlet Protection (3.07)

(d) Culvert Inlet Protection (3.08)

(e) Riprap (3.19)

(f) Temporary Seeding (3.31)

(g) Permanent Seeding (3.32)

(h) Mulching (3.35)

(i) Soil Stabilization Blankets and Matting (3.36)

3.3 Maintenance. Inspect all control measures following each storm event, and at least weekly, to ensure maximum effectiveness. Clean as required. Repair any damage or deteriorated conditions immediately.

3.4 Removal. Remove all control measures at the completion of the work and restore site as required by these specifications.

3.5 Failure to Execute. In the event the Contractor repeatedly fails to satisfactorily control erosion and siltation, the Owner reserves the right to employ outside assistance or to use

his own forces to provide the erosion control measures indicated and specified. The cost of such work, plus related Engineering costs, will be deducted from monies due to the Contractor for other work.

END OF SECTION

SECTION 02010—SITE CLEARING

1.0 General. This section pertains to preparing work sites for excavation for installation of precast concrete structures and water line installation.

1.1 Work Included. Inspection of work sites, identification of conflicting structures, and coordination with property Owners including VDOT on whose property water lines or valve stations will be installed. Site clearing as may be required.

1.2 Related Work. Specified elsewhere includes the following:

(a) Section 02005 – Erosion and Sediment Control

(b) Section 02070 – Seeding

(c) Section 0220—Earthwork

1.3 Quality Assurance

(a) Prior to beginning work, become thoroughly familiar with existing site conditions and all Sections of this Division. Video taping and/or photographing sufficiently to reveal the details of existing conditions is required.

(b) Comply with all federal, state, and local applicable codes, regulations and requirements.

1.4 Work Requirements

(a) Protection of Existing Improvements and Properties

(i) Protect improvements on adjoining properties as well as those on the Owner's Property.

(ii) Restore all areas damaged by construction and associated activities to their original condition, as acceptable to the property Owners, and/or the WCSA, and other parties having jurisdiction or authority.

(iii) For utility line trench construction only that part work area actually needed for construction shall be cleared or used by heavy equipment unless directed otherwise by the Owner and the Engineer.

1.5 Submittals

(a) Project Record Documents

2.0 Products

2.1 General. All products shall be in accordance with the provision of the following specifications

3.0 Execution

3.1 Site Inspection

(a) Prior to all work, carefully inspect the entire site and all objects designated to be removed and to be preserved.

3.2 Clarification

(a) The Drawings do not purport to show all objects existing on the site. Before commencing any work, verify with the Engineer all objects not clearly identified to be removed or to be preserved and any discrepancies not fully resolved.

3.3 Prior Conditions Inspections

(a) Prior to all work of this section, inspect the installed work of all other trades, if applicable, and verify that all such work is complete to the point where installation may commence in accordance with the designed improvements in accordance with all provisions required. Immediately notify the Engineer and do not proceed with installation in non-conforming areas until all identified discrepancies have been resolved.

3.4 Protection and Safety

(a) Verify all required and necessary personal protection and safety devices either required or necessary are in place and operational.

3.5 Utilities

(a) Before starting excavation or other site work which will affect existing utilities, establish location and extent of utilities in the work area and disconnect or arrange for disconnection of all utility services to be removed, performing all such work in accordance with the requirements of the utility company, or other entity involved or having jurisdiction.

(b) Maintain, reroute, extend or abandon as required, existing utility lines in areas of excavation; cap, plug or seal such lines and identify at grade.

(c) Preserve in operating condition all active utilities traversing the site and designated to remain.

(d) Remove utility lines to be abandoned from areas of excavation; cap, plug or seal such lines and identify at grade.

(e) Restore all utilities as required by the Utility Owner.

(f) Accurately locate and record abandoned and active utility lines, re-routed or extended on Record Drawings.

(g) Notify the Engineer immediately when active utilities are encountered which are not shown on the drawings or previously identified. Existing utility lines shall be protected, relocated or otherwise modified, as directed by the Utility Owner or as approved by the Engineer.

3.6 Procedure

(a) Establish extent of sitework, by area and elevations; designate and identify datum elevation.

(b) Set required lines and levels.

(c) Maintain bench marks, monuments and other reference points.

(d) Provide sitework in accordance with lines and levels required for construction of the Work, including space for forms, bracing and shoring, foundation drainage systems applying damp proofing and waterproofing, and to permit inspection.

(e) Clearing

(i) Remove from the site trees, brush, shrubs, downed timber, rotten wood, rubbish, other vegetation as well as fences, and incidental structures necessary to allow for new construction.

1) Clearing work shall be restricted to area within rights-of-way or easements or within “Construction Limits” indicated on the Drawings.

2) Undisturbed stumps and roots which will be a minimum of 5 feet below finished grade and will not be located under or within 10 feet of any structure, may be left in place. Tops of Stumps left in place shall not be more than 6 inches above 6 inches above original grade.

3) Install and maintain temporary fencing as may be required for control of farm animals or other purposes.

(ii) Only that portion of the work area actually needed for construction shall be cleared or used by heavy equipment unless directed otherwise by the Owner and Engineer.

(f) Existing Trees and Shrubs

(i) Only clear trees and shrubs that are to remain within “construction limits” that are necessary to accomplish the work.

(ii) Refer to easements (copies of which shall be provided by the Owner) for specific site clearing limitations.

(iii) For utility line trench construction only that part of the work area actually needed for construction shall be cleared or used by heavy equipment unless directed otherwise by the Owner and the Engineer.

(iv) Maintain communication with Owners of property which will be traversed with the work. Immediately inform the Owner of conflicts.

(v) Provide protection for roots and branches over 1½ inch in diameter that are cut during construction operations. Coat the cut faces with emulsified asphalt or other coating especially formulated for horticultural use on cut or damage plant tissue. Temporarily cover all exposed roots with wet burlap to prevent roots from drying out. Provide earth cover as soon as possible.

(g) Cleanup

(i) Debris resulting from site clearing operations shall be removed continuously with the progress of the work.

(ii) Burning of debris on site is permitted only when acceptable to the applicable regulatory authority and in compliance with all applicable, federal state and local ordinances, codes and regulations.

(iii) Sale of material on the site is prohibited.

(iv) Remove debris from the site in such a manner as to prevent spillage.

(v) Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.

(vi) Obtain permission, as required, for removal and disposal of debris from the Owner of the disposal location, the Engineer and/or the appropriate regulatory authorities having jurisdiction.

3.7 Surplus Material

(a) Remove surplus backfill materials from the site,

(b) Surplus materials shall be disposed of in a manner and at a location approved in advance by the Owner of the disposal location, the Engineer and/or the appropriate regulatory authorities having jurisdiction.

(c) Leave stockpile areas free of all excess fill materials and seed and restore to the original condition.

3.8 Excess Water Control

(a) Comply with all applicable Local, State, and Federal laws and regulations governing Erosion and Sediment Control and Storm Water Management.

(b) Provide berms or channels to prevent run-off into subgrade; promptly remove all water collecting in depressions.

(c) Do not place, spread, or roll fill material during unfavorable weather conditions. Do not resume operation until moisture content and fill density are satisfactory.

(d) Provide and maintain at all times during construction, ample means and devices with which to promptly remove and dispose of all water from every source entering the excavations. Dewater by means which will ensure dry excavations and the preservation of final grade lines and grades of bottoms of excavations.

3.9 Maintaining Traffic

(a) Do not close or obstruct roadways without appropriate permits when the regulating authority is the Virginia Department of Transportation (VDOT).

(b) When the regulating authority is not VDOT, do not close or obstruct roadways without approval of the Engineer.

(c) Conduct operations with minimum interference to public or private roadways.

(d) Maintain designated temporary roadways, walkways and detours for vehicular and pedestrian traffic.

(e) Restore all areas used for temporary roadways and detours to original condition.

END OF SECTION

SECTION 02070—SEEDING

1.0 General

1.1 Work Included

(a) Provide all equipment, materials, labor, and services required to establish a permanent vegetative cover over all areas disturbed or altered by construction.

(b) Alternatively, where noted on the plans, provide all equipment, materials, and labor to needed to provide alternative finished ground cover as noted below.

(c) For private development projects, compliance with this section of the specifications is strictly the responsibility of the developer. Prior to acceptance of water system improvements, WCSA reserves the right to require written statements of acceptance of restoration from private property Owners whose land has been disturbed by the projects.

1.2 Related Work

(a) Section 02200—Earthwork

1.3 Submittals

(a) Product Data: Submittals on seed and fertilizer shall include a test report from the Virginia Department of Agriculture and Consumer Services (VDACS) or a comparable testing lab. The test report shall bear the specific lot number of the product as well as the date sampled, the purity, and germination, the percent weed seed, the analysis, date tested as well as other pertinent data about the product.

(b) Guarantee: Written guarantee for a period of one growing season (minimum six months). Replacement shall be at no cost to the Owner.

1.4 References

(a) The materials and method of construction for protective covering and erosion control shall be in accordance with the latest revisions of the Virginia Department of Transportation (VDOT) Road and Bridge Specifications, and the Virginia Erosion and Sediment Control Handbook and other applicable laws, regulations and requirements.

1.5 Job Conditions

(a) Topsoil shall be stockpiled, on the project site or other approved location, for reuse on all disturbed areas in the grading and landscape work.

(b) Seeding shall not begin until all site work has been completed, except land where disturbed by construction of utility trenches shall be seeded so that no more than 2000 linear feet remain unseeded at any one time, weather permitting.

(c) Seeding shall only be performed between March 1 and May 31 or between August 15 and September 30. At other times, sodding or seeding with annual rye for temporary cover shall be made until the desired spring or later summer seeding time. Alternative methodologies will be considered on a case by case basis by the Owner.

(d) Seeding shall not be performed on frozen or muddy grounds or when prevailing winds exceed five (5) miles per hour.

2.0 Products

2.1 General

(a) Materials shall be delivered in unbroken containers, clearly marked by the manufacturer as to contents. Limes, fertilizer and seed shall be labeled as to proportions, analysis and quality. Store all materials in a manner affording protection from damage by weather or vandalism.

2.2 Lime

(a) Lime shall be ground or pulverized agricultural grade limestone containing not less than 85 percent total carbonates and shall be ground to such fineness that at least 50% will pass a 100 mesh sieve and at least 90% will pass a 20 mesh sieve.

2.3 Fertilizer

(a) The fertilizer shall be an agricultural grade 10-20-10 or any equivalent 1-2-1 ratio fertilizer. Fertilizer shall be agricultural grade, free flowing, and uniform in composition and shall conform to State and Federal regulations. Fertilizer shall bear the manufacturer's guaranteed statement of analysis.

2.4 Seed

(a) Grass seed for lawns and open fields shall be 100 percent by weight Kentucky 31 Tall Fescue. Grass seed for drainage channels shall be 67 percent by weight Kentucky 31 Tall Fescue and 33 percent by weight Red Creeping Fescue. In restored areas, species and mixture shall match existing vegetation.

(b) Grass seed shall be clean, fresh stock and labeled in accordance with the Federal Seed Act and shall be produced by a recognized manufacturer and guaranteed by the dealer. The seed shall have State of Virginia certification.

2.5 Mulch

(a) Wood cellulose fiber used for hydraulic mulching shall consist of specially manufactured commercially available products containing wood cellulose fiber, recycled newsprint fibers, or a combination of these materials. The wood cellulose fiber or newsprint fiber will contain no growth or germination inhibiting factor and shall contain a dye for color. The dye shall allow the operator to monitor the amount of mulch being applied to the area to insure proper coverage.

2.6 Weed Barrier

(a) When the alternative gravel cover is specified on the drawings to be used in lieu of a vegetative cover, underlay the gravel or rip rap with a weed barrier. The weed barrier shall be Mirafi 500x or approved equal.

2.7 Gravel and Rip Rap

(a) When the alternative gravel cover is specified on the drawings to be used in lieu of a vegetative cover, the stone shall be VDOT #21A graded gravel except on slopes which exceed 15% where VDOT Class I rip rap shall be used.

3.0 Execution

3.1 Subgrade Preparation

(a) All subgrade for finished lawn areas and drainage channels shall be raked to remove all debris and stones over two (2) inches in diameter. All subgrade for open field areas and shoulders shall be raked to remove all debris and stone over three (3) inches in diameter.

(b) Prior to spreading topsoil, the subgrade shall be loosened to a minimum depth of four (4) inches by tilling, disking or harrowing.

3.2 Topsoil Preparation

(a) Topsoil shall be spread over the prepared subgrade in all lawn areas to a minimum depth of four (4) inches. Bond topsoil to subgrade by tilling, disking or harrowing. Topsoil shall not be spread over the subgrade when either the topsoil or subgrade is frozen or excessively wet.

(b) Where topsoil is not applied, the surface of finished grade shall also be prepared as specified for topsoil hereinafter.

(c) Prior to seeding finished lawn areas and drainage channels, topsoil surface shall be raked to remove all debris and stones over two (2) inches in diameter and to smooth any surface irregularities. Prior to seeding open field areas and shoulders, topsoil shall be raked to remove all debris and stones over three (3) inches in diameter and to smooth any surface irregularities.

(d) Topsoil finish grade of lawn areas and open fields shall be slightly higher than existing grade and rounded off to avoid abrupt changes in grade.

3.3 Preparation of areas to be seeded

(a) Slopes 3:1 or steeper

(i) On slopes, use the walking or tracking method with a dozer or other tracked equipment. Vertically "walk" the slope so as to leave track marks perpendicular to the toe of the slope. Remove large rocks, stones and roots over two inches in diameter.

(ii) Where this tracking of slope areas is not possible or practical, the use of a slope chain may be used to loosen the top two inches of soil for proper seedbed preparation. The chain shall be dragged across the top of the slope. The spikes on the chain shall produce puncture marks in the slope as well as serve to loosen the soil surface.

(iii) Where the sloped areas are smoothly graded and are unable to be loosened satisfactorily for seedbed preparation, cutting horizontal grooves into the slope may be required with the use of grading equipment or by other means.

(iv) If the slope is freshly graded and the surface is friable without disturbing, the Contractor may be allowed to seed the slope without further slope preparation.

(b) Areas Flatter Than 3:1

(i) Use a disk or harrow to loosen the top 4 inches of soil. Where this is not possible backdrag the area with the toothed bucket or dozer type equipment to loosen the soil surface.

(ii) Rake the area smooth and remove roots, rocks and other debris that may interfere with the seeding operation. Debris larger than two inches in diameter should be raked from the surface with the use of a York Rock Rake, hand rake or other comparable equipment.

(iii) In the final preparation of the surface, care should be taken to insure that low areas or depressions do not occur which could later cause areas of ponding or settling.

(c) Ditch lines, Waterways, Channel Change Areas

(i) Care should be taken to insure that a minimum of disturbance occurs in all areas that are to carry water through the site. Preparation for seeding in these areas consists of removing large stones, rocks, roots and other debris that may interfere with the germination of seed.

(ii) In ditch lines that will receive erosion control treatment, the ditch shall be free of all obstructions that may prevent the erosion control from being attached securely and to the bottom and sides of the ditch.

3.4 Lime Application

(a) Lime shall be applied at the rate of 45 lbs. /1000 sq. ft.

(b) Lime may be applied with the use of a bulk spreader, drop type spreader, hydroseeder or any other equipment approved for application by the Engineer. The application shall result in an even spreading of the lime over the entire area to be seeded.

(c) In areas 3:1 or flatter the lime shall be applied after the disking operation and before raking the soil. Lime shall be applied before any application of fertilizer except when the seeding equipment used is a hydroseeder. On slopes 3:1 or steeper or where a hydroseeder is used in the seeding operation, the application of lime can be made in connection with the fertilizer seed and mulch in a slurry mix in the hydroseeder.

3.5 Fertilizer Application

(a) The rate of application should be the equivalent of 25 lbs. /1000 sq ft.

(b) Fertilizer may be applied with the use of a bulk spreader, cyclone spreader, hydroseeder or other equipment approved for application by the Engineer. The application shall result in an even spreading of the fertilizer over the entire area to be seeded.

(c) The Contractor shall take care so as to not spill large amounts of fertilizer in the areas to be seeded during the loading and spreading of fertilizer.

(d) The fertilizer shall be worked into the topsoil to a depth of 3 inches.

3.6 Seeding

(a) Prior to seeding, scarify the topsoil surface with a rake to a minimum depth of ¼ inch. The application of seed shall be by broadcast, cyclone type, drill type, hydroseeder, or other equipment approved for application by the Engineer. The application of the seed over the area shall be even and at the rates specified.

(b) The Contractor shall take great care to insure that the seed is not sown into areas that are to receive landscaping or other treatment such as asphalt and or concrete pavement. This includes but is not limited to bed areas, landscaped berms, parking areas and sidewalks, etc.

(c) After sowing, seed shall be rolled immediately mulched with straw or wood cellulose fiber.

3.7 Mulching

(a) Straw mulch will be applied at the rate of 45 lbs. /1000 sq. ft. Wood cellulose fiber mulch shall be applied at the rate of 35 lbs. dry weight/1000 sq. ft.

(b) The application of straw mulch will be through a blower or other approved equipment capable of shredding the material from the bale and distributing it evenly over the seeded areas. The application of mulch will take place no more than 24 hours after the seeding operation of the area.

(c) The application of wood cellulose fiber mulch shall be in a slurry mix through a hydroseeder. The slurry mixture shall be constantly agitated from the initial mixing point until the material is discharged onto the ground. The material shall then be applied over the seeded area in a manner not disruptive to the placement of seed.

(d) The Contractor will take all necessary precautions to prevent the application of the wood cellulose fiber mulch, straw or binders onto landscaped areas, fixtures, fences and signs in the area to be mulched.

3.8 Mulch Tackifier

(a) Straw mulch shall be tacked as needed to the seeded area by the use of one of the following methods. A crimping device may be used that will punch the straw into the soil to prevent wind disturbance. The use of a chemical binder manufactured for the purpose of securing mulch may also be used when applied with a hydroseeder. The use of wood cellulose is allowed for tacking straw mulch.

(b) After sowing, seed shall be rolled immediately and mulched with straw or wood cellulose fiber. When a chemical binder is used, follow the manufacturer's recommendations as to the rates of material required. The Contractor may also elect the use of an application of wood cellulose fiber at the rate of 750 pounds to the acre as a tackifier in lieu of the above methods.

(c) The tacking or securing of the straw mulch shall be completed immediately after mulching is complete.

3.9 Protection and Maintenance of Seeded Areas

(a) After the seeding is completed in a particular area, the area shall be protected from vehicular, and or foot traffic by erecting, barricades, signs, ropes or other such devices to prevent traffic where necessary.

(b) The Contractor shall be responsible for maintaining seeded areas until substantial completion has occurred and all the requirements of this section have occurred

(c) Surfaces gullied or otherwise damaged following seeding shall be repaired and re-graded as required and re-seeded as directed by the Engineer.

(d) In utility installation and erosion control areas, the maintenance period shall be the amount of time required to establish the desired species or its companion crop over 90% of the seeded area or 90 calendar days from the last seeding date.

(e) In industrial lawn and shoulder areas, the maintenance period will extend through the time necessary to establish a healthy, uniform, two (2) inch high close stand of grass, free of weeds, bare spots, and surface irregularities.

3.10 Acceptance of Seeded Areas

(a) The acceptance of seeded areas shall be at the end of the establishment period mentioned in other sections or at substantial completion, whichever occurs later. Final acceptance shall be made when the specified vegetation is successfully established in the area to be accepted

3.11 Alternative Rock Cover

(a) Where designated on the plans a gravel or rip rap cover shall be provided in lieu of a vegetative cover as follows.

(b) After final grading, remove all vegetative cover remaining in the area designated to receive the rock cover. Remove all rocks and sharp stones or other objects that may puncture the weed barrier.

(c) Place the weed barrier on the ground in accordance with the manufacturer’s recommendation.

(d) Cover the weed barrier with the appropriate stone taking care not to puncture or other wise damage the weed barrier. On slopes less than 15% the stone shall be a VDOT Class 21A graded gravel and on slopes 15% or greater a VDOT Class I rip rap shall be used as the stone cover. The presence of fine material is not desirable and should be avoided when selecting material. Loading, hauling and

placement activities should be carried out to reduce degradation of the rip rap to fine material.

END OF SECTION

SECTION 02200—EARTHWORK

1.0 General. The work included under this section shall be subject to the requirements of all other applicable sections of these specifications, drawings and contract documents. This section of the specifications includes excavation, disposal of excess materials, borrow of additional suitable materials, backfilling, compaction, testing, finished grading, restoration of any and all materials encountered or required to be transferred onto the site to obtain the elevations indicated in preparation for new foundations, site work and underground piping. The Contractor shall be responsible for furnishing equipment, labor and materials (unless otherwise specified) to complete all necessary earthwork, including restoration, as shown on the drawings or described in the specifications and contract documents.

(a) The Contractor shall place specific emphasis on and be responsible for:

(i) Prevention of embankment erosion and siltation problems,

(ii) Proper consideration of drainage problems resulting from construction,

(iii) Avoidance of dust buildup,

(iv) Proper traffic flow as defined by the Virginia Department of Transportation (VDOT),

(v) Minimum noise pollution

(vi) Prompt and proper backfilling of trenches,

(vii) stabilizing excavated and fill areas by seeding, staking, riprapping or other acceptable methods as soon as finished grade is achieved, and

(viii) Prompt cleanup and disposal of all debris and restoration of property, including but not limited to mailboxes, fences, shrubbery, sidewalks, driveways, and paving.

(b) Restoration. All properties shall be restored to a condition good as or better than existing prior construction or as acceptable to the Owner, WCSA, property Owner and other parties having jurisdiction or authority.

(c) Claims and Damages. The Contractor shall be responsible for all claims or damages resulting from any nuisances, inconveniences, or disruptions caused by the work.

1.2 Work Included

(a) General site excavation, filling, and backfilling.

(b) Excavation and backfilling for site structures

(c) Excavation and backfilling for utilities lines.

(d) Blasting.

(e) Finish grading.

1.3 Related Sections

(a) Section 02010 Site Clearing

(b) Section 02005 Erosion and Sediment Control

(c) Section 02070 Seeding

(d) Section 02419 Boring, Jacking and Tunneling

(e) Section 02713 Water System

1.4 Regulations

(a) Comply with all codes, laws, ordinances and regulations of governmental authorities having jurisdiction over this part of the work.

(b) Work within existing or proposed Virginia Department of Transportation (VDOT) Right-of-Ways shall meet all requirements of VDOT.

1.5 References

(a) Virginia Department of Transportation (VDOT) Road and Bridge Specifications, latest edition.

(b) American Society for Testing Materials (ASTM) D698 Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 5.5 lb. (2.49 kg) Hammer and 12-inch (305 mm) Drop.

(c) American Association of State Highway and Transportation Officials - (AASHTO) T-180, modified test, (ASTM D1557 Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10 lb. Hammer and 18 inch Drop).

(d) Virginia Department of Labor and Industry – Occupational Safety and Health Standards for the Construction Industry; Subpart U – Blasting and the Use of Explosives, Subpart P - Excavations, Trenching, and Shoring.

1.6 Testing Services

(a) The Contractor shall arrange for and coordinate the services of an independent soils testing laboratory to perform the testing specified in this Section. Unless otherwise explicitly specified, the Contractor shall pay for these services.

(b) The testing laboratory shall be approved by the Engineer and will be responsible for conducting and interpreting tests, including stating in each report whether or not the test specimens conform to all requirements of the Contract Documents and specifically note any deviation there from.

(c) General requirements for backfill density testing shall be as specified below. Other testing shall be as required by the ENGINEER.

(i) In areas to be paved, density tests for determination of the specified compaction shall be made by a testing laboratory and spaced one (1) every three hundred (300) feet of trench.

(ii) In areas not under pavement the ENGINEER will determine the need for testing on a case by case basis.

(iii) The CONTRACTOR shall arrange for and coordinate the testing. The ENGINEER shall approve the testing laboratory in advance. Sampling and in-field testing shall be witnessed by the ENGINEER or his designated representative.

(iv) The OWNER will pay for the initial testing. If any tests reveal compaction which does not comply with the specifications, all additional testing shall be conducted at the expense of the CONTRACTOR to determine the extent of noncompliance.

(v) Improperly compacted material shall be removed, replaced and re-compacted, and the area retested to insure compaction specifications have been met, all at no expense to the OWNER.

(vi) Copies of all test results and field and office worksheets are to be furnished to the Engineer within 48 hours after completion of tests. Results are to be signed by the individual responsible for conducting the tests and indicate the test method used, the optimum moisture content, and the maximum density.

1.7 Examination of Site and Records

(a) The Contractor shall examine the site, the Drawings, and records of existing soil conditions for the project available through the Engineer to determine the conditions under which the work will be performed. The Contractor shall formulate his own conclusions as to the subsurface conditions and shall remove all materials to the design subgrades indicated or hereinafter specified.

(b) Subsurface soil investigation data, including records of test borings (if any have been conducted) are made available for information only and are not guaranteed to represent all subsurface conditions that will be encountered. Additional test borings or other exploratory operations may be made by the Contractor at no cost to the Owner.

1.8 Protection of Utilities

(a) The location of existing utilities, including underground utilities, is indicated on the drawings insofar as their existence and location were known at the time of preparation of the drawings. However, nothing in these Contract Documents shall be construed as a guarantee that such utilities are in the location indicated or that they actually exist, or that other utilities are not within the area of operations. It is the sole responsibility of the Contractor to make all necessary investigations to determine the existence and locations of such utilities.

(b) The Contractor may obtain field utility locations by calling "Miss Utility" (1-800 552-7001) forty-eight (48) hours prior to working in the vicinity of existing facilities, if calls have been responded to by Utility Owners and an additional twenty-four (24) hours if they have not responded. If the utilities fail to locate and

evidence of other facilities is present, a second call shall be made providing an additional three (3) hour notice.

(c) Report any lines not shown or incorrectly shown on the drawings to the Engineer for further Direction.

(d) Protect all existing service lines and related structures encountered in the excavation work. Where such lines and structures have been undermined due to the excavation work, provide suitable supports. If damaged, repair such lines or structures in accordance with procedures acceptable to the Owners of such lines or arrange for their repair with the proper authorities of companies. The Contractor shall pay for any damage to and for maintenance and protection of existing utilities and structures.

(e) Documentation of restoration required by this section shall be presented to the Owner prior to acceptance of the work.

1.9 Precautions

(a) The Contractor shall take every precaution to guard against any movement or settlement of existing or new construction, utilities, paving, walks, light standards, piping, conduit, etc., and shall provide at his own expense, all sheet piling, bracing or shoring necessary in connection therewith. The Contractor shall be entirely responsible for the design, and adequacy of any sheet piling, bracing and shoring required.

1.10 Sheeting and Shoring

(a) Sheeting and shoring shall be furnished in accordance with the provisions of VOSHA. And as necessary to construct and protect the excavation, existing utilities, structures of all types, and as necessary for the safety of the employees.

(b) Sheeting shall not be removed except when such removal will not result in damage to the work or the adjacent property. Sheeting left in place shall be cut off 18 inches below the existing ground surface, and shall be dimensionally located on the set of contract drawings provided by the Contractor showing “Record Drawings”.

1.11 Protection of utilities in fill areas

(a) New underground utilities shall not be laid in areas of fill prior to the actual performance of the grading operation, unless the depth of the cover over such utilities in undisturbed ground is a least 14 inches for steel or ductile iron pipe and 30 inches for pipes of other materials. Such depth of cover requirements may be reduced provided the pipe is protected by concrete encasement or constructed in another manner satisfactory to the Engineer.

2.0 Products

2.1 Suitable Material

(a) Suitable material shall be construed as material that classifies as select material Type I or II according to Section 207 of the VDOT Road and Bridge Specifications (latest revision). Suitable material necessary for establishing the

indicated grades shall be furnished by the Contractor and approved by the Engineer.

(b) Materials classified by ASTM D 2487 as GW, GP, GM, GC, SW, SP, SM, SC, ML, and CL are satisfactory as fill and are satisfactory in situ.

(c) The maximum particle size shall be four inches in the largest dimension, except in the uppermost lift of fill, where the maximum particle size shall be two inches in the largest dimension. Maximum size particles shall not be in excess of 20% of the volume of fill material, and such particles shall be throughout the mass.

2.2 Unsuitable Material

(a) Materials classified by ASTM D 2487 as OL, OH, MH, CH, and PT are unsatisfactory in-situ and as fill.

(b) Material such as clay mass, frozen materials, cinders, ashes, refuse and vegetable or organic material shall be construed as unsuitable fill material.

(c) Unsuitable materials also include man-made fills, refuse, or backfills from previous construction.

(d) The unsuitable material shall be removed and replaced with suitable earth or stone compacted in the trench as these specifications or the Engineer may direct. Replacement materials shall be furnished as an incidental cost of excavation.

2.3 Approved Granular Material

(a) Approved granular material shall be will graded crushed stone conforming to size No. 57 or 68 as specified in Section 203 of the VDOT Road and Bridge Specifications (latest revision).

2.4 Aggregate Backfill Material

(a) Aggregate backfill material shall be VDOT No. 21A or 21B as specified in Section 208 of the VDOT Road and Bridge Specifications (latest revision)

2.5 Classification of Excavated Materials

(a) All excavated materials shall be unclassified, and excavation shall be included in the lump sum price, or unit prices bid.

2.6 Topsoil

(a) Material obtained from excavations, suitable for topsoil is defined as the upper 6 inches of existing soil cover. Topsoil shall consist of friable clay loam, free from roots, stones other undesirable material and shall be capable of supporting a good growth of grass.

3.0 Execution

3.1 General

(a) The area within the limits of work shall be cleared and grubbed and shall be cleaned of all debris. For water lines the limit of work is defined as that area necessary to facilitate the construction of those utility lines.

(b) Under structures materials not suitable for foundation purposes shall be backfilled with suitable material and compacted as specified herein.

(c) Cleared material shall be removed from the site and disposed of by the Contractor, in a manner and at a location approved by the Engineer.

(d) Topsoil shall be carefully stripped to its full depth from all areas indicated to be graded or to be built upon. Stripped topsoil shall be stored in accordance with acceptable erosion and sediment control procedures and protected for reuse later. Where practicable, top soil removed from lawns or otherwise improved or landscaped areas shall be used to replace top soil in those same areas. Segregation and separate storage of topsoil from these areas may be necessary and would be considered appropriate in order to accomplish the above.

(e) All areas to receive fill shall be stripped of root mat five feet beyond toe of anticipated fills or as directed by the Engineer. Topsoil, all vegetation such as roots, brush, heavy sods, heavy growth of grass, and all decayed vegetable matter, rubbish and other debris within the area upon which fill is to be placed, shall be stripped or otherwise removed before the fill is started. In no case will such objectionable material be allowed to remain in or under the fill area.

3.2 Excavation

(a) General

(i) All Excavations of every description and of whatever substances encountered within the grading limits shall be performed to the grades, slopes and elevations indicated. All excavated materials which are not considered suitable for fill and any surplus of excavated material which is not required for fill shall be disposed of by the Contractor in a manner and at a location approved in advance by the Engineer.

(ii) Excavations shall extend a sufficient distance away from the walls to permit erection and removal of forms and installation of drains and other permanent work. Excavations shall be carefully made to the depths indicated, with the bottoms level, free of loose material, and free of all loam, organic material and other unsuitable material as specified. All excavations shall be approved by the Engineer prior to the placing of any concrete or other foundations as may be specified.

(b) Proofrolling

(i) The excavated areas for tank foundations or precast concrete structures shall be proofrolled in order to aid in locating of any soft areas within the subsurface. Proofrolling of the exposed surface shall consist of four (4) complete passes of the area, with two (2) passes in a direction perpendicular to the preceding passes. All proofrolling shall be observed by an independent and qualified inspection Engineer, furnished by the Contractor, and approved by the Engineer.

(c) Rock Excavation

(i) Beneath Precast or Cast in Place Concrete Structures

1) Where rock is encountered notify the Engineer or his designated representative,

2) Where the entire structure will bear on rock, and where required finished elevations will not be affected by the presence of rock, it shall be used to support the foundation unless otherwise directed by the Engineer. The rock shall be leveled to a hard, clean surface,

3) Where only a part of the foundation will bear on rock, rock shall be removed to a depth of at least 6 inches and not more than 10 inches below the indicated bottom of the structure or structure foundation. If rock is excavated below the foundation, the resulting void shall be filled and compacted with approved granular material as specified herein. For cast in place structures, the excavation shall allow 18 inches, horizontally, outside structure walls or outside concrete work where forms are required.

(ii) Beneath Utility Trenches. For utility trenches, rock shall be removed to a minimum depth of 6 inches and not more than 12 inches below the bottom of the pipe and all undercut trench excavation shall be backfilled and compacted with approved granular material.

(d) Excavation for Trenches

(i) Length of Open Trench Allowed - Pipe trenches shall not be excavated too far in advance of pipe laying operations.

1) On VDOT right of way, no more than 500 feet of trench may be opened at any one time unless otherwise stipulated by the VDOT permit or other requirements.

2) On private right of way, no more than 500 feet of trench may be opened at any one time unless otherwise approved by the Engineer,

3) No trenches shall be left open overnight,

4) The bottom of trenches shall at all times be protected against frost and freezing.

(e) Extent of Excavation. The Contractor shall excavate all material encountered in the trenches and ditches, detailed on the drawings along the alignments shown on the drawings to the depth specified in this section,

(f) Topsoil. Topsoil shall be stripped from the excavation area and stockpiled separately from other backfill material in an approved area (in accordance with erosion and sediment control requirements) until needed for final backfill and grading,

(g) Local High Points. Trenches shall be graded to avoid local high points. Trenches shall be graded either level or on a continuous upslope to areas highpoints, designated on the drawings,

(h) Depth of Cover. Trenches shall be excavated to minimum cover of 30 inches for all types of pipe but no more than 48 inches as measured from the top of the pipe to the existing ground surface or final grade, whichever is lower, unless specifically approved by the Engineer and WCSA,

(i) Depth of Cover in VDOT Right of Way. Depth of cover in the VDOT right of way shall be 36” unless otherwise required by VDOT, but no more than 48 inches as measured from the top of the pipe to the existing ground surface or final grade, whichever is lower, unless specifically approved by the Engineer and WCSA,

(j) Uniform Bedding. The trench shall be excavated so as to provide a uniform and continuous bearing and support for the pipe on solid and undisturbed ground between bell holes. Bell holes shall be excavated to accommodate each bell. Any part of the bottom of the trench excavated below the specified grade shall be brought back to grade with approved material and compacted in accordance with these specifications,

(k) Width. Trench width shall be sufficient to allow pipe installation without walking or standing on pipe. The minimum width of the trench at the top of the pipe shall normally not be less than 12 inches wider than the greatest diameter of the pipe line (generally the bell). However trench width at the top of the pipe may be as little as 8 inches wider (at the top of the pipe) than the greatest diameter of the pipe line under certain laying conditions such as excavation in rock. The use of a minimum width less than 12 inches is conditioned on being able to properly bed, join and backfill the pipeline. Should actual conditions cause the efficacy of bedding, jointing or backfilling to be questioned; the ENGINEER will require a greater minimum trench width. Also, as workman safety is of paramount concern, greater minimum trench widths may be required to accommodate sheeting, shoring or trench boxes needed to assure installer safety. Safety considerations will always be the default consideration in determining minimum trench width. The maximum width of the trench shall not be greater than 24 inches wider than the greatest diameter of the pipe line,

(l) Unsuitable material. unsuitable material at subgrade shall be removed and replaced with suitable material at no cost to the Owner,

(m) Rock excavation. All rock, boulders, underground masonry and large stones greater than ½ cubic yard in volume encountered within 6 inches of pipe line, valves and other water line appurtenances shall be removed to provide a minimum clearance of 6 inches and replaced with approved material and compacted in accordance with these specifications. The cost of approved material and placement and compaction of it shall be considered incidental to excavation and preparation of the trench for pipe line installation and shall therefore be considered by the Owner as included in the bid cost unless otherwise stated.

(n) Blasting. The use of blasting for excavation is generally not allowed by WCSA, but will be considered on a case by case basis. Blasting will only be allowed if the Contractor demonstrates to the satisfaction of the Engineer that the following issues will be addressed;

(i) Compliance with the Occupational Safety and Health Standards for the Construction Industry. Subpart U,

(ii) Compliance with the Virginia Statewide Fire Protection Code VR 394-01-6 and all amendments and revisions thereof,

(iii) Personnel will be utilized which are trained and certified in the use of explosives for the use intended,

(iv) The Contractor possesses insurance and bonds as may be required by the local jurisdiction, or required by the Engineer, to cover the damages possible to individuals and property which may be adversely affected by blasting operations,

(v) The charges used shall not make the excavation unduly large or irregular,

(vi) Will not shatter the rock upon or against which masonry is to be built, nor injure masonry or existing structures at the site or in the vicinity thereof,

(vii) Each blast shall be covered with rubber tire or steel mats,

(viii) Blasting will not occur within 25 feet of completed pipes or structures,

(ix) Other requirements as deemed appropriate by the Engineer.

(x) Whenever the Engineer determines that further blasting may injure or damage adjacent rock, masonry or other structures, blasting shall be discontinued. In such case, the remaining rock shall be excavated by baring, wedging or other approved method,

(xi) Where sewers, gas, water, steam or other utility ducts or lines, busing connections or other structures have been exposed during excavation, such structures shall be adequately protected from damage before proceeding with the blasting. Any structure, pipe line or conduit damaged by blasting shall be promptly repaired at no cost to the Owner,

(xii) Blasting shall not be carried on within 300 feet of any radio transmitter or radio frequency emission equipment such as high frequency welders, and blasting caps shall be kept in tightly closed, all metal calls when in the vicinity of such equipment.

(xiii) A sufficient quantity of explosives to avoid delay to the work shall be kept on the site, but at no time shall there be a quantity in excess of that which will be required for use within the following twelve hours. Explosives shall be stored, handled and used in accordance with State and local regulations and the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc. The magazine keeper shall keep an accurate daily record and account of each piece of explosive, detonator, and equipment from the time of delivery at the magazine until used or removed from the site.

(xiv) The Contractor shall take out permits and execute a bond, as required by the ordinances of the jurisdiction, in which the work is being done, relating to permits and bonds for blasting.

(xv) Any damage to foundations or other work caused by use of explosives shall be corrected at the Contractor's expense

(xvi) Advise Owners of adjacent buildings or structures in writing prior to blasting. Describe blasting and seismic operations as required. The Contractor shall conduct a pre-blasting inspection of nearby facilities and structures as necessary for protection against false claims.

(xvii) Prior to firing blasts, the Contractor shall have a competent person, carrying a red flag, stationed at a reasonable distance from the blast at each avenue of approach to give warning.

(xviii) The Contractor shall hold the Owner harmless for any injuries and for all damage caused by the explosives and shall satisfactorily correct and pay for all injuries and damage resulting from the use of explosives.

(o) Sheeting and Shoring. Sheeting and shoring shall be provided by the Contactor as needed for the protection of his work, employees, the public, adjacent structures and to guard against contingencies which might give rise to delays in work. Where trench wall sloping is needed for safety or other reasons, the Engineer shall be contacted to reassess the suitability of the specified pipe. Responsibility and cost for sheeting and shoring shall be borne solely by the Contractor. Sheeting shall be removed or cutoff by the Contractor during backfilling operations in accordance with these specifications. Trench construction and safety shall be governed by the Virginia Occupational Safety and Health Standards for the Construction Industry – Subpart P.

(p) Drainage. The Contractor shall remove by appropriate means water accumulated in the bottom of the trench during pipe laying operations. Excavations shall be kept dry during pipeline installation.

(i) The Contractor shall utilize means necessary to prevent surface water from washing into the trench. Grading or construction of berms shall be performed as required to prevent water from flowing into trenches or other excavations.

(ii) Any water that accumulates in the trench shall be promptly removed. Where soil in the trench bottom displays a “quick” tendency, the water should be removed by pumps and suitable means such as well points or pervious under drain bedding until the pipe has been installed and the backfill has been placed to a sufficient height to prevent pipe flotation.

(iii) The Contractor is responsible for disposing of water pumped from the trench, in a manner which complies with all applicable laws and regulations governing erosion and sediment control, storm water management and other laws and regulation by governing authorities.

(q) Location of Stockpiled Material - Excavated material suitable to be utilized for backfilling shall be piled alongside the trench at a distance sufficient to avoid overloading the trench walls and causing cave-ins, and located to prevent obstruction of driveways, roads and hydrants. All excavated material not suitable for or not required for backfilling, including that from the trenches, shall be removed and disposed of by the Contractor at his expense in a manner and at a location approved by the Engineer.

(r) Roadway Protection. No cleated equipment shall be used on pavements without proper protection, to prevent damage to pavement. Roadway drainage structures shall not be allowed to become clogged by construction activities. Drainage facilities and pavement affected by construction activities shall be maintained in a manner acceptable to VDOT. The Contractor shall be responsible for repair of damaged drainage structures. These repairs shall be made in accordance with VDOT requirements.

(s) Coordination with Property Owners

(i) The Contractor shall notify the property Owner in advance of commencing work and in the event of disrupting utility or other services to such property. In addition, he shall notify the Owner or responsible person in charge of the utility to be interrupted and arrange for the orderly disruption and restoration of service so that inconvenience to the property Owner or tenant is minimized.

(ii) Private roads and entrances shall not be blocked by construction activities except for short time periods. Should it become necessary that a private entrance be blocked, prior accommodations shall be made with property Owners to allow entrance and exit when necessary. All private driveways, roads, etc. shall be restored to an equal or better condition to that prior to construction.

(iii) The Contractor is responsible for complying with conditions on easements, copies of which shall be provided to the Contractor by the Owner. The Contractor is responsible for advance notice to the property Owner regarding disturbances to improvements on the property, including removal or impact to trees, shrubbery, fences and other improvements. Conflicts with property Owners shall be reported to the Engineer.

(t) Excess Material. Excess material, including but not limited to, excess cut material, unsuitable fill material, and rock or other unsuitable material resulting from excavation or blasting operations, shall be disposed of by the Contractor in a manner and at a location approved by the Engineer.

3.3 Bedding

(a) Suitable material shall be used for fill and subgrade preparation. Material shall be free of debris, roots and organic matter. Frozen material shall not be used as fill or for subgrade preparation. Any additional material necessary for establishing the indicated grades shall be furnished by the Contractor and approved by the Engineer as part of the contract at no additional cost to the Owner.

(b) Bedding for culverts and other drainage structures within the VDOT right of way shall be in accordance with the latest amended or revised VDOT Road and Bridge Specifications and Standards.

(c) Bedding for Precast Concrete Appurtenances for Water Systems – A minimum of 6 inches of appropriately graded crushed stone shall be provided for all precast concrete structures which are appurtenances for water systems. Should the manufacturer of the precast concrete structures have bedding recommendations or requirements different than that specified above, compliance with the most

restrictive requirements or recommendations shall be attained unless the Engineer approves otherwise.

(d) Utility Line Bedding

(i) Ductile Iron Pipe – Improved bedding is only required where the pipe subgrade is in rock.

(ii) Improved bedding for ductile iron pipe shall consist of 6 inches of compacted approved granular material (VDOT #57 or #68 stone).

(e) PVC pipe. Improved bedding is required to be provided to the spring line (midpoint) of the pipe,

(i) Improved bedding for PVC pipe 4” and larger shall be 4” of VDOT #57 or #68 stone under all pipes and bells, compacted to 95% of maximum density as measured by ASTM D698,

(ii) Improved bedding for PVC pipe 2” and smaller shall be 4” of VDOT #68 stone under all pipes and bells compacted to 95% of maximum density as measured by ASTM D698.

(f) Special care shall be taken to backfill under the pipe and to tamp this material into place to provide a firm bed. Material shall be deposited on both sides of the pipe simultaneously and tamped into place.

(g) Concrete encasement – requirements for concrete encasement of ductile iron or PVC water line, as specified on the drawings shall supersede the above bedding requirements,

3.4 Backfilling and Compaction

(a) General

(i) Suitable material shall be used for backfilling. Material shall be free of debris, roots and organic matter. Frozen material shall not be used as backfill.

(ii) Any additional material necessary for establishing the indicated grades shall be furnished by the Contractor and approved by the Engineer as part of this contract.

(iii) For bedding, backfilling and compaction under paved surfaces on private property (sidewalks, curb and gutter, etc.), Section 3.4.G below applies.

(iv) The intent of compaction is to prevent lateral movement of the utility lines.

(b) Backfill Material and Compaction

(i) Backfill Under Paved Surfaces - The entire depth of backfill under paved surfaces including driveways, sidewalks, and roadways shall be aggregate material complying with the specifications for #21A stone as listed in the current version of the Virginia Department of Transportation Road and Bridge Specifications. Backfill shall be placed in 6 inch layers

compacted to 95% of theoretical maximum density, as determined by ASTM (American Society for Testing Materials) Method D698 or AASHTO (American Association of State Highway and Transportation Officials) up to the level of the pavement subgrade. Compaction by flooding with water or flooding is not allowed.

(ii) Backfill Under Non-Paved Surfaces - Initial backfill to a depth of 1 foot over the top of the pipe in areas within the VDOT of right of way but not under pavement, and on private right of way, shall be clean earth free of clods or stones greater than 1" in diameter, approved aggregate such as #21A stone or other materials approved by the ENGINEER. Initial backfill shall be placed in 6" layers to a depth of 1 foot and compacted to 95% of theoretical maximum density as determined by ASTM Method D698 or AASHTO Method T-180. Final backfill may contain stones or rocks up to 4 inches in their greatest dimension unless otherwise specified. Layers of final backfill up to 12 inches in depth may be used from 12 inches above the top of the pipe to 4 inches below the elevation of the final grade. Final backfill shall be compacted to 95% maximum density or greater than the density of the undisturbed soil surrounding the trench as determined by ASTM Method D698 or AASHTO Method T-180.

(iii) Mechanical or pneumatic tampers must be used for compaction.

(iv) Compaction equipment must not come into contact with the pipe.

(v) Compaction of each layer of earth shall be before the next layer is applied.

(vi) All pipe lines shall have a minimum of 18" of cover before any rolling equipment is used for compaction,

(vii) Care shall be taken to prevent damage to the pipe lines or other structures, during compaction,

(viii) Damage to pipe lines or other structures resulting form compaction shall be corrected by the Contractor without expense to the Owner,

(ix) Compaction by "puddling", either natural or man-induced, shall not be allowed. Final backfill consisting of topsoil in grassed areas may be mounded above surrounding ground to allow for settlement.

(c) Marking of Pipe Lines – Plastic encased aluminum foil tape shall be installed above all non-metallic pipe such that the buried pipe can be located in the future. The tape shall be color coded and bear the words "potable water line". The marking tape shall be buried 12 to 18 inches below the level of the final grade or in accordance with the manufacturer's instructions. Tape shall be Lineguard Detectable Underground Marking Tape or approved equal.

3.5 Work Within the VDOT Right of Way

(a) General. The Contractor shall work within the VDOT right of way as required by the Owner and approved by VDOT. The Contractor shall not initiate work within the VDOT Right of Way until a Permit for the same has been obtained from

VDOT and a copy of the Permit and associated surety bonds have been delivered to the Owner.

(b) Traffic Control. All traffic control and directional signs shall be supplied by the Contractor. Placement and type of all traffic control devices and signs shall comply with VDOT requirements.

(c) Traffic Routing. Traffic shall not be blocked or re-routed without permission from VDOT. Where one-way traffic is permitted to be maintained, and is underway it shall be flagged continuously until such time as regular traffic patterns are restored unless other wise permitted in writing by VDOT. Appropriate authorities including emergency responders (police, fire and rescue personnel) and others as specified by VDOT or WCSA shall be notified of this situation.

(d) Erosion and Sediment Control. At all appropriate locations, silt fences, straw barriers, brush barriers, or other measures are to be utilized in the prevention of erosion and sediment control. The Owner is responsible for complying with requirements for filing Erosion and Sediment Control plans with the appropriate authorities.

(e) Stormwater Management. It is strictly forbidden to block or otherwise impede surface water flow through VDOT drainage culverts and other drainage structures owned by VDOT or others. The Owner is responsible for complying with requirements for filing Stormwater Management plans with the appropriate authorities.

(f) Roadway Crossings. Crossings of VDOT roadways shall comply with the following requirements:

(i) All crossings of VDOT roads shall be made by boring, jacking or tunneling unless otherwise approved in writing by VDOT.

(ii) When a crossing is made by boring, jacking or tunneling, the crossing shall consist of a steel casing pipe and water carrier pipe constructed of mechanical joint ductile iron pipe. The length of casing and carrier pipe shall be as indicated on the plans approved by VDOT. Movement of the carrier pipe within the casing pipe shall be controlled by approved means.

(iii) If a crossing cannot be accomplished by boring, jacking or tunneling, the permittee may contact VDOT Abingdon Residency for special permission to open cut the roadway and install the water line. In cases where WCSA is the permittee, WCSA must be contacted who will in turn contact VDOT. Water pipe line utilized for open-cut road crossings shall be mechanical joint ductile iron pipe with the need for casing being determined by VDOT on a case by case basis.

(iv) If pavement cutting is allowed by VDOT to install a road crossing, the pavement cut and pavement repair and restoration shall be made in accordance with the VDOT requirements. General directions and requirements for such operations are included in WCSA specifications and shown as a WCSA standard detail. However these directions are general in nature and VDOT may require alternative methods as it sees fit. Compliance with all VDOT requirements and permits shall be at no additional expense to the Owner.

(v) All open cutting and pavement restoration activities shall be accomplished at the Contractor's expense. The bid price for road crossings whether bid as boring, jacking and tunneling or by open cut will be considered to include these expenses. The trench in paved areas shall be maintained daily, as required, to provide a smooth crossing for vehicles until such time as the final pavement is placed.

(g) Bedding and Backfill Requirements for utility lines in the VDOT Right of Way – See the requirements in Paragraph 3.2.D. and Paragraph 3.3.B above.

(h) Pavement Restoration, Repair and Replacement. Pavement, repair restoration and replacement shall be completed in accordance with the standard details included in the plans and/or these specifications. VDOT directives for pavement restoration, repair or replacement should they be different from the Standard Details shall supersede the requirements shown in the standard details.

3.6 Pipe or Structures to be Abandoned or Removed

(a) Pipe indicated on the plans to be abandoned shall be plugged, capped or sealed with concrete a minimum distance of 18" from new water lines.

(b) Pipe indicated on the plans to be removed shall be completely removed then backfilled with suitable material and thoroughly compacted, in accordance with related backfill work specified elsewhere. Removed pipe not required in the completion of the work shall be taken from the site and disposed of by the Contractor in an approved manner.

(c) Structures indicated on the plans to be abandoned shall be cut off or removed to a minimum depth of twenty-four (24) inches below finished grade then backfilled with suitable material and thoroughly compacted, in accordance with related backfill work specified elsewhere. Existing frames and covers shall be returned to the respective Owner if not reused on this project.

(d) Structures indicated on the plans to be removed shall be demolished and completely removed, then backfilled with suitable material and thoroughly compacted, in accordance with related backfill work specified elsewhere. Existing frames and covers shall be returned to the respective Owner, if not reused on this project.

(e) Abandonment and disposal costs shall be borne by the Contractor.

3.7 Final Grading and Cleanup

(a) Finish grading shall be done as required to establish the slopes indicated. The grades shall be formed to easy contours sloping toward inlets and ditches. The grading shall eliminate low spots and pockets that do not drain. Ditches shall be cleaned and excavated to the sections and elevations originally present.

(b) All lumber, earth clods or rocks larger than four inches and other undesirable materials shall be removed from the site at the completion of construction. If in a tended lawn or crop area, all stones or material which are unsightly or which could damage moving or other equipment, shall be removed. Clean up shall be done as promptly as practicable and/or at least once a week. Ditches which are disturbed shall be restored as promptly as practical and/or at least once a week.

Establish and maintain sediment and erosion control measures as stipulated in Section 02005.

(c) Final Grading. Uniform smooth grading of disturbed areas shall be accomplished after backfill and compaction.

(i) In grass or lawn areas, the last 4 inches of fill will consist of topsoil or an approved substitute which will support turf growth after fertilizing and seeding. Final backfill in grassed areas may be mounded above surrounding ground to allow for settlement.

(ii) Settlement or other damage that occurs prior to acceptance of this work shall be repaired and grades satisfactorily re-established.

(iii) The Contractor shall maintain the surface over the trench or excavation for a period of one (1) year after final completion and acceptance of the work, both in public right of way and private property, and shall fill in any settled areas with suitable fill and reseed or repair the pavement as the situation warrants.

(iv) Topsoil and seeding of all disturbed areas shall be performed in accordance with Section 02070.

3.8 Restoration. All surface improvements which have been damaged, removed, or otherwise impacted by construction, on public or private property, shall be restored to conditions equal to or better than conditions existing prior to beginning work. These surface improvements shall include but are not limited to:

- Roadways, alleys and driveways of soil, gravel, concrete or bituminous mixture,
- Lawns, gardens, grass plots, sod,
- Shrubbery, ornamental trees, vegetable and flower gardens,
- Signs, fences, and other surface improvements.

(a) It shall be the responsibility of the Contractor to extensively document by photograph, video tape, or other means the conditions existing prior to work beginning such that existing conditions can be proven without question

(i) Photographs shall be in a digital format with a minimum total pixel resolution of 2 megabytes.

(ii) Video tapes shall be in VHS or 8mm format, digital video in DVD format will be acceptable.

(b) Any agreement made with property Owners to not restore conditions to that existing prior to the work beginning, should be documented in writing, with a written copy being given to the property Owner.

(c) Restoration includes, but is not limited to, final grading, seeding, pavement replacement, concrete replacement, and drainage structures. Contractor shall install no more than 2,000 linear feet of pipe before initiating restoration activities. . Within VDOT rights-of-way and within residential or commercial yards, this

distance shall be limited to 500 linear feet unless other requirements are specified on the VDOT permit for work within the VDOT right of way. In no case shall restoration be delayed more than 7 days after laying pipe. Appropriate erosion and sediment control measured shall be employed until restoration is completed.

3.9 Landscape. Grass plots, sod, shrubbery, ornamental trees, signs, fences and mail boxes shall be restored to the conditions equal or better than those existing prior to making the excavation. All disturbed areas not covered by pavement or structures shall be fertilized, limed, seeded with the type of seed that produces a stand of grass similar to that existing prior to the work and mulched in accordance with these specifications.

3.10 Pavement replacement on private property. Pavement restoration in the VDOT right of way has been addressed in Paragraph 3.05 H above. Existing pavement on private property which has been cut, damaged, or removed during construction shall be repaired or replaced in the same manner as VDOT pavement with the materials compatible to that existing

3.11 Maintenance of Utility Trenches

(a) The Contractor shall maintain the surface over the trench or excavation for a period of one (1) year after final completion and acceptance of the work, both in public right of way and private property, and shall fill in any settled areas with suitable fill and reseed or with pavement as the location warrants.

END OF SECTION

SECTION 02419—BORING, JACKING AND TUNNELING

1.0 General

1.1 Work Included

(a) This section covers the installation of pipelines using horizontal earth boring and jacking. Tunneling is not covered by these specifications and shall only be considered when it is absolutely necessary. Tunneling will be approved on the basis of plans and specifications specifically prepared for the project by a registered professional Engineer with tunneling experience.

1.2 Related Sections

(a) Section 02200 – Earthwork

(b) Section 02713 – Water System

(c) Section 15060 – Pipe and Pipe Fittings

(d) Section 15100 – Valves, Appurtenances and Specialty Devices

1.3 Regulations

(a) Comply with all codes, laws, ordinances and regulations of governmental authorities having jurisdiction over this part of the work.

(b) Work within existing or proposed Virginia State Rights-of-Way shall meet all requirements of the Virginia Department of Transportation.

(c) Comply with all codes, laws, ordinances, regulations, and permits of governmental and other authorities having jurisdiction over this part of the work. These may include but are not limited to

(i) Virginia Department of Transportation (VDOT) Road and Bridge Specifications, latest edition.

(ii) American Railway Engineering Association (AREA) Specifications, latest edition.

1.4 References

(a) Virginia Department of Transportation (VDOT) Road and Bridge Specifications, latest edition

(b) American Railway Engineering Association (AREA) Specifications, latest edition.

1.5 Submittal

(a) Product data for steel casing pipe and associated appurtenances shall be submitted prior to installation, including evidence that pipe and mounting devices complies with the requirements of these specifications.

(b) Proposed methodology for supporting the carrier pipe within the casing with manufacturer's information and instructions if applicable.

2.0 Products

2.1 Steel Casing Pipe. Steel casing as specified in other sections.

3.0 Execution

3.1 General

(a) The Contractor shall take every precaution to guard against any movement or settlement of existing or new construction, railways, utilities, paving, walks, light standards, piping, conduit, etc., and shall provide at his own expense, all sheet piling, bracing or shoring necessary in connection therewith. The Contractor shall be entirely responsible for the design, and adequacy of any sheet piling, bracing and shoring required.

3.2 Highway Crossing

(a) Pipeline crossing shall be installed in a steel casing installed by the "dry case as you go" boring and jacking method.

(b) The pipeline crossing shall be installed as shown on the Drawings.

(i) If the Contractor determines that boring and jacking of the highway crossing is not possible due to rock, the Contractor shall make application to VDOT to allow open cutting of the crossing. Contractor shall make every effort to bore and jack before abandoning this method, including use of a rock head. If the trench is allowed to be open cut, VDOT will determine the need for casing pipe. Mechanical joint ductile iron pipe shall be provided for the utility line and the trench shall be backfilled entirely to the bottom of the pavement base course with approved aggregate backfill material and the pavement restored in accordance with VDOT requirements.

(ii) All operations of the Contractor shall be subordinate to the free and unobstructed use of the highway right of way for passage of traffic without delay or danger to life, equipment or property. The Contractor shall provide all necessary bracing, bulkheads, and shields to ensure complete safety to all traffic at all times. The Contractor shall arrange for and pay for all flagmen, signs and other measures required by VDOT.

(iii) Dry Jacked Boring Method

1) The jacking operation shall be performed in such a manner that settlement of the ground, railway, or the highway above the pipeline will not occur.

2) The use of water or other fluids in connection with the boring and jacking operation shall not be allowed.

3) Excavation shall not precede the jacking operation more than is necessary.

4) Lengths of steel pipe shall be welded to the preceding length installed.

5) Excavation shall be made by auger or other methods at the Contractor's option, and approved by the Engineer to suit conditions encountered.

6) The Contractor shall repair or replace, as directed by the Engineer, at his own expense, casing pipe which is damaged during the jacking operation.

7) Carrier Pipe Installation - After installation of the casing pipe, the carrier pipe shall be installed.

8) Each joint of the carrier pipe shall be adequately supported by casing chocks, pressure treated skids fixed to the pipe with stainless steel bands, “spiders” or other devices as approved by WCSA, the Engineer or VDOT as appropriate. Spacing of supports shall be in accordance with the recommendation of the supports manufacturer, the VDOT Road and Bridge Specifications (latest revision) or as directed by the Engineer.

9) The ends of the casing pipe or the tunnel shall be closed off by concrete or masonry block wall prior to backfilling. A drain line shall be provided at the lower end and shall run to a one cubic yard french drain. The drain shall be constructed of cement lined ductile iron pipe or alternative material acceptable to the Engineer.

END OF SECTION

SECTION 02420—DIRECTIONAL BORE AND INTEGRAL POLYETHYLENE PIPE

1.0 General

1.1 Work Included

(a) Installation of pipelines using directional drilling techniques.

1.2 Regulations and Permits

(a) Comply with all codes, laws, ordinances, regulations, and permits of governmental and other authorities having jurisdiction over this part of the work including the Army Corp of Engineers, Virginia Marine Resources Commission and the Department of Environmental Quality.

1.3 References

(a) Virginia Department of Transportation (VDOT) Road and Bridge Specifications, latest edition.

(b) American Water Works Association (AWWA) standard C906, latest edition.

1.4 Experience

(a) The Contractor shall have at least five (5) years of directional drilling experience with significant experience with directional drilling through rock. The Contractor shall have at a minimum performed 5 similar projects within the last three years.

1.5 Submittals

(a) Shop drawings and product data for polyethylene pipe and fittings, including evidence that pipe complies and is certified to comply with applicable AWWA standards including AWWA standard C-906 and National Sanitation Foundation Standards 61, and other applicable standards and specifications.

(b) Shop drawings and product data for polyethylene connection expansion joints and evidence that products and methodologies comply with applicable standards, permits and specifications.

(c) Evidence of directional drilling experience through rock and with projects of similar scope and size at Engineer's request.

2.0 Products

2.1 Polyethylene Pressure Pipe and Fittings

(a) Polyethylene Pressure Pipe and fittings, 4" through 24" diameter, used for water system applications shall meet AWWA standard C906 and NSF Standard 61 approval for its use in the conveyance of drinking water .The outer diameter of the pipe shall be similar to that of ductile iron pipe.

(b) The size of the polyethylene pipe for the crossing shall be as shown on the plans. The pipe shall be SDR-9 (200 psi normal working pressure) in accordance with AWWA standard C906. It shall have the same outside diameter as the pipe it is to join with on either side of the crossing or have the ability to be supplied with fittings designed for use with polyethylene pipe to match the required size(s).

2.2 Polyethylene Connection Expansion Joints

(a) Provide the EX-TEND 200 expansion joint as manufactured by EBAA IRON, INC. or approved equal. This fitting will protect the different pipe materials against linear expansion and shall be installed at each end of the directionally drilled segment of polyethylene pipe. This expansion joint shall be manufactured of ductile iron conforming to the material properties of ANSI/AWWA C153/A21.53. Each expansion joint shall be pressure tested against its own restraint to a minimum of 350 psi. Megalug or other approved joint restraint shall be provided with each mechanical joint connection.

3.0 Execution

3.1 Installation

(a) The polyethylene pipe shall be installed by directional drilling techniques. The selected technique shall be capable of monitoring the vertical and horizontal location of the installed pipe at all times. The Contractor shall verify that the polyethylene pipe has been installed within the private 20 foot permanent easement or VDOT right-of-way, whichever is applicable, and at a minimum depth of 36 inches below the ground surface and 36 inches below the bottom of streams, water courses or storm sewers. Strict adherence to the specifications for the separation of water and sewer lines is required. Any deviation from “normal” water and sewer line separation requirements, as defined by the specifications, shall be approved by the ENGINEER in writing. Also note that when “unusual” separation as defined in the specifications are approved by the ENGINEER both the water and sewer lines must be tested in place and exhibit zero leakage.

(b) The polyethylene pipe, fittings, and expansion joints shall be pressure tested in accordance with the specifications.

(c) The polyethylene pipe, fittings and expansion joints shall be disinfected in accordance with the specifications.

(d) The directional bore and integral pipe system shall be warranted for a period of 1 year against failure and leakage.

END OF SECTION

SECTION 02571—DISINFECTION OF WATER SYSTEM

1.0 General

1.1 Basics. Disinfection shall be attended by a WCSA Inspector. All new water system components shall be disinfected before they are placed in service. Disinfection shall be performed in accordance with AWWA C651, latest revision, except that the tablet method included in the standard shall not be used. The basic disinfection procedure is a follows:

(a) Inspection of equipment and chemicals to insure integrity,

(b) Preventing contaminating materials from entering the water main,

(c) Removing by flushing or other means those materials that may have entered the water main,

(d) Chlorinating any residual contamination, and flushing chlorinating solution from the main.

(e) Protecting the existing distribution system from backflow from the new lines, which may be caused by hydrostatic pressure testing and disinfection,

(f) Documenting that an adequate level of chlorine contacted each pipe to provide disinfection,

1.2 Related Requirements

(a) Section 02713; Water System

1.3 Submittals

(a) Documentation of the preliminary flushing procedure,

(i) Size of openings used to flush

(ii) Approximate gallons of water used,

(iii) Flushing duration time

(b) Documentation of the disinfection procedure including

(i) Size and lengths of pipe disinfected,

(ii) Type of disinfectant used,

(iii) Amount of disinfectant used

(iv) Results of chlorine residual testing to verify adequate residual, at each location where bacteriological samples will be taken

(v) Date and time that adequate residual was verified,

(vi) Date and time final flushing started,

(vii) Date and time final flushing ended,

(viii) Amount of chlorinated water flushed from line,

(ix) Chemical used for dechlorination,

(x) Amount of dechlorinating chemical used,

(c) Bacteriological Sampling

(i) Locations of sampling,

(ii) Date and time 1st samples collected,

(iii) Date and time 2nd samples collected,

(iv) Sample results.

(d) Redisinfection. gather all of the above information each time the main is redisinfected

2.0 Products

2.1 Forms of Chlorine for Disinfection

(a) The following forms of chlorine may be used in the disinfection operations after approval by the Engineer: Liquid Chlorine shall not be used unless specifically permitted by the Engineer.

(i) Sodium Hypochlorite – Complying with ANSI/AWWA Standard B301, latest revision.

(ii) Care must be used in control of conditions and length of storage to minimize its deterioration

(b) Calcium Hypochlorite – Complying with ANSI/AWWA Standard B300, latest revision.

(i) The material shall be stored in a cool, dry, and dark environment to minimize its deterioration.

2.2 Equipment Used for Disinfection

(a) Chemical feed equipment (solution vats, metering pumps, hoses, mixing tanks, etc.) that is not new and that has been used for any purpose other than delivering potable water, food grade chemicals or solutions, or chlorine based disinfectants shall not be used in the disinfection process for the water lines.

3.0 Execution

3.1 Preventative and Corrective Measures during Construction

(a) Precautions shall be taken to prevent contaminating materials from entering the water main during storage, installation, or repair.

(b) Heavy accumulations of particulate materials generally contain bacteria, and prevent even high concentrations of chlorine from killing these and other pathogenic organisms that may be present.

(c) See other sections of these specifications which address keeping the pipe clean and free from contamination during construction.

(d) Line already constructed must be sealed to prevent the entrance of small animals, contaminated surface water, etc.

(e) If dirt enters the pipe it shall be removed and the interior pipe surface swabbed with a 5% chlorine solution. If the OWNER and the ENGINEER concur that as dirt remaining in the pipe will not be removed by flushing, then the interior of the pipe shall be cleaned by mechanical means such “pigs” or other suitable devices in conjunction with the application of a 1% disinfecting solution.

(f) If the main is flooded during construction, it shall be cleared of the floodwater by draining and flushing with potable water until the main is clean. The section exposed to the flood water shall be filled with chlorinated water that, at the end of a 24 holding period, shall have a free chlorine residual of not less than 25 mg/L. The chlorinated water may then be drained or flushed from the main. This partial disinfection procedure shall not be substituted for the final disinfection procedure which must be performed after construction is completed.

3.2 Preliminary Flushing

(a) Prior to disinfection all water mains shall be flushed. All valves and hydrants shall be operated during this operation. Flushing velocities should not be less than 2.5 feet per second (fps). The volume of water flushed shall be at least the equivalent volume of the pipeline being flushed. Flushing shall continue until the water is clear. Please note that Flushing is not a substitute for preventative measures during construction. Certain contaminants such as caked deposits resist flushing at any feasible velocity.

(b) Guidance for determining flow and openings needed to attain a pipeline velocity of 2.5 ft/sec is given below.

(c) Required Flow and Openings to Flush Pipe at 2.5 ft/sec. (Assumes 40 psi in pipeline)

Line Size	GPM[1]	Size of Tap (inches) Number of Taps on Pipe[2]			Number of 2 1/2 in. hydrant outlets
		1 in.	1.5 in.	2 in.	
2"	25	1			1
4"	100	1			1
6"	200		1		1
8"	400		2	1	1
10"	600		3	2	1
12"	900			2	2

1 GPM = gallons per minute

assumes discharge through 5 ft. section of galvanized pipe with 1-90^{o} elbow

3.3 Methods of Chlorine Application

(a) Two methods of chlorination are given below. The Engineer shall approve the particular method to be used. The tablet method included in the AWWA standards is not listed below and is not acceptable. Equipment used to feed chlorine solution to the main shall be new or shall have only been used for this same purpose previously. WCSA will prohibit the use of any equipment for this purpose that it feels is not safe for the disinfection of water lines which will provide potable water to its' customers.

(i) Continuous Feed Method. Potable water shall be introduced into the pipe line at a constant flow rate at a point not more than 10 ft. downstream from the beginning of the new main. Chlorine shall be added at a constant rate to this flow so that the chlorine concentration in the water in the pipe is at least 50 milligrams per liter (mg/L). The chlorinated water shall remain in the pipe line at least 24 hours, or 48 hours if the water temperature is less than 41^{o} F, after which, the chlorine concentration in the water shall be at least 10 mg/L. All valves and appurtenances shall be operated while the chlorinated water remains in the pipe line.

(ii) Slug Method. Potable water shall be introduced into the pipe line at a constant flow rate at a point not more than 10 ft. downstream from the beginning of the new main. This water shall receive a chlorine dosage that will result in a chlorine concentration of 100 mg/L in a "slug" of the water. The chlorine shall be added long enough to insure that all portions of the pipe are exposed to the 100 mg/L chlorine solution for at least 3 hours. The chlorine residual shall be checked at regular intervals not to exceed 2000 feet to insure that adequate residual is maintained. As the chlorinated water passes valves and appurtenances, they shall be operated to insure disinfection of these appurtenances

3.4 Introduction of Potable Water

(a) If potable water from an existing water main is introduced into a proposed water main to be disinfected the Contractor shall tightly close the gate valve separating the proposed main from the existing main immediately after introduction of water, so that the heavily chlorinated water can not enter the existing system.

3.5 Final Flushing

(a) Clearing the Main of Heavily Chlorinated Water

(i) After the applicable retention period, the heavily chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the system or is acceptable for domestic use.

(b) Disposing of Heavily Chlorinated Water

(i) The environment to which the chlorinated water is to be discharged shall be inspected and if there is any question that the chlorinated discharge

will cause damage to the environment, then a reducing agent shall be applied to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water.

(ii) Where necessary, federal, state, and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.

3.6 Bacteriological Tests

(a) After the mains have been flushed, water samples shall be collected, by WCSA unless otherwise approved, at regular intervals, not exceeding 2000 feet throughout the length of the pipe line.

(b) Samples shall include one set from the end of the line and at least one set from each branch. No fire hydrant or hose shall be used in the collection of samples. Taking samples from blow-offs is acceptable. The Contractor shall install sample taps if required. A minimum of two water samples for bacteriological analysis must be collected 24 hours apart and analyzed by a certified laboratory. The results of these samples must indicate no coliform bacteria contamination before water mains are to be placed in service.

3.7 Redisinfection

(a) If contamination is indicated by the bacteriological tests, the main shall be rechlorinated by the continuous-feed or slug method and resampled until satisfactory results are obtained.

END OF SECTION

SECTION 02713—WATER SYSTEM

1.0 General

1.1 Description

(a) Work Included. The work shall include the installation and testing of potable water pipe and appurtenances which may include but is not necessarily limited to pipe line, fittings, valves, hydrants, road crossing, stream crossings, marking tape, joint restraint devices, precast concrete structures, connection devices joint restraining devices, air release valves and other specialty devices. Unless otherwise specified in the Contract Documents this will include providing all necessary products and furnishing the equipment, labor, and appurtenances for the installation of piped utilities. All work shall be completed as shown on the plans and as specified in related sections and as follows.

(b) Installation of all material shall be in strict accordance with the manufacturer's recommendations and these specifications unless otherwise approved by the Engineer and WCSA. Conflicts between these specifications and manufacturers recommendations shall be reported to the Engineer promptly.

(c) Products used in the work of this section shall be manufactured, fabricated and assembled in the U.S. where possible by manufacturers regularly engaged in the production of this product and/or similar products.

(d) All pipe and appurtenances whose wetted parts will contact potable water systems shall be certified to comply with NSF Standard 61.

(e) Insofar as is possible and practicable all pipe and appurtenances shall comply with appropriate AWWA standards.

(f) Applicable sections of the Commonwealth of Virginia Waterworks Regulations pertaining to design apply to all projects. This includes limitations on the length of lines smaller than 4-inches in diameter unless hydraulically justified.

1.2 Related Sections

(a) Section 02005 – Erosion and Sediment Control

(b) Section 02010 – Site Clearing

(c) Section 02070 - Seeding

(d) Section 02200 – Earthwork

(e) Section 02419 - Boring, Jacking and Tunneling

(f) Section 02420 - Directional Boring

(g) Section 02571 - Disinfection of Water Lines

(h) Section 02713 - Water System

(i) Section 03410 – Precast Concrete Structures

(j) Section 15060 – Pipe and Fittings

(k) Section 15100 - Valves, Appurtenances and Specialty Devices

1.3 Regulations

(a) Comply with all codes, laws, ordinances and regulations of all governmental authorities having jurisdiction over this part of the work.

(b) Obtain all required permits and approvals of governmental, property Owners and other authorities having jurisdiction over the work, prior to beginning the work affected. These may include but are not necessarily limited to the following.

(i) For developer funded projects:

1) Stream Crossings – Army Corps of Engineer (ACOE), Department of Environmental Quality (DEQ), Virginia Marine Resources Commission (VMRC), Virginia Department of Game and Inland Fisheries (DGIF),

2) Railroad Crossings – Norfolk Southern Corporation

3) Waterworks Construction – Virginia Department of Health – Office of Drinking Water (VDH-ODW)

4) Encroachments upon public roadways and accesses – Virginia Department of Transportation (VDOT), Incorporated Towns as they may have jurisdiction - including Abingdon, Damascus, and Glade Spring.

5) Erosion and Sediment Control – Washington County Building Official,

6) Stormwater Management – Virginia Department of Conservation and Resources (DCR)

7) Wetlands Mitigation – DEQ, DCR, ACOE.

8) Easements, Right of Ways and Other Property Acquisition Issues - obtaining easements, right of ways and otherwise acquiring property for infrastructure construction and subsequent operation and maintenance activities is the sole responsibility of the Developer. WCSA must approve all permanent easements for operation and maintenance purposes. It is strongly suggested that the content of these easements, right of ways or other property acquisition documents be approved in advance prior to execution to insure the contents are acceptable to WCSA.

(ii) For Washington County Service Authority funded and contracted projects:

1) Unless otherwise provided for, WCSA will file all required plans and obtain all necessary permits from the above agencies except,

2) VDOT – appropriate permit to work on the right of way, also VDOT requires Contractors working in their right of way to have the appropriate land disturber permit from DCR,

(iii) Obtaining easements and right of ways for infrastructure construction and is the responsibility of the Owner.

(c) Work within existing or proposed Virginia State Rights-of-Way shall meet all requirements of the Virginia Department of Transportation.

(d) Erosion and sediment control practices shall be in accordance with the requirements of the, approved erosion and sediment control plan prepared by the Owner

(e) Disinfection procedures shall be in accordance with the Commonwealth of Virginia Waterworks Regulations as augmented by Washington County Service Authority policies and procedures

1.4 References

(a) Virginia Department of Health, Office of Drinking Water (VDH-ODW) – Waterworks Regulations

(b) Virginia Department of Transportation (VDOT) Road and Bridge Specifications, latest edition.

(c) Erosion and Sediment Control Handbook (DCR)

(d) American Water Works Association (AWWA) latest revision

(e) American Society for Testing Materials (ASTM)

(f) American National Standard Institute (ANSI)

(g) National Sanitation Foundation (NSF)

(h) Uni-bell – PVC Pipe Association (Uni-bell)

(i) Virginia Registration Law

1.5 Submittals. Shop Drawings and Manufacturer's Information as requested in the related sections

1.6 Quality Assurance

(a) Comply with all applicable laws and regulations of the Regulatory Agencies having jurisdiction,

(b) Comply with all the applicable standards of the referenced organizations,

(c) Comply with all rules, regulations, policies and procedures of the Washington County Service Authority.

(d) Perform the work in a manner acceptable to the standards of the Construction Industry, while attaining the requirements of these specification and incorporating the workmanship, quality, and integrity of the Construction Industry.

2.0 Products. See related sections and submit manufacturer's information and other information indicating compliance with these specifications and applicable standards.

3.0 Execution

3.1 General

(a) Water lines and appurtenances shall be laid to lines and grades shown on the drawings,

(b) If provided for by the contract documents, supply and install residential connection devices according to these specifications

(c) Installation shall be in strict accordance with manufacturer's recommendations and guidelines and these specifications.

3.2 Existing Utilities

(a) The location of existing utilities, including underground utilities, is indicated on the drawings insofar as their existence and location were known at the time of the preparation of the drawings. However, nothing in these Contract Documents shall be construed as a guarantee that such utilities are in the location indicated or that they actually exist or that other utilities are not within the area of operations. The Contractor shall make all necessary investigations to determine the existence and locations of such utilities far enough in advance of pipe laying, to allow for adjustments due to conflicts in the horizontal and vertical location of the pipe line.

(b) The Contractor may obtain field utility locations by calling "Miss Utility" (1-800 552-7001) forty-eight (48) hours prior to working in the vicinity of existing facilities if calls have been responded to by Utility Owners and an additional twenty-four (24) hours if they have not responded. If the utilities fail to locate and evidence of other facilities is present, a second call shall be made providing an additional three (3) hour notice.

(c) Based on the location and the elevation of the existing utilities, the horizontal and vertical alignment of the new pipe shall be adjusted (within the limitations of acquired easements) to avoid sharp changes in direction or the creation of local high points.

(d) The Contractor shall be responsible for the protection of and continued operation of existing utilities and structures during water line and appurtenance construction.

3.3 Existing WCSA Waterworks

(a) Operation of existing valves and appurtenances on the WCSA water system is absolutely and strictly prohibited.

(b) Existing system configuration and existing materials in use shall be investigated in advance of system construction. Should lines sizes, materials used or other inconsistencies be discovered which are contrary to what the plans indicate the Engineer shall be contacted immediately.

3.4 Connections to Existing System. Responsibilities of the Contractor and the Owner when connections are made to the existing system may be specified on the plans. Generally this work is to be a cooperative effort between the Contractor and the Owner and must be in compliance with the following unless otherwise stated on the plans. All main line connections shall be made under the following conditions;

(a) In coordination with the Owner,

(b) With a representative of the Owner present,

(c) In compliance with Owner dictated policies, procedures, and specifications, and

(d) WCSA will provide all pipes, sleeves, tapping valves and other appurtenances needed to accomplish the work and the Contractor shall be responsible for providing for assistance purposes, labor, construction equipment, gravel, concrete and other incidental items needed to accomplish main line connections to the existing system unless otherwise stated in the Contract Documents.

(e) For developer funded projects, the developer shall be responsible for reimbursing the Owner for connection costs as stipulated on the Owners fee schedule. Where the fee schedule specifies that labor and equipment costs shall be reimbursed to the Owner, the Developer is responsible for this payment.

3.5 New Connections Facilitated by Construction. When provided for by the Contract Documents – the Contractor shall supply and install small meter connection devices as the water line is constructed. These installations will generally be limited to the size of meter required for residential supply (5/8 inch) which will supply a maximum instantaneous peak demand of 20 gpm and less.

(a) Connection devices utilized shall include those listed in Article 2.7 in Section 15100 - Valves, Appurtenances, and Specialty Devices and shall include as a minimum, pipe saddle, corporation stop, copper (or other approved service line) between the corporation stop on the main and the meter cutoff valve, meter cutoff valve, yoke with expansion wheel, check valve, capped meter out line and the water meter box with lid,

(b) When connection devices are installed by the Contractor, pressure testing, and disinfection shall occur up to the meter (yoke) cutoff valve,

(c) For private developer funded projects, participation in the WCSA Voucher Program requires that connections device as listed in A. above must be installed as the line is constructed and tested as provided for in B above. Failure to do so automatically disqualifies the Contractor from participation in the WCSA Voucher Program.

3.6 Installation of Water Pipe Lines

(a) Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work. Underground installation of ductile iron pipe shall be in accordance with AWWA Standard C-600, latest revision.

Underground installation of PVC pipe shall be in accordance with AWWA Standard C-605, latest revision. The following requirements for the installation of pipe shall be observed unless otherwise approved;

(i) In preparation for pipe installation, placement (stringing) of pipe should as close to the outside edge of the VDOT right of way as is practicable. The aim here is to place the pipe where it will cause the least interference with traffic. No more than 2000 feet of pipe shall be strung at any given time.

(ii) Laying of the pipe shall be commenced immediately after the excavation is started and every means shall be used to maintain pipe laying close behind trench excavation.

(iii) Depth of cover for all water lines shall be 30 inches, except under roadways and roadway ditches where the depth of cover shall be 36 inches unless otherwise stated in these specifications, shown on the drawings or directed by the Engineer.

(iv) Excavation and backfill shall conform to the requirements of Section 02200 (Earthwork) of these specifications

(v) All pipes, fittings, valves, hydrants, appurtenances and specialty devices shall be carefully lowered into the trench by appropriate means to insure that pipe, fittings, valves, appurtenances and specialty devices, and their finishes or coatings are not damaged by rough handling. Under no circumstances shall pipe be thrown, dropped or tossed in the ditch,

(vi) Prior to placement of pipe in the trench, the trench shall be dewatered of all free water standing in the trench. If there is a possibility of the trench becoming inundated with water prior to completion of the pipeline, water proof stoppers shall be placed in the open end(s) of pipe. Proper precautions shall be taken to prevent the flotation of pipe,

(vii) It is very important to maintain the pipe as clean as possible as doing so will facilitate pipe flushing, disinfection and generally help protect the public health. Foreign material shall be prevented from entering the pipe, while it is being placed in the trench and prior to filling. During laying operations, no debris, tools, clothing, or other materials shall be placed inside the pipe,

(viii) All lumps blisters and excess coating shall be removed from the socket ends of each pipe, and the outside of the plain end and inside the bell shall be wiped clean and dry and be free from dirt, sand, grit or any other foreign material before the pipe is laid,

(ix) Provide approved embedment for the pipe as defined elsewhere in these specifications. The pipe and joint shall be uniformly supported and secured in place with the specified embedment material before joints are made.

(x) The pipe shall be laid with the bell end pointing the direction of work progress. When pipe is laid on slopes exceeding 10% or greater, the laying shall start at the lower end and proceed upgrade. Adjustments to line or grade shall be made by adjusting the granular material height

under the bell, not under the barrel of the pipe. After adjustment take care to compact the bedding on either side of the pipe barrel according to the specifications.

(xi) When pipe is cut in the field, the cut shall provide a smooth end at a right angle to the longitudinal axis of the pipe. Pipe spigot ends shall be deburred, beveled, and re-marked with an insertion limit line at the proper location. For best performance, the length and angle of field bevels shall match the factory cut bevels. However, when inserting PVC pipe into shallow depth bells, such as those on some fittings and valves, the bevel shall be cutoff to form a deburred, square-cut end with only a slight outer bevel.

(xii) When assembling gasket joints, an approved lubricant shall be applied as specified by the pipe manufacturer. When joints are assembled in cold weather conditions, factory installed gaskets may be temporarily removed and placed in a heated location such as a warm truck cab or shelter, if removal is permitted and recommended by the pipe manufacturer. Only gaskets supplied by the particular pipe and fittings manufacturer shall be used with that particular pipe or fitting.

(xiii) All joints shall be watertight and any leaks or defects discovered shall be immediately repaired to the satisfaction of the Engineer.

(xiv) Pipe jointing shall be accomplished in accordance with manufacturer's criteria, belling the pipe by hand using a wood block to protect the bell end. Mechanized equipment shall not be used to join or push the pipe together.

(xv) Mechanical joints shall be assembled in accordance with the fitting - manufacturer's recommendations.

(xvi) If the specified or required alignment requires deflections in excess of those allowed, the Contractor shall install fittings in compliance with these specifications.

(xvii) Ductile iron pipe may be deflected at the joint but the offset shall not exceed the deflection limits recommended by the manufacturer. The maximum joint deflection for ductile iron is given in the following table:

(xviii) Maximum Axial Joint Deflection for Ductile Iron Pipe

Pipe Size (inches)	Ductile Iron (Push On Joints) Lengths (ft)		Ductile Iron Mechanical Joint Lengths (ft)	
	18 foot	20 foot	18 foot	20 foot
4	19 in.	21 in.	31 in.	35 in.
6	19 in.	21 in.	27 in.	30 in.
8	19 in.	21 in.	20 in.	22 in.
10	19 in.	21 in.	20 in.	22 in.
12	19 in.	21 in.	20 in.	22 in.

(xix) Axial-joint deflection for PVC pipe is allowed but shall not exceed the maximum specified by the pipe manufacturer. Excessive axial-joint deflection may result in damaging stresses or leakage. Longitudinal pipe bending is also allowed for pipe diameters of 12 inches and smaller but only when improved bedding is utilized. When bending the pipe longitudinally, the Contractor shall block or brace pipe joints to insure that bending of the pipe barrel does not result in an axial deflection that exceeds the manufacturer's published limits. Bending radii shall not be less than that specified by AWWA C-900. These minimum radii will result in an offset (inches) at the end of a joint of 20 feet of DR-14 PVC pipe not to exceed that indicated in the following table.

(xx) Maximum Longitudinal Bending Expressed as Offset in Inches

Pipe Size (inches)	PVC AWWA C-900 DR-14
	20 foot
4	24 in.
6	17 in.
8	13 in.
10	10 in.
12	9 in.

(xxi) Curved alignment of PVC pipe larger than 12" in diameter shall be accomplished through axial joint deflection only and this shall be in accordance with the pipe manufacturer's published axial-joint deflection limits. The trench may be curved to change direction or to avoid obstructions, within the limits specified by the pipe manufacturer.

(xxii) Reaction or thrust restraints shall be provided for each dead end, valve, bend, tee, and unrestrained hydrant. Thrust blocks of concrete poured to the dimensions specified on the standard details when undisturbed and well drained soil is present is the standard to which other joint restraint systems will be judged. Prior to pouring thrust blocks wrap the pipe contacting the thrust block in plastic, tar paper or other materials to prevent the concrete from binding to the pipe itself. Also please see the standard details as they pertain to harnessing valves to tees,

(xxiii) Restraining devices including mega lugs, duc lugs, One-Bolt devices, grip rings, Aqua Grip or others may generally be used at the Contractors discretion in addition to thrust blocking. Proprietary restraining devices the Contractor proposes to utilize shall be proposed to WCSA when shop drawings are submitted. Restraint devices shall not be utilized until approved by WCSA.

(xxiv) Proprietary restraining devices or alternative harnessing may be utilized in lieu of concrete thrust blocking on angle fittings less than 45 degrees and may be proposed in lieu of concrete thrust blocks when soil conditions will not support concrete thrust blocks or where there are limited clearances preventing the use of a concrete thrust block. The use of mechanical restraint devices or other harnessing techniques in

lieu of concrete thrust blocking shall be proposed and approved by WCSA prior to construction.

(xxv) All pipes which has been disturbed after being laid shall be taken up, the joints cleaned, the pipe shall be inspected for damage, and the pipe shall be properly reinstalled and tested according to these specifications.

(xxvi) When pipe laying conditions are interrupted or terminated at the end of the day, pipe ends shall be sealed temporarily to prevent entry of water debris, small animals, and similar types of contamination.

3.7 Installation of Fittings and Valves

(a) Unless otherwise specified, installed valves shall be placed with operating stems vertical and operating nuts at the top, and valve boxes shall be installed plumb and centered over the valve.

(b) After being correctly positioned, fill shall be carefully tamped around the valve box. A concrete apron shall be installed around the box as shown on the standard details section of the plans. The top of the concrete and cover shall be flush with the finished grade, unless otherwise directed by the Engineer.

(c) The full weight of fittings and valves shall not be carried by the pipe. Provide support for these appurtenances in the form of crushed stone, cap block or other acceptable means.

(d) Installation shall comply with these specifications and the standard detail included with these specifications.

3.8 Hydrants

(a) Hydrants shall be installed in accordance with the standard detail including harnessing and thrust blocking.

(b) The full weight of fittings and valves shall not be carried by the pipe. Provide support for these appurtenances in the form of crushed stone, treated wood or acceptable means.

(c) A gravel drain pit with a minimum volume of 0.5 cubic yards must be provided for the hydrant drain. Hydrants shall not be located in areas where the drain would be below the high seasonal level of the ground water. Seasonal high ground water levels can be recognized often by the grey color and dampness of the soil.

(d) All hydrants shall be plumb, and have a factory applied bright red finish. The Contractor will be responsible for touching up the hydrants if the finish is damaged during installation.

3.9 Service Connections

(a) On WCSA funded projects, coordinate the location of service connections with the WCSA inspector.

(b) If provided for by the Contract, service connections shall be installed as the pipe is laid. Service connections shall be installed in accordance these specifications and the standard detail included in them. .

(c) Where possible service connections shall be located and service locations set such that a single connection to the main would be extended to the service location at a property line boundary. In this way two connections may served with a single connection to the main (1") and a single service line to the meter (1") and a y-branch connector can be used to allow the installation of 2 meters one on either side of the property line.

(d) All manufacturers' recommendations for installation shall be followed.

(e) All taps shall be made using a service saddle, complying with the requirements of these specifications,

(f) The pipe adjacent to the tap should be covered with a protective blanket prior to tapping.

(g) Meter shall be installed such that the top of the meter box is located at final grade.

(h) Care shall be taken to install and maintain meter yoke in the upright position.

3.10 Installation of Other Appurtenances. Comply with all manufacturers' recommendations, the requirements of these specifications and accompanying standard details on the drawings.

3.11 Separation of Water and Sanitary Sewer Lines

(a) Prior to using the techniques listed under "Unusual Conditions" below, the Engineer and WCSA shall be consulted and his approval obtained.

(b) Parallel Installation

(i) Normal Conditions: Water mains shall be laid at least 10 feet horizontally from any sanitary sewer, storm sewer or sewer manhole whenever possible; the distance shall be measured edge to edge.

(ii) Unusual Conditions: When local conditions prevent a horizontal separation of 10 feet, a water main may be laid closer to a storm or sanitary sewer provided that:

1) The bottom of the water line is at least 18 inches above the top of the sewer

2) Where this vertical separation cannot be obtained, the sewer shall be constructed of pipe complying with the AWWA standards for water pipe, tested in place at 30 psi and exhibit no leakage.

(c) Crossing

(i) Normal Conditions: Water mains crossing house sewers, storm sewers or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer, whenever possible.

(ii) Unusual Conditions: When local conditions prevent a vertical separation as described in 3.11.C.1, the following construction shall be used:

1) Sewers passing over or under water mains should be constructed of the materials is 3.11.b.ii.2

(iii) Water mains passing under sewers shall, in addition, be protected by providing:

1) A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water main:

2) Adequate structural support for the sewers to prevent excessive deflection of joints and settling on and breaking the water main:

3) That the length of water pipe be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.

4) Both the sewer and the water main shall be constructed of water pipe and tested in accordance with Section 3.11.b.ii.2.

(d) Sewer Manholes

(i) No water pipe shall pass through or come into contact with any part of a sewer or sewer manhole.

(ii) No water pipe shall pass within 10 feet of a drain field line for an onsite wastewater disposal system, unless special construction techniques approved by the Engineer are employed.

(e) Concrete encasement of water and or/sewer lines will be considered by WCSA in lieu of certain of the above requirement on a case by case basis.

3.12 Pressure and Leakage Testing

(a) All pressure and leakage testing shall be performed in the presence of a WCSA inspector.

(b) The Contractor shall furnish and install suitable temporary testing plugs or caps for the pipe, all necessary pressure pumps, hose, pipe connections, meters, gages and other similar equipment, and provide all labor required, all without additional compensation for conducting pressure and leakage tests of the new water lines. WCSA may, at its discretion, furnish a water meter and a pressure gage for use in conducting these tests.

(c) The hydrostatic test boundaries shall be each valved section of the water line and each valve as a minimum shall be subjected to test pressure on one side.

(d) Allow a minimum of 24 hours for concrete thrust restraints to set up prior to testing. In cold or humid conditions additional time may be required to allow concrete to cure before pressure testing.

(e) Potable water from the existing water system shall be used for testing. The line shall be slowly filled with water, and the specified test pressure (based on the

lowest point of the line or section under test and corrected to the elevation of the test gauge) shall be applied using a pump connected to the pipe. Before applying the test pressure, expel all air from the line.

(f) The test pressure for the water lines shall be 200 psi minimum, but not less than 150% of the working pressure in the line, and this pressure shall be maintained for a period of not less than two (2) hours. Valves shall not be operated in either the open or closed direction at differential pressures above the rated pressure. The system should be allowed to stabilize at the test pressure before conducting the hydrostatic test.

(g) The amount of water forced into the line during this two hour test period shall be determined and this amount shall be taken as a basis to compute the leakage per hour. Pressure shall be maintained within 5 psi of the specified test pressure during the test. The allowable leakage shall be based upon the following formula: $L = S*D*P^{1/2}/133{,}200$, where L = Allowable leakage in gallons per hour S = Length of pipe tested, in feet D = Nominal diameter of pipe in inches P = Average test pressure is psi. For a two hour test the allowable leakage given by the above equation shall be multiplied by 2 to give the allowable leakage over a two hour period.

(h) All leaks evident in exposed pipe or valves or at the surface shall be uncovered and repaired regardless of the total leakage as indicated by the test. Tests shall be repeated until leakage has been reduced below the allowable amount.

END OF SECTION

DIVISION III

SECTION 03410—PRECAST CONCRETE STRUCTURE

1.0 General

1.1 Work Included

(a) Furnish all labor, materials, prefabricated structures, equipment, and services required to construct and install the precast concrete structures, related items and accessories as indicated on the Drawings.

(b) All concrete vaults, frames, covers and hatches and access-ways shall have an H-20 road rating.

1.2 Related Requirements

(a) Section 02200 - Earthwork

(b) Section 15060 - Pipes and Fittings

(c) Section 15100 – Valves, Appurtenances and Specialty Devices

(d) Section 02010 - Site Clearing

1.3 Submittals

(a) The Contractor shall submit shop drawings showing all dimensions, reinforcement, opening details, inserts, and other details necessary for the fabrication and installation of all precast concrete structures and items to demonstrate compliance with the drawings and specifications.

(b) The Contractor shall submit manufacturer prepared design analysis and calculations indicating that allowable stresses will not be exceeded during any and all phases of manufacture, shipping and handling, and installation. These analyses must also include calculations to verify that all units have been designed to withstand all loadings at the burial depths indicated on the plans. These analyses shall be sealed by a professional Engineer licensed in the State of Virginia and shall be submitted with the shop drawings.

1.4 Quality Assurance

(a) The materials and methods of construction for precast concrete shall comply with the latest revisions of the applicable ASTM and VDOT standards. Precast structures shall conform to the details on the Drawings and in these specifications.

(b) At the request of the Engineer, the manufacturer shall submit test reports indicating the concrete 28-day compression strength results for each production of material was performed for the structures that are a part of this work.

1.5 References

(a) Virginia Department of Transportation (VDOT) - Road and Bridge Specifications and Standard Details - Latest Revisions

(b) American Society for Testing Materials (ASTM)

(i) C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections

(ii) C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures

(iii) C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures

(iv) C913 - Standard Practice for Installation of Underground Precast Concrete Water and Wastewater Structures

(c) American Concrete Institute (ACI):

(i) ACI 318 - Building Code Requirement for Reinforced Concrete

(ii) ACI 318.1 - Building Code Requirement for Structural Plain Concrete

2.0 Products

2.1 General. Unless otherwise approved, precast concrete structures shall comply with the following general requirements:

(a) Precast concrete structures shall be constructed of steel reinforced concrete.

(b) Concrete shall have a minimum 28-day compressive strength of 4000 psi for manholes sections and 5000 psi for other precast concrete structures, as determined by ASTM accepted test methods,

(c) Precast concrete sections shall be monolithic, water tight and designed for the use indicated and installation as shown on the drawings.

(d) Portland cement shall be ASTM C150 Type 2, using a minimum of 8 bags per cubic yard.

(e) Aggregates shall be sized between for 1” to standard number 4 sized stone and meet the requirements of ASTM C33. Coarse aggregates shall be angular granitic stone only.

(f) Sand shall be free from organic matter.

(g) Honeycombed or retempered concrete will not be acceptable.

(h) Joints between monolithic sections shall be sealed with, O-rings, 1 inch Butyl Rubber rope sealant conforming to AASHTO-198 or other acceptable means.

(i) Welded wire fabric used for reinforcing shall comply with ASTM-305.

(j) The maximum entrained air in finished concrete shall be 5%.

(k) Manhole steps may be supplied to facilitate entry so long as the opening is flush with the vertical wall.

2.2 Combination Air Valve Vaults

(a) Units shall be made of cylindrical monolithic risers and manhole cone or flat top sections with a standard manhole ductile or cast iron frame and cover, concrete thickness shall be a minimum of 5 inches. The floor shall be of compacted #68 stone. Pipe entry shall be doghouse style, with the openings being located a minimum of 30 inches below grade. Pipe openings shall be large enough to prevent damage to the pipe should some structure settling occur.

(b) Risers shall be 4' in diameter and manhole opening shall be as shown on the standard detail.

(c) Vault risers shall be located on a foundation sufficient to prevent settling of the manhole on the pipeline.

(d) Manhole frame and covers

(i) The manhole lids shall be cast or ductile iron and have the word "WATER" cast into the top in minimum 4" high letters.

(ii) Manhole frames and covers shall be cast ductile iron in accordance with the dimensions shown on the standard details. Minimum opening diameter shall be 24 inches.

(iii) Frames and covers shall have machined bearing surfaces to prevent rocking or rattling. Castings shall be uniform in quality, without defects

(iv) Standard manhole frames and covers shall be GTS, manufactured by Quality Water Products, or equal.

(v) A bituminous coating shall be applied to the frame exterior where it will come in contact with the frame cover.

(vi) Casting shall be manufactured true to pattern with component parts fitted together in a satisfactory manner.

(e) Manhole access

(i) Manholes steps shall be provided in all manholes and shall be on a maximum of 16 inch centers.

(ii) Manhole steps shall be steel encapsulated in corrosion resistant rubber or copolymer polypropylene plastic as manufactured by Delta Pipe Products Model PS1-PF or equal.

(iii) Steps shall be in accordance with the dimensions and capable of withstanding the loads specified in ASTM C-478.

2.3 Pressure Reducing Valve Vaults. These shall be supplied and installed as shown on the standard detail.

(a) Access Ladders. Ladders where required shall be constructed entirely of aluminum.

(i) Rails shall be 3/8" x 2 ½" flat bar and spaced 16 to 18 inches apart.

(ii) Wall mounted standoffs for the ladder shall be 3/8" x 2 1/8" flat bar welded to the rails 48 to 60 inches on center.

(iii) Plates connecting the ladder to the standoffs shall be sized to place the ladder so that access is convenient,

(iv) 1 3/8 inch diameter slip resistant ribbed rungs shall be spaced 12" on center and shall be welded to the inside of each rail.

(v) Ladders shall be L1B Series Ladder as manufactured by Halliday Products, Inc., or equal.

(b) Access Frames and Covers

(i) Access frame and cover shall have a ¼ inch thick one-piece extruded aluminum frame, incorporating a continuous concrete anchor,

(ii) Frame drain shall be directed such that water storm will not run over piping or valves,

(iii) A bituminous coating shall be applied to the frame exterior where it will come in contact with concrete,

(iv) Door panel shall be ¼ inch aluminum diamond plate reinforced to withstand a live load of 300 lb/ft^2,

(v) Door shall open to 90^o and automatically lock with an aluminum or stainless steel hold arm and release handle,

(vi) Door shall close flush with the frame, and rest on a built-in neoprene cushion gasket.

(vii) Hinges and all fastening hardware shall be stainless steel.

(viii) Unit shall lock with a stainless steel slam lock with removable key and have a non-corrosive handle.

(ix) Unit shall be guaranteed against defects in material and or workmanship for a period of 10 years.

(x) Access cover and frame shall be as manufactured by Halliday Products, Inc.

(c) Pipe connections. Pipe connections shall allow for some settling of precast concrete structures while maintaining the integrity of the pipe.

(i) Pipe connections to precast concrete structures shall be made utilizing rubber gaskets cast integrally in the structure at the time of Manufacturer. Rubber gasket shall conform to ASTM C-443 and shall be the performance and test requirements of ASTM C-425. Flexible

connections shall be A-LOK Manhole Pipe Seal manufactured by A-LOK Corp., or equal

(ii) As an alternate connections may be made utilizing field installed positive seal gasketing system. Field installed connections shall be PRESS – BOOT manufactured by Press Seal Gasket Corporation, KOR-N-SEAL, manufactured by National Pollution Control System, Inc., or equal.

(iii) Pipe knockouts shall be installed at locations of wall penetrations by pipe.

3.0 Execution

3.1 Unloading, Moving, and Setting

(a) Unloading instructions from the precast structure manufacturer shall be observed. Lifting shall be by devices installed for this purpose by the Manufacturer. Lifting devices appropriate for the structure being handled shall be used for unloading, moving and setting the structure in place.

(b) Concrete structures shall be installed level and plumb by the Contractor on a minimum 6” deep bed of #57 crushed stone or as indicated on the Drawings in the manufacturer’s information.

(c) All items shall be installed in accordance with the manufacturer's recommendations.

END OF SECTION

DIVISION XV

SECTION 15060—PIPE AND FITTINGS

1.0 General

1.1 Description

(a) Work Included. The work shall include the furnishing, installation, and testing of all pipe fittings and structures, furnishing the equipment, labor, and appurtenances for the installation of piped utilities. All work shall be completed as shown on the plans and as specified in related sections and as follows.

(b) All pipe and fittings shall be new, free from defects or contamination and shall, whenever possible be the product of a single manufacturer.

(c) Products used in the work of this section shall be manufactured, fabricated and assembled in the U.S. where possible by manufacturers regularly engaged in the production of the product or similar products.

(d) All pipe and appurtenances for potable water systems shall be certified to comply with NSF Standard 61.

(e) Insofar as is possible and practicable all pipe and appurtenances shall comply with appropriate AWWA standards.

1.2 Related Sections

(a) Section 02200 Earthwork

(b) Section 03410 Precast Concrete Structures

(c) Section 02419 Boring, Jacking and Tunneling

(d) Section 02420 Directional Boring

(e) Section 02571 Disinfection of Water Lines

(f) Section 02713 Water System

(g) Section 15100 Valves, Appurtenances and Specialty Devices

1.3 Regulations

(a) Comply with all codes, laws, ordinances and regulations of governmental authorities having jurisdiction over this part of the work.

(b) Work within existing or proposed Virginia State Rights-of-Way shall meet all requirements of the Virginia Department of Transportation.

1.4 References

(a) Virginia Department of Transportation (VDOT) Road and Bridge Specifications, latest edition.

(b) American Water Works Association standards (AWWA) latest revision

(c) American Society for Testing Materials (ASTM)

(d) American National Standard Institute (ANSI)

(e) National Sanitation Foundation (NSF)

(f) Uni-bell – PVC Pipe Association (Uni-bell)

1.5 Submittals

(a) Manufacturers Information shall be submitted for all valves and specialties proposed to be used in the project. This information shall include manufacturer's names, class of materials, catalog numbers, and Engineering data as necessary to show compliance with specific requirements.

(b) The Contractor's proposal for the use of mechanical restraint devices if he proposes to use these in lieu of concrete thrust blocking. Manufacturer's information shall be submitted demonstrating a high degree of capability and reliability for such mechanical restraint devices.

1.6 Delivery, Storage and Handling. Delivered pipe and appurtenances shall be accompanied by a shipping manifest, indicating contents of shipment, date of shipment, shipping origin. Pipe and fittings shall be unloaded, stored, and handled in accordance with manufacturer's recommendations and accordance with applicable standards such as Section 4 of AWWA standard C-600, latest revision, for ductile iron pipe and Chapter 10 from the PVC Pipe Handbook. The following generalized procedures for PVC pipe should be employed;

(a) Unloading and Inspection

(i) Each pipe shipment should be inventoried and inspected with care upon arrival. The following procedures for acceptance of delivery are recommended:

1) Make overall examination of the load. If the load is intact, ordinary inspection while unloading should be sufficient to insure that the pipe has arrived in good condition.

2) If the load has shifted, has broken packaging, or shows rough-treatment, each piece should be carefully inspected for damage.

3) Do not dispose of any damaged material. The carrier will notify you of the procedure to follow. Notify carrier immediately and make claim in accordance with their instructions.

(ii) Unloading. When unloading package units, the following instructions should be carefully followed.

1) Remove restraints from the top unit loads. These may be either fabric or steel straps or ropes.

2) If there are boards across the top and down the sides of the load which are not part of pipe packaging, remove them.

3) Use a fork lift with thin chisel forks, extend forks (or front-end loader equipped with forks) to remove each top unit (one at a time) from the truck. Remove back units first.

4) Do not run the forks too far under units as fork ends striking adjacent units may cause damage. Insure forks are fully engaged. If a fork lift is not available, a spreader bar with fabric straps which are capable of handling the load (with straps spaced approximately 8 feet apart and looped under the load) may be used. Cables may also be used if cushioned with rubber hose sleeves or other material to prevent abrasion of the pipe.

5) During the removal and handling, be sure that the units do not strike anything. Severe impact could cause damage (particularly during cold weather).

6) Caution. Do not handle units with individual chains or single cables, even if padded. Do not attach cables to unit frames or banding for lifting.

(iii) Pipe package units should be stored and placed on level ground. Package units should not be stacked more than eight feet high. Units should be protected by from damage in the same way that they were protected while loaded on the truck.

(iv) To unload lower units, repeat the above unloading process. Care should be taken to insure that pipe is not dropped or damaged.

(b) Storage and Handling. Due to the presence of heavy equipment, jobsite damage is a possibility on pipe construction projects. The following procedures and practices are recommended to prevent damage to PVC pipe:

(i) Storage

1) Pipe should be stored, if possible, at the job site in unit packages provided by the manufacturer. Caution should be exercised to avoid compression, damage, or deformation to bell ends of the pipe.

2) When unit packages of PVC pipe are stacked, insure that the weight of upper units does not cause deformation to pipe in lower units.

3) PVC pipe unit packages should be supported by racks or dunnage to prevent damage to the bottom during storage. Supports should be spaced to prevent pipe bending.

4) When exposure in excess of two years of direct sunlight is anticipated, PVC pipe should be covered with an opaque material while permitting adequate air circulation above and around the pipe as required to prevent excessive heat accumulation.

5) PVC pipe should not be stored close to heat sources or hot objects such as heaters, boilers, steam lines, engine exhaust, etc.

6) When unit packages of PVC pipe are stacked, insure that the height of the stack does not result in instability which could cause stack collapse, pipe damage, or personnel injury.

7) The interior, as well as all sealing surfaces of pipe, fittings, and other accessories should be kept free from dirt and foreign matter.-

8) Gaskets should be protected from excessive exposure to heat, direct sunlight, ozone, oil, and grease.

9) Solvent cement, when used, should be stored in tightly sealed containers away from excessive heat.

(ii) Handling

1) When using fork lifts or other handling equipment, follow procedures that prevent damage to PVC pipe. (See previous discussion on “Unloading.”)

2) When handling PVC pipe, avoid severe impact blows, abrasion damage, and gouging or cutting by metal surfaces or rocks. Avoid stressing bell joints and damage of bevel ends.

3) Pipe should be lowered, not dropped, from trucks and into trenches.

4) In preparation for pipe installation, placement (stringing) of pipe should be as close to the trench as practical and on the opposite side from excavated earth. Pipe shall be strung on the extreme periphery of the VDOT right of way and no more than 2000 feet of pipe may be strung at any given time. Bell ends should point in the direction of work progress.

5) In subfreezing temperatures, extra caution is advised in handling to prevent impact damage.

6) Note: Handling techniques considered acceptable at warm temperatures may be unacceptable at very cold temperatures. When handling PVC pipe in cold weather, consideration must be given to variation in the pipe's impact strength. The impact strength of PVC pipe at 0°F (-18°C) is no worse and sometimes better than the impact strength of most other pipe products; however, unlike some other materials, PVC pipe's impact strength at 0°F (-18°C) is lower than its impact strength at 73°F (23°C).

2.0 Products

2.1 Materials Allowed

(a) Pipe line materials to be utilized shall be as specified on the plans and these specifications.

(b) Ductile Iron Pipe

(i) General

1) Ductile iron pipe shall be in accordance with AWWA C151, latest revision

2) Pipe thickness shall be in compliance with AWWA C150, latest revision

3) All pipes shall be cement lined with a bituminous seal coat in accordance with AWWA C104, latest revision. The lining shall be standard thickness.

4) Ductile iron pipe shall be tested in accordance with the procedure contained on AWWA C151, latest revision.

5) All pipes shall be in nominal 18-foot or 20-foot lengths.

6) Each length of pipe shall be printed with:

(a) Manufacturer Name

(b) Pressure or thickness classification

(c) AWWA Standard compliance

(ii) Exposed Pipe. Pipe installed in buildings or above ground shall have flanged joints. Pipe shall be Pressure Class 350 unless otherwise approved.

1) Joints shall be flanged using fittings in accordance with these specifications

2) Pipe shall be Pressure Class 350 or Thickness Class 50 unless otherwise approved.

3) Exposed pipe shall be painted and therefore shall not have an exterior bituminous coating.

(iii) Buried Pipe. Buried ductile iron pipe shall have push on joints unless otherwise stated on the plans.

1) Pipe shall be Pressure Class 350 or Thickness Class 50 unless other otherwise stated on the plans.

2) Pipe buried underground shall also have a bituminous coating on the outside in accordance with AWWA standards.

3) Joints shall be push on and shall be in accordance with AWWA C111 unless mechanical or flanged joints are otherwise specified. Gaskets shall be new vulcanized natural or vulcanized

synthetic rubber, free of porous areas, foreign material and visible defects.

4) Lubricant shall be nontoxic, shall not support the growth of bacteria, shall have no deteriorating effects on the gasket material and shall not impart taste and odor to water in a pipe flushed in accordance with AWWA C601, latest revision.

5) Mechanical joints and push on joints shall have the same pressure rating as the pipe or fittings of which they are a part.

6) Mechanical joint systems and fittings shall be in compliance with AWWA C110, latest revision.

7) Mechanical joint rubber gaskets shall conform to AWWA C111, latest revision

(iv) Fittings. Ductile iron fittings shall conform to AWWA C104, AWWA C110 for standard body and AWWA C 153 for compact body fittings and meet the following requirements:

1) Fittings for ductile iron pipe shall be manufactured of gray cast iron or ductile iron and in accordance with AWWA C110.

2) All pipe fittings shall be cement lined with a bituminous seal coat in accordance with AWWA C104, latest revision. The lining shall be standard thickness.

3) Joints for fittings shall be mechanical joints unless otherwise stated on the drawings.

4) Lugs to accommodate harnessing devices such as thread rod shall be cast into fittings which will be used with harnessing devices.

5) Harnessing or proprietary joint restraint systems may be used in lieu of thrust blocking when approved by WCSA or these specifications.

6) All ductile iron fittings, harnessing rods, clamps bolts and nuts shall be coated after assembly with an approved bituminous coating which shall have a dry thickness of at least 4 mils.

(v) Polyvinyl Chloride (PVC) Pipe. 4” and larger shall meet the following requirements:

1) PVC pipe shall be made from clean, virgin, PVC compound conforming to ASTM D 1784 and meet the following requirements unless otherwise specified;

2) Pipe shall be DR-14 bell and spigot pressure pipe conforming to AWWA C-900, latest revision with a rated working pressure of 200 psi, unless otherwise shown on the plans.

3) Use of this pipe shall be generally limited to working pressures of 150 psi or less. However greater working pressures may be allowed if it can be shown that under actual operating conditions (as defined by WCSA) a safety factor of greater than 4 will be attained.

4) The pipe shall be supplied in 20 foot lengths, with the following data noted on each piece;

   (a) Manufacturer,

   (b) DR and/or Classification,

   (c) Confirmation that it complies with AWWA C-900,

   (d) NSF approved stamp indicated compliance with NSF Standard 61.

5) Jointing

   (a) Pipe joints shall be push on type, with rubber rings which comply with ASTM D 3139, latest revision and ASTM F 477, latest revision.

   (b) Gaskets and lubricants shall be made from materials that are compatible with the pipe and with each other when used together,

   (c) Gasket and lubricants shall not adversely affect the potable quality of the water to be transported,

   (d) Lubricant shall be nontoxic, shall not support the growth of bacteria, shall have no deteriorating effects on the gasket material and shall not impart taste and odor to water in a pip flushed in accordance with AWWA C601, latest revision,

   (e) Elastometric gaskets shall meet the requirements of ASTM F477 for applications with hydraulic heads greater than 50 ft of water.

6) Fittings for DR-14 PVC pipe shall be manufactured of gray cast iron or ductile iron.

   (a) Fittings shall comply with AWWA C110, latest revision,

   (b) Joints for fittings shall be mechanical joints,

   (c) All pipe fittings shall be cement lined with a bituminous seal coat in accordance with AWWA C104, latest revision. The lining shall be standard thickness.

(d) All ductile iron fittings, harnessing rods, clamps bolts and nuts shall be coated after assembly with an approved bituminous coating which shall have a dry thickness of at least 4 mils.

(vi) PVC pipe 2 inches in diameter shall be Aquamine as manufactured by Aquamine, LLC (a Victaulic Company), or approved equal and meet the following requirements;

1) The pipe and couplings shall be SDR 17 with a pressure rating of 250 psi.

2) The pipe and couplings shall be certified as being in compliance with NSF Standard 61 and be marked as such,

3) The pipe and couplings shall be in compliance with ASTM standard D-1784 and shall contain impact modifiers and ultraviolet light inhibitors to enhance long term performance,

4) The couplings used to join the pipe shall be manufactured by Aquamine and shall affect a restrained joint by means of a nylon spline inserted into the space created when the groove on the pipe and the interior groove in the coupling are aligned.

5) Couplings shall comply with ASTM standard D-3139 and shall contain a pre lubricated permanent type O-ring seal on each end for a watertight hydraulic seal.

6) Valves shall be as specified in Section 15100.

(vii) Pipe and appurtenances smaller than 2", including that used for service lines (from the main to the meter and when applicable from the meter to the home) shall be Type K (soft temper) copper tubing when buried and Type L (hard temper) when exposed and shall meet the following requirements;

1) Type K copper tubing shall be in conformance with ASTM Standard B88,

2) Fittings shall wrought copper or cast bronze,

3) Exposed joints shall be soldered except where threaded or flanged fittings are required,

4) Soldered joint fittings shall conform to ANSI B16.22 or ANSI B16.18,

5) Solder used shall be a 95-5 Tin-Antimony alloy in conformance with ASTM standard B32, latest revision,

6) Bending with a mechanical or hydraulic bender may be used to change directions of copper tubing so long as wide sweep bends are formed and no kinks or wrinkles in the bend can be observed.

2.2 Steel Casing Pipe. Steel casing pipe for potable water lines shall comply with the following;

(a) Steel casing pipe shall conform to the materials standards of ASTM A 139, Grade B or approved equal,

(b) Only new steel pipe will be permitted,

(c) The casing pipe shall have a exterior coat of bituminous material with a minimum dry film thickness of 4 mil,

(d) The casing pipe and welded joints shall be of leak-proof construction so as to prevent leakage (in or out) throughout its length,

(e) The casing shall have the following wall thicknesses

(i) Smaller than 18 inch casing – 0.250 inch (wall thickness)

(ii) 18 inch casing – 0.312 inch

(iii) 24 inch casing – 0.375 inch

(iv) 30 inch and larger casing – 0.500 inch

2.3 Flange Adapters. Flange adapters 3 inches in diameter shall be the Series 2100 Megaflange as produced by EBBA Iron, Inc., or approved equal and meet the following requirements;

(a) Shall be made of ductile iron conforming to ASTM standard A536, and be lined with fusion bonded epoxy conforming to AWWA Standard C213, latest revision,

(b) Shall have a restraint mechanism and shall be individually actuated gripping wedges, with torque limiting actuating screws

(c) Shall have torque flanged bolt circles compatible and complying with ASTM C115,

(d) Capable of a minimum of 3 degrees of joint deflection during assembly or permit lengths of pipe to be field cut to within 0.6 inch of the maximum distance between flanges to allow for simplified alignment of flanged appurtenances,

(e) Shall have a pressure rating of 350 psi.

2.4 Couplings. For ductile or cast iron pipe shall be Dresser Style 38, or approved equal

2.5 Transition joints. Between PVC and steel or copper pipe and fittings shall be made with transition fittings cemented to the PVC pipe and jointed to steel or copper with connections specified for those materials.

2.6 Pipe Joint Restraints

(a) Concrete thrust blocks will be considered acceptable restraining devices. Thrust blocks shall have the minimum dimensions as shown on the standard details.

(b) Mechanical pipe joint restraint systems such as threaded rod, etc. shall be used as shown on the standard details.

(c) Additional mechanical (proprietary) pipe joint restraint systems acceptable to WCSA, such as Megalugs, grip rings, Aquagrip, Snap Lok, Bolt Lock, Field Lok or approved substitutes may be used at the Contractors discretion.

(d) In certain cases mechanical pipe joint restraint systems such as Megalugs and other mechanical joint restraint systems will be considered acceptable substitutes for concrete thrust blocking, such as on fittings which introduce a change in direction of less than 45 degrees. The Contractor shall propose in advance to the Engineer the use of mechanical pipe joint restraint systems.

(e) In certain cases mechanical pipe joint restraint systems may be preferable to concrete thrust blocking, such as in situations when soil conditions are not acceptable (for example when in fill or wet conditions) or when there is not sufficient clearance to allow installation of the size thrust block required for the application. The Contractor shall propose in advance to the Engineer the use of mechanical pipe joint restraint systems.

2.7 Pipe Supports

(a) Floor pipe supports shall be adjustable cast iron pipe saddle type supports as manufactured by ITT Grinnell (Fig 264) or equal, and shall be furnished where indicated on the drawings, complete with support pipe and base flange drilled for anchor bolting to the floor.

3.0 Execution

3.1 General

(a) Piping shall be installed in accordance with the installation specifications in Division 2,

(b) Pipe shall be cut and fit accurately to dimensions determined on site. Forcing or springing pipe into place shall not be acceptable,

(c) Open ends of pipes shall be plugged during installation to prevent entry of dirt or extraneous material,

(d) Exposed piping shall be installed to maintain the aesthetics of the project by maintaining alignment, and placing importance on neatness.

(e) Pipe shall be installed taking into consideration accommodating future maintenance,

(f) Pipe shall be installed in strict accordance with the manufacturers instructions,

(g) Pipe ends shall be prepared for installation according to the pipe manufacturer's instructions,

(h) Changes in pipe direction shall be accomplished with fittings except as allowed above for copper tubing, and

(i) Interior small diameter piping shall be carefully aligned and connected together, Valves and fittings shall be made up to endure no distortion or damage to these parts. Threaded ends shall be protected against damage and shall not be used if damaged. All valves shall be installed with a union on one side to permit easy removal for replacements and repairs.

END OF SECTION

SECTION 15100—VALVES, APPURTENANCES AND SPECIALTY DEVICES

1.0 General

1.1 Description

(a) Work Included: The work shall include the furnishing, installation without leakage (unless otherwise allowed by AWWA standards or these specifications), and testing of all valves, specialties and appurtenances as indicated in the plans or contract documents. All work shall be completed as shown on the plans and as specified in related sections and as follows. Valves assemblies shall be installed, painted, tested and adjusted.

(b) All valves and appurtenances shall be new, free from defects or contamination and shall, whenever possible be the product of a single manufacturer.

(c) Products used in the work of this section shall be manufactured, fabricated and assembled in the U.S. where possible by manufacturers regularly engaged in the production of the product or similar products.

(d) Insofar as is possible and practicable, all pipe and appurtenances shall comply with appropriate AWWA standards.

(e) All valves, appurtenances and specialties shall be installed in strict accordance with the contract documents unless otherwise specified.

1.2 Related Sections

(a) Section 02200 Earthwork

(b) Section 03410 Precast Concrete Structures

(c) Section 02571 Disinfection of Water Lines

(d) Section 02713 Water System

(e) Section 15060 Pipe and Fittings

1.3 Regulations

(a) Comply with all codes, laws, ordinances and regulations of governmental authorities having jurisdiction over this part of the work.

(b) Work within existing or proposed Virginia State Rights-of-Way shall meet all requirements of the Virginia Department of Transportation.

1.4 References

(a) Virginia Department of Transportation (VDOT) Road and Bridge Specifications, latest edition.

(b) American Water Works Association Standards (AWWA) latest revision

(c) American Society for Testing Materials (ASTM)

(d) American National Standard Institute (ANSI)

(e) National Sanitation Foundation (NSF)

(f) American Society of Sanitary Engineers (ASSE)

1.5 Manufacturers Representation

(a) Pressure Reducing Valves

(i) The Contractor shall provide as part of the work, at no additional cost to the Owner, the services of a competent and experienced factory trained representative for

1) Initial startup

2) Adjustment as necessary after startup

3) Training of WCSA designated personnel

4) Inspection and adjustment, as necessary, one year after startup

(ii) Travel time, time on site, and other normal activities of the manufacturer's representative shall all be included in the bid price at no additional cost to the Owner.

(iii) Other valves, appurtenances and special devices –

1) Provide for manufacturers representation, as recommended by the valve, appurtenance or specialty device manufacturer. Representation shall include startup, adjustment, and follow-up representation as appropriate.

1.6 Submittals

(a) Provide manufacturer information and other data as appropriate to demonstrate that valves, appurtenances, and specialty devices proposed for use meet the requirements of the specifications and are appropriate for the functionality of the design.

(b) Valves, appurtenances and specialty devices for which the manufacturer recommends on-site representation, provide proposed attendance details, including that for installation inspection, device adjustment, and follow-up visits, as recommended by the manufacturer.

2.0 Products

2.1 Gate Valves. Gate valves 2" and larger shall be resilient seated gate valves complying AWWA Standard C-509, latest revision, unless otherwise stated or specified on the plans and meet the following requirements; Two inch gate subjected to a working pressure of less than 150 psi may be of bronze construction with a solid

wedge disk with threaded ends and be Milwaukee Model 1140 or approved equal complying with MSS-SP-80.

(a) This specification applies to gate valves with opening diameters from 2" to 12" with non-rising stems,

(b) Four-inch and larger valves shall be designed to sustain a maximum working pressure of 250 psig and a static test pressure of 500 psig Hydrostatic testing shall not exceed the valve working pressure and be in accordance with AWWA Specification C509 for valves meeting that specification. The maximum test pressure or differential pressure (when pressures on the opposite sides of the valve are not the same) shall not exceed the maximum working (rated) pressure of the valve. As added protection against deformation of the valve or components, differential pressures shall be reduced to less than 150 psi before the valve is opened. In these cases pressure relief shall be accomplished at the connection of the test pump or as otherwise approved.

(c) Valves 4" and larger shall have 2" square operating nut and shall open when turned counterclockwise, Two inch valves shall be operated by a hand wheel and shall open when turned counter clockwise.

(d) Valves complying with AWWA C-509 (latest revision) shall be stamped or otherwise marked to indicate compliance with that standard, or be accompanied by an affidavit from the manufacturer indicating that the specific valve complies with the latest revision of AWWA C-509,

(e) Valves 4" and larger shall have wetted valve parts shall be suitable for exposure to potable water with a pH range of 6.5 to 8.5 and all interior wetted parts shall have a corrosion resistant internal epoxy coating complying with NSF Standard 61 indicating suitability for use with potable water,

(f) Valve stem shall be sealed with O-rings,

(g) Valve ends for gate valves 4 inches and larger shall be mechanical joint for underground applications and flanged for exposed applications,

(h) Valve ends for 2 inch gate valves shall be threaded or otherwise approved.

(i) Valves 4-inches and larger shall be the Mueller A2360, American Flow Control - Series 2500 or approved equal.

(j) Exposed gate valves located in a pump house or other installation where the valve is enclosed by a protective structure shall be wheel handle operated.

2.2 Check Valves. Check valves shall be swing check valves for water service with potable water having a pH of greater than 6.0, complying AWWA Standard C-508, latest revision, unless otherwise stated or specified on the plans. The check valve specifications are augmented as follows:

(a) This specification applies to swing check valves from 2" diameter to 12 inches diameter.

(b) Valves shall be capable of a sustaining a maximum working pressure of 175 psig.

(c) Check valves shall not be subjected to a pressure of greater than 175 psig during testing.

(d) Exposed check valves shall have flanged ends and non-exposed check valves shall have mechanical joint ends,

(e) 2 inch valves shall have threaded ends unless otherwise specified,

(f) Valve shall be operated by an external swing arm with adjustable weight,

(g) Swing check valves specified under this section shall not be applied in situations where water hammer, or hydraulic surges are present as these conditions require special design considerations,

(h) Swing check valves shall be stamped or otherwise labeled indicating compliance with AWWA Standard C-508 or be accompanied by an affidavit from the manufacturer indicating that the specific valve complies with the latest revision of AWWA C-508,

2.3 Air/Vacuum Relief Valves. Valves installed for the purpose of distribution system vacuum relief and/or air relief shall be combination air valves complying with AWWA Standard C512, latest revision. This specification applies to valve 1, 2, 3, and 4-inch orifice sizes only. Combination air valves shall be capable of exhausting large quantities of air during pipe filling operations and admitting large quantities of air should the pressure in the pipe line go negative. Combination air valves shall also be capable of exhausting small amounts of air as may accumulate over periods of time in pipeline systems. Combination air valves must meet the following specifications:

(a) Valves shall be sized according to the manufacturers recommendations,

(b) Valves shall be combination air valves,

(c) Unless otherwise required, combination air valve shall be mounted on the top of the main pipe line in a vertical position and an isolation valve should be provided between the combination air valve and the main, to facilitate maintenance or replacement of the air valve,

(d) Valve shall be installed in a enclosure as shown on the standard detail in these specifications,

(e) Valves shall not be installed in a location subject to flooding. In areas subject to flooding or in poor drainage areas the vent shall extend above ground to as directed by the Engineer.

(f) Unless specific sizing information is provided, assume the combination air valves shown on the plans to have a 2 inch orifice,

(g) Working pressure rating of the valve shall be 300 psi unless otherwise specified,

(h) The body inlet and outlet ports shall be sized to insure the minimum flow area is equal to or greater than the area of a circle with diameter equal to the nominal valve size,

(i) Valve bodies shall be of gray cast iron or ductile iron and be trimmed with a material resistant to corrosion,

(j) Valve shall have NPT threaded ends unless a flanged valve is specifically called for,

(k) Valves shall have a stamp indicating compliance with AWWA Standard C508 or be accompanied by an affidavit from the manufacturer verifying the same, and

(l) The combination air valve shall be a Claval Model 36, an APCO Series 140C or approved equal.

2.4 Blow-off Valves. Blow-off valves shall be installed in locations indicated on the plans and shall be field assembled in accordance with the WCSA standard detail for the same. The blow-off shall be configured to be installed in the preferred configuration unless the WCSA project field representative approves an alternate installation method. Preassembled blow-off assemblies will be considered on as case by case basis.

2.5 Ball Valves. Unless otherwise approved, Ball valves up to and including 4 inch diameter used for isolating service or throttling shall be have bronze body and trim, a brass stem, female thread inlet and outlet connections. The valve shall have buna seats with a brass ball which is either chrome plated or has a PTFE coating. Ball valves with diameters of 6 inches and up shall comply with AWWA Standard C-507 latest revision.

2.6 Fire Hydrants. Furnish and install all hydrants as shown on the plans and as specified herein. Fire hydrants shall not be connected to lines smaller than 6-inches in diameter. Hydrants shall comply with AWWA Standard C502, latest revision for dry barrel fire hydrants and shall comply with the following:

(a) Fire hydrants shall not be located in areas subject to flooding or in areas where the seasonal ground water table will cover the drain holes. Exceptions to this requirement will be considered on a case by case basis by WCSA.

(b) Fire hydrant shall be connected to the main utilizing a mechanical joint and the entire assembly shall include a separate gate valve which may be used to shut off the fire hydrant.

(c) A minimum of 0.5 cubic yards of approved granular material shall be provided as a sump for the hydrant drain. Fire hydrants shall not be installed in areas where the seasonal groundwater table will be higher than the hydrant barrel drain outlet. Should this situation be encountered in a location where a hydrant is specified by the plans, the Engineer shall be contacted for further directions. Plugging of hydrant drains is not permitted.

(d) The final grade around the hydrant shall be up to the bury line. If this can not be readily obtained, the WCSA project field representative shall be consulted concerning the need for extensions or other modifications to adjust the hydrant height. The hydrant shall be installed vertically plumb,

(e) The fire hydrant assembly shall be installed in accordance the manufacturer's instructions and in accordance with the standard detail in these specifications. Restraints shall be as shown on the standard detail.

(f) Hydrants shall be designed for a minimum working pressure of 200 psig but shall remain functional and not sustain structural damaged when subjected to a hydrostatic pressure of 400 psig.

(g) Hydrants shall be functional and capable of being opened or closed without difficulty upon application of a torque of 200 lbf/ft. at the operating nut, the direction of opening shall be counterclockwise

(h) All hydrants shall be traffic rated with frangible sections located at or near the ground surface. Hydrants with frangible sections designed to break on impact shall, except for the frangible sections, conform with all the structural requirements of the applicable standard,

(i) All hydrants shall be coated in strict accordance with the manufacturer's recommendations. The final finish shall be bright red unless otherwise specified.

(j) If the hydrant is to be disassembled for any reason, a brass sleeve must be used to protect the oil seals from damage when removing the housing from the upper stem.

(k) Hydrants shall be 5 ¼ inch with 2 – 2 ½ inch hose outlets and a single 5 ¼ inch pump outlet,

(l) Hydrants shall be the Mueller Super Centurion 200 5 ¼ inch or American Flow Control B-84-B 5 ¼ inch or approved equal.

2.7 Residential Connection Devices. When provided for by the Owner the following devices shall be utilized for making residential (or other as specified) connections;

(a) General. For the devices the following general requirements apply:

(i) The below specified devices shall be utilized unless alternates have been specifically approved in writing by WCSA,

(ii) All devices shall be installed in strict accordance with the manufacturers recommendations,

(iii) Device service diameter shall be ¾ inch when 1 residential service is served and 1 inch when 2 or 3 service connections are served. Y-branch fittings, supplied by the manufacturer of the other connection devices shall be used to adapt a single service line to 2 or 3 supply meters,

(iv) Insofar as it is practicable, all connection devices shall be in compliance with NSF Standard 61.

(v) Insofar as it is practicable, threaded devices shall have threads in compliance with AWWA Standard 800, latest revision, Standard for Underground Service Line Valves and Fittings.

(vi) All copper fittings and pipe shall be domestically produced or fabricated unless otherwise approved.

(b) Service Saddle. The pipe saddle shall have stainless steel straps with a brass or an epoxy coated ductile or cast iron body. Pipe saddles shall be sized appropriately for the main they will attach to and shall have a Mueller BR1S, Ford Model FC-101, or a Romac 101S.

(c) Corporation Stops. Corporation stop shall be ¾ inch or 1 inch unless otherwise specified. Working pressure rating of the valve shall be 300 psi unless otherwise

specified. Inlet threads shall of the Mueller (AWWA) taper or AWWA iron pipe design. Brass components shall be fabricated of 85-5-5-5 ASTM B-62 brass. The shut off ball shall be PTFE coated. Outlet connection shall be the Mueller 110 Compression Connection or equal. Corporation stops shall have a working pressure of 300 psi. Corporation stops shall be the Mueller Model B-25008, or the Ford Model FB1000. Ford brand corporation stops shall incorporate the Q nut option to effect a compression outlet connection. For PVC pipe only adhesives and sealants approved by the pipe manufacturer shall be used.

(d) Yoke Valve. Meter cutoff valve assemblies shall consist of a ball valve in a straight alignment, with brass components shall be fabricated of ASTM B-62 brass. The shaft stem shall be sealed with double O-rings to prevent leakage; the ball shall be PTFE coated and have a stainless steel reinforced seat O-ring. A lock wing shall be provided, and end connections shall be the Mueller 110 compression connection. Valves shall be the Mueller B-24359, or the Ford B91-323Y with Q nut connections.

(e) Meter Yoke Bar and Expansion Wheel. Meter yoke shall be of cast iron construction and shall be the Mueller H-5020 or Ford Y502. An expansion hand-wheel shall be provided of the same brand as the meter yoke.

(f) Check Valve. A check valve assembly shall be provided for each meter set up yoke assembly. It shall contain dual a dual check valve assembly, with a lock nut inlet and F.I.P. outlet. The assembly shall be ASSE approved. The check valve shall be a Mueller H-14247-A or a Ford HHS-9 (with the proper suffix to indicate ASSE compliant.

(g) Meter Boxes. shall be manufactured by Armor and be 18” white rectangular meter box, item # 194102. Substitutes will be considered on a case by case basis.

2.8 Valve Boxes. Each buried valve shall be provided with a valve box and meet the following requirements:

(a) Valve boxes shall be of ductile or cast iron construction and have a height adjustable shaft capable of adjusting a minimum of 1 foot.

(b) Valve box sizes shall suit the depth of bury and valve size at each location.

(c) The open shaft diameter of the valve box shall be 5¼ inches unless otherwise specified by the drawings.

(d) Valve boxes which will not adjust to the extent necessary shall be capable of accommodating risers that will increase the effective height of the valve box in increments of 1 foot.

(e) Valve boxes shall have a removable cast or ductile iron lid which has the word “WATER” cast into the design.

(f) Valve boxes shall be provided with 2 foot by 2 foot by 6 inch thick concrete apron surrounding the valve top. (See standard detail.)

(g) Valve boxes shall be centered over the valve and installed plumb.

(h) Valve boxes shall be Tyler 6850 or 6860 Series, or other valves boxes as approved by WCSA.

2.9 Pressure Reducing Valves. Pressure reducing valves shall operate to give a constant pressure (set pressure) on the downstream side regardless of the flow or inlet pressure conditions. Pressure reducing valve pairs (larger and smaller) will generally be installed in parallel, with smaller diameter valves operating to meet domestic demands and larger diameter valves installed to transmit fire flows. The valves shall comply with all of the following requirements unless otherwise stated on the plans or approved in writing. Valve sets shall be designed to handle flows from 0 to 1500 gpm unless otherwise specified.

(a) The operating valve shall be provided by a single manufacturer as a single assembly.

(b) Valves shall be hydraulically operated, diaphragm actuated, in a globe configuration.

(c) Valves will be of ductile iron construction and shall 150 lb. flanged ends. Valve trim shall be stainless steel.

(d) The pilot control for each valve shall consist of an all bronze body with a stainless steel seat. The pilot control will be a 30-300 psi range. The pilot controls shall have an opening speed control and visual valve position indicator.

(e) All wetted parts of the main body of the valve shall have a fusion bonded epoxy coating compliant with NSF Standard 61.

(f) Valve model, size, design pressure, flow conditions and settings shall be as stated on the plans.

(g) The valve manufacturer shall warrant the valve to be free of defects in material and workmanship for a period of three years from date of shipment.

(h) Valves shall be manufactured by CLA-VAL or approved equal.

2.10 Pressure Relief Valves. Pressure relief valves shall function by releasing water in anticipation or the actual occurrence of pressures exceeding the set point of the valve. This valve shall control high pressures and power failure surges by bypassing system pressure (by exhausting water to waste) that exceeds the high pressure control setting and also by opening a preset amount when a pressure is sensed below a preset minimum in anticipation of a surge. The valves shall comply with all of the following requirements unless otherwise stated on the plans or approved in writing.

(a) Entire mechanism shall be sold and purchased as a package from a single manufacturer.

(i) The valve shall be hydraulically operated, single diaphragm-actuated.

(ii) The diaphragm assembly containing a non-magnetic 303 stainless steel stem of sufficient diameter to withstand high hydraulic pressures. The diaphragm assembly shall be the only moving part. The diaphragm must be capable of withstanding without failure a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested

100,000 times to insure longevity. The diaphragm shall not be used as the seating surface.

(iii) The main valve body and cover shall be constructed of ASTM A-536 ductile iron with a 250 lb working pressure and shall have 150 lb. flanged ends. Valve trim shall be stainless steel.

(iv) The pilot control shall consist of an all bronze body with a stainless steel seat. The pilot control will be operative over a 30-300 psi range.

(v) All wetted parts of the main body of the valve shall have a fusion bonded epoxy coating compliant with NSF Standard 61.

(vi) Valve model, size, design pressure, flow conditions and settings shall be as stated on the plans or other contract documents.

(vii) The valve manufacturer shall warrant the valve to be free of defects in material and workmanship for a period of three years from date of shipment.

(viii) Valves shall be manufactured by CLA-VAL or approved equal. The valve size, inlet pressure and flow conditions, and set point will be specified on the drawings.

2.11 Pressure Gauges. Pressure gauges shall have. 4 ½ inch diameter cases. Gauges shall have white faces with black numerals, acrylic windows, stainless steel bourdon tubes and phenol cases. Accuracy of measurement shall be provided with a Type 316 stainless steel porous metal disc type pressure snubber having 0.0013 to 0.0025 inch pore openings and an isolation valves. Gauges shall be graduated in psig where practical although compound gauges may be graduated in feet of water. The gauge range shall be appropriate to meet system design requirements with normal operating pressure being indicated in the mid range of the dial. The drawings may specify the range of operation expected. Gauges on the suction side of pump stations which may be subject to a vacuum shall be compound type gauges. The pressure gauges shall be Ashcroft Duraguage or approved equal.

2.12 Water Line Marking Tape. Plastic encased aluminum foil tape shall be installed above all non-metallic pipe such that the buried pipe can be located in the future. The tape shall be color coded and bear the words “potable water line”. The marking tape shall be located 12 to 18 inches below final grade or at the depth recommended by tape manufacturer. Tape shall be Lineguard Detectable Underground Marking Tape or approved equal.

3.0 Execution

3.1 Inspection. Examine closely valves, appurtenances, and specialties. Inspect the locations where appurtenances are specified to be installed. Resolve incompatibilities before initiating work.

3.2 Installation. All Valves

(a) Piping appurtenances are to be installed in shall be kept clean and protected from the entry of debris which may adversely affect operation of valve, appurtenance or specialty.

(b) Before installation of the valve, appurtenance or specialty, inspect it for the presence of dirt and debris and damage and resolve problems before installation is attempted.

(c) Prior to installation, become thoroughly familiar with manufacturers installation instructions, guidelines and recommendations.

(d) Orient valve or device to promote functionality, usability, and maintenance.

(e) Install devices strictly according to manufacturer's information.

(f) Valves, appurtenances and specialty devices shall be installed in such a manner that no external forces are transferred to the device from piping or other sources.

(g) Provide thrust blocking, restraining devices, and supports as detailed on the standard details included as an appendix to these specifications.

(h) All unexposed (underground) valves shall be provided with a valve box in compliance with these specifications.

(i) Flush all valves of foreign material at appropriate velocities subsequent to installation.

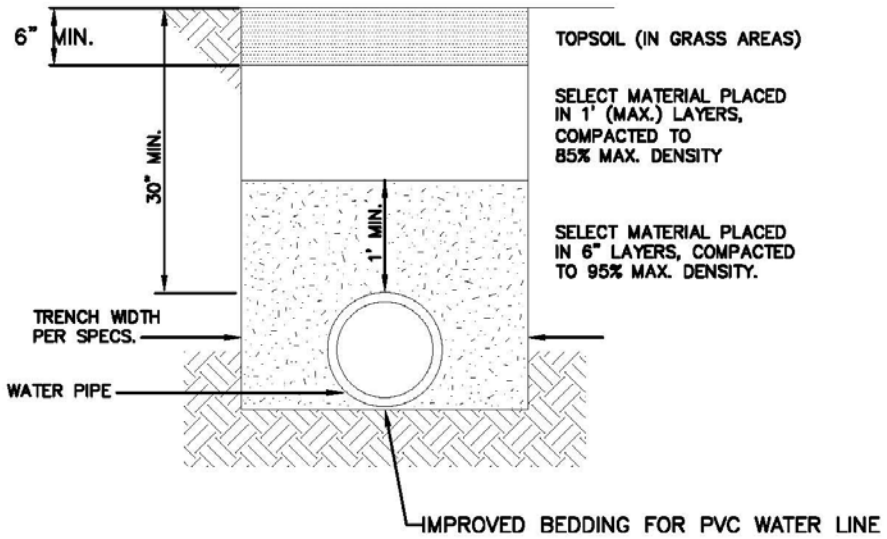
(j) Provide for manufacturers representation, as recommended by the valve, appurtenance or specialty device manufacturer. Representation shall include startup, adjustment, and follow-up representation as appropriate.

(k) Test, calibrate, and adjust valves, appurtenances, and specialty devices as necessary.

END OF SECTION

STANDARD DETAILS

Standard Detail 1. Waterline Typical Trench & Backfill



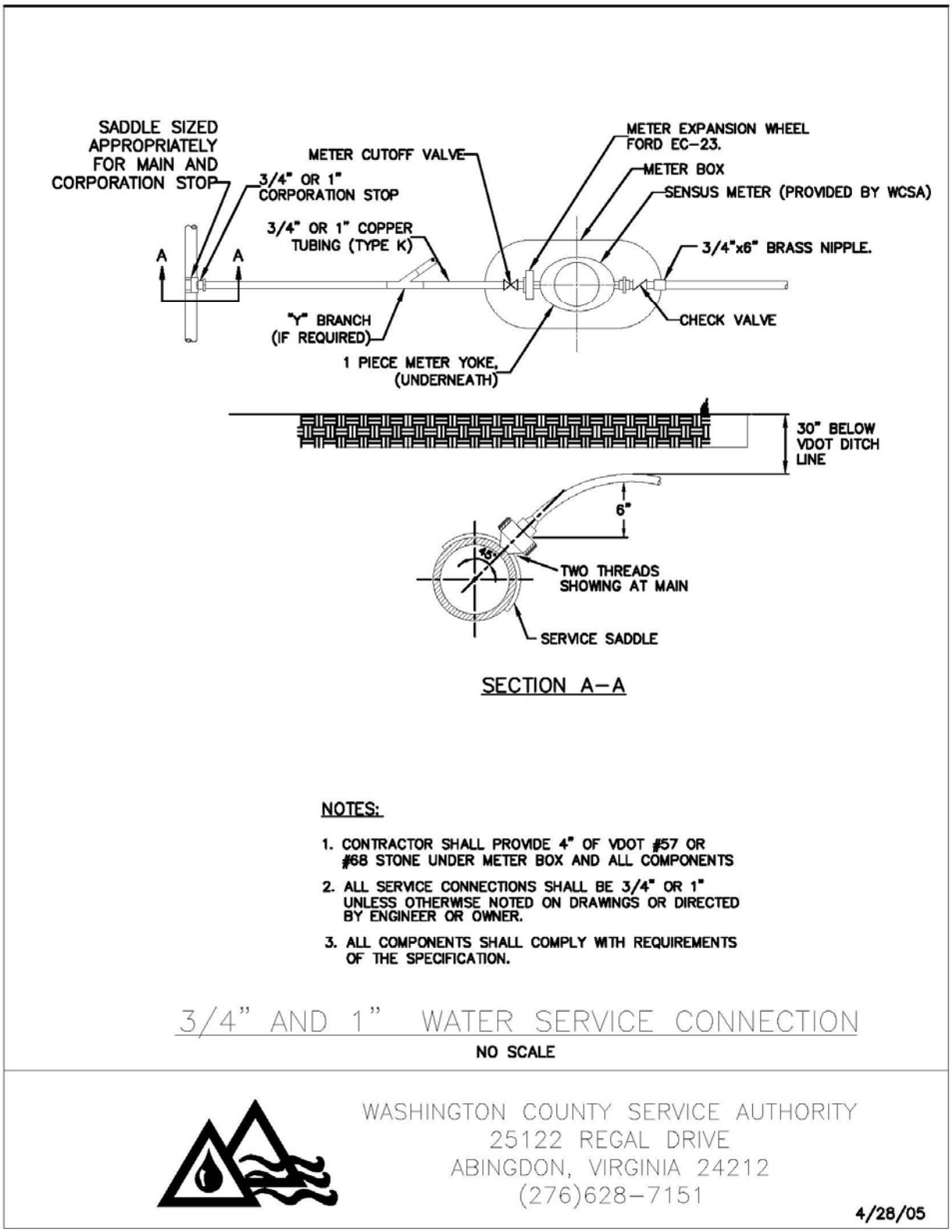
NOTE:
ROLLING COMPACTION NOT ALLOWED UNTIL DEPTH OF BACK FILL EXCEEDS 12".

WATERLINE
TYPICAL TRENCH & BACKFILL

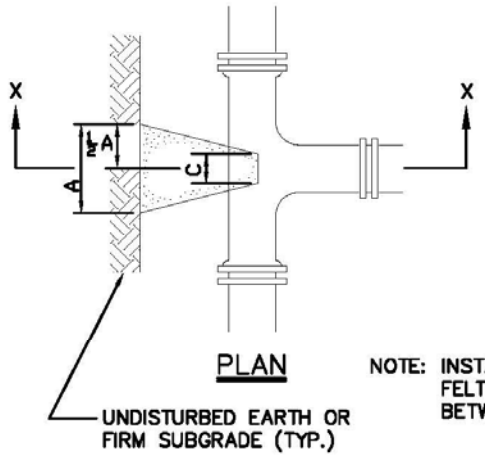
WASHINGTON COUNTY SERVICE AUTHORITY
25122 REGAL DRIVE
ABINGDON, VIRGINIA 24212
(276)628-7151

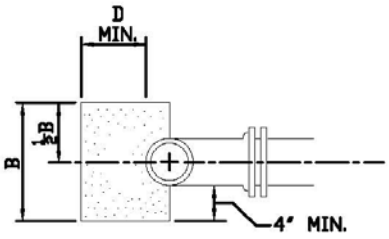
4/28/05

Standard Detail 2. Water Service Connection



Standard Detail 3. Tees, Tapping Sleeves, Plugs and Caps



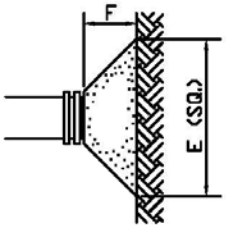


SECTION X–X

NOTE: INSTALL TWO LAYERS OF 15 LB. BUILDER'S FELT OR TWO LAYERS OF 6 MIL. POLYETHYLENE BETWEEN CONCRETE AND FITTING.

TEE	BRANCH DIAMETER										
	3"	4"	6"	8"	10"	12"	14"	16"	20"	24"	30"
A	12"	12"	16"	18"	26"	30"	36'	40"	48"	60"	80"
B	12"	16"	20"	30"	32"	42"	49"	56"	72"	80"	96"
C	8"	8"	12"	12"	12"	12"	14'	16"	24"	24"	24"
D	6"	6"	8"	9"	10"	12"	13"	14"	18"	20"	24"

BASED ON NORMAL OPERATING PRESSURE UP TO 150 PSI



NOTE: INSTALL TWO LAYERS OF 15 LB. BUILDER'S FELT OR TWO LAYERS OF 6 MIL. POLYETHYLENE BETWEEN CONCRETE AND FITTING.

PLUG	PIPE DIAMETER										
	3"	4"	6"	8"	10"	12"	14"	16"	20"	24"	30"
E	14"	16"	21"	29"	36"	41"	47"	54"	64"	75"	88"
F	8"	8"	10"	10"	12"	14"	15"	16"	18"	20"	24"

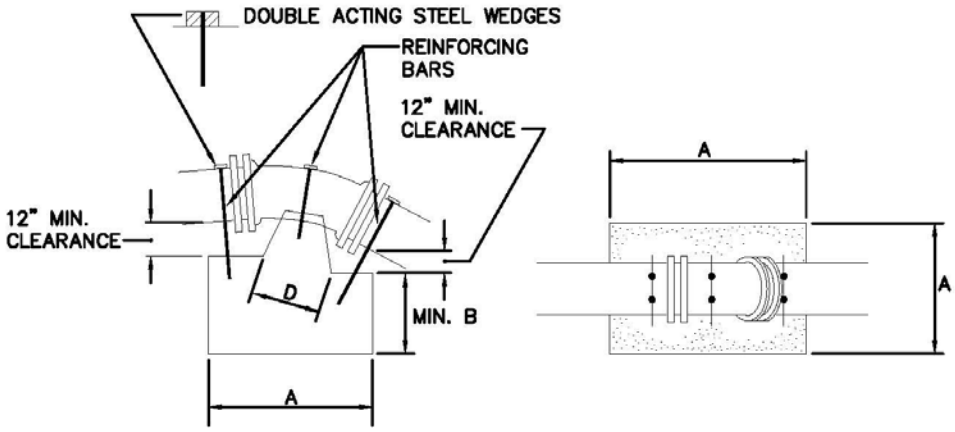
BASED ON NORMAL OPERATING PRESSURE UP TO 150 PSI

THRUST BLOCK DETAILS
TEES, TAPPING SLEEVES, PLUGS & CAPS

WASHINGTON COUNTY SERVICE AUTHORITY
25122 REGAL DRIVE
ABINGDON, VIRGINIA 24212
(276)628–7151

4/28/05

Standard Detail 4. 22 ½ to 11 ¼ Degree Bends



NOTE:
1. EMBED REINFORCING BARS MINIMUM OF 36 DIAMETERS INCLUDING HOOK.
2. PAINT EXPOSED BARS WITH TWO COATS OF BITUMINOUS PAINT.
3. WHERE 4 BARS ARE REQUIRED, PLACE 2 BARS SYMMETRICALLY AROUND FITTING.
4. INSTALL TWO LAYERS OF 15 LB. BUILDER'S FELT OR TWO LAYERS OF 6MIL POLYETHYLINE BETWEEN CONCRETE AND FITTING.

C = NUMBER AND SIZE OF REINFORCING BARS
D = DIMENSION OF PIPE DIAMETER

BEND		PIPE DIAMETER										
		3"	4"	6"	8"	10"	12"	14'	16"	20"	24"	30"
11 1/4°	A	18"	18"	24"	24"	27"	30"	34'	39"	48"	54"	60"
	B	18"	18"	18"	24"	24"	27"	28'	30"	30"	36"	36"
	C	3#5	3#5	3#5	3#6	3#6	3#6	3#6	3#6	3#8	3#8	3#8
22 1/2°	A	18"	24"	30"	33"	42"	48"	51'	54"	66"	72"	84"
	B	18"	18"	24"	27"	27"	30"	43"	36"	42"	48"	54"
	C	3#5	3#5	3#5	3#6	3#6	4#6	4#6	4#6	3#8	4#8	4#8
45°	A	24"	30"	26"	42"	48"	54"	57"	60"	90"	98"	120"
	B	18"	24"	24"	30"	33"	36"	39'	42'	48"	54"	60"
	C	3#5	3#5	3#5	3#6	4#6	4#6	4#8	4#8	4#8	4#8	4#9

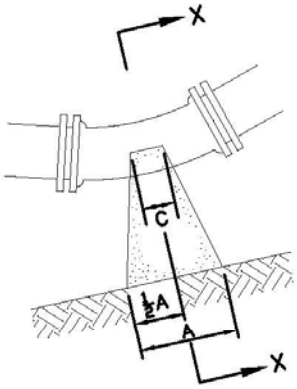
BASED ON NORMAL OPERATING PRESSURE UP TO 150 PSI

THRUST BLOCK DETAILS
UPPER VERTICAL BENDS

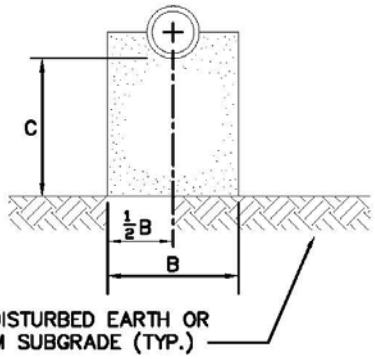
WASHINGTON COUNTY SERVICE AUTHORITY
25122 REGAL DRIVE
ABINGDON, VIRGINIA 24212
(276)628-7151

4/28/05

Standard Detail 5. 45 to 90 Degree Bends



ELEVATION



SECTION X–X

NOTE: INSTALL TWO LAYERS OF 15 LB. BUILDER'S FELT OR TWO LAYERS OF 6 MIL. POLYETHYLENE BETWEEN CONCRETE AND FITTING.

BEND		PIPE DIAMETER										
		3"	4"	6"	8"	10"	12"	14"	16"	20"	24"	30"
11 1/4°	A	6"	6"	6"	8"	8"	8"	10"	13"	15"	22"	32"
	B	12"	12"	14"	16"	18"	24"	26"	28"	32"	36"	40"
	C	8"	8"	8"	8"	8"	8"	8"	9"	10"	12"	14"
22 1/2°	A	6"	6"	10"	11"	15"	16"	20'	25"	33"	39"	43"
	B	12"	12"	14"	16"	18"	24"	26"	28"	32"	36"	40"
	C	8"	8"	8"	8"	9"	9"	10"	12"	14"	16"	18"
45°	A	10"	12"	14"	21"	19"	32"	40'	48"	66"	72"	98"
	B	12"	12"	14"	16"	18"	24"	26'	28"	32"	42"	48"
	C	8"	8"	8"	8"	12"	14"	16'	18"	24"	30"	36"

BASED ON NORMAL OPERATING PRESSURE UP TO 150 PSI

THRUST BLOCK DETAILS
LOWER VERTICAL BENDS

WASHINGTON COUNTY SERVICE AUTHORITY
25122 REGAL DRIVE
ABINGDON, VIRGINIA 24212
(276)628–7151

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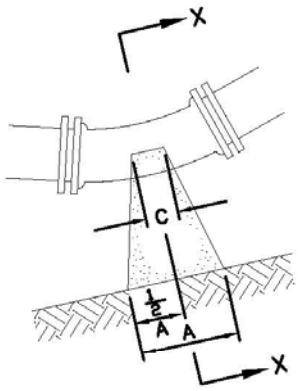
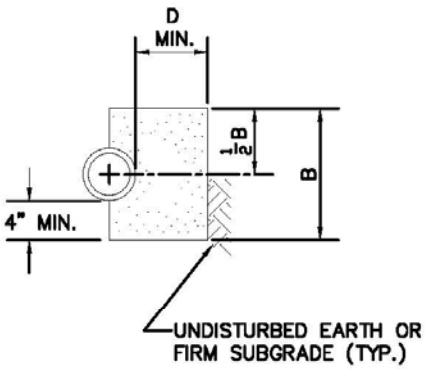
Standard Detail 6. Upper Vertical Bends



PLAN



SECTION X–X

NOTE: INSTALL TWO LAYERS OF 15 LB. BUILDER'S FELT OR TWO LAYERS OF 6 MIL. POLYETHYLENE BETWEEN CONCRETE AND FITTING.

PIPE DIA.	11 1/4° BEND					22 1/2° BEND				
	A	B	C	D	E	A	B	C	D	E
3"	4"	12"	4"	6"	2"	6"	12"	6"	7"	2"
4"	4"	12"	4"	6"	2"	6"	12"	6"	7"	2"
6"	6"	14"	6"	7"	2"	8"	14"	6"	8"	2"
8"	8"	16"	8"	7"	2"	12"	16"	8"	8"	4"
10"	9"	18"	8"	8"	4"	15"	18"	8"	10"	4"
12"	12"	20"	12"	9"	4"	18"	20"	12"	12"	6"
14"	14'	22"	12"	9"	4'	21"	22"	12"	13'	6"
16"	15"	24"	12"	9"	6"	24"	24"	12"	15"	6"
20"	30"	12"	10"	10"	6"	30"	30"	12"	18"	9"
24"	18"	36"	12"	12"	6"	36"	36"	12"	18"	9"
30"	24"	42"	16"	14"	9"	48"	42"	16"	21"	12"

BASED ON NORMAL OPERATING PRESSURE UP TO 150 PSI

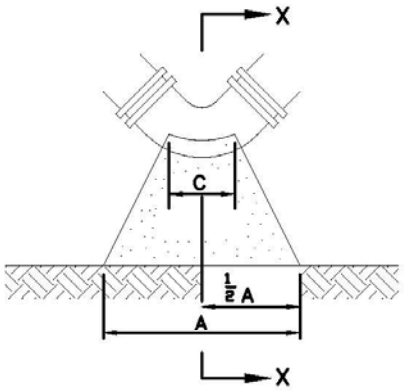
E = ADDITIONAL LENGTH TO BE ADDED TO DIMENSION A FOR EACH ADDITIONAL 50 PSI PRESSURE UP TO 300 PSI

THRUST BLOCK DETAILS
11 1/4° – 22 1/2° BENDS

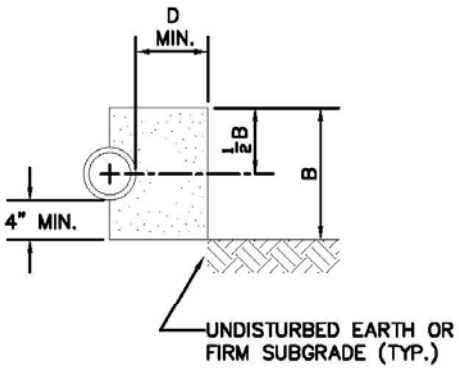
WASHINGTON COUNTY SERVICE AUTHORITY
25122 REGAL DRIVE
ABINGDON, VIRGINIA 24212
(276)628–7151

4/28/05

Standard Detail 7. Lower Vertical Bends



PLAN



SECTION X–X

NOTE: INSTALL TWO LAYERS OF 15 LB. BUILDER'S FELT OR TWO LAYERS OF 6 MIL. POLYETHYLENE BETWEEN CONCRETE AND FITTING.

PIPE DIA.	45° BEND					90° BEND				
	A	B	C	D	E	A	B	C	D	E
3"	9"	12"	6"	6"	4"	12"	12"	6"	12"	6"
4"	9"	12"	6"	6"	4"	16"	12"	6"	12"	6"
6"	12"	14"	6"	8"	4"	21"	14"	6"	18"	6"
8"	18"	16"	8"	9"	6"	30"	16"	8"	18"	9"
10"	24"	18"	8"	10"	6"	36"	24"	10"	18"	9"
12"	30"	20"	12"	12"	9"	48"	24"	12"	18"	12"
14"	27"	25"	12"	13"	9"	54'	27"	14'	19'	12"
16"	42"	30"	12"	15"	9"	60"	30"	16"	21"	12"
20"	56"	30"	12"	16"	16"	72"	40"	20"	21"	24"
24"	60"	36"	12"	21"	24"	84"	48"	24"	24"	30"
30"	72"	48"	16"	27"	24"	108"	60"	30"	24"	36"

BASED ON NORMAL OPERATING PRESSURE UP TO 150 PSI

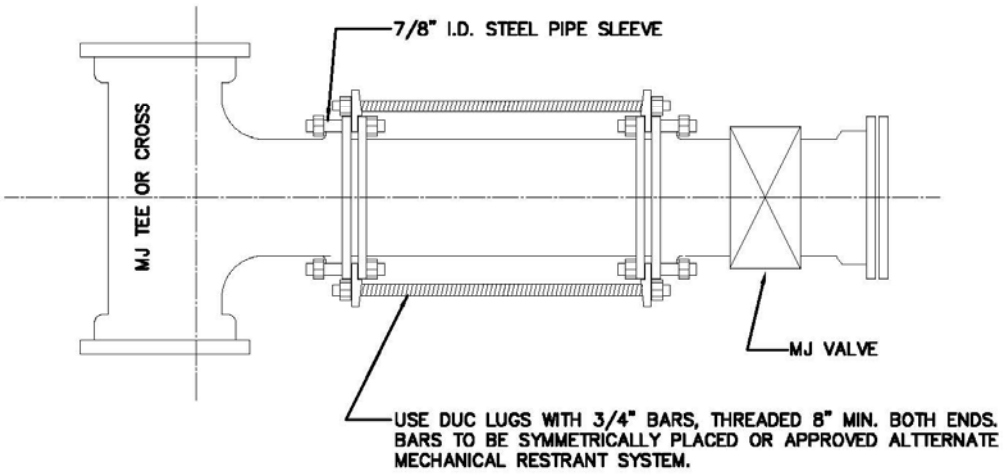
E = ADDITIONAL LENGTH TO BE ADDED TO DIMENSION A FOR EACH ADDITIONAL 50 PSI PRESSURE UP TO 300 PSI

THRUST BLOCK DETAILS
45° – 90° BENDS

WASHINGTON COUNTY SERVICE AUTHORITY
25122 REGAL DRIVE
ABINGDON, VIRGINIA 24212
(276)628–7151

4/28/05

Standard Detail 8. Method of Strapping Valve to Main



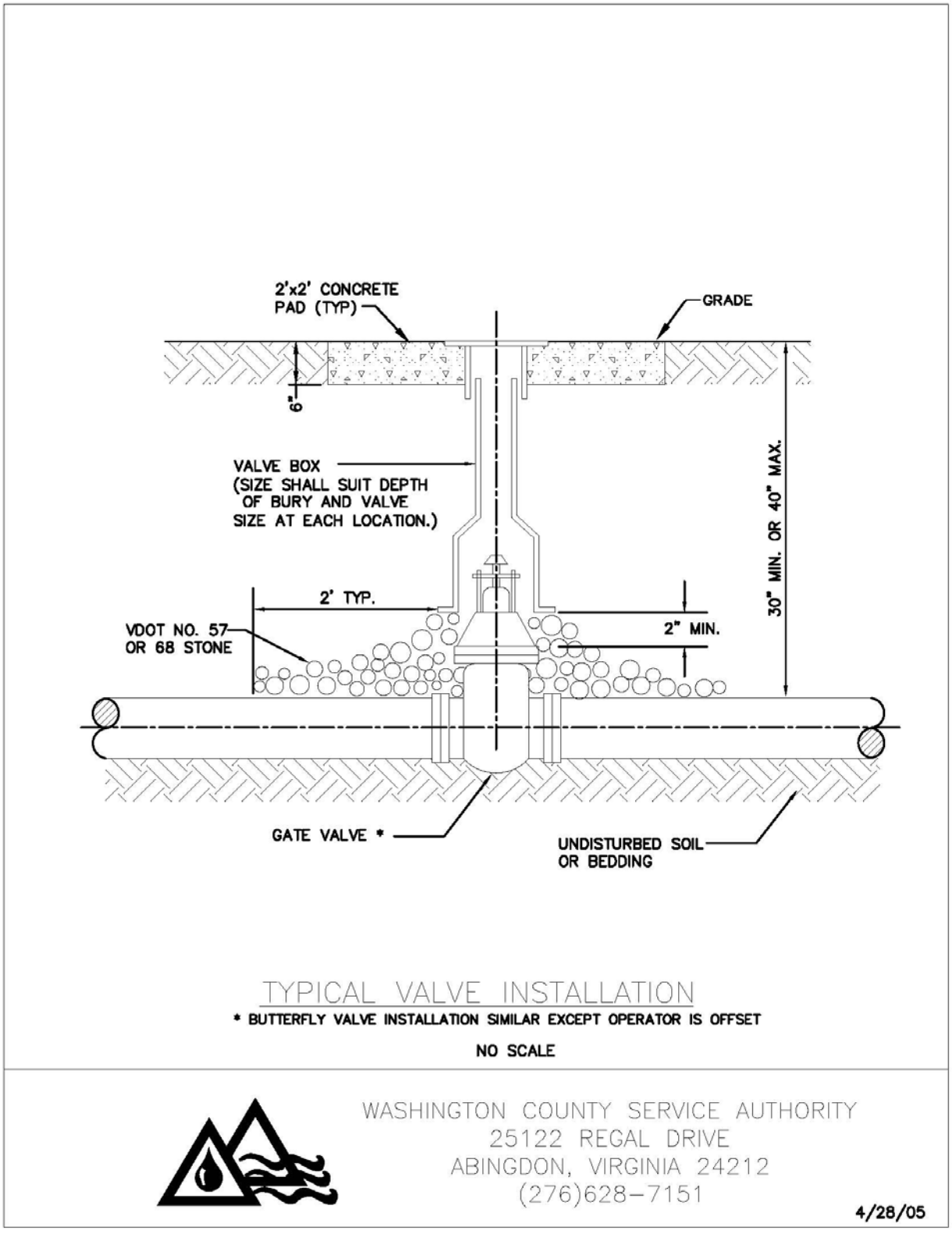
VALVE SIZE	NUMBER OF 3/4" BARS REQUIRED	MAX. LENGTH OF SPIGOT PIPE
3"	2	24"
4"	4	24"
6"	4	27"
8"	4	27"
10"	4	27"
12"	6	27"
14"	6	30"
16"	8	36"
20"	12	36"
24"	16	36"
30"	20	42"

METHOD OF STRAPPING
VALVE TO MAIN

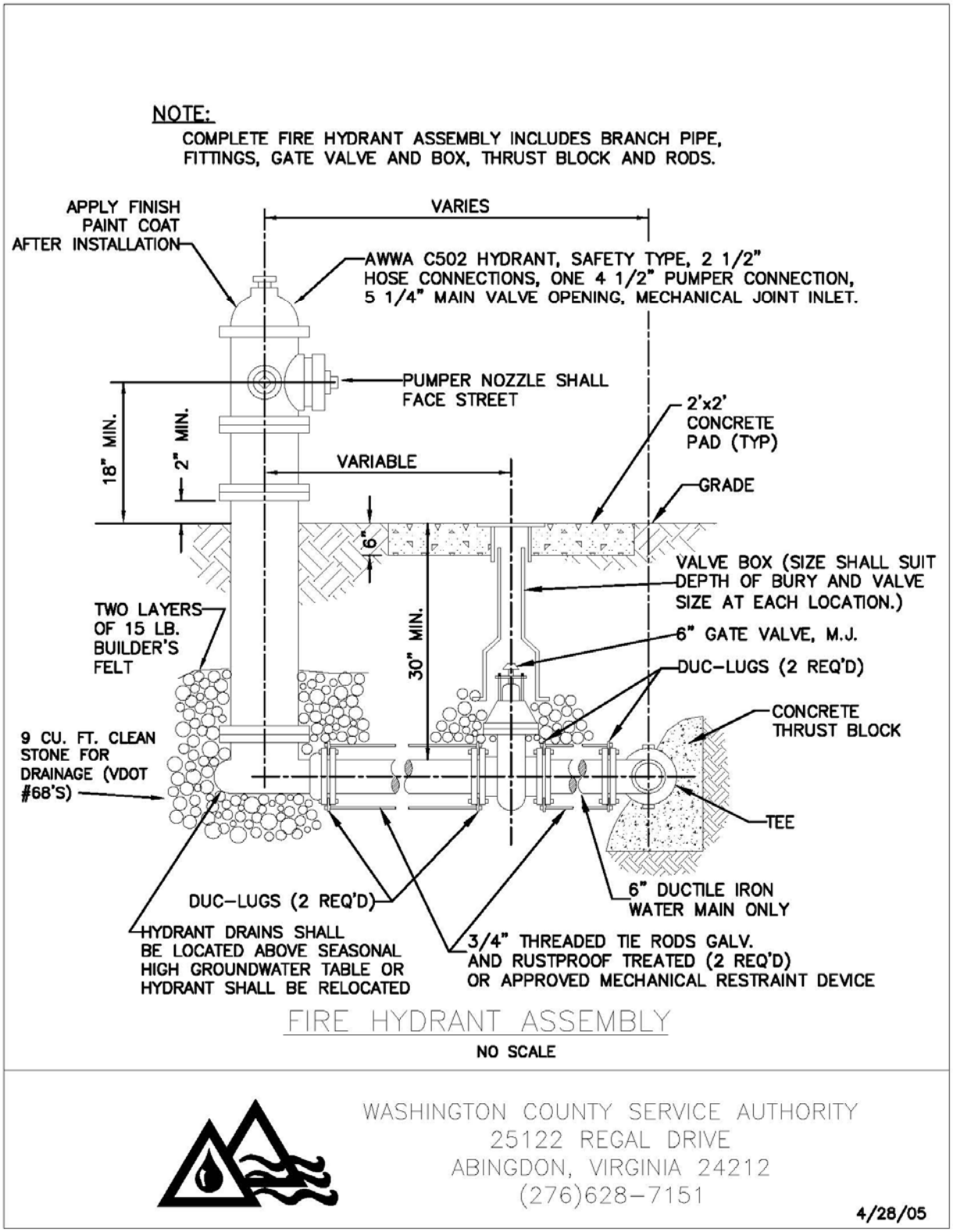
WASHINGTON COUNTY SERVICE AUTHORITY
25122 REGAL DRIVE
ABINGDON, VIRGINIA 24212
(276)628-7151

4/28/05

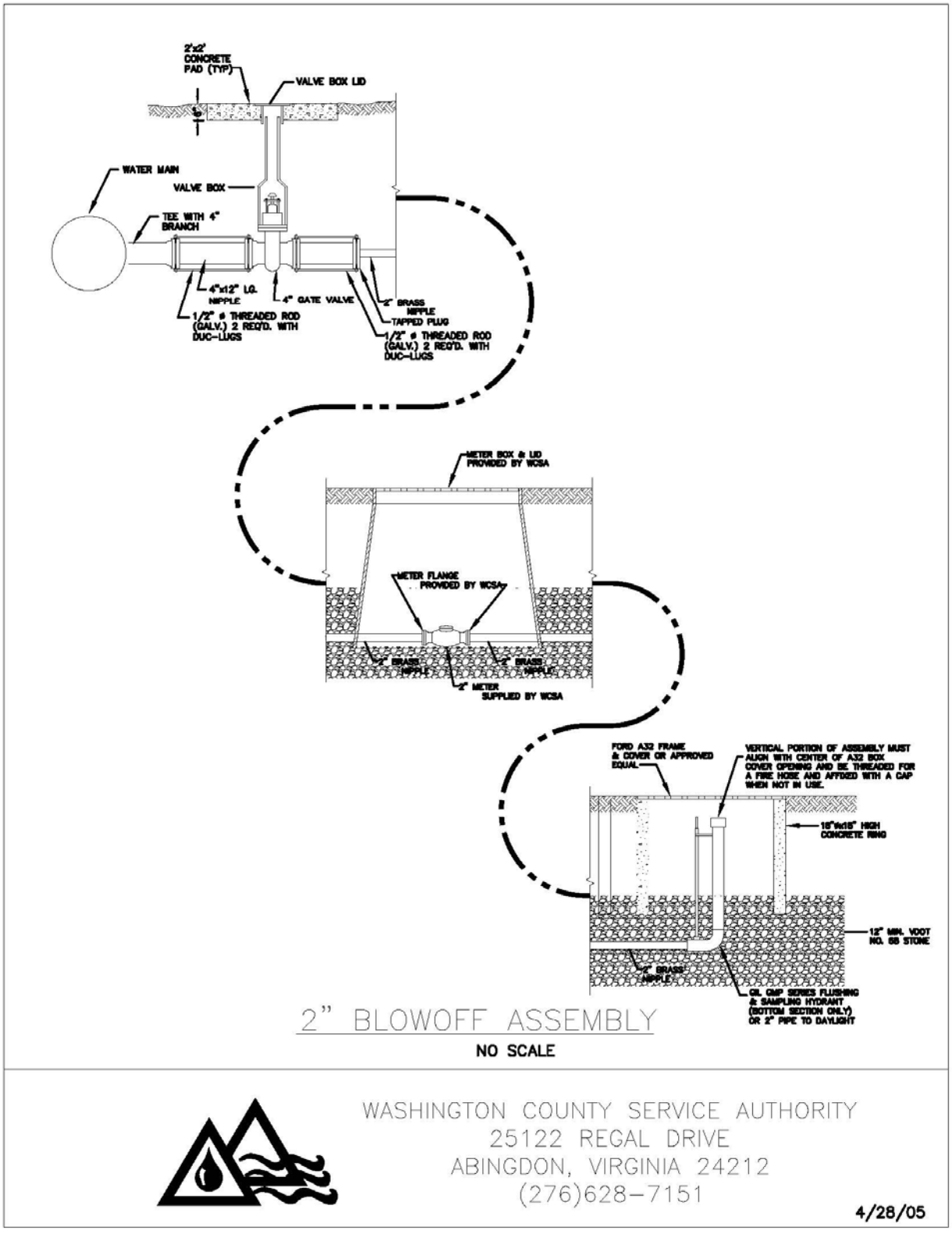
Standard Detail 9. Typical Valve Installation



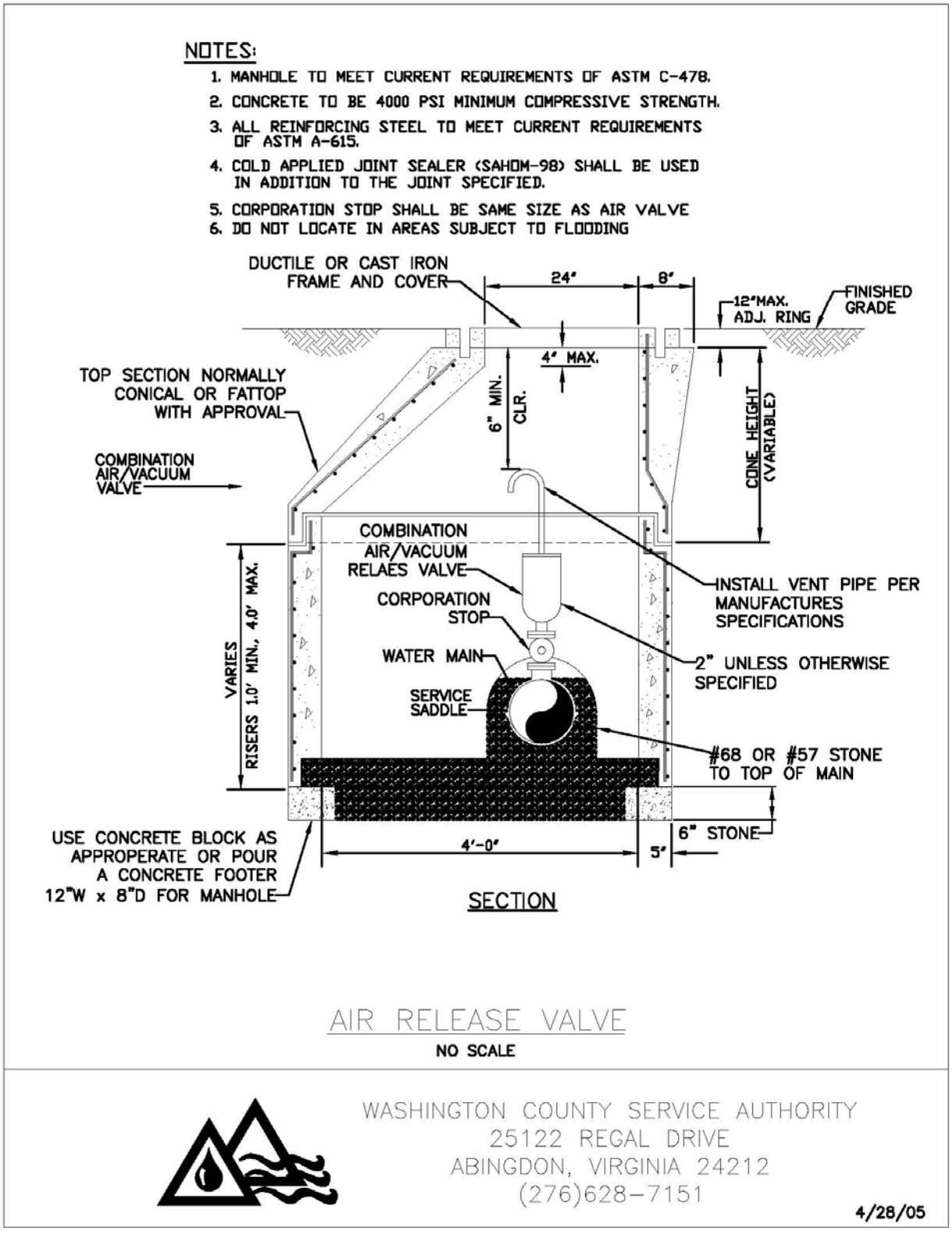
Standard Detail 10. Fire Hydrant Assembly



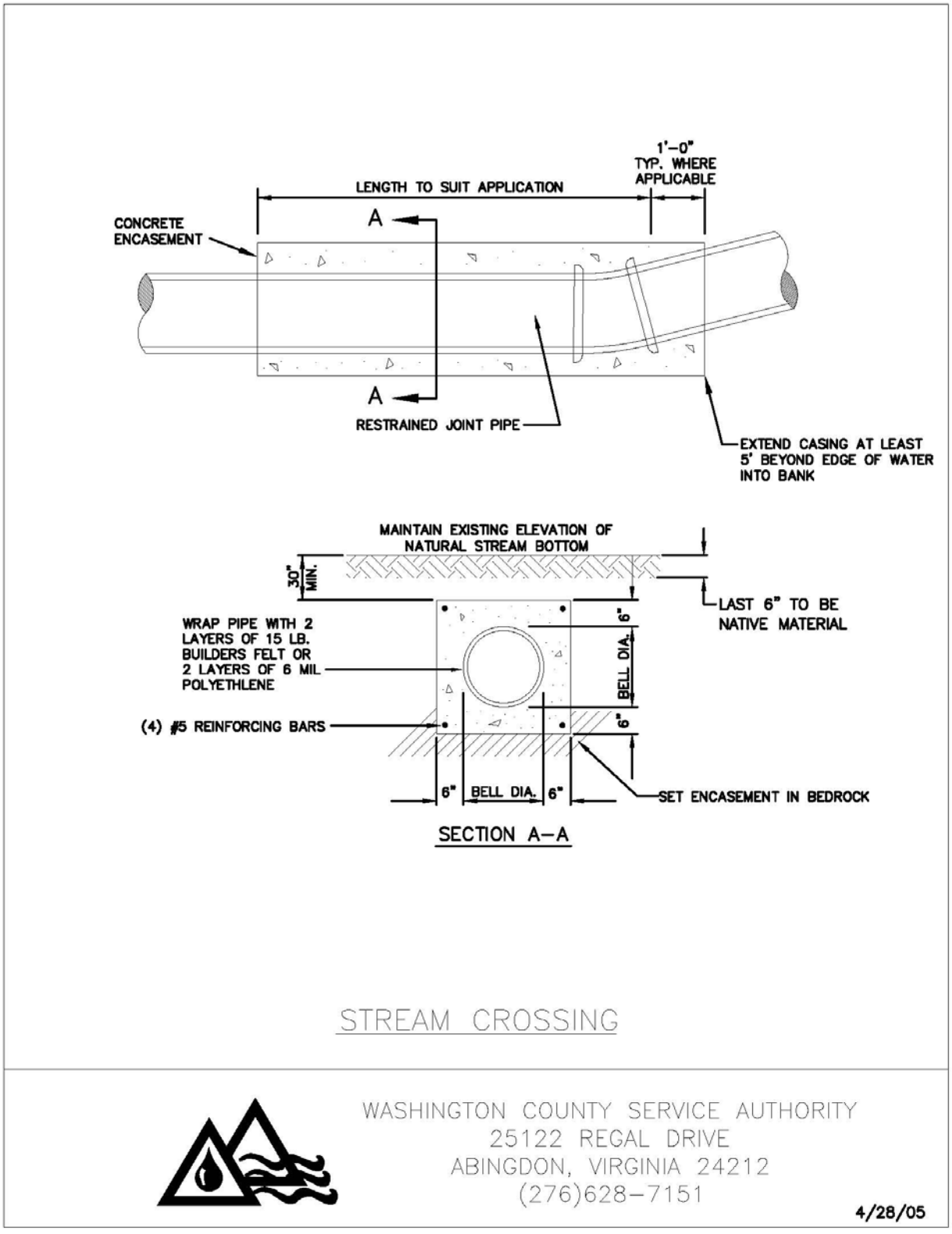
Standard Detail 11. 2" Blowoff Assembly



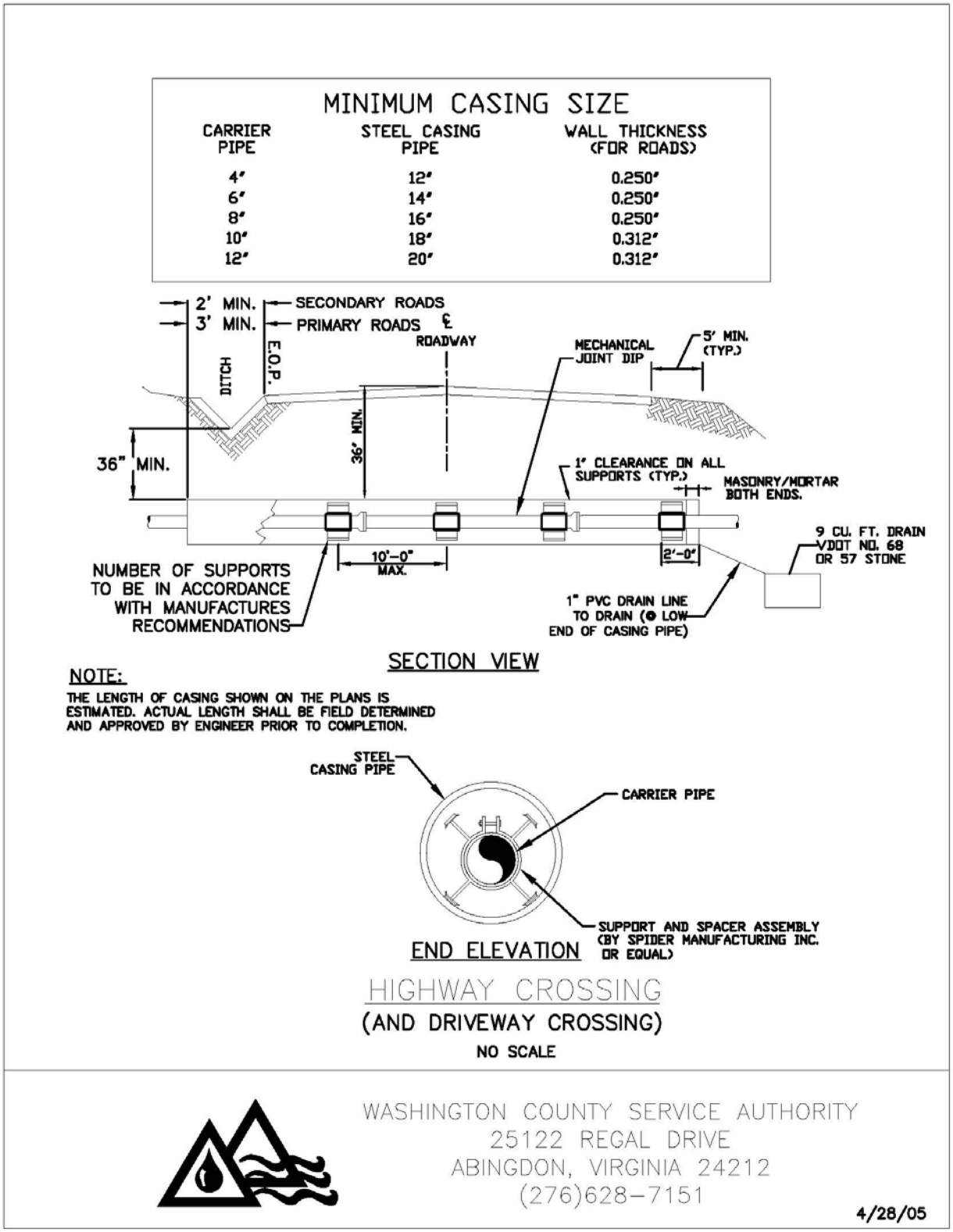
Standard Detail 12. Air Release Valve



Standard Detail 13. Stream Crossing



Standard Detail 14. Highway Crossing



Standard Detail 15. Longitudal Asphalt Patching

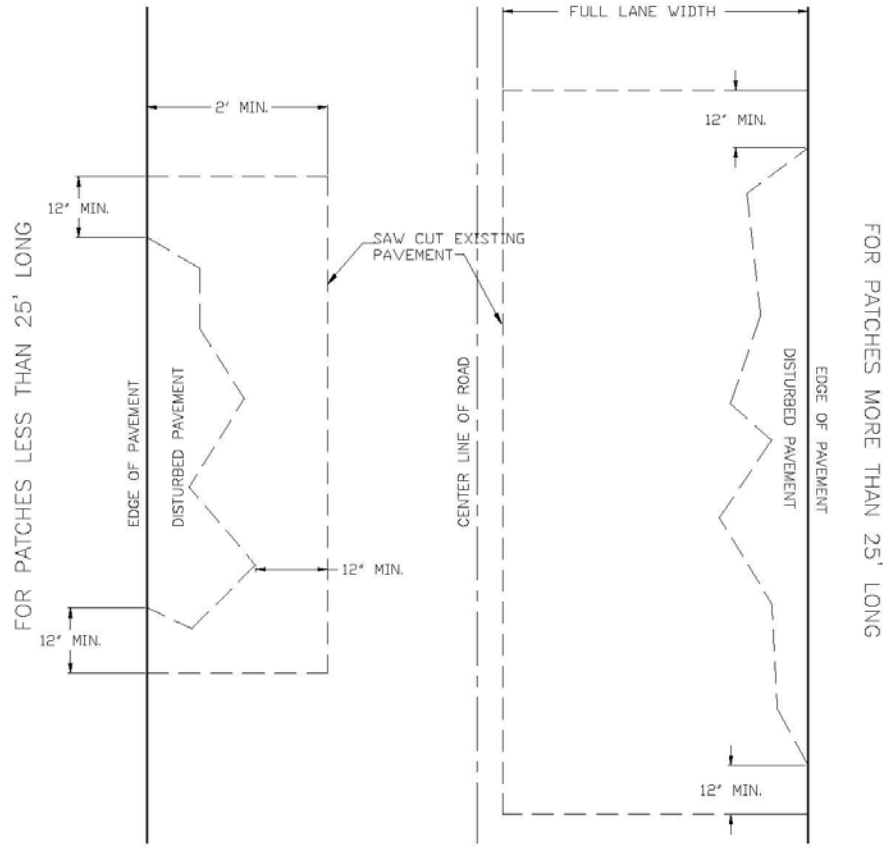
NOTE: A LIQUID ASPHALT TACK COAT SHALL BE APPLIED TO SAW CUT EDGES OF EXISTING PAVEMENT PRIOR TO PLACING PATCH.

NOTE: DISTURBED AREAS OVER 25 FEET IN LENGTH SHALL REQUIRE A FULL LANE OVERLAY FOR THE FULL LENGTH OF THE DISTURBED AREA PLUS 12 INCHES MINIMUM ON EACH END OF THE DISTURBED AREA.

NOTE: THICKNESS OF ASPHALT PATCH SHALL BE 1.5 TIMES THE THICKNESS OF THE EXISTING ASPHALT, BUT IN NO CASE SHALL IT BE LESS THAN 3". ASPHALT SHALL BE TYPE SM19.0A OR EQUILIVANT.

NOTE: DENSITY REQUIREMENTS FOR BACKFILL MATERIAL AND ASPHALT SHALL CONFORM WITH THE VIRGINIA ROAD & BRIDGE SPECIFICATIONS.

NOTE: PERMANENET PATCHING SHALL BE PLACED WITHIN ONE WEEK OF THE COMPLETION OF THE INSTALLATION. 9PER SECTION OF DISTURBED PAVEMENT)



METHOD FOR LONGITUDAL ASPHALT PATCHING

WASHINGTON COUNTY SERVICE AUTHORITY
25122 REGAL DRIVE
ABINGDON, VIRGINIA 24212
(276)628-7151

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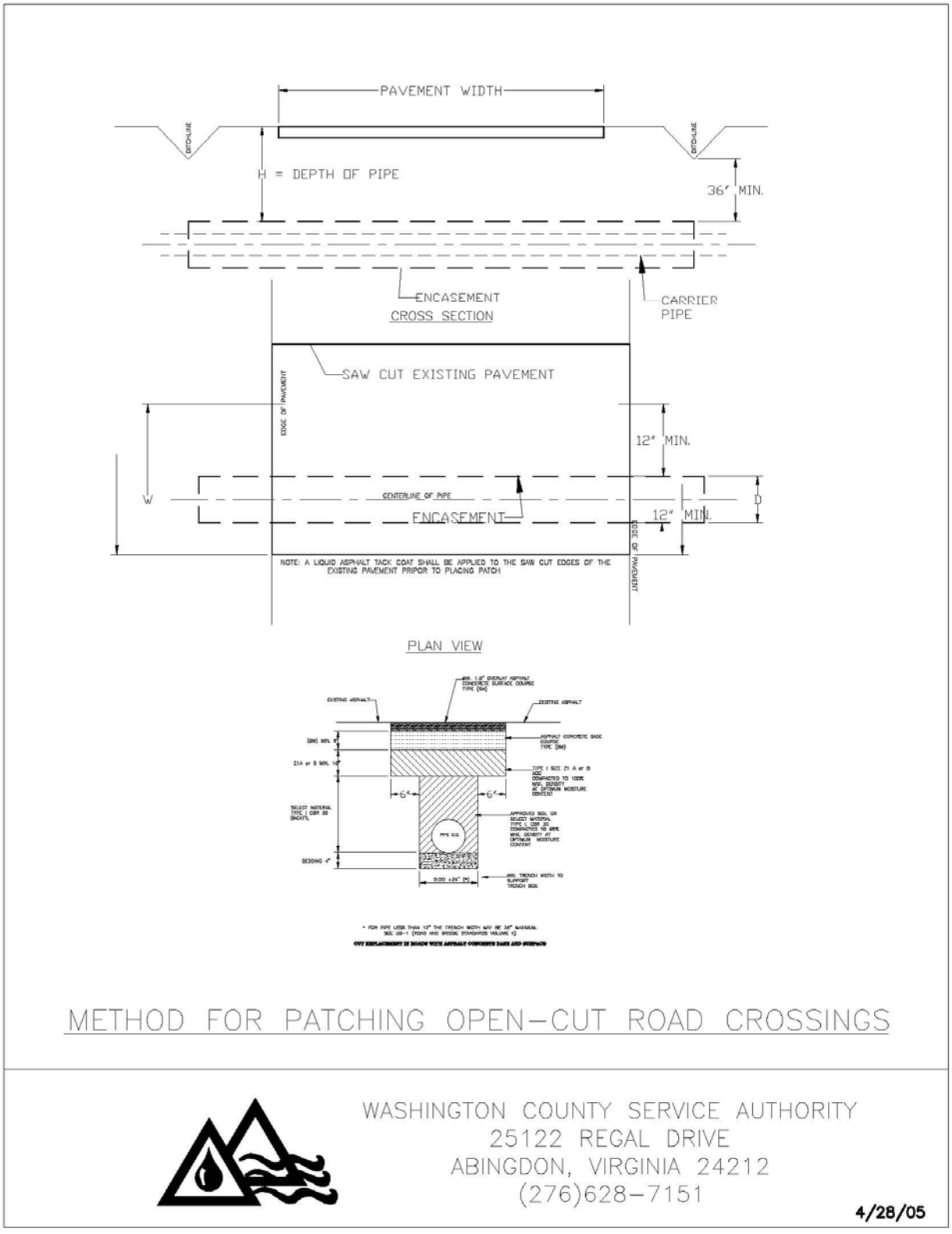
Standard Detail 16. Open Cut Patching



Appendix A Code of Virginia Title 54.1 Chapter 4

For the convenience of the user, WCSA has included the following provisions of Title 54.1 of the Code of Virginia in effect as of July 1, 1989. The Code of Virginia may be amended annually by the General Assembly. Accordingly, the user is responsible for obtaining and reviewing the most current version of this Title in order to stay fully informed as to the requirements of the law.

++

TITLE 54.1

CHAPTER 4

ARCHITECTS, ENGINEERS, SURVEYORS AND

LANDSCAPE ARCHITECTS

§54.1-400. Definitions - As used in this chapter unless the context requires a different meaning:

"Architect" means a person who, by reason of his knowledge of the mathematical and physical sciences, and the principles of architecture and architectural design, acquired by professional education, practical experiences, or both is qualified to engage in the practice of architecture and whose competence has been attested by the Board through licensure as an architect.

The "practice of architecture" means any service wherein the principles and methods of architecture are applied, such as consultation, investigation, evaluation, planning and design, and includes the responsible administration of construction contracts, in connection with any private or public buildings, structures or projects, or the related equipment or accessories.

"Board" means the Board for Architects, Professional Engineers, Land Surveyors, and Landscape Architects.

"Certified landscape architect" means a person who, by reason of his special knowledge of natural, physical and mathematical sciences, and the principles and methodology of landscape architecture and landscape architectural design acquired by professional education, practical experience, or both, is qualified to engage in the practice of landscape architecture and whose competence has been attested by the Board through certification as a landscape architect.

The "practice of landscape architecture" by a certified landscape means any service wherein the principles and methodology of landscape architecture are applied in consultation, evaluation, planning (including the preparation and filing of sketches, drawings, plans and specifications) and responsible supervision or administration of contracts relative to projects principally directed at the functional and aesthetic use of land.

"Improvements to real property" means any valuable addition or amelioration made to land and generally whatever is erected on or affixed to land which is intended to enhance its value, beauty or utility, or adapt it to new or further purposes. Examples of improvements to real property include, but are not limited to,

structures, buildings, machinery, equipment, electrical systems, mechanical systems, roads, and water and wastewater treatment and distribution systems.

"Land surveyor" means a person who, by reason of his knowledge of the several sciences and of the principles of land surveying, and of the planning and design of land developments acquired by practical experience and formal education, qualified to engage in the practice of land surveying, and whose competence has been attested by the Board through licensure as a land surveyor.

The "practice of land surveying" includes surveying of areas for a determination or correction, a description, the establishment or reestablishment of internal and external land boundaries, or the determination of topography, contours or location of physical improvements, and also includes the planning of land and subdivisions thereof. The term "planning of land and subdivisions thereof" shall include, but not be limited to, the preparation of incidental plans and profiles for roads, streets and sidewalks, grading, drainage on the surface, culverts and erosion control measures, with reference to existing state or local standards.

"Professional engineer" means a person who is qualified to practice engineering by reason of his special knowledge and use of mathematical, physical and engineering sciences and the principles and methods of engineering analysis and design acquired by engineering education and experience, and whose competence has been attested by the Board through licensure as a professional engineer.

The "practice of engineering" means any service wherein the principles and methods of engineering are applied to, but are not necessarily limited to, the following areas: consultation, investigation, evaluation, planning and design of public or private utilities, structures, machines, equipment, processes, transportation systems and work systems, including responsible administration of construction contracts. The term "practice of engineering" shall not include the service or maintenance of existing electrical or mechanical systems.

§54.1-401. Exemptions - The following shall be exempted from the provisions of this chapter:

1. Practice of professional engineering and land surveying by a licensed architect when such practice is incidental to what may be properly considered an architectural undertaking.

2. Practice of architecture and land surveying by a licensed professional engineer when such practice is incidental to an engineering project.

3. Practice as a professional engineer, architect, land surveyor or certified landscape architect in this Commonwealth by any person not a resident of and having no established place of business in this Commonwealth, or by any person resident in this such professional service in another state or country and files within fifteen days after commencement of such practice an application, with the required fee, for licensure as a professional engineer, architect or land surveyor or certification as a landscape architect. The exemption shall continue until the Board has had sufficient time to consider the application and grant or deny licensure or certification.

4. Engaging in the practice of professional engineering as an employee under a licensed professional engineer, engaging in the practice of architecture as an employee under a licensed architect, or engaging

in the practice of land surveying as an employee under a licensed land surveyor; provided, that such practice shall not include responsible charge of design or supervision.

5. Practice of professional engineering, architecture, or land surveying solely as an employee of the United States. However, the employee shall not be exempt from other provisions of this chapter if he furnishes advisory service for compensation to the public in connection with engineering, architectural or land surveying matters.

6. Practice of professional engineering, architecture or land surveying as a regular full-time, salaried employee of this Commonwealth or any political subdivision thereof; provided that such person does not furnish advisory service for compensation to the public or as an independent contracting party in this Commonwealth or any political subdivision thereof in connection with engineering, architectural or land surveying matters.

7. Practice of architecture or professional engineering by an individual, firm, or corporation on property owned or leased by such individual, firm or corporation, unless the public health or safety is involved.

8. Practice of engineering solely as an employee of a corporation engaged in interstate commerce, or as an employee of a public service corporation, by rendering such corporation engineering service in connection with its facilities which are subject to regulation by the State Corporation Commission; provided, that corporation employees who furnish advisory service to the public in connection with engineering matters other than in connection with such employment shall not be exempt from the provisions of this chapter.

§54.1-402. Further exemptions from license requirements for architects and professional engineers. - A. No license as an architect or professional engineer shall be required pursuant to §54.1-406 for persons who prepare plans, specifications, documents and designs for the following, provided any such plans, specifications, documents or designs bear the name and address of the author and his occupation:

1. Single- and two-family homes, townhouses and multi-family dwellings, excluding electrical and mechanical systems, not exceeding two and one-half or forty feet in height; or

2. All farm structures used primarily in the production, handling or storage of agricultural products or implements, including, but not limited to, structures used for the handling, processing, housing or storage of crops, feeds, supplies, equipment, animals or poultry, or

3. Buildings and structures classified with respect to use as business (Use Group B) and mercantile (Use Group M), as provided in the Uniform Statewide Building Code, excluding electrical and mechanical systems, where such building or structure does not exceed 5,000 square feet in total net floor area, three stories, or forty feet in height; or

4. Buildings and structures classified with respect to use as factory and industrial (Use Group F) and storage (Use Group S) as provided in the Uniform Statewide Building Code, excluding electrical and mechanical systems, where such building or structure does not exceed 15,000 square feet in total net floor area, three stories, or forty feet in height; or

5. Additions, remodeling or interior design without a change in occupancy or occupancy load and without modification to the structural system or a change in access or exit patterns or increase in fire hazard; or

6. Electric installations which comply with all applicable codes and which do not exceed 600 volts and 800 amps, where work is designed and performed under the direct supervision of a person licensed as a master's level electrician or Class A electrical contractor by written examination, and where such installation is not contained in any structure exceeding two and one-half stories or forty feet in height or located in any of the following categories:

a. Use Group A-1 theaters which exceed assembly of 100 persons;

b. Use Group A-4 except churches;

c. Use Group I, institutional buildings, except day care nurseries and clinics without life-support systems; or

7. Plumbing and mechanical systems using packaged mechanical equipment, such as equipment of cataloged standard design which has been coordinated and tested by the manufacturer, which comply with all applicable codes. These mechanical systems shall not exceed gauge pressures of 125 pounds per square inch, other than refrigeration, or temperatures other than flue gas of 300°F (150°C) where such work is designed and performed under the direct supervision of a person licensed as a master's level plumber, master's level heating, air conditioning and ventilating worker, or Class A contractor in those specialties by written examination. In addition, such installation may not be contained in any structure exceeding two and one-half stories or forty feet in height or located in any structure which is defined as to its use in any of the following categories:

a. Use Group A-1 theaters which exceed assembly of 100 persons;

b. Use Group A-4 except

c. Use Group I, institutional buildings, except day care nurseries and clinics without life-support systems; or

8. The preparation of shop drawings, field drawings and specifications for components by a contractor who will supervise the installation and where the shop drawings and specifications (i) will be reviewed by the licensed professional engineer or architect responsible for the project or (ii) are otherwise exempted; or

9. Buildings, structures, or electrical and mechanical installations which are not otherwise exempted but which are of standard design, provided they bear the certification of a professional engineer or architect registered or licensed in another state, and provided that the design is adapted for the specific location and for conformity with local codes, ordinances and regulations, and is so certified by a professional engineer or architect licensed in Virginia.

B. No person shall be exempt from licensure as an architect or engineer who engages in the preparation of plans, specifications, documents or designs for:

1. Any unique design of structural elements for floors, walls, roofs or foundations; or

2. Any building or structure classified with respect to its use as high hazard (Use Group H).

C. Terms used in this section, and not otherwise defined in this chapter, shall have the meanings provided in the Uniform Statewide Building Code in effect on July 1, 1982, including any subsequent amendments.

§54.1-403. Board members and officers; quorum - The Board of Architects, Professional Engineers, Land Surveyors and Landscape Architects shall be composed of eleven members as follows: three architect, three professional engineers, three land surveyors and two certified landscape architects. Board members shall have actively practiced or taught their professions for at least ten years prior to their appointments. The terms of Board members shall be five years.

The Board shall elect a president from its membership.

Seven Board members, consisting of two engineers, two architects, two land surveyors and one certified landscape architect, shall constitute a quorum.

§54.1-404. Regulations; code of professional practice and conduct - The Board shall promulgate regulations not inconsistent with this chapter governing its own organization, the professional qualifications of applicants, the requirements necessary for passing examinations in whole or in part, the proper conduct of its examinations, the implementation of exemptions from license requirements, and the proper discharge of its duties.

The regulations may include a code of professional practice and conduct, the provisions of which shall serve any or all of the following purposes:

1. The protection of the public health, safety and welfare;

2. The maintenance of standards of objectivity, truthfulness and reliability in public statements by professionals;

3. The avoidance by professionals of conflicts of interests;

4. The prohibition of solicitation or acceptance of work by professionals on any basis other than their qualifications for the work offered;

5. The restriction by the professional in the conduct of his professional activity from association with any person engaging in illegal or dishonest activities; or

6. The limitation of professional service to the are of competence of each professional.

§54.1-405. Examinations and issuance of licenses and certificates - The Board shall hold at least one examination each year at times and locations designated by the Board. A license to practice as a professional engineer, an architect, or a land surveyor, or a certificate to practice as a landscape architect shall be issued to every applicant who complies with the requirements of this chapter and the regulations of the Board. The licenses or certificates shall be signed by at least four members of the Board.

Any person with at least eight years' combined education and experience as a landscape architect or any person with a degree in landscape architecture from an institution of higher education approved by the Board may take the examination for certification as a landscape architect.

§54.1-406. License required - A. Unless exempted by §54.1-401 or §54.1-402, a person shall hold a valid license prior to engaging in the practice of architecture or engineering which includes design, consultation, evaluation or analysis and involves proposed or existing improvements to real property.

Unless exempted by §54.1-401, a person shall hold a valid license prior to engaging in the practice of land surveying.

B. Except as authorized in §54.1-402, any person, partnership, corporation or other entity offering to practice architecture, engineering, or land surveying without being registered or licensed in accordance with the provisions of this chapter, shall be subject to the provisions of §54.1-111 of this title.

C. Any person, partnership, corporation or other entity which is not authorized to practice in accordance with this chapter and which uses the words "architecture", "engineering" or "land surveying" or any modification or derivative thereof in its name or description of its business activity in a manner that indicates or implies that it practices or offers to practice architecture, engineering or land surveying as defined in this chapter shall be subject to the provisions of §54.1-111.

§54.1-407. Land surveying - Notwithstanding the provisions of any regulation promulgated by the Board for Architects, Professional Engineers, Land Surveyors and Landscape Architects, a land surveyor shall not be required by Board regulations to set corner monumentation or perform a boundary survey on any property when (i) corner monumentation has been set or is otherwise required to be set pursuant to the provisions of a local subdivision ordinance as mandated by §15.1-465 or subdivision (g) of subsection A of §15.1-466, or where the placing of such monumentation is covered by a surety bond, cash escrow, set-aside letter, letter of credit, or other performance guaranty, or (ii) the purpose of the survey is to determine the location of the physical improvements on the said property only, if the prospective mortgagor or legal agent ordering the survey agrees in writing that such corner monumentation shall not be provided in connection with any such physical improvements survey. The provisions of this section shall apply only to property located within the Counties of Arlington, Fairfax, Loudoun, Prince William, Spotsylvania and Stafford; and the Cities of Alexandria, Fairfax, Falls Church, Fredericksburg, Manassas and Manassas Park.

§54.1-408. Practice of land surveying; subdivisions - In addition to the work defined in §54.1-400, a land surveyor may, for subdivisions, site plans and plans of development only, prepare plats, plans and profiles for roads, storm drainage systems, sanitary sewer extensions, and water line extensions, and may perform other engineering incidental to such work, but excluding the design of pressure hydraulic, structural, mechanical, and electrical systems. The work included in this section shall involve the use and application of standards prescribed by local or state authorities. The land surveyor shall pass an examination given by the Board in addition to that required for the licensing of land surveyors as defined in §54.1-400. Any land surveyor previously licensed pursuant to subdivision (3)(b) of former §54-17.1 may continue to do the work herein described without further examination.

Except as provided, nothing contained herein or in the definition of "practice of land surveying" in §54.1-400 shall be construed to include engineering design and the preparation of plans and specifications for construction.

§54.1-409. Landscape architecture - Resulting plans and specifications, submitted under the seal, stamp or certification of a certified landscape architect, may be accepted by local and state authorities, in connection with both public and private projects. However, no landscape architect, unless he is also licensed as a land surveyor, shall provide boundary surveys, plats or descriptions for any purpose, except in conjunction with or under the supervision of an appropriately licensed professional, who shall provide certification, as required.

Nothing contained herein or in the definition of "practice of landscape architecture" in §54.1-400 shall be construed to restrict or otherwise affect the right of any nurseryman, uncertified landscape architect, landscape designer, land planner, community planner, landscape gardener, golf course designer, turf maintenance specialist or any other similar person from engaging in such occupation, or from rendering any service in connection therewith that is not otherwise proscribed. No person shall hold himself out as, or use the title of, "certified landscape architect", unless he has been certified pursuant to the provisions of this chapter.

§54.1-410. Other building laws not affected; duties of public officials -

A. Nothing contained in this chapter or in the regulations of the Board shall be construed to limit the authority of any public official authorized by law to approve plans, specifications or calculations in connection with improvements to real property. This shall include, but shall not be limited to, the authority of officials of local building departments as defined in §36-97 (10), to require pursuant to the Uniform Statewide Building Code, state statutes, local ordinances, or code requirements that such work be prepared by a person licensed or certified pursuant to this chapter.

B. Any public body authorized by law to require that plans, specifications or calculations be prepared in connection with improvements to real property shall establish a procedure to ensure that such plans, specifications or calculations be prepared by an architect, professional engineer, land surveyor or landscape architect licensed, certified or authorized pursuant to this chapter in any case in which the exemptions contained in §54.1-401 or §54.1-402 are not applicable.

§54.1-411. Organization for practice; registration - A. Nothing contained in this chapter or in the regulations of the Board shall prohibit the practice or architecture, engineering, land surveying or the offering of the title of certified landscape architecture by any corporation, partnership, sole partnership or other entity provided such practice or certification is rendered through its officers, principals or employees who are appropriately licensed or certified. No such organization shall limit the liability of any license or

certificate holder for damages arising from his acts or limit such corporation, partnership, sole proprietorship or other entity from liability for acts of its employees or agents. No such corporation, partnership, sole proprietorship, or other entity, or any affiliate thereof, shall, on its behalf or on behalf of any such licensee or certificate holder, be prohibited from (i) purchasing or maintaining insurance against any such liability; (ii) entering into any indemnification agreement with respect to any such liability; or (iii) receiving indemnification as a result of any such liability.

B. Except for professional corporations holding a certificate of authority issued in accordance with §13.1-549 and sole proprietorships that do not employ other individuals for which licensing is required, any person, corporation, partnership or other entity offering or rendering the practice of architecture, engineering, land surveying or offering the title of certified landscape architecture shall register with the Board. As a condition of registration, the entity shall name at least one licensed architect, professional engineer, land surveyor or certified landscape architect for such profession offered or rendered. The person or persons named shall be responsible and have control of the regulated services rendered by the entity.

C. The Board shall adopt regulations governing the registration of persons, corporations, partnerships, sole proprietors and other entities as required in subsections A and B which:

1. Provide for procedural requirements to obtain and renew registration on a periodic basis;
2. Establish fees for the application and renewal of registration sufficient to cover costs;
3. Assure that regulated services are rendered and controlled by persons authorized to do so; and
4. Ensure that conflicts of interests are disclosed.