City of Winston-Salem, North Carolina
Department of Public Works
Engineering Division

Technical Specifications and Detail Drawings
Water Line and Sanitary Sewer Line Construction

January 2014
January 2014 Water and Sanitary Sewer Technical Specifications

Major Changes and Revisions

Technical Specifications

Section A Materials

VI-1       ADDED Brass Fittings material specification that meets No Lead regulations.
VI-4       MODIFIED acceptable model numbers for Corporation Cocks.
VI-6       REVISED K-81A Guardian to K-81D Guardian.
VI-8       MODIFIED acceptable model numbers for Meter Yokes and Accessories.
VI-9-10    ADDED PVC pressure pipe and fittings (2 inch only).
VI-11      ADDED Service Saddles for ASTM D-2241 PVC Pipe.

Section B Methods of Construction

VI-20      REVISED Excavating and Backfilling Trenches, MODIFIED Rock or stone 2 inches in their greatest dimension may be used in backfill.
VI-24      REVISED Sewer Force Mains (PVC).
            ADDED Tracer Wire and Marker Tape.
VI-27-31   REVISED Installation of Water Pipe.
            ADDED 2 inch PVC Installation, ADDED Tracer Wire and Marker Tape.
            ADDED 2 inch water main taps to 6 inch or larger water main.
VI-31      REVISED Cutting of Ductile Iron Pipe and PVC Pipe.
VI-33      REVISED Pressure Testing, ADDED 2 inch PVC water main.
            ADDED 2 inch main size to table.
VI-35      REVISED Disinfection, ADDED 2 inch main size to table.
            ADDED Blow-off Assemblies.
VI-41      REVISED Final Inspection.

Detail Drawings

Many detail drawings were renumbered.


ADDED NEW DRAWINGS VII-23 thru VII-26 and VII-53
NOTE: Whenever the word “Contractor” appears, it shall mean the person, firm or corporation licensed to install public utilities (water and sewer lines) in North Carolina. Whenever the word “Engineer” appears, it shall mean the City Engineer who is authorized to act for the Assistant City Manager/Public Works or any person authorized to act on behalf of the City of Winston-Salem.
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January 2014

WATER AND SANITARY SEWER
TECHNICAL SPECIFICATIONS

All references to specifications by the following institutes, associations, and societies shall be made to the latest revision of each specification:

ANSI - American National Standards Institute
ASTM - American Society for Testing Materials
AWWA - American Water Works Association
AASHTO - American Association of State Highway and Transportation Officials

SECTION A

MATERIALS

All materials shall be new and are subject to approval by the Engineer. Only materials meeting specifications and/or the Engineer's approval will be used.

BRASS FITTINGS: All brass fittings shall be manufactured in accordance with AWWA C800 and ASTM B-584. All brass components in contact with potable water must be made from CDA/UNS Brass Alloy C89833 with a maximum lead content of .25% by weight. Brass alloys not listed in ANSI/AWWA C800 Paragraph 4.1.2 are not approved. All fittings shall be UL classified to NSF/ANSI 61 and NSF/ANSI 372 standards and stamped or embossed with a mark or name indicating that the product is manufactured from the low-lead alloy as specified.

BRICK: All brick used on the work will be hard, tough, sound clay or shale brick, of first-class quality, thoroughly vitrified and especially suitable to the class of work for which it is to be used. All brick will meet ASTM C32, Grade MS or higher. All brick will be laid in Class "A" cement mortar.

CASING SPACERS: Casing spacers shall be made of Type 304 stainless steel (including risers and hardware). Each shell shall be PVC lined and shall have bolted flanges. Casing spacer runners shall be constructed of ultra high molecular weight polymer (minimum 1½" wide) with a friction coefficient of not more than .12. Risers shall be 10 gauge. Risers and runners for top and bottom shells shall be of equal height. With approval of the Engineer, unequal height risers and runners may be used to obtain proper grade for sanitary sewer mains. Casing spacers must be designed to ensure that only the runners of the spacer are in contact with the steel encasement pipe. The bell of the carrier pipe will not be allowed to be in contact with the encasement. Casing spacers shall be manufactured by one of the following:

(1) Cascade Waterworks Manufacturing Company
(2) Advance Products and Systems, Inc.
(3) BWM Company
CAST IRON SOIL PIPE AND FITTINGS: All cast iron soil pipe and fittings will conform to ASTM A74 and be classified as SV (service weight). Single or double hub is acceptable. No-hub pipe shall not be used. All pipe and fittings shall be uniformly coated with bituminous coating. Joints will be rubber gasket. Rubber gaskets shall conform to ASTM C564. 4" x 4" combination wye and eighth bends shall be short pattern - Fig. No. SV-32 by Charlotte Pipe and Foundry (or approved equal). 4" cleanouts shall consist of a 4" service weight cast iron ferrule (with 3" iron pipe size tap) and a 3" brass plug. The plug shall have a low raised square head (Southern Code). Cleanouts shall be Part Number 184 by Jumbo Manufacturing Company (or approved equal).

CEMENT: All cement used on the work will meet ASTM C150. Brand will be subject to the approval of the Engineer upon submission of typical test reports. Type I or II may be used in all work. Where high early strength concrete may be required, Type III cement may be used with permission of the Engineer.

COARSE AGGREGATE: Coarse aggregate shall consist of sound, hard and tough broken stone and will conform to the specifications for coarse aggregate given in ASTM C33.

CONCRETE: All concrete will be made of cement, water and aggregate as herein specified and will further be in accordance with the following definite requirements for the various classes.

A design of the mix made by an independent laboratory for each class of concrete will be submitted to the Engineer for approval before concreting is started.

During the progress of work, standard compressive strength test specimens will be made, cured in accordance with ASTM C31 and tested by an independent testing laboratory in accordance with ASTM C39. At least three cylinders will be made for each test. Tests will be submitted for each 50 cubic yards or fraction thereof for each class of concrete used for the first 200 cubic yards of each class placed. For the next 300 cubic yards used, one test will be furnished for each 100 cubic yards and for all over 500 cubic yards, one test for each 500 cubic yards. Should there be any evidence that concrete is not up to standard, a strength test may be required at any time.

Class AA concrete will have a minimum 28-day compressive strength of 4,500 pounds per square inch and a slump not to exceed 3-1/2 inches.

Class A concrete will have a 28-day compressive strength of 3,000 pounds per square inch and a slump not to exceed 3-1/2 inches.

Class B concrete will have a 28-day compressive strength of 2,500 pounds per square inch and a slump not to exceed 2-1/2 inches.

Determination of the slump will be made in accordance with ASTM C143.

Reinforced concrete will normally be Class A. Concrete for special cases will be as specified under the specific structures.
Materials of the proportions determined for the concrete specified will be mixed in a batch mixer of approved type for not less than one and one-half minutes after the materials, including the water, are in the mixer. Unless the requirement is waived by the Engineer, the Contractor will install a batch meter on the mixer to time each mix for the guidance of the operator. No materials will be placed in the drum until all of the previous batch has been discharged. Water will be added at the time the other materials are being run into the mixer and the mixer will be provided with a satisfactory device for accurately measuring the water for each batch.

The equipment used for making concrete as herein specified will be adequate for the particular work in hand, and of such character as to insure at all times rigid control of the quantities of all materials entering into the mixture. Ready-mixed concrete under ASTM C94 may be used with approval of the Engineer. Cement, aggregates, water and design and testing will be as above specified.

Concrete will be poured continuously in layers not exceeding 12 inches. Concrete will not be thrown or dropped from a height sufficient to cause jarring of concrete already in place. After being placed, the concrete shall be worked sufficiently by vibration, spading, rodding or forking to fill all voids and hold any steel reinforcement.

No concrete will be poured when the air temperature is below 40 degrees Fahrenheit unless the Engineer's approval has been first obtained for the specific pour.

Each construction joint will be thoroughly cleaned with steel brushes, roughened and all loose materials removed by washing with a hose before concrete is fully set. The concrete should be dry enough to prevent injuring the concrete when the joint is cleaned.

In connecting new concrete with concrete already set, the surface will be again thoroughly washed to remove dust and debris and the surface covered with a thin layer of mortar of the same proportions of sand and cement as is used in making the concrete.

Formwork will be of standard form plywood. All forms will be clean, smooth and tight with all angles, interior and exterior, chamfered to prevent leaving any sharp edges in the finished concrete. Forms will be constructed true to line and grade, and braced so as to maintain such line and grade when concrete is placed. Twisted wires will not be used to tie forms together. All concrete edges at the top of the forms (unless chamfered) will be rounded with a suitable edging tool. Necessary precautions should be taken to prevent loss of moisture from concrete after it has been poured. The method and period of curing shall be determined by the Engineer. Formwork for columns, walls and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from form removal operations. All other formwork shall be removed as permitted by the Engineer. All exposed concrete surfaces shall be smooth and free of any form marks.

No waterproofing material or admixture will be used in the concrete without the Engineer's approval.

**COPPER PIPE:** All copper pipe will conform to ASTM B88. All copper shall be Type K, soft copper and all joints shall be compression.
CORPORATION COCKS: All corporation cocks shall be made of brass in accordance with the brass specification contained herein. All corporation cocks shall also be of the ball valve type with AWWA inlet threads.

The following are acceptable:

\[\frac{3}{4}"\], 1", 1 1/2" and 2" - FBl000-G-NL by Ford or 74701BT by McDonald

DUCTILE IRON PIPE: Ductile iron pipe shall be designed to conform to ANSI A21.50 (AWWA C150) and shall be manufactured to conform to ANSI A21.51 (AWWA C151). The interior of pipe for water will be cement lined in accordance with ANSI A21.4 (AWWA C104). The interior of pipe for sanitary sewer will be lined with 40 mils of Protecto 401 Ceramic Epoxy. All bells and spigots for sanitary sewer pipe must be lined with a minimum of 8 mils of Protecto 401 Joint Compound or approved equal. The exterior of all pipe shall be coated with a bituminous coating. Pipe joints will be single rubber gasket push-on type or mechanical joint type unless otherwise specified or otherwise shown on the Engineer's drawings. Rubber gasket joints shall conform to ANSI A21.11 (AWWA C111). Pipe design laying condition will be Type 2, flat-bottom trench with backfill lightly consolidated to centerline of pipe. Pipe for sanitary sewer shall be minimum thickness Class 50. Pipe for water shall be pressure Class 350 for 3" - 16" and pressure Class 250 for 18" and above. Any deviations in class shall be otherwise specified or otherwise shown on the Engineer's drawings. The unit price for ductile iron pipe in the Contract shall include the furnishing of necessary ductile iron pipe, labor, supervision, equipment and tools necessary for installing the pipe as shown on the Engineer's drawings or as may be directed by the Engineer. The unit price shall also include all excavation (except rock excavation), furnishing and placing suitable backfill, hauling and unloading of all pipe and removal and disposal of all rigid and flexible pavement. If for any reason the Engineer finds any or all ductile iron pipe unacceptable, the Contractor shall be responsible for obtaining acceptable pipe. The Engineer's acceptance or rejection of all pipe will be final. Payment for pipe installation will not be made until the areas disturbed by the pipe installation have been restored to their original grade and satisfactorily seeded and mulched.

DUCTILE IRON FLEXIBLE RESTRAINED JOINT PIPE: Ductile iron flexible restrained joint pipe shall be installed at the locations shown on the Engineer’s drawings. All restrained joint pipe shall have flexible push-on joints designed to deflect a minimum of 3° per joint. At locations where field cutting of restrained joint pipe is required, a special field cut kit shall be used by the Contractor. Field welding will not be allowed. Field cut kits shall provide restraint equivalent to factory manufactured restrained joint pipe. Field kits shall be provided by the pipe manufacturer. Restrained joint pipe with a gripping gasket as the only means of restraint will not be allowed. Pipe shall be Flex-Ring by American, TR Flex by U.S. Pipe, Snap-Lok by Griffin or Super-Lock by Clow.

FENCE GATES: At the unit price named, 14 foot wide, 48" high gates will be furnished and installed in farm fences at locations as directed by the Engineer or as indicated on the Engineer's drawings. Gates will be installed as per the City of Winston-Salem detail drawing.
Gates will be five panel type, fabricated using 4 ½", 24 gauge galvanized, steel forms or an approved tubular type gate. Gates will be mounted on 6" diameter, 8 foot long, pressure treated posts at the hinged ends. Hinges will utilize 5/8" pins screwed into posts, turned up at the bottom and turned down at the top. Female receivers mounted on gate frames will rotate on pins. All hinges, pins, etc. shall be hot-dip galvanized.

Slide latches will be provided to slide into receivers attached to 6" diameter, 8 foot long, pressure treated posts. Minimum retention for treated posts shall be .4 lbs. of chromated copper arsenate per cubic foot of wood.

For locking purposes, a 5/16" link chain 28" long, will be furnished and attached to the latch posts. Furnished with each gate will be a Corbin padlock number 2863, master keyed to the City of Winston-Salem's Utilities Division standard. The City will provide the Corbin padlock.

**FENCING (OUTFALLS):** At the unit price named per linear foot, 48" high fencing shall be furnished and installed at locations as directed by the Engineer or as shown on the Engineer's drawings. Fencing will be installed as per the City of Winston-Salem detail drawing.

Fencing shall be 2" x 4" galvanized woven wire fabric. Posts shall be 4" x 4" pressure treated lumber (6 feet long). Minimum retention for treated posts shall be .4 lbs of chromated copper arsenate per cubic foot of wood.

**FIRE HYDRANTS:** All fire hydrants shall be dry-barrel fire hydrants which comply with ANSI/AWWA C502. All hydrants will have a dry top with O-ring seals which permanently seal off the stem operating threads from water and keep the lubricant in. All hydrants shall be opened by turning the operating nut on top of the hydrant counterclockwise. The main valve shall be a compression type valve with a valve opening of 4 ½" or 5 1/4" unless otherwise specified. Each hydrant will have two hose nozzles and one steamer nozzle. The 2 ½" hose nozzles and the 4 1/4" steamer nozzle shall have Winston-Salem standard threads. The nozzle shall be fastened into the hydrant barrel by mechanical means, but shall not be leaded into the barrel. Nozzle caps shall be chained to the barrel. All hydrants will be furnished with a breakable traffic feature that will break upon impact. The feature shall consist of a breakable safety flange on the barrel and a breakable safety coupling in the main valve stem. Hydrants must have a bronze main valve seat ring that threads into a bronze drain ring. Each hydrant shall have at least two bronze drain outlets. All hydrants will have 6" mechanical joint base connections unless otherwise specified by the Engineer. Hydrants shall be designed for a minimum working pressure of 250 psi. Assembled hydrants shall be subjected to hydrostatic tests of twice the rated working pressure in accordance with ANSI/AWWA C502. All exterior iron surfaces below ground level shall be covered with two coats of asphaltic varnish or fusion bonded epoxy. All exterior iron surfaces above ground level shall be painted yellow to the satisfaction of the Engineer. Yellow paint shall be Rust-Oleum 7446, Rust-Oleum V2148, or Kimball Midwest 80-942. All interior iron surfaces of the hydrant shoe which are in contact with water (including the lower valve plate and nut) shall be coated with a minimum of 8 mils of fusion bonded epoxy or liquid epoxy in accordance with ANSI/AWWA C550. All hydrants shall have a thrust or anti-friction washer in the operating area of the hydrant bonnet. A weather cap around the operating
nut on top of the hydrant is required. Hydrants accepted by the City of Winston-Salem are as follows:

(1) Super Centurion 250, manufactured by Mueller Company  
(2) MK-73-5, manufactured by American Flow Control  
(3) K-81D Guardian, manufactured by Kennedy Valve Company

Hydrants will normally be three and one-half feet from the ground to the bottom of the hydrant (42" bury). However, when plans indicate a deeper bury is required, such hydrants will be furnished conforming to the depth of bury as shown on the plans. Hydrant extensions will be installed only if necessary.

**FITTINGS (DUCTILE IRON):** Ductile iron fittings shall meet all requirements of ANSI A21.10 (AWWA C110) and will be of the mechanical joint type unless otherwise specified. All glands shall be ductile iron, not gray iron. The interior of fittings for water will be cement lined in accordance with ANSI A21.4 (AWWA C104). The interior of fittings for sanitary sewer will be lined with 40 mils of Protecto 401 Ceramic Epoxy. All bells and spigots for sanitary sewer fittings must be lined with a minimum of 8 mils of Protecto 401 Joint Compound or approved equal. The exterior of all fittings shall be coated with a bituminous coating. Fittings coated on the interior and exterior with 8 mils of fusion bonded epoxy in accordance with ANSI/AWWA C116 and ANSI/AWWA C550 are acceptable. Fittings will have a minimum pressure rating of 250 psi unless otherwise specified by the Engineer. All Fittings are subject to approval by the Engineer, and his acceptance or rejection shall be final. Rubber gasket joints shall conform to ANSI A21.11 (AWWA C111). Ductile iron compact fittings conforming to ANSI A21.53 (AWWA C153) are acceptable. "DI" or "Ductile" shall be cast on each fitting. Fittings shall be paid for at the unit price per pound for fittings in the Contract. This price shall include the cost of furnishing and installing the fittings and accessories. Payment will be made based on weights for ductile iron fittings as listed in AWWA C110. Weights for fittings up to and including 30" are on file in the Engineering Division. The weights to be used for payment include fitting weight only. No payment will be made for glands, bolts and gaskets. In case of discrepancy, the City chart shall prevail over AWWA C110.

**IRON AND STEEL (MISCELLANEOUS):** All miscellaneous iron and steel such as angle iron, checkered plate covers, valve stem guides and supports, etc. will be galvanized.

Galvanizing will be by the hot-dip process after the materials have been cut, assembled and all holes punched. Any field welds or bolts which may be used to fasten iron or steel together will be painted immediately after installation with two coats of cold galvanizing compound.

**LIME:** Lime for cement mortar will meet ASTM C207, Type N.
MANHOLE RINGS AND COVERS (TYPE 1): Manhole rings and covers will be made of cast iron and will conform to ASTM A48, Class 35B. In addition, all manhole rings and covers shall be designed to support an H-20 wheel load. All castings will conform to the shape and dimensions shown on the City of Winston-Salem detail drawing and will be free from holes, cracks or any other defects. Rings and covers will have machined seats so that the cover will not rattle. Rings will weigh a minimum of 190 pounds and covers a minimum of 120 pounds. The name of the manufacturer and the part number shall be cast permanently on the ring and the cover. Castings that do not meet specifications shall be rejected. Rings and covers furnished under these specifications shall be manufactured by one of the following:

1. East Jordan Iron Works, Inc. (Ring - Part No. V-1384-1; Cover - Part No. V-1384)
2. U.S. Foundry & Manufacturing Corp. (Ring - Part No. 669; Cover - Part No. KL)

MANHOLE RINGS AND COVERS (TYPE 2): Rings and covers shall meet all specifications for Type 1 rings and covers and shall conform to the City of Winston-Salem detail drawing for Type 2. Rings and covers shall be manufactured by one of the following:

1. East Jordan Iron Works, Inc. (Ring - Part No. V-2384; Cover - Part No. V-1385)
2. U.S. Foundry & Manufacturing Corp. (Ring - Part No. 669-2; Cover - Part No. KL-2)

MANHOLE RINGS AND COVERS (TYPE 3): Rings and covers shall meet all specifications for Type 1 rings and covers, except that rings will weigh a minimum of 136 pounds and covers a minimum of 120 pounds. All rings and covers shall conform to the City of Winston-Salem detail drawing for Type 3. Rings and covers shall be manufactured by one of the following:

1. East Jordan Iron Works, Inc. (Ring - Part No. V-2484-3; Cover - Part No. V-2384)
2. U.S. Foundry & Manufacturing Corp. (Ring - Part No. 571; Cover - Part No. KK)

MANHOLE STEPS: All manhole steps shall conform to current OSHA standards and ASTM C478. The approved step is shown on a City of Winston-Salem detail drawing. All other steps must be approved by the Engineer prior to being installed.

METERS: All 5/8" - 2" meters will be installed by the City of Winston-Salem. The unit price for water connections shall include everything shown on City of Winston-Salem detail drawings except for the meter and the expansion connection.

METER BOXES (CAST IRON - 5/8" AND 1" METERS): Cast iron meter boxes will conform to ASTM A48, Class 30B. All boxes will conform to the shape, dimensions and weights shown on the City of Winston-Salem detail drawing and will be free from holes, cracks or any other defects. All boxes shall be thoroughly coated with an asphaltic
varnish. The name of the manufacturer shall be permanently cast on each piece. Meter boxes that do not meet specifications shall be rejected. Cast iron meter boxes furnished under these specifications shall be manufactured by one of the following:

(1) Sigma Corp.
(2) SIP Industries
(3) DSI International

**METER BOXES (POLYMER CONCRETE - 1½" AND 2" METERS):** Meter boxes for 1½" and 2" meters shall be manufactured by Quazite (Strongwell Corporation). The box shall have two 4" x 4" mouse hole openings (one on each end) with a 4" x 4" knockout above each opening. The cover shall be non-locking with a 6" x 9" steel meter lid centered on the cover. The meter lid must open to at least the vertical position. The cover shall also have two pull slots (1" wide), a skid resistant surface and the word "Water" cast into the cover. Meter boxes that do not meet specifications shall be rejected. Part numbers are as follows:

Box: PG2436B500
Cover: PG2436WAP1-50

**METER YOKES AND ACCESSORIES:** All brass shall conform to the brass specification contained herein.

The following materials are acceptable:

A. 3/4" Water Connection

1. Meter yoke - Y501 by Ford, H-5010 by Mueller or 14-1 by McDonald
2. Angle ball valve with padlock wings - BA94-313W-G-NL by Ford (City side)
3. Angle ball valve without padlock wings - BA94-313-G-NL by Ford (property side)

B. 1" Water Connection

1. Meter Yoke - Y504 by Ford
2. Angle ball valve with padlock wings - BA94-444W-G-NL by Ford – two required

C. 1½" Water Connection - Custom-setter with ball valve bypass and ball valves on inlet and outlet. (VBB76-12B-11-66-NL by Ford) as per City of Winston-Salem detail drawing.

D. 2" Water Connection - Custom-setter with ball valve bypass and ball valves on inlet and outlet (VBB77-12B-11-77-NL by Ford) as per City of Winston-Salem detail drawing.
MORTAR: Lime and cement mortar will be composed of one part cement to two parts well-aged lime paste or hydrated lime to four parts sand, the proportions to be by measure in boxes. Commercial mortar compounds with the approval of the Engineer may be substituted for the lime and cement.

Unless otherwise provided, cement mortar will be of two classes known as Class A and Class B. Class A mortar will consist of cement and sand mixed in the proportions of one part cement to two parts sand with not more than 6.3 gallons of water per bag of cement. Class B mortar will consist of cement and sand mixed in the proportion of one part cement to three parts sand with not more than 6.3 gallons water per bag of cement.

All mixtures may be varied to increase workability only by reducing the amount of sand or blending one or more sands. Mortar in which cement has been placed for more than an hour will not be used. When air temperature is below 40 degrees Fahrenheit, no mortar will be used without special permission of the Engineer.

POLYETHYLENE ENCASEMENT: Polyethylene encasement shall be installed on the ductile iron pipe at the locations shown on the Engineer’s drawings. Materials and installation shall conform to ANSI A21.5 (AWWA C105). The polyethylene shall have a minimum thickness of 8 mil, shall be tubing type and shall be manufactured of virgin material. Installation of the polyethylene tubing shall conform to Method “B” outlined in Section 4.3.2.2 of ANSI A21.5 (AWWA C105). The tape used for installation of polyethylene tubing shall be plastic-backed adhesive with a thickness of 12 mils and a minimum width of 1 ½". The tape shall be capable of bonding to metal, bituminous coating and polyethylene at a temperature range of 32 to 120 degrees F.

POLYVINYL CHLORIDE (PVC) PIPE FOR SANITARY SEWER FORCE MAINS: 4" PVC pipe shall conform to AWWA C900, pressure Class 200 psi at 73.4 degrees Fahrenheit. The dimension ratio shall be 14. 3" and smaller PVC pipe shall conform to ASTM D2241, pressure Class 200 psi. The dimension ratio shall be 21. All pipe shall have an integral bell and a single gasketed joint.

POLYVINYL CHLORIDE (PVC) PRESSURE PIPE AND FITTINGS: (2 INCH ONLY)
Pipe and fittings shall be manufactured and tested in the U.S.A. All two (2) inch PVC pipe and fittings shall have a hydrostatic minimum working pressure of 250 psi (SDR 17 or SDR 13.5) and pipe shall conform to ASTM D-2241 or the latest revision. PVC pipe shall have the National Sanitation Foundation (NSF) seal of approval. Pipe jointing shall be push on integral bell type with elastomeric joints and shall conform to ASTM D-3139. PVC pipe shall be furnished in standard lay lengths of twenty feet with one or both ends tapered for use with the integral bell. Any lubrication used shall conform to AWWA and the pipe manufacturer. Fittings shall be push on joint PVC with elastomeric joints and shall conform to ASTM D-3139.

The unit price for PVC pressure pipe in the Contract shall include the furnishing of necessary PVC pipe and fittings, labor, supervision, equipment and tools necessary for installing the pipe and fittings as shown on the Engineer's drawings or as may be directed by the Engineer. The unit price shall also include all excavation (except rock excavation),
furnishing and placing suitable backfill, hauling and unloading of all pipe and removal and disposal of all rigid and flexible pavement. The unit price for PVC pressure pipe shall include all fittings, jointing materials, blocking, and other necessary appurtenances. If for any reason the Engineer finds any or all PVC pipe unacceptable, the Contractor shall be responsible for obtaining acceptable pipe. The Engineer's acceptance or rejection of all pipe will be final. Payment for pipe installation will not be made until the areas disturbed by the pipe installation have been restored to their original grade and satisfactorily seeded and mulched.


RIP RAP: Rip Rap shall include Class 1 and 2 Rip Rap and Class A and B Erosion Control Stone. All materials shall conform to Section l042 of the N.C. Department of Transportation Standard Specifications for Roads and Structures. Rip Rap thickness shall be 1.5 times the maximum stone diameter or as shown on the Engineer's drawings. At creek crossings, Rip Rap shall be placed a minimum of 10 feet on each side of the centerline of the pipe. Rip Rap shall be placed to the satisfaction of the Engineer. Rip Rap from the quarry will be paid for on a unit price basis as set forth in the proposal. No payment will be made for field stone or broken concrete used as Rip Rap. Filter fabric shall be placed under all Rip Rap. The filter fabric cost shall be included in the unit price for Rip Rap.

SAND: All sand used in mortar or as fine aggregate in concrete will be clean, sharp, practically free from loam, clay or vegetable matter, and so graded as to insure workability and watertightness when mixed with other ingredients. Sand will conform to ASTM C33, and when made into mortar will have a compressive strength at 7 and 28 days of not less than 100 percent of mortar made with standard sand. Independent laboratory tests will be submitted for approval of the Engineer.

SCREENINGS: Screenings shall be placed on all paved roadways prior to beginning any trenching activities. Screenings shall be placed on the affected pavement area as directed by the Inspector. All screenings shall be removed once backfilling has been completed.

SERVICE SADDLES (SEWER): Service saddles for 4” sewer connections may be used in lieu of wyes. Saddles shall be style "CB" sewer saddle by Romac Industries, Inc.

SERVICE SADDLES (WATER): Service saddles shall be used as follows:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Maximum Size Direct Tap on Ductile Iron Pipe Without Saddle</th>
</tr>
</thead>
<tbody>
<tr>
<td>4”</td>
<td>¾”</td>
</tr>
<tr>
<td>6”</td>
<td>1”</td>
</tr>
<tr>
<td>8”</td>
<td>1”</td>
</tr>
<tr>
<td>12”</td>
<td>1 ½”</td>
</tr>
</tbody>
</table>
**For Ductile Iron Pipe:** The saddle body shall be ductile iron with corrosion resistant paint. The body shall have a CC threaded outlet. Attached to the body shall be double U-bolt straps. Straps, washers and nuts shall be high-strength, low-alloy steel in accordance with ANSI A21.11 (AWWA C111). Saddles shall be Model 202 by Romac Industries, Inc. or Model 313-024 by Smith-Blair, Inc.

**For ASTM D-2241 PVC Pipe:** The saddle body shall be no lead brass alloy per ASTM B62 and AWWA C800 requirements. The body shall have a CC threaded outlet. The gasket “O” ring design shall conform to ASTM D2000 requirements. Service saddles for use on ASTM D-2241 PVC pipe shall be Ford S70 type or approved equal.

**STEEL ENCASEMENT PIPE:** Steel encasement pipe shall be smooth wall pipe with welded joints. The pipe shall have a minimum yield strength of 35,000 psi. The encasement pipe must be capable of withstanding highway loadings and must have an inside diameter which will allow the carrier pipe to be removed subsequently without disturbing the encasement pipe.

Minimum wall thicknesses for steel encasement pipe are as follows:

<table>
<thead>
<tr>
<th>ENCASEMENT PIPE SIZE (Outside Diameter)</th>
<th>WALL THICKNESS (NCDOT)</th>
<th>WALL THICKNESS (Railroad)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16”</td>
<td>.250”</td>
<td>.281”</td>
</tr>
<tr>
<td>18”</td>
<td>.250”</td>
<td>.312”</td>
</tr>
<tr>
<td>20”</td>
<td>.250”</td>
<td>.344”</td>
</tr>
<tr>
<td>24”</td>
<td>.250”</td>
<td>.375”</td>
</tr>
<tr>
<td>30”</td>
<td>.312”</td>
<td>.469”</td>
</tr>
<tr>
<td>36”</td>
<td>.375”</td>
<td>.532”</td>
</tr>
<tr>
<td>48”</td>
<td>.500”</td>
<td>.688”</td>
</tr>
</tbody>
</table>

Encasement pipe installed on railway rights-of-way shall be subject to specifications by the American Railway Engineering Association. Pipe diameter shall be as shown on the Engineer's drawings.

**STEEL FOR REINFORCEMENT:** All reinforcement steel bars will conform to ASTM A615 (Grade 60) and all reinforcement welded steel wire fabric will conform to ASTM A185. All steel will be free from rust or other coatings which would destroy the bond between the steel and the concrete. Bars shall be tied together and supported to prevent damage by construction loads or pouring of concrete. On the ground and where necessary, concrete blocks cast of the same concrete as is to be poured will be used for the purpose of supporting the steel. On formwork, bar chairs and spacers approved by the Engineer shall be used for support. Where the concrete surface will be exposed, the portions of all accessories in contact with the formwork will be galvanized or coated with plastic.
STONE (MISCELLANEOUS): Miscellaneous stone shall be ABC stone. This stone shall be used for driveways, streets, parking lots, etc.

STONE (STABILIZATION): Stabilization stone shall be #5 or #57 stone. This stone shall be used in unstable soil, under or around pipe, under manholes, etc.

T-HEAD BOLTS AND HEXAGONAL NUTS: All T-head bolts and nuts used for mechanical joint pipe, valves, hydrants or fittings shall be high-strength, low-alloy steel in accordance with ANSI A21.11 (AWWA C111). Cast iron bolts will not be accepted.

THREADED RODS: Threaded rods used for thrust restraint shall be 3/4" high-strength, low-alloy steel rods which conform to ASTM A242. The minimum yield strength shall be 36,000 psi and the tensile strength shall be at least 60,000 psi. Use of threaded rods must be approved by the Engineer.

TIE BOLTS: Tie bolts used for thrust restraint shall be Star Figure No. SST 7 (or SST 756) - 3/4" high-strength, low-alloy steel tie bolts. High-strength, low-alloy steel washers and tie nuts shall be used with all tie bolts. Use of tie bolts must be approved by the Engineer.

VALVES (AIR RELEASE): All air release valves shall conform to ANSI/AWWA C512. The unit price for an air release valve will include furnishing and installing a corporation cock on the main, two bronze ball valve curb stops, brass pipe, brass fittings and an air release valve, all enclosed in a manhole as indicated on City of Winston-Salem detail drawings. The air release valve shall be a Type 316 stainless steel (all parts), pressure air valve (operating pressure 0-200 psi) manufactured by Crispin or an approved equal. The bronze ball valve curb stops shall have a minimum working pressure of 200 psi.

VALVES (GATE) (3" THROUGH 16") : All gate valves shall be resilient-seated gate valves which meet the specifications of ANSI/AWWA C509 or ANSI/AWWA C515. The valve body, bonnet and seal plate shall be coated on all exterior and interior surfaces with a minimum of 8-10 mils of fusion bonded epoxy in accordance with ANSI/AWWA C550. The valve shall incorporate a guide system with guide lugs on the wedge or on the body. The wedge shall be gray or ductile iron, fully encapsulated with rubber (including guide lugs and stem nut holder). Non-rising stem valves shall have two O-ring seals above the stem thrust collar that can be replaced with the valve under pressure. Non-rising stem valves shall also have a thrust washer on the stem thrust collar. Valves used for buried service will have a non-rising stem, mechanical joint end connections, and a 2" square operating nut. The word "OPEN" and an arrow to indicate the direction of opening the valve shall be cast on the flanged base of the operating nut. Above ground valves, unless otherwise specified, will have an outside screw and yoke rising stem or a non-rising stem, flanged end connections, and a handwheel to operate the valve. The word "OPEN" and an arrow to indicate the direction of opening the valve shall be cast on the rim of the handwheel. All valves will open by turning the nut or handwheel counterclockwise. Valves installed in manholes will normally be considered to be buried service valves and valves installed in vaults will normally be considered to be above ground valves.
Resilient-seated gate valves shall be designed for a minimum working pressure of 250 psi. Each valve shall be seat tested at the rated working pressure and shell tested at twice the rated working pressure in accordance with ANSI/AWWA C509 - Section 5 or ANSI/AWWA C515 - Section 5. All valves shall be warranted for 10 years from date of purchase against defective materials and workmanship. Gate valves furnished under these specifications must be manufactured by one of the following:

1. Clow Valve Company
2. M & H Valve Company
3. American Flow Control
4. U.S. Pipe and Foundry Company
5. Mueller Company
6. Kennedy Valve Company

Gate valves shall be paid for at the unit price named under the proper item. This shall include the cost of furnishing and installing gate valves and cast iron valve boxes (or manholes if specified).

**VALVES (SWING CHECK):** All swing check valves shall meet the specifications of AWWA C508. The valves shall have an iron body, be of the clear waterway type and have bronze to bronze or rubber to bronze seat construction. End connections can be flanged or mechanical joint. Check valves shall be designed for a working pressure of 175 psi for 2-12 inch valves and 150 psi for 16-24 inch valves. Assembled check valves shall be subjected to the following hydrostatic tests in accordance with AWWA C508 - Section 5:

1. Shell Test - 350 psi for 2-12 inch valves
   300 psi for 16-24 inch valves
2. Seat Test - 175 psi for 2-12 inch valves
   150 psi for 16-24 inch valves

Check valves normally will be lever and weight or lever and spring operated only if used for above ground service, but may be used at any time if so specified by the Engineer. All valves shall have two coats of asphaltic varnish applied to the outside ferrous metal surfaces. All interior iron surfaces (including the disc, clapper and clapper arm) shall be coated with a minimum of 8 mills of fusion bonded epoxy or liquid epoxy in accordance with ANSI/AWWA C550. Check valves furnished under these specifications must be manufactured by one of the following:

1. Mueller Company
2. American Flow Control
3. M & H Valve Company
**VALVES (TAPPING):** Tapping sleeves and valves shall be used for "wet" taps into existing water mains as indicated on the Engineer's drawings. The Contractor shall verify the type of material, size, etc., of the existing main prior to ordering the sleeve. The sleeve shall be a split sleeve with mechanical joint end connections and a flanged outlet. Sleeves shall be designed for a minimum working pressure of 200 psi. For taps on larger mains (24" and above), a saddle may be used in lieu of a sleeve, but only if the tap is less than or equal to half the size of the line to be tapped. The tapping valve shall meet all specifications for "gate valves" except that the valve shall have an inlet flange (with centering ring) for connection to the flanged sleeve outlet. The unit price named shall include installation also.

All tapping sleeves and valves shall be water tested before the tap is made. Test pressure shall be 200 psi. All tapping sleeves and valves shall be installed level. The Engineer must be present during the entire tapping and testing process.

Approved tapping sleeves are as follows:

(1) Mueller Company  
(2) American Flow Control  
(3) Tyler Pipe Company  
(4) U.S. Pipe and Foundry Company  
(5) Kennedy Valve Company

Approved tapping saddles are as follows:

(1) American Flow Control  
(2) U.S. Pipe and Foundry Company

Approved tapping valves are as follows:

(1) Clow Valve Company  
(2) M & H Valve Company  
(3) American Flow Control  
(4) U.S. Pipe and Foundry Company  
(5) Mueller Company  
(6) Kennedy Valve Company
**VALVE BOXES:** Cast iron valve boxes will conform to ASTM A48, Class 30B. All boxes will conform to the shape and dimensions shown on the City of Winston-Salem detail drawings and will be free from holes, cracks or any other defects. All castings will be thoroughly coated with an asphaltic varnish. The name of the manufacturer shall be permanently cast on each piece. Valve boxes that do not meet specifications shall be rejected. Cast iron valve boxes furnished under these specifications shall be manufactured by one of the following:

(1) Sigma Corp.
(2) SIP Industries
(3) DSI International

**VITRIFIED CLAY PIPE AND FITTINGS:** Vitrified clay pipe shall be manufactured in accordance with ANSI/ASTM C700, tested in accordance with ANSI/ASTM C301 and shall be classified as extra strength pipe. The specific type of joint shall be the O-ring compression type joint. This joint shall conform to ANSI/ASTM C425. All pipe will be unglazed. All pipe shall be subject to inspection by the Engineer and his acceptance or rejection will be final. The unit price for vitrified clay pipe shall include the furnishing of necessary vitrified clay pipe, labor, supervision, equipment and tools necessary for installing the pipe as shown on the Engineer's drawings or as may be directed by the Engineer. The unit price shall also include all excavation (except rock excavation), furnishing and placing suitable backfill, hauling and unloading of all pipe and removal and disposal of all rigid and flexible pavement. Payment for pipe installation will not be made until the areas disturbed by the pipe installation have been restored to their original grade and satisfactorily seeded and mulched. Pipe shall be manufactured by one of the following:

(1) Logan Clay Products Company
(2) Superior Clay Corporation
(3) Can Clay Corporation
SECTION B

METHODS OF CONSTRUCTION

1. GENERAL

MOBILIZATION: The work covered by the bid item "Mobilization" consists of preparatory work and operations, including but not limited to those necessary for the movement of personnel, equipment, supplies, and incidentals to the project site, for the establishment of offices, buildings, and other facilities necessary for work on the project; removal and disbandment of those personnel, equipment, supplies, incidentals, or other facilities that were established for the prosecution of work on the project; and for all other work and operations which must be performed or for costs incurred prior to beginning work on the various items on the project site. All work will be paid for at the Contract lump sum price for "Mobilization".

Partial payments for the item of "Mobilization" will be made with the first and second partial pay estimates paid on the Contract, and will be made at the rate of 50 percent of the lump sum price for "Mobilization" on each of these partial pay estimates, less retainage, provided the amount bid for "Mobilization" does not exceed 5 percent of the total amount bid for the Contract. Where the amount bid for the item of "Mobilization" exceeds 5 percent of the total amount bid for the Contract, 2-1/2 percent of the total amount bid will be paid on each of the first two partial pay estimates, and that portion exceeding 5 percent will be paid on the last partial pay estimate. All such payments will be made less the retainage.

EASEMENTS: The necessary easements for construction for all pipe lines under this Contract which are not on street right-of-way will be secured by the City of Winston-Salem. Easements will normally be as follows: permanent easements - 20 feet; construction easements - 30 feet. The Contractor shall stay within the construction easement. If the Contractor desires an additional easement for easier access, storage, or any other purpose, it will be his/her responsibility to obtain the easement from the individual property owner. If the Contractor desires such additional easement he shall acquire same from the property owner and present a signed easement agreement satisfactory to the City prior to entering upon such additional easement to perform the work. Such work will begin only after the Contractor receives written approval from the City. Failure to comply with these terms relating to easements by the Contractor shall constitute breach of this Contract. The City will not be responsible for, and the Contractor shall hold the City harmless from, any damages or claims from property owners resulting from the Contractor working outside the easements obtained by the City. The Contractor shall not receive any additional compensation for any delays due to acquisition of easements by the City.

All trees, buildings, etc., within the 20' permanent easement will be removed unless otherwise directed by the Engineer. If necessary for construction of the pipe line, any trees, buildings, etc., within the construction easement may be removed by the Contractor. Any trees, buildings, etc. that are to be saved shall be designated on the Engineer's drawings and/or marked by a City survey party. If property owners desire to keep wood from trees, they are requested by the City to remove trees prior to the
Contractor commencing clearing and grubbing activities. After beginning such activities, trees, buildings, etc., are to become the property of the Contractor.

**SAFETY PROVISIONS AND TRAFFIC CONTROL:** The Contractor shall provide adequate barricades, construction signs, warning lights, guards and traffic flagmen as required by the Engineer. Such protection shall be maintained during the progress of the construction work and until it is safe for traffic to use the roadway. All material piles, equipment and pipe which may serve as obstructions to traffic shall be enclosed by barricades and shall be protected by proper lights. The rules and regulations of the local authorities and the North Carolina Department of Transportation regarding safety provisions and traffic control shall be observed at all times.

The Contractor shall carry on the work in a manner which will cause the least interruption to traffic and may close a street only with the permission of the Engineer and/or the City Department of Transportation. Should it become necessary to allow only one way traffic, the Contractor shall provide one flagman with a stop-slow paddle for each end of the one way strip for proper direction of traffic.

The standard procedures for construction signing of the North Carolina Department of Transportation and the Manual on Uniform Traffic Control Devices shall be followed. One example of these procedures is shown on a City of Winston-Salem detail drawing contained herein. Where this procedure proves impractical, a suitable signing system will be devised prior to construction and may be substituted with the approval of the Engineer.

Traffic along State roads is to be maintained at all times and is not to be interfered with during peak hour traffic flow, generally considered to be between 7:00 a.m. and 9:00 a.m. and 4:00 p.m. to 6:00 p.m. All traffic control devices are to be in accordance with the latest edition of the Manual on Uniform Traffic Control Devices.

The Contractor will not be directly compensated for any traffic control measures necessary, as this work will be considered incidental to the work covered by the various Contract items.

**PAVEMENT REMOVAL:** All rigid or flexible pavement, sidewalk, driveways, etc., to be removed under this Contract shall be completed as specified herein. All such removal (including hauling and disposal) shall be included in the price bid for furnishing and installing pipe unless specified otherwise.

The Contractor shall cut the pavement with a saw or other approved means at the location indicated on the designated detail drawing. Under no circumstances will the Contractor be allowed to pull up pavement without prior cutting. All cutting will be neat and straight. The width of pavement cuts shall not exceed the width indicated on the designated detail drawing.

Should pavement be damaged outside the area specified above, the Contractor will be charged $4.60/square foot for excessive pavement cuts. This shall also apply to pavement damaged away from the trench area. Any charges arising under this provision will be deducted from Contract payments.
CLEARING AND GRUBBING: The work of clearing shall consist of the cutting, removal, and satisfactory disposal of all vegetation and debris in wooded areas.

The work of grubbing shall consist of the removal and satisfactory disposal of all vegetation and surface debris. Where the material being removed is high in organic matter content, such as root mat and other vegetative matter, it shall be considered vegetation and removed as part of the work of grubbing.

The work of clearing and grubbing shall also include the removal and satisfactory disposal of stumps, crops, weeds, and other annual growth; the removal and satisfactory disposal of fences, steps, walls, chimneys, column footings, signs, junked vehicles, and other rubble and debris; and the filling of holes and depressions.

Clearing and grubbing operations shall be completed sufficiently in advance of trenching operations as may be necessary to prevent any of the debris from the clearing and grubbing operations from interfering with the trenching operations.

All work under this section shall be performed in a manner which will cause a minimum of soil erosion. The Contractor shall perform such erosion control work, temporary or permanent, as may be directed by the Engineer and as shown on the plans in order to satisfactorily minimize erosion resulting from clearing and grubbing operations.

Failure on the part of the Contractor to perform the required erosion control measures will be just cause for the Engineer to direct the suspension of clearing and grubbing operations. The suspension will be in effect until such time as the Contractor has satisfactorily performed the required erosion control work.

(a) Clearing

The work of clearing shall be performed within the limits required by the plans, or as established by the Engineer.

The Engineer will designate all areas of growth or individual trees which are to be preserved due to their desirability for landscape or erosion control purposes. When the trees to be preserved are located within the construction limits, they will be so shown on the plans or designated by the Engineer.

The Contractor shall conduct his operations in a manner to prevent limb, bark, or root injuries to trees, shrubs, or other types of vegetation that are to remain growing and also to prevent damage to adjacent property. When any such injuries unavoidably occur, all rough edges of scarred areas shall first be made reasonably smooth in accordance with generally accepted horticultural practice, and the scars then thoroughly covered with an asphaltum base tree paint. Any such plants that are damaged by any construction operations to such an extent as to destroy their value for shade or other landscape purposes, shall be cut and disposed of by the Contractor, without extra compensation, when so directed by the Engineer.
(b) Grubbing

Within the areas between construction limits and the limits of clearing and grubbing, all holes and other depressions shall be filled, and the area brought to sufficiently uniform contour that subsequent mowing operations will not be hindered by irregularity of terrain. This work shall be done regardless of whether the irregularities were the result of the Contractor's operations or were originally existing.

(c) Disposition of Timber, Stumps, and Debris

The property owner will have no right to use or reserve for his use any timber after the Contractor commences his clearing and grubbing activities. All timber cut during the clearing operations is to become the property of the Contractor, and shall be removed by him.

The Contractor shall not cut any timber beyond the clearing limits established by the Engineer nor shall he cut any timber which is to be preserved for landscape or erosion control purposes except at the direction of the Engineer.

All timber, stumps and debris shall be disposed of in a manner acceptable to the Engineer.

(d) Basis of Payment

The work of clearing and grubbing will be paid for at the lump sum price for “Clearing and Grubbing.” The acreage shown on the lump sum bid item is provided to assist the Contractor in establishing a bid price and to properly distribute the cost of clearing and grubbing to the various projects in the Contract. The acreage will also be used as a basis for making Contract additions. A percentage of the lump sum bid will be paid the Contractor as the work progresses. The bid price and payments will be full compensation for all work covered by this section including but not limited to the removal and disposal of all surface vegetation; the removal and disposal of all fences, steps, walls, chimneys, column footings, other footings, foundation slabs, basements, other foundation components, signs, junked vehicles, and other rubble and debris; and the dressing up of all areas between the construction limits and the right-of-way or easements shown on the plans.

EXCAVATING AND BACKFILLING TRENCHES FOR ALL PIPE LINES: All excavation will be of one classification regardless of the nature of the material encountered, except for solid rock formation in trenches. This will be paid for by the cubic yard at the unit price given for "Rock Excavation." This will include the cost of furnishing all labor, equipment, and material required for the removal and disposal of the rock and the cost of providing suitable material for bedding of the pipe and backfilling the excavation. The width of the trench allowed in rock excavation will be three feet (3') greater than the nominal diameter of the pipe to be laid. Where rock is encountered in excavating for manholes, rock will be figured for the outside diameter of the structure plus three feet (3').
Rock excavation will include the excavation of all solid ledge rock which cannot be removed by ordinary excavating equipment. All boulders greater than one cubic yard in size will also be considered rock excavation.

Should rock be encountered in trenches, it will be uncovered in sections not less than fifty feet (50') in length and the Engineer immediately notified in order to enable him to obtain a record of it. Rock removed without such record having been made shall not be paid for. Rock excavation shall be carried six inches (6") below the bottom of the pipe and shall be so paid for. Rock excavation for manholes shall be carried six inches (6") below the bottom of the manhole and shall be so paid for. The trenches will be brought back to grade by the pipe laying crew with suitable material, properly compacted and no extra compensation shall be paid for such refilling.

All blasting operations will be conducted in strict conformance with the existing ordinances of the City of Winston-Salem (or any other governing authority) and accepted safe practices relative to the storage and use of explosives. Blasting will be done only by experienced personnel. Extreme care and precaution will be used to prevent injury to workmen and to existing pipe, buildings or other structures either below or above the surface of the ground. Sufficient warning will be given to all persons in the area prior to blasting. The Contractor will be responsible for all damage due to blasting operations.

Trenches for pressure lines (water or sanitary sewer) will, wherever possible, have continuous grades between air valves and blow-offs or hydrants so as to avoid air pockets and will be of sufficient width to give room for properly making the joints. Trenches will be of such depth as to provide a minimum of 36 inches of cover above the top of all pressure lines. The price for excavating and backfilling trenches (except for rock excavation) will in all cases be included in the unit price for pipe.

Backfilling along the sides of the pipe and immediately above the pipe will be done by hand with extreme care. On large pipe lines (12" and above), backhoes or other equipment may be used upon approval by the Engineer. In order to insure proper grade and alignment and to insure that backfill material is distributed under the pipe properly, each joint of pipe shall be backfilled to the center of the pipe and hand tamped as each joint is laid.

All trench backfill under paved areas (or proposed paved areas), parking areas, sidewalks and shoulders shall be compacted to a density of at least 95 percent of maximum dry density as determined by AASHTO T99. The final 12" of subgrade shall be compacted to 100 percent density (see pavement repair detail drawings). Cross country water lines or sanitary sewer outfalls shall have backfilled compaction of 90 percent density unless otherwise directed by the Engineer.

From one (1) foot above the top of the pipe to the subgrade, material containing rocks or stones up to 2 inches in their greatest dimension may be used. Otherwise, rock shall not be used as backfill.

Suitable backfill shall be defined as loam, clay, sand, gravel or other materials satisfactory to the Engineer.
Under no circumstances shall pipe be laid in water. The Contractor shall not have open in excess of two hundred (200) feet of water and/or sewer main trench at one time. Backfilling shall be completed at the end of each day's work.

**INSTALLATION OF STEEL ENCASEMENT PIPE:** Encasement pipe shall be installed by dry boring and jacking. The boring auger shall be mounted inside the encasement pipe. The installation of the pipe and the boring of the hole shall be done simultaneously. As the boring operation progresses each new section of encasement pipe shall be butt welded to the previously installed section. Voids are to be filled with a Portland cement grout consisting of one (1) part Portland cement grout to three (3) parts sand at sufficient pressure to insure there will be no settlement of the highway or railroad. Encasement pipe shall be sealed at the ends with an approved rubber seal to prevent flowing water or debris from entering the space between the encasement pipe and the carrier pipe. Encasement pipe shall be installed prior to laying the carrier pipe within 50 feet of either end of the encasement. The Contractor is responsible for using the methods and equipment needed to attain the alignment, grade and elevation shown on the Engineer's drawings. Any deviations shall be corrected at the expense of the Contractor.

All carrier pipe shall be ductile iron flexible restrained joint pipe. Casing spacers are required and shall be placed at 10 foot intervals within the encasement. One spacer shall be placed not more than 2 feet from each end of the encasement. Only the runners of the casing spacer shall be in contact with the encasement. The bell of the carrier pipe will not be allowed to be in contact with the encasement. The Engineer must be present to observe the entire installation of the carrier pipe. The cost of furnishing and installing casing spacers shall be included in the unit price for encasement pipe.

In the event that an obstruction is encountered during the dry boring operation, the auger is to be withdrawn, the excess pipe cut off and capped, and the void completely filled with Portland cement grout as described above. If the Contractor installs the encasement according to the Engineer's Drawing, the Contractor will be paid for actual footage installed in the event an obstruction is encountered. Open cutting will not be allowed unless approved by the North Carolina Department of Transportation. When encasement pipe is installed on railway rights-of-way, the Contractor must obtain all insurance required by the railway. The cost of insurance shall be included in the unit price for encasement pipe.

2. **SANITARY SEWER**

**INSTALLATION OF SANITARY SEWER PIPE:** All materials for laying and jointing the pipe in the trench will conform to the specifications for such material herein given and will be furnished by the Contractor. Grade lines for aligning and grading the pipe in the trench will be established by the Engineer, and all labor and material required will be furnished by the Contractor. Pipe laying in general will conform to ASTM C12. Pipe shall be paid for according to the depth from the original ground elevation of the centerline of the trench to the invert of the pipe. Pipe laid deeper than proposed (due to Contractor error) shall be paid for at proposed depth. Pipe laid shallower than proposed shall be paid for at shallower depth. Quantities shall be determined based on the as-built horizontal distance from center of manhole cover to center of manhole cover.
Tie-ins (including connections) to all existing manholes will be made by coring a hole in the manhole wall and installing a flexible sleeve. Cores will be paid for at the appropriate unit price named in the Contract.

Prior to being lowered into the trench, each pipe will be inspected by the crew foreman. Faulty pipe shall be rejected and removed from the work site.

No pipe will be laid within ten (10) feet of excavation operations or within thirty (30) feet of rock which must be blasted for removal. The open end of all pipes will be plugged when pipe laying is not in progress, and all pipe will be protected against injury from falling rock when blasting.

Pipe will be laid with the bell ends facing the direction of laying. A bell hole will be dug for each bell, but only of sufficient size to insure that the pipe will bear evenly throughout its length on the bottom of the trench.

Bedding for vitrified clay pipe on stable subgrade shall be in accordance with the City of Winston-Salem detail drawing. The limits for bedding will normally be shown on the profile of the Engineer’s drawing. When unstable subgrade is encountered, pipes shall be bedded on stabilization stone. The bedding shall have a minimum thickness beneath the pipe of four inches (4”) or one-eighth of the outside diameter of the pipe, whichever is greater. The required thickness shall be determined by the Engineer. All bedding stone will be paid for at the price named for "Stabilization Stone."

The Contractor is solely responsible for meeting all invert, grade, and alignment requirements. In the event the Contractor fails to meet these requirements, the Contractor shall remove any manholes and/or pipe and correct the problem. No additional compensation will be allowed.

Whenever the Engineer's drawings show, or for other reasons it may be necessary to substitute ductile iron pipe for vitrified clay pipe, the Contractor will furnish all necessary labor, equipment and material to install the pipe at the unit price for ductile iron at that specific depth. When changing from vitrified clay to ductile iron, a donut manufactured by Fernco, Inc. or approved equal or a flexible coupling with two stainless steel clamps, manufactured by Fernco or approved equal, may be used to make the joint. When changing from ductile iron to vitrified clay, the flexible coupling will be used. Twelve inches of stabilization stone will be used around all joints where couplings or donuts are used. All ductile iron shall meet the specification for "Ductile Iron Pipe" and shall be installed in accordance with water line specifications.

Backfilling of trenches will be carefully done with selected material thoroughly tamped to a point above the top of the pipe as specified under "Excavating and Backfilling Trenches for All Pipe Lines."

Upon completion of the entire work all lines will present a clean and unbroken barrel. The Engineer will not accept any pipeline or manhole which contains silt, sediment, or other foreign material. The Contractor shall at his expense flush, or otherwise cause the line (and manholes) to be cleaned out without any foreign material being discharged into the existing sanitary sewer system. The Contractor will be responsible for the complete
removal of all plugs. Any defective lines will be repaired by the Contractor at his own expense. Any materials left along the line of the trench after work on the sewer is completed will be removed by the Contractor, and if not owned by the Contractor, stored as directed by the Engineer.

**SANITARY SEWER MANHOLES:** Manholes shall be built at the locations shown on the Engineer's drawings. Manholes shall be constructed of precast reinforced concrete. Construction will conform to City of Winston-Salem detail drawings. Depth of manholes shall be as shown on the Engineer's drawings.

Standard manholes shall have a depth of six feet (6') from the top of the manhole cover to the invert at the center of the manhole. Depths in excess of 6' shall be paid for separately at the price named for "Extra Depth Manholes." Manholes installed deeper than proposed (due to Contractor error) shall be paid for at the proposed depth. Manholes installed shallower than proposed shall be paid at the shallower depth.

Manhole shelves and channels can be constructed of brick and mortar, Class AA concrete or be of the precast type. Channels shall be built to a depth of three-quarters of the diameter of the pipe and shall conform to the inside diameter of the influent and effluent pipes. The channel shall be constructed from the invert of the influent pipe to the invert of the effluent pipe. The channel shall be smooth in order to avoid any turbulence in the manhole. Four inch (4") connections will be allowed to spill into manholes. Pipes greater than 4" will not be allowed to spill into manholes. Manhole shelves shall slope from the manhole wall to the channel. The shelf at the wall shall be a minimum of three inches (3") higher than the shelf at the channel. A maximum of two inches (2") shall be allowed for the protrusion of the influent and effluent pipes beyond the inside wall of the manhole.

All manhole joints shall be sealed on the outside of the manhole with butyl adhesive tape (minimum 6" wide). The tape shall be EZ-Wrap by Press-Seal Gasket Corp. or approved equal.

Manholes on outfalls shall be built 24" above existing ground unless a Type "B" manhole is used or the manhole is in a yard.

Precast reinforced concrete manholes used on right-of-way maintained by the North Carolina Department of Transportation must be approved by the North Carolina Department of Transportation before being installed.

When unstable subgrade is encountered, manholes shall be bedded on stabilization stone. All stone will be paid for at the price named for "Stabilization Stone".

The Contractor shall be responsible for adjusting the manhole ring and cover to street grade. All points on the top edge of the ring and cover shall match street grade before the Contractor is relieved of any further adjustments. Final adjustment is generally determined at the time of the street cut repair.
**DROP MANHOLES:** Whenever the vertical distance between the influent and effluent pipes is 30" or more, the Engineer will require a special drop pipe to be built into the manhole. If the distance is less than 30", the influent pipe will come into the manhole on the invert of the channel unless the shelf is noted on the Engineer’s drawings. The drop will consist of a tee in the main sewer where it enters the manhole, a vertical drop pipe down the side of the manhole and a 90 degree bend at the bottom of the drop pipe. See Winston-Salem detail drawings for further specifications on drop manholes. Payment for the drop pipe, fittings, nipples, straps, etc. (manhole will be paid for separately at the price for "Manholes") will be included in the unit price per vertical foot for "Drop Assembly." The distance paid for shall be measured from the invert at the top of the drop pipe to the invert at the bottom of the drop pipe.

**SEWER CONNECTIONS:** Sewer connections shall be installed as shown on City of Winston-Salem detail drawings. Wyes will not be allowed within 5 feet of a manhole. Only one bend will be allowed for connecting the sewer connection to the sewer main. If more than one bend is needed (Ex: bored sewer connection), the road shall be open cut and the connection installed properly. Connections into manholes will require a flexible sleeve at the manhole. Four-inch (4") connections will be allowed to spill into manholes. Four-inch (4") connections will be allowed to spill into manholes. For connections which spill, the 4" pipe shall protrude a minimum of 4" and a maximum of 6" beyond the inside wall of the manhole. Connections into manholes must be at least 6" from the nearest manhole step. Sewer connections shall be a maximum of 75 feet from the sewer main to the cleanout. Six-inch (6") connections must connect into a manhole. Cleanouts shall be installed between property corners of the lot for which the connection is intended.

**SEWER FORCE MAINS (PVC):** Installation (including pressure testing) shall conform to Methods of Construction for water pipe contained hereafter. Disinfection will not be required. PVC pipe will be handled with care and shall not be dumped, dragged, dropped or thrown. Heavy materials must not be top loaded on PVC pipe. PVC pipe shall not be stored uncovered in direct sunlight. Trenches will be carefully graded to insure continuous and equal bearing the full length of all joints. Backfilling of trenches will be carefully done with selected material removing all sharp rocks. Air release valves shall be located at all high points as shown on the Engineer’s drawings.

A solid copper-clad steel tracer wire of #12 gauge (or larger) with a 30 mil green high density polyethylene (HDPE) insulation shall be installed with all buried plastic PVC force mains. The tracer wire shall be installed directly over and on the center of the pipe. Wire nut splices shall not be allowed. After installation, the tracer wire shall be tested for continuity. The tracer wire shall be considered acceptable when a continuous non-interrupted read is obtained for the entire length of the pipe line. A 6” wide identification tape printed with the wording “SEWER” shall be installed 18 inches above the pipe. The tracer wire and identification tape shall be considered incidental to force main construction.
VACUUM TESTING OF MANHOLES: Each manhole constructed by the Contractor shall be vacuum tested by the Contractor after assembly of the manhole. The test shall be conducted in accordance with ASTM C-1244. The test shall be performed after all grade rings and rings and covers have been installed. After the testing equipment is in place, a vacuum of 10 inches of mercury shall be drawn on the manhole. The time for the vacuum to drop to 9 inches of mercury must be greater than the minimum time listed below:

<table>
<thead>
<tr>
<th>Manhole Depth</th>
<th>Diameter of Manhole</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>48”</td>
</tr>
<tr>
<td>0 - 10'</td>
<td>60 sec.</td>
</tr>
<tr>
<td>10 - 15'</td>
<td>75 sec.</td>
</tr>
<tr>
<td>15 - 25'</td>
<td>90 sec.</td>
</tr>
<tr>
<td>25 - 30'</td>
<td>105 sec.</td>
</tr>
</tbody>
</table>

The Engineer shall be present during the entire testing process. Any repairs to manholes which fail the vacuum test must be made on the inside and outside of each manhole. The cost of vacuum testing shall be included in the unit price for manholes.

ACCEPTANCE TESTING: After the pipeline is completely backfilled and before being placed into service, a low-pressure air test with an approved pressure gauge will be conducted by the Contractor in accordance with ASTM C-828. Each section of pipeline (including connections) between manholes will be tested by plugging the upstream manhole and the downstream manhole. By using mirrors, lights, etc., the Contractor must show the Engineer that the 2 plugs are at the proper location and that the line is clear between the plugs. Air is added to the line until the pressure is between 3.0 psi and 4.0 psi. If the pressure drops more than 1.0 psi during the time shown on the chart below, the line is presumed to have failed the test. If the top of the pipe to be tested is below the ground water table, an infiltration test may be required. Infiltration shall not exceed 100 gallons per inch diameter per mile of pipe per 24 hours. An obvious leak in any section will be corrected even if the section passes testing. The Engineer must be present during the entire testing process. Any work done without his supervision will not be accepted. Air testing will be required for pipelines 42” and smaller. Larger pipelines will require infiltration and/or exfiltration testing. The cost of testing shall be included in the unit price for pipe. Exfiltration limits shall be the same as infiltration. Air test time shall be as follows:
### MINIMUM AIR TEST TIME

<table>
<thead>
<tr>
<th>Main Size</th>
<th>Time (minutes per 100 feet of pipe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8&quot;</td>
<td>1.5</td>
</tr>
<tr>
<td>10&quot;</td>
<td>1.8</td>
</tr>
<tr>
<td>12&quot;</td>
<td>2.1</td>
</tr>
<tr>
<td>15&quot;</td>
<td>2.4</td>
</tr>
<tr>
<td>18&quot;</td>
<td>2.7</td>
</tr>
<tr>
<td>21&quot;</td>
<td>3.3</td>
</tr>
<tr>
<td>24&quot;</td>
<td>3.9</td>
</tr>
<tr>
<td>27&quot;</td>
<td>4.5</td>
</tr>
<tr>
<td>30&quot;</td>
<td>5.1</td>
</tr>
<tr>
<td>36&quot;</td>
<td>6.3</td>
</tr>
<tr>
<td>42&quot;</td>
<td>7.6</td>
</tr>
</tbody>
</table>

**VIDEO INSPECTION**: As a final measure required for acceptance, the Contractor shall clean and televis all sanitary sewer mains prior to requesting final inspection. The Contractor shall televis the entire sewer main and all service connections. The process shall begin at the upstream manhole for each segment, and proceed to the downstream manhole for that same segment. Connections shall be televised from the cleanout to the main. Video inspection may occur only after Record Drawings are accepted and approved by the City of Winston-Salem. Prior to video inspection of mains in paved areas, structures must be raised to final grade and 2" of asphalt must be in place. The City will not accept video that is more than 90 days old unless approved by the Engineer.

The camera used for inspection shall be one specifically designed and constructed for sanitary sewer pipeline inspection. Lighting for the camera shall be suitable to provide a clear color picture of the entire periphery of the pipe. The camera must be able to pan and tilt in order to allow for 360 degree viewing. The camera must also be capable of receiving and transmitting a picture having not less than a resolution of 320(x) by 240(y). The television system shall be equipped to indicate the camera travel distance in feet by display on the video viewing screen. All television equipment (camera, monitor, etc.) must be capable of producing picture quality which is satisfactory to the Engineer.

Prior to video inspection, the Contractor shall clean the sewer mains with a high velocity water jet. All debris shall be collected in the downstream manhole and removed by the Contractor. Debris shall not be released into the existing sewer system. During the entire video process, the distance counter must be set at zero at the upstream manhole for each segment (i.e. reset the counter to zero at each manhole). The Contractor will be required to pan and tilt at each manhole and at each service connection. Each manhole must be marked with the manhole station on the interior with paint or some other legible identifier. Each cleanout stack must be marked with the house number or the lot number. The Contractor will also be required to pan and tilt when any potential problems or abnormalities are noticed or suspected. Maximum travel speed for the camera will be 30 feet per minute. The following video screen data will be required:
• Project name and project number
• Date of inspection
• Travel distance and time
• Station of start and end manholes
• Depth of start and end manholes
• Size of main
• Type of pipe

All above data shall be shown at the start and end manholes of each segment. While the camera is moving through the pipe, distance shall be the only data shown on the screen (top left or top right of screen).

The entire video inspection shall be submitted to the Engineer on DVD (2 copies) and formatted with software compatible and readable by the City of Winston-Salem. The City of Winston-Salem shall not be responsible for purchasing additional software necessary to view the DVD.

Any video that does not clearly show the pipe and service connections will be rejected. In the event that repairs are made, the segment receiving the repairs shall be flushed and televised again. The Engineer must oversee the entire cleaning and televising process. Prior to beginning the process, a 24 hour notice must be given by the Contractor to the Engineer. The cost of cleaning and televising shall be included in the unit price for pipe.

3. WATER

INSTALLATION OF WATER PIPE: The bid price for water mains will include the pipe and the installation of the pipe to a depth as shown on plans at all locations required by the Engineer. Minimum cover will be 36 inches. Pipe laying for ductile iron in general will conform to ANSI/AWWA C600. Pipe laying for PVC in general will conform to ANSI/AWWA C605. Pipe shall be paid for based on the total horizontal centerline distance along the water main. No deduction will be made for valves, fittings, manholes, etc.

All material for the laying and jointing ductile iron and PVC pipe in the trench will conform to the specifications for such material as hereinbefore given and will be furnished by the Contractor. Pipe, fittings, valves and other pipe line accessories shall be loaded, transported, unloaded, stored, handled and installed by methods that will insure final installation in a sound and undamaged condition. Ductile iron pipe and fittings shall be handled in such a manner that neither the lining nor the coating will be damaged. PVC pipe shall be loaded and unloaded in accordance with the manufacturer’s published recommendations. Recommended hauling devices, such as hooks inserted in the ends of pipe, shall have well-padded surfaces. All PVC water pipe will be shipped and stored at the project in such a manner as to be protected from exposure to direct sunlight and heat sources such as engine exhaust. Ductile iron pipe and fittings in which the linings are broken or loosened in unloading or subsequent handling shall be rejected by the Engineer. Under no circumstances shall water main pipe, fittings or valves be dropped to the ground onto or against hard or solid objects or materials, or otherwise subjected to possible damage from impact or shock. In distributing pipe line materials at the site of the work, each piece shall be unloaded opposite or as close as possible to the installation.
in order to avoid unnecessary rehandling. All gaskets shall be stored out of direct sunlight.

All pipe will be thoroughly cleaned of all earth and rubbish before being placed in the trench. Pipe will be laid on true lines and grades as directed by the Engineer. Pipe shall normally be laid with the bell ends facing the direction of laying. Bell holes will be dug at each joint to assure the pipe barrel will lie flat on the trench bottom. Every open end of the pipe will be securely plugged when pipe laying is not in progress. Pipe will be placed on firm foundation so as to prevent subsequent settlement and the trenches will be carefully excavated to the proper grade so that it will not be necessary to fill-in under the pipe. Under no circumstances shall pipe be laid in water, and no pipe shall be laid under unsuitable weather or trench conditions. A maximum of 200 feet of open trench shall be allowed in the process of excavation.

Ductile iron mechanical joints shall be installed as follows:

The bell, spigot, gland and gasket shall be wiped clean (and wire brushed if necessary) of all dirt, sand, etc. The bell, spigot and gasket shall then be coated with soapy water or approved pipe lubricant and the gland and gasket slipped over the spigot end of the pipe. The spigot shall then be centered in the bell and the gasket carefully pushed evenly into the bell. The gland shall be pushed up to the gasket with the gland being parallel to the face of the bell. Bolts shall be inserted and the nuts tightened uniformly by hand until snug. At this point the joint may be deflected if so desired. Final tightening of the bolts shall be done with a ratchet torque wrench, unless the Engineer decides that a non-torque wrench is acceptable. It is essential that the gland be brought toward the pipe bell evenly, maintaining approximately the same distance between the gland and the face of the bell at all points. This may be done by partially tightening the bottom bolt; then the top bolt; next, the bolts on either side; and finally the remaining bolts, alternately tightening bolts 180 degrees apart. This cycle is then to be repeated until all bolts are tightened to a torque as listed below:

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>BOLT SIZE</th>
<th>TORQUE (FOOT-POUNDS)</th>
<th>LENGTH OF NON-TORQUE WRENCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>3”</td>
<td>5/8”</td>
<td>45 – 60</td>
<td>8”</td>
</tr>
<tr>
<td>4” – 24”</td>
<td>3/4”</td>
<td>75 – 90</td>
<td>10”</td>
</tr>
<tr>
<td>30” – 36”</td>
<td>1”</td>
<td>100 – 120</td>
<td>14”</td>
</tr>
</tbody>
</table>

If effective sealing is not obtained at the maximum torque specified for the size of bolt used, the joint shall be disassembled, thoroughly cleaned and reassembled. Overstressing of bolts to compensate for poor installation practice will not be permitted.

Ductile Iron push on joints shall be installed as follows:

All interior bell and exterior spigot surfaces shall be cleaned, the gasket installed in the bell, and all joint surfaces lubricated with the pipe manufacturer's lubricant. Lubricant shall be applied according to each manufacturer's recommendations. Gaskets from
different pipe companies are not interchangeable. The spigot end must be beveled. The spigot shall then be pushed straight into the full depth of the bell. The spigot end of the pipe shall not be allowed to touch the ground or trench wall after lubrication. The joint may be deflected only after the joint is assembled. All instructions and recommendations of the pipe manufacturer relative to gasket installation and jointing operations shall be observed and followed by the Contractor. It is essential that each gasket is in proper position when the pipe is "shoved home." A leaking joint will result from an improperly made joint. Each defective joint, if any, discovered after pipe has been laid, shall be repaired by and at the expense of the Contractor by a method acceptable to and approved by the Engineer.

Joint deflection for mechanical and push-on joints shall in no case be greater than 80 percent of the maximum recommended by the pipe manufacturer and/or ANSI/AWWA C600.

2” PVC push on joints shall be installed as follows:

All instructions and recommendations of the pipe manufacturer relative to gasket installation and jointing operations shall be observed and followed by the Contractor. All interior bell and exterior spigot surfaces, the fitting and the elastomeric gaskets shall be cleaned. Factory installed gaskets should not be removed. The pipe manufacturer’s lubricant shall be applied in accordance with the pipe manufacturer’s published recommendations. The spigot end of the pipe shall not be allowed to touch the ground or trench wall after lubrication. The elastomeric gasket will have been factory installed in most bell joints. If the gasket is not pre-installed, position the gasket in the annular groove of the bell or coupling. To assure compatibility, only gaskets supplied by the particular pipe and fitting manufacturer(s) shall be used. Pipe spigot ends are pre-marked at the factory with a circumferential insertion line. This line references how far the spigot should be inserted into the adjoining PVC pipe bell. Field-cut pipe spigot ends shall be marked and beveled to match the manufacturer’s insertion line. Pipe-to-pipe joints shall be assembled to only to the insertion line. After assembly, the insertion line shall remain visible and be nearly flush with the lip of the adjoining PVC pipe bell. Joints assembled beyond the insertion line shall be considered over-assembled and may result in damaging stresses or leakage. The bell or coupler shall be in straight alignment with the pipe spigot end before and during joint assembly.

Pipe design laying condition shall be Type 2, flat-bottom trench with backfill lightly consolidated to centerline of pipe except when pipe is bent longitudinally within a curve. When installing pipe within a curve the pipe laying condition shall be Type 3, with the pipe bedded in a minimum of 4 inches of loose soil with backfill lightly consolidated to the top of the pipe. When laying 2” PVC in other than a straight line, the trench may be curved to change direction as shown on the plans and shall in no case be curved in less than a 50 foot radius. All curvature should be accomplished by bending the pipe rather than by deflecting the joints. There is no deflection allowed at the joints. To avoid deflecting the joints while achieving curvature, joints shall be sufficiently braced or backfilled and compacted to keep them stationary. It is essential that each gasket is in proper position when the pipe is "shoved home." A leaking joint will result from an improperly made joint. Each defective joint, if any, discovered
after pipe has been laid, shall be repaired by and at the expense of the Contractor by a method acceptable to and approved by the Engineer.

For installation of PVC pipe to PVC couplings or PVC fittings the above procedure shall be followed except the factory-applied insertion line may not provide for proper depth of assembly. The Contractor shall determine the proper insertion depth by measuring the inside depth of the fitting bell or coupler and subtracting no less than 0.5 in. while also ensuring that full engagement of the gasket with the joined pipe spigot will occur. The Contractor shall mark new insertion line(s) on the pipe spigot(s) to be joined. After assembly, the new insertion line shall be nearly flush with the lip of the adjoining coupler or PVC fitting bell. When installing PVC pipe to metallic fittings, the insertion depth is generally less than those of PVC pipe and fittings. Before assembly or insertion, the Contractor shall make sure the pipe spigot end is squarely cut, deburred and given only a slight outer bevel. If the pipe spigot end has the factory bevel, the factory bevel shall be removed or shortened to ensure that when assembled the gasket will be in full contact with the nonbeveled portion of the pipe outside diameter. The fitting manufacturer’s assembly recommendations shall be followed.

A solid copper-clad steel tracer wire of #12 gauge (or larger) with a 30 mil blue high density polyethylene (HDPE) insulation shall be installed with all buried plastic water mains and connected to blow-off assemblies and services. The tracer wire shall be installed directly over and on the center of the pipe. The tracer wire shall be installed so that electrical continuity is maintained throughout the pipe system. As few connections as possible shall be made in the tracer wire. Connections will be made using a corrosion proof connector recommended for direct burial use. Wire nut splices shall not be allowed. After installation, the tracer wire shall be tested for continuity. The tracer wire shall be considered acceptable when a continuous non-interrupted read is obtained for the entire length of the pipe line. For blow-off assemblies and water services connected to plastic water main pipe, tracer wire shall be spliced to water main tracer wire and extended to the water meter box. A 6” wide identification tape printed with the wording “WATER” shall be installed 18 inches above all PVC water pipe. The tracer wire and identification tape shall be considered incidental to water main construction.

Standard corporation cocks will be installed at any location as directed by the Engineer for filling, flushing or disinfecting the line. No extra payment will be made for corporation cocks so installed. They shall be left tightly closed after the line is completed.

All existing valves larger than 12" that must be operated shall be operated by the Utilities Division of the City of Winston-Salem. The Engineer must be present if existing valves are operated by the Contractor.

All manholes on State maintained right-of-way must be approved by the North Carolina Department of Transportation. Cast iron manhole rings and covers will be furnished and set in mortar. Covers will have the word "Water" cast thereon. Gate valves shall require cast iron valve boxes. Eight-inch PVC or 8" ductile iron pipe shall be centered over the
valve nut and the valve box placed over the 8" pipe (see City of Winston-Salem detail drawing).

All valves, hydrants and fittings will be placed in the line as indicated on the Engineer's drawings and in accordance with instructions from the Engineer. On stub outs, the Contractor shall be required to use retainer glands on the valve and on all fittings (see City of Winston-Salem detail drawing).

All taps shall be made after the water main has pressure. No "dry" taps will be allowed. On dead end mains, taps for permanent water connections shall not be made beyond the last hydrant or blowoff. Direct tapping of Ductile Iron (without a saddle) will be allowed in accordance with the following:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Maximum Size Tap Without Saddle</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&quot;</td>
<td>¾&quot;</td>
</tr>
<tr>
<td>6&quot;</td>
<td>1&quot;</td>
</tr>
<tr>
<td>8&quot;</td>
<td>1½&quot;</td>
</tr>
<tr>
<td>12&quot;</td>
<td>1½&quot;</td>
</tr>
</tbody>
</table>

Two (2) inch water mains taps to a 6 inch or larger water main shall be installed where shown on the Engineer’s drawings or as directed by the Engineer. The unit price for 2 inch tap shall include everything shown on the 2 inch water main tap to 6 inch or larger water main detail drawing.

Sleeves used for tieing to existing mains, etc. shall be made of ductile iron (minimum 12" in length). If after all pipe is homed up, the gap between the two plain ends is more than 1", a filler shall be cut to go between the two plain ends. The filler shall be at least 3" wide but not more than 5" wide, and the filler shall be ½" wider than the depth of the mechanical joint bell for that size of pipe.

Bell joint leak clamps shall be made of ductile iron.

All concrete and asphalt driveways less than 30 feet in width shall be bored (no encasement) for installation of all water pipe up to and including 8" pipe. The auger bit shall be just large enough to allow passage of the pipe bell through the bored hole. The Contractor shall be paid for the measured width of each driveway along the centerline of the water main plus five feet.

**CUTTING OF GRAY IRON DUCTILE IRON PIPE AND PVC PIPE:** Gray iron pipe will be cut with one of the following devices: Hydraulic cutters, wheel-type cutters or saw. Ductile iron pipe will be cut with a saw only. PVC pipe will be cut with a circular saw, handsaw or similar equipment. Any variations in the above-described must have prior approval of the Engineer. Pipe ends must be beveled if used for push-on joint.

**CONCRETE THRUST BLOCKS:** Concrete thrust blocks shall be constructed as directed by the Engineer at all bends, tees, tapping sleeves, tapping saddles, reducers, plugs, etc. to provide restraint against thrust resulting from internal pressure. Any exceptions to this such as restrained joints or mechanical joints with retainer glands will
be noted on the Engineer's drawings or otherwise specified. Thrust blocks will not be required for restrained joint pipe (exception - blocking will be required when connecting restrained pipe to existing pipe). All thrust blocks will be constructed of a minimum of Class A concrete. Thrust blocks for horizontal bends and fire hydrants shall be constructed in accordance with the City of Winston-Salem detail drawings. All blocking for vertical bends shall be designed and/or approved by the Engineer. On tie-in sections, the Contractor may be required by the Engineer, to anchor pipe bends, tees, etc. with precast concrete blocking, steel beams, rodding or other approved method to allow the water line to be placed back into service as soon as possible. Polyethylene shall be placed over all fittings before the concrete is poured. All nuts and bolts shall be clear of concrete so that the joint will be accessible. Plywood shall be used as forms for blocking. Concrete is to be poured only against stable undisturbed soil and should be allowed to set prior to any backfilling. Thrust blocks should be allowed to cure two days prior to pressure testing the water main. Higher strength concrete may be required when it is necessary to pressure test prior to the end of the two day curing time.

No direct payment will be made for thrust blocks where the size of the pipe is 12 inches in diameter or smaller; payment shall be included in the unit price for the pipe. For pipe larger than 12 inches, thrust blocks will be paid for as Class A concrete. The Contractor shall be responsible for presenting concrete delivery tickets to the Engineer at the time of delivery. Payment shall be based upon the quantity of concrete required by the Engineer.

**SETTING FIRE HYDRANTS:** The unit price for hydrants will include furnishing, unloading, hauling, and installing the hydrant in the location indicated on the drawings in accordance with the following specifications:

Hydrants will be set as shown on the Engineer's drawings or in accordance with specific instruction from the Engineer. Hydrant legs will be included with the quantity of 6" water pipe to be paid for and will be measured from the center of the main to the center of the hydrant.

A concrete thrust block will be poured behind and under the hydrant shoe. No. 57 stone will be placed around the base of each hydrant from the bottom of the thrust block to within 12 inches of the surface of the ground. Such material will extend at least 6 inches away from the hydrant barrel in all directions and particular care will be taken to prevent this material from becoming filled with earth or other improper material which will prevent proper drainage from the hydrant barrel. A 6" gate valve with box will be furnished and installed in each hydrant leg and will be paid for under the price proposed for 6" gate valves and boxes. Each hydrant shall be painted with at least one coat of yellow paint (See Fire Hydrants, Section A) after the hydrant has been set and final grade has been established.

Hydrants must be installed in accordance with the City of Winston-Salem detail drawing for hydrant and valve installation and may not be backfilled until inspected and approved by the Engineer. Hydrant extensions will be installed only if necessary and will be paid for at unit price for same. When installing a hydrant extension, care shall be taken to insure that the breakable safety coupling in the main valve stem is at the same location as the safety flange on the barrel. No payment will be made for the No. 57 stone used around each hydrant.
FLUSHING: Prior to pressure testing and disinfection, the Contractor shall flush all water mains with a polyurethane foam pipe pig (minimum 5 pounds per cubic foot density) by Knapp Poly Pig, Inc. or approved equal. The pipe pig shall be propelled hydraulically through the mains at a rate sufficient to remove all foreign matter. Valves shall be operated in a manner which will direct the pipe pig toward the end of the main or a selected discharge point. The pig shall be removed through an open end of the main, a fitting, or through a fire hydrant which has the main valve seat ring removed. Flushing shall continue until the Engineer determines that the mains are free from all foreign matter. The Engineer must be present during the entire flushing process. Any work done without his supervision will not be accepted. The cost of flushing shall be included in the unit price for pipe.

PRESSURE TESTING: After flushing of the water main is completed, all ductile iron water mains shall be tested in accordance with AWWA C600 - Section 4 and two (2) inch PVC water mains shall be tested in accordance with AWWA C605 – Section 7. The test shall be performed with all hydrant valves (4 ½" or 5 1/4") closed, but all hydrant leg valves (6") open. All corporation cocks shall be open and angle valves inside meter boxes will be closed. The number of sections to be tested at one time shall be determined by the Engineer. Testing shall not be performed within 24 hours after the new main is filled or within two days after the thrust blocks have been poured. Test pressure at the high point in the new main shall be 200 psi, and this pressure shall be maintained for no less than two hours. Test pressures above 200 psi must be approved by the Engineer. If after the two hour period the pressure has dropped more than five psi, a quantity of water must be used to bring the pressure back up to test pressure. This quantity of water must be metered and shall not exceed the following allowable leakage figures:

* ALLOWABLE LEAKAGE IN GALLONS PER 1000 FEET OF MAIN

<table>
<thead>
<tr>
<th>MAIN SIZE</th>
<th>2”</th>
<th>4”</th>
<th>6”</th>
<th>8”</th>
<th>12”</th>
<th>16”</th>
<th>20”</th>
<th>24”</th>
<th>30”</th>
<th>36”</th>
</tr>
</thead>
<tbody>
<tr>
<td>GALLONS</td>
<td>0.38</td>
<td>0.76</td>
<td>1.15</td>
<td>1.53</td>
<td>2.29</td>
<td>3.06</td>
<td>3.82</td>
<td>4.59</td>
<td>5.73</td>
<td>6.88</td>
</tr>
</tbody>
</table>

* This table is figured for 200 psi. Engineer will provide allowable leakages for higher test pressures.

If the allowable leakage is exceeded, the Contractor shall repair the defective portion of the main until leakage is within the specified allowance. All leaks shall be repaired regardless of whether or not the allowable leakage is exceeded. The Engineer must be present during the entire pressure testing process. Any work done without his supervision will not be accepted. The cost of pressure testing shall be included in the unit price for pipe.

DISINFECTION: All water mains shall be disinfected by the Contractor in accordance with AWWA C651. The Contractor shall furnish qualified personnel to do the work who are experienced with chlorine and disinfecting agents. Disinfection shall be accomplished by the continuous feed method using liquid chlorine or a hypochlorite solution. If liquid
chlorine (100 percent available chlorine) is used, a chlorine-gas water mixture shall be injected into the new main through a solution feed chlorinator and a booster pump. If hypochlorite is used, the hypochlorite solution shall be applied to the new main with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions. In addition, a rate setter or meter may be required in order that the flow in gallons per minutes may be determined. Hypochlorites shall either be calcium hypochlorite (65 percent available chlorine in granular or tabular form) or sodium hypochlorite (5 - 15 percent available chlorine in liquid form).

Water from the existing distribution system or other approved source and the chlorine solution must both be made to flow at rates which will guarantee a chlorine concentration of 50-100 parts per million throughout the new main. This high concentration chlorine solution shall not be pumped into copper service connections (this could cause the copper to corrode). Concentrations above 100 parts per million must be approved by the Engineer. The main line valve separating the existing and new water mains shall remain closed during the disinfection process. A bypass line and backflow preventer will be used in order to prevent backflow into the existing system. The backflow preventer must be approved by the City of Winston-Salem Utilities Division. Pumping of the chlorine solution shall be continued until tests conducted at the extremities of the new main indicate a concentration of the required 50-100 parts per million. The chlorinated water shall then be retained in the new main for 24 hours, during which time all valves and hydrants in the new main shall be operated in order to disinfect all parts of the system. After the 24 hour period there should be at least 10 parts per million concentration of chlorine throughout the main. The chlorinated water shall then be flushed from the main until the chlorine concentration in the water leaving the main is no higher than the concentration in the existing distribution system. The chlorinated water must be flushed into the sanitary sewer system or dechlorinated to 0 parts per million of chlorine prior to discharge. The Utilities Division must be notified prior to flushing. Dechlorination shall be accomplished using equipment by Pollard or approved equal. While the main is being flushed, all service connections shall be thoroughly flushed in order to disinfect each connection.

After final flushing and before the main is placed in service, a sample or samples shall be collected by City personnel from the line and tested for bacteriological quality. The number of samples to be taken and the location of the samples shall be determined by the Engineer. The minimum number of samples shall be one for every 4,000 feet of pipe. No hose or fire hydrant shall be used in collection of samples. If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated by the Contractor until satisfactory samples have been obtained. The City, upon 24 hours advance notice, will furnish the personnel and laboratory facilities to conduct the required bacteriological tests. No samples will be taken on Friday, the day before a holiday or on a holiday.

The Engineer must be present during the entire disinfection process. Any work done without his supervision will not be accepted. The cost of disinfection shall be included in the unit price for pipe. Pounds of calcium hypochlorite used for disinfection shall be as follows:
POUNDS OF CALCIUM HYPOCHLORITE REQUIRED TO DISINFECT WATER MAINS WITH 100 PARTS PER MILLION OF CHLORINE

<table>
<thead>
<tr>
<th>MAIN SIZE</th>
<th>POUNDS PER 1000 FEET OF PIPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2”</td>
<td>0.2</td>
</tr>
<tr>
<td>4”</td>
<td>0.8</td>
</tr>
<tr>
<td>6”</td>
<td>1.8</td>
</tr>
<tr>
<td>8”</td>
<td>3.1</td>
</tr>
<tr>
<td>12”</td>
<td>7.0</td>
</tr>
<tr>
<td>16”</td>
<td>12.4</td>
</tr>
<tr>
<td>20”</td>
<td>19.4</td>
</tr>
<tr>
<td>24”</td>
<td>28.0</td>
</tr>
<tr>
<td>30”</td>
<td>43.9</td>
</tr>
<tr>
<td>36”</td>
<td>63.0</td>
</tr>
</tbody>
</table>

**BLOW-OFF ASSEMBLIES**: Blow-off assemblies shall be placed as indicated on the Engineer’s drawings or as directed by the Engineer. The unit price for blow-off assemblies shall include everything shown on the blow-off assembly detail drawing.

4. **FINAL PREPARATIONS**

**CONCRETE AROUND STRUCTURES**: All manhole rings and covers and valve boxes located within any pavement area (including gravel and dirt streets) shall have placed around them a concrete collar constructed of Class A (3000 psi) concrete, 6" thick, extending a minimum of 12" from the outside circumference of the structure (see City of Winston-Salem detail drawing for concrete pad around valve box). For paved streets, the elevation of the top of the concrete collar shall be at the same elevation as the bottom of the surface course of pavement. For gravel or dirt streets, the elevation of the top of the collar shall be the same as the street elevation. No direct payment will be made for the construction of these concrete collars but the cost of same shall be included in the unit prices bid on the various items in the Contract.

**RESTORATION OF STREETS, CURB AND GUTTER, DRIVEWAYS, SIDEWALKS, ETC.**: When restoration is to be performed by the City, the trench shall be backfilled by the Contractor to a point 3" below the existing surface. The remaining 3" shall be filled and compacted with miscellaneous stone. The Contractor shall be responsible for maintaining the cut without hazard to vehicular traffic or pedestrian traffic until the City repairs the cut or a final inspection is conducted by the Engineer.

Asphalt or concrete pavement repair performed by the Contractor shall be done in accordance with City of Winston-Salem detail drawings and North Carolina Department of Transportation Standard Specifications. The Contractor shall be responsible for maintaining the cut until a final inspection is conducted by the Engineer.

Gravel or dirt streets will be maintained in a passable condition with three inches (3") of miscellaneous stone spread over the entire traveled area.
Replacement of curb and gutter, driveways and sidewalks shall be in accordance with City of Winston-Salem standards and/or North Carolina Department of Transportation Standard Specifications.

**SEEDING AND MULCHING:** The unit price for “Seeding and Mulching” shall include: preparing seedbeds; furnishing and thoroughly incorporating into the soil lime and fertilizer; furnishing and covering seed; furnishing, placing and securing a mulch covering and other operations incidental to establishing an acceptable full ground cover.

(a) **Seedbed Preparation**

Grass and weeds, if any, shall first be cut or otherwise disposed of satisfactorily. Areas to be seeded shall be brought to the proper line, grade and cross-section as shown on the plans or as required by the Engineer. Minor shaping and smoothing of uneven and rough areas outside of the graded section shall be done as directed by the Engineer in order to provide for more effective erosion control and for ease of subsequent mowing operations. All rocks shall be removed for Type I seeding and all rocks over 2” in diameter shall be removed for Type II seeding.

The soil shall be scarified or otherwise loosened to a depth of not less than five (5) inches. After initial scarification, dolomitic limestone and fertilizer shall be applied to the soil and worked in throughout the scarified zone. The top two or three inches of soil shall be worked into a satisfactory seedbed, free of clods, by discing, using drags, harrows, or other appropriate means. The preparation of the seedbed shall not be done when the soil is frozen, extremely wet or otherwise in an unfavorable working condition. The Contractor shall get the Engineer’s approval of the finish grading and seedbed preparation prior to seeding. Failure to comply may result in the Contractor reworking the unapproved areas at his cost.

(b) **Seed Application**

In all cases the seed used must be certified by the North Carolina Department of Agriculture. The date of certification of all seed must be within eight (8) months of the date of sowing. Certification tags from all seed shall be given to the Engineer for inspection and approval prior to seeding.

Seed shall be distributed uniformly over the seedbed at the specified rate of application. The seedbed shall be lightly raked or dragged so as to cover the seed with a layer of soil. The seedbed shall be compacted as directed by the Engineer.

**Type I Seeding, Application Rate Per 1000 Square Feet (lawns or other focal areas):**

- 100 lbs. of lime
- 20 lbs. of 10-20-20 or 20 lbs. of 10-10-10 in combination with 4 lbs. of 0-46-0
- 5 lbs. of tall fescue, containing a blend of 2 or more tall fescues
- 1 lb. of Kenblue or Kentucky Bluegrass
- 1 lb. of winter annual rye (November 1 to March 1)
Type II Seeding, Application Rate Per 1000 Square Feet (general or low maintenance areas):

100 lbs. of lime
15 lbs. of 10-20-20 or 15 lbs of 10-10-10 in combination with 3 lbs. of 0-46-0
4 lbs. of tall fescue, containing a blend of 2 or more tall fescues
1 lb. of sericea lespedeza (use unscarified seed August 15 to February 1)
1/4 lb. of German millet (May 1 to August 15)
1 lb. of rye grain (prior to May 1 or after August 15)

Seeding mixtures other than those listed above shall be approved by the Engineer prior to seeding.

(c) Applying Mulch

Mulch shall consist of grain straw or other equally satisfactory material approved by the Engineer. Mulch shall be spread uniformly over the area by hand or by mechanical spreader at the rate of 2 bales per 1000 square feet minimum. The mulch shall be applied uniformly to allow some sunlight to penetrate and air to circulate, while serving to partially shade the ground, reduce erosion, and conserve soil moisture. Mulch shall be held in place by means of stakes and twine, spraying of an asphalt emulsion or other means approved by the Engineer.

The rate of application of an asphalt emulsion will be sufficient to bond together the mulch particles without giving a heavy coating of the asphalt material. Adequate precautions shall be taken to prevent spraying asphalt emulsion on cars, fire hydrants, or other structures. The Contractor shall clean any structures that are sprayed.

(d) Seedbed Preparation and Seeding Specifications - Wetland Areas

1. Surface water control measures to be installed according to plan.

2. Areas to be seeded shall be ripped and spread with available topsoil 6" deep. Total seedbed prepared depth shall be 6" to 8" deep.

3. Loose rocks, roots and other obstructions shall be removed from the surface so that they will not interfere with establishment and maintenance of vegetation. Surface for final seedbed preparation, at finish grades shown, shall be reasonably smooth.

4. Provide agricultural lime at rate required to bring soil acidity to slightly acid - ph 6, according to soil test report.

5. Lime and fertilizer shall be applied uniformly and mixed with the soil during seedbed preparation.

6. Apply 0-20-10 commercial fertilizer at the rate of 20 lbs./1000 s.f. for warm season mix (see schedule).
7. Apply 10-20-10 commercial fertilizer at the rate of 20 lbs./1000 s.f. for cool season mix (see schedule).

8. Apply 10-10-10 commercial fertilizer at the rate of 20 lbs./1000 s.f. for temporary cover crops. In addition, provide 15 lbs./1000 s.f. of superphosphate.

9. The following is for the warm season mix:

a. All warm grass seed shall be debearded or conditioned by brushing to create a product nearly the same as debearding. This does not apply to Switchgrass.

b. Disc two times to break-up crop residue and dirt clods prior to seeding.

c. Pack soil to create a firm seedbed with a cultipacker or roller.

d. If a rain shower should fall after the seedbed is prepared but before planting, break up any crust formation.

e. Seeding shall be installed to a depth of 1/4" utilizing a rangeland drill or conventional grass drills. It is extremely important that seed not be planted deeper than ½" deep. Do not disc or harrow after seeding. This will put the seed too deep. A Brillion seeder will be acceptable.

10. Seed in accordance with the following schedule and application rates:

**Wetland Areas**

<table>
<thead>
<tr>
<th>Dates</th>
<th>Types</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 1 - July 15</td>
<td>Warm Season Mix</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Switchgrass, Cave-in-rock, Alamo</td>
<td>8 bulk#/acre or 4 oz./1000 s.f.</td>
</tr>
<tr>
<td></td>
<td>Smartweed</td>
<td>2 bulk#/acre or 1 oz./1000 s.f.</td>
</tr>
<tr>
<td></td>
<td>and Japanese Millet or Sorghum Sudan Grass Hybrids (mow prior to maturity)</td>
<td>20 lb./acre or ½ lbs./1000 s.f.</td>
</tr>
<tr>
<td>July 16 - Sept. 1</td>
<td>Temporary crop of Japanese Millet or Sorghum Sudan Grass Hybrids (to be followed by permanent mixture)</td>
<td>20 lb./acre or ½ lbs./1000 s.f.</td>
</tr>
<tr>
<td>Sept. 2 - Nov. 1</td>
<td>Cool Season Mix</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reed Canary Grass</td>
<td>12 bulk#/acre or 6 oz./1000 s.f.</td>
</tr>
</tbody>
</table>
Smartweed  
2 bulk #/acre or
1 oz./1000 s.f.

Nov. 1 - March 31  Temporary crop of wheat
(to be followed by permanent
mixture)  40 lbs./acre

11. Contractor shall be required to provide a permanent mixture according to the
schedule.

12. Temporary crops must be incorporated prior to seeding of permanent mixtures.

13. Cover crops or temporary crops must be mowed at proper time to prevent seed
heads from maturing. Wheat may be harvested.

14. Grass mix and temporary covers shall be mulched with straw applied at the rate
of 75 lbs. to 100 lbs./1000 s.f. Use clean wheat straw.

15. If hydroseeded, use Virgin Paper Mulch only.

Note: Seed and additional information for the wetland mix as well as for
other grass areas may be purchased from, but not limited to:

Sharp Brothers Seed Company
Route 4, Box 237 A
Clinton, Missouri 64735
Phone: 1-800-451-3779

16. Yards and golf course lawn areas shall be returned to existing conditions
and grass mixtures.

17. Wetlands crossings shall be covered with “Terra Jute” erosion control
netting or equal installed per manufacturer directions.

Local Distributor:

Web Tec, Inc.
P.O. Box 240302
Charlotte, NC 28224
800-438-0027 or 704-552-6722

(e) Payment

“Seeding and Mulching” will be paid as follows:

1. Inside street right-of-way: length of main installed times 20 feet.
2. Outside street right-of-way: length of main installed times easement width.
No deduction will be made for driveways or streets. No payment will be made for areas disturbed for long side connections.

When seeding and mulching has been damaged and the Contractor has fully complied with the specifications, the Contractor shall be paid at the unit price for "Seeding and Mulching" to repair the areas of damage. This shall also apply to areas beside driveways or other paved areas needing reseeding once the pavement has been repaired. As an exception to the above, the Contractor shall repair, at his cost, any damage which is due to his carelessness or neglect.

Payment for pipe installation will not be made until the areas disturbed by the pipe installation have been restored to their original grade and satisfactorily seeded and mulched. All seeding and mulching will be completed within 15 calendar days following the initial ground disturbing activity.

**CLEANING UP:** All surplus or spoil material and all tools and temporary structures shall be removed from the site by the Contractor. All dirt, rubbish and excess earth from the excavation shall be hauled to a dump provided by the Contractor and the construction site left clean to the satisfaction of the Engineer. In every instance, the Contractor shall be responsible for leaving the site in as good or better shape than before the construction was begun. It shall be up to the Engineer to determine when the clean up operation is finished and acceptable to the City.

Any excavation from trenches which has been placed on roadway surfaces and driveways will be completely removed from such surfaces as soon as practical, but in no case will excavation material be left on pavement at the end of a work day. Necessary equipment for removal of such material will be available at all times to preclude the development of traffic hazards from dust and/or slick areas caused by rainfall on clay material. The City/County Utility Commission will provide water to the Contractor at no charge for the purpose of flushing streets. To obtain the water at no charge, the Contractor must fill out a Hydrant Use Permit. Tanker trucks used for flushing must be equipped with a backflow preventer or provide a six-inch clear air gap between the filling pipe and the tank. Hydrants opened (and closed afterwards) for filling tanks or flushing must be operated by personnel trained in their operation. Only hydrant wrenches shall be used for opening the hydrants. Any damages associated with the Contractor operating the hydrant shall be repaired by the Contractor at his cost. The Contractor must have the Hydrant Use Permit on site when drawing water from the system. The permit is valid only for the purpose of flushing streets noted on the permit where utility construction has occurred. Failure to follow any of these criteria can result in fines to the Contractor as allowed by the Commission.

All salvageable materials from the City's water or sewer system belong to the City of Winston-Salem and must be turned over to the Construction and Maintenance Section of the Utilities Division.
**FINAL INSPECTION:** The Contractor is instructed to request a final inspection only after the work has been checked by the Contractor. All defects observed by the Engineer during the final inspection shall be repaired by the Contractor at the expense of the Contractor. After the Contractor satisfactorily corrects all defects and the project is deemed acceptable by the Engineer, a final inspection memorandum will be issued by the Engineer. All defects in materials and workmanship discovered during the one (1) year warranty will be corrected by the Contractor at the expense of the Contractor.
ALL WARNING SIGNS TO BE A MINIMUM OF 36" X 36" AND TO BE LUMINOUS WHEN USED AT NIGHT.

WARNING SIGNS INDICATING DAILY CONDITIONS (EX: ONE LANE ROAD AHEAD, FLAGMAN) SHALL BE BAGGED OR REMOVED AT THE END OF EACH DAY AND REINSTALLED AT THE BEGINNING OF THE NEXT WORK DAY.

STANDARD LAYOUT FOR SIGNING CONSTRUCTION AND MAINTENANCE OPERATIONS ON TWO LANE HIGHWAYS WHERE ONE LANE IS CLOSED.

WARNING SIGN SEQUENCE IN OPPOSITE DIRECTION SAME AS SHOWN ABOVE.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

SIGNING CONSTRUCTION OPERATIONS

N.T.S. REVISED 9-01-04

APPROVED
ASPHALT PAVEMENT REPAIR
(FOR NON–STATE MAINTAINED ROADS)

EXISTING PAVEMENT
Saw Cut

TOTAL WIDTH OF PAVEMENT CUT = WIDTH OF TRENCH BOX + 4'

SAW CUTS TO BE PERPENDICULAR TO SURFACE. FACE OF CUTS TO BE NEAT, CLEAN AND STRAIGHT. TACK COAT TO BE APPLIED TO ALL EXISTING ASPHALT SURFACES PRIOR TO PLACING NEW ASPHALT.

THE BACKFILL SHALL BE MADE IN 6" LAYERS AND SHALL BE COMPACTED TO AT LEAST 95% OF STANDARD DENSITY (AASHTO METHOD T-99). EACH LAYER MUST BE THOROUGHLY TAMPERED BY A MECHANICAL TAMPER BEFORE THE NEXT LAYER IS PLACED. ALL ASPHALT PAVEMENT REPLACED SHALL BE IN ACCORDANCE WITH THE MOST CURRENT N.C.D.O.T. STANDARD SPECIFICATIONS. SUBGRADE DENSITY SHALL BE 100%.

CITY OF WINSTON–SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 11-6-13

APPROVED

R:\Data\Utility\Utility Spec Drawings/asph_pavmt_repair.dwg
ASPHALT DRIVEWAY REPAIR

CENTER OF PATCH

EXISTING PAVEMENT

SAW CUT

TOTAL WIDTH OF PAVEMENT CUT = WIDTH OF TRENCH BOX + 4'

2' SF 9.5A

6" ABC

12" SUBGRADE

TRENCH BOX MAXIMUM WIDTH = 5'

BACKFILL (SEE NOTES)

PROPOSED UTILITY

MIN. 1'

MIN. 1'

STABILIZATION STONE (IF REQUIRED BY ENGINEER)

UNDISTURBED SOIL

SAW CUTS TO BE PERPENDICULAR TO SURFACE. FACE OF CUTS TO BE NEAT, CLEAN AND STRAIGHT. TACK COAT TO BE APPLIED TO ALL EXISTING ASPHALT SURFACES PRIOR TO PLACING NEW ASPHALT.

THE BACKFILL SHALL BE MADE IN 6" LAYERS AND SHALL BE COMPACTED TO AT LEAST 95% OF STANDARD DENSITY (AASHTO METHOD T-99). EACH LAYER MUST BE THOROUGHLY TAMMED BY A MECHANICAL TAMPER BEFORE THE NEXT LAYER IS PLACED. ALL ASPHALT PAVEMENT REPLACED SHALL BE IN ACCORDANCE WITH THE MOST CURRENT N.C.D.O.T. STANDARD SPECIFICATIONS. STONE BASE DENSITY AND SUBGRADE DENSITY SHALL BE 100%.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REvised 11-6-13

APPROVED

R:\Data\Utility\Utility Spec Drawings/asph_dw_repair.dwg

VII-2A
CONCRETE PAVEMENT & DRIVEWAY REPAIR

WHERE THE EDGE OF THE PATCH OR SECTION OF REMOVED PAVEMENT IS LESS THAN 10' FROM A TRANSVERSE EXPANSION OR CONTRACTION JOINT OR CRACK, THE ENTIRE SECTION OF PAVEMENT SHALL BE REMOVED UP TO THE JOINT OR CRACK AND REPLACED WITH NEW CONCRETE AND ABC STONE IN ACCORDANCE WITH THE MOST CURRENT N.C.D.O.T. STANDARD SPECIFICATIONS.

THE BACKFILL SHALL BE MADE IN 6" LAYERS AND SHALL BE COMPACTED TO AT LEAST 95% OF STANDARD DENSITY (AASHTO METHOD T-99). EACH LAYER MUST BE THOROUGHLY TAMPED BY A MECHANICAL TAMPER BEFORE THE NEXT LAYER IS PLACED. STONE BASE AND SUBGRADE DENSITY SHALL BE 100%.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

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MILL & PATCH METHOD (OPTION A)
(FOR STATE MAINTAINED ROADS)

CENTER OF PATCH

EXTENT OF THE MILL AND ASPHALT INLAY
TO BE DETERMINED BY THE ENGINEER

SAW CUT PRIOR TO MILLING

EXISTING PAVEMENT

MILL 1-1/2" AND REPLACE WITH SF9.5A

4" 719.0B

5 1/2" 825.0B

TRENCH BOX

5" MAXIMUM WIDTH
FLOWABLE FILL (CONCRETE)
HAVING A 100-200 PSI
MAXIMUM COMPRESSIVE
STRENGTH AT 28 DAYS
OR OTHER MATERIAL AS
APPROVED BY THE ENGINEER.
FLOWABLE FILL MUST
NOT CONTACT PIPE.
(TRAFFIC BEARING ROAD PLATE
OR STEEL PLATE TO BE USED
FOR 24 HOURS DURING
CURING OF CONCRETE)

MIN.

STABILIZATION STONE
TO TOP OF PIPE

UNDISTURBED SOIL

EXISTING PAVEMENT STRUCTURE

THE PAVEMENT STRUCTURE
SHOWN IS THE MINIMUM
PAVEMENT STRUCTURE FOR
SURFACE, INTERMEDIATE &
BASE LAYERS TO BE USED
UNLESS OTHERWISE DIRECTED
BY THE ENGINEER. SAW CUTS
TO BE PERPENDICULAR TO
SURFACE, FACE OF CUTS TO
BE NEAT, CLEAN AND STRAIGHT.
TACK COAT TO BE APPLIED TO
ALL EXISTING ASPHALT
SURFACES PRIOR TO PLACING
NEW ASPHALT.

SUITABLE BACKFILL WILL BE
REQUIRED ABOVE STONE, IN
PLACE OF FLOWABLE FILL, IF
COVER IS GREATER THAN 3'.

"PROFILE VIEW"

NOTE: THE SUITABLE BACKFILL SHALL BE MADE IN 6" LAYERS AND SHALL BE COMPACTED
TO AT LEAST 95% OF STANDARD DENSITY (AASHTO METHOD T-99). EACH LAYER MUST
BE THOROUGHLY TAMMED BY A MECHANICAL TAMPER BEFORE THE NEXT LAYER IS PLACED.
ALL ASPHALT PAVEMENT REPLACED SHALL BE IN ACCORDANCE WITH THE MOST CURRENT
N.C.D.O.T. STANDARD SPECIFICATIONS.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 11-6-13

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APPROVED

VII-4
EXISTING PAVEMENT OVERLAY & PATCH METHOD (OPTION B)
(FOR STATE MAINTAINED ROADS)

CENTER OF PATCH

EXTENT OF THE OVERLAY TO BE DETERMINED BY THE ENGINEER

SAW CUT

TOTAL WIDTH OF PAVEMENT CUT = WIDTH OF TRENCH BOX

SAW CUT

EXISTING PAVEMENT

OVERLAY WITH 1-1/2" SF9.5A

4" I9.0B

5 1/2" B25.0B

EXISTING PAVEMENT STRUCTURE

TRENCH BOX

5' MAXIMUM WIDTH

FLOWABLE FILL (CONCRETE) HAVING A 100-200 PSI MAXIMUM COMPRESSIVE STRENGTH AT 28 DAYS OR OTHER MATERIAL AS APPROVED BY THE ENGINEER.

FLOWABLE FILL MUST NOT CONTACT PIPE.

(TRAFFIC BEARING ROAD PLATE OR STEEL PLATE TO BE USED FOR 24 HOURS DURING CURING OF CONCRETE)

PROPOSED UTILITY

"PROFILE VIEW"

THE PAVEMENT STRUCTURE SHOWN IS THE MINIMUM PAVEMENT STRUCTURE FOR SURFACE, INTERMEDIATE & BASE LAYERS TO BE USED UNLESS OTHERWISE DIRECTED BY THE ENGINEER. SAW CUTS TO BE PERPENDICULAR TO SURFACE. FACE OF CUTS TO BE NEAT, CLEAN AND STRAIGHT. TACK COAT TO BE APPLIED TO ALL EXISTING ASPHALT SURFACES PRIOR TO PLACING NEW ASPHALT.

SUITABLE BACKFILL WILL BE REQUIRED ABOVE STONE, IN PLACE OF FLOWABLE FILL, IF COVER IS GREATER THAN 3'.

STABILIZATION STONE TO TOP OF PIPE

UNDISTURBED SOIL

NOTE: THE SUITABLE BACKFILL SHALL BE MADE IN 6" LAYERS AND SHALL BE COMPACTED TO AT LEAST 95% OF STANDARD DENSITY (AASHTO METHOD T-99). EACH LAYER MUST BE THOROUGHLY TAMPED BY A MECHANICAL TAMP BEFORE THE NEXT LAYER IS PLACED. ALL ASPHALT PAVEMENT REPLACED SHALL BE IN ACCORDANCE WITH THE MOST CURRENT N.C.D.O.T. STANDARD SPECIFICATIONS.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 11-6-13

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APPROVED

VIII-5
SAW CUT & PATCH METHOD (OPTION C)  
(FOR STATE MAINTAINED ROADS)

CENTER OF PATCH

TOTAL WIDTH OF PAVEMENT CUT = WIDTH OF TRENCH BOX + 4'

SAW CUT

EXISTING PAVEMENT

SAW CUT

TOTAL WIDTH OF PAVEMENT CUT = WIDTH OF TRENCH BOX + 4'

SAW CUT

EXISTING PAVEMENT STRUCTURE

5" MAXIMUM WIDTH FLOWABLE FILL (CONCRETE)

FLOWABLE FILL (CONCRETE)

STABILIZATION STONE TO TOP OF PIPE

"PROFILE VIEW"

NOTE: THE SUITABLE BACKFILL SHALL BE MADE IN 6" LAYERS AND SHALL BE COMPACTED TO AT LEAST 95% OF STANDARD DENSITY (AASHTO METHOD T-99). EACH LAYER MUST BE THOROUGHLY TAMPED BY A MECHANICAL TAMP BEFORE THE NEXT LAYER IS PLACED. ALL ASPHALT PAVEMENT REPLACED SHALL BE IN ACCORDANCE WITH THE MOST CURRENT N.C.D.O.T. STANDARD SPECIFICATIONS.

CITY OF WINSTON—SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 11-6-13

APPROVED
NOTE:
SEE TECHNICAL SPECIFICATIONS FOR BEDDING REQUIREMENTS FOR UNSTABLE SUBGRADE AND ROCK FORMATIONS.

*Bc = Outside Diameter of Pipe

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

BEDDING REQUIREMENTS AND SAFE COVER FOR VITRIFIED CLAY PIPE ON STABLE SUBGRADE

N.T.S. REVISED 9-20-01

APPROVED
**4 FT. PRECAST REINFORCED CONCRETE MANHOLE**

Flat top sections used shall be designed to support an H-20 wheel load. Use of a flat top must be approved by the engineer.

Type 1 or 2 ring and cover—Type 2 to be bolted to cone-w/ 4-type 304 stainless steel expansion anchors (3/4" Hilti Kwik Bolt II or approved equal)

Max. 3 courses of brick (8 in.) or 2-5" grade rings may be added vertically. (Not allowed with type 2 ring & cover)

Max 24" from top of ring & cover to top step—top step must be in cone section

Eccentric cone section

Steps not to be placed over influent or effluent pipes. Steps to be along vertical wall surface from shelf to top of cone.

Note: Do not bolt ring to cone if dirt or concrete surrounds the ring (ex: yard, shoulder, etc.)

Four foot manhole to be used for pipe with a diameter of less than 18" unless otherwise specified by the engineer.

Precast concrete manholes shall conform to ASTM C-478. Manholes must be allowed to cure a minimum of 3 days prior to shipment. The date of manufacture and name of manufacturer shall be on all manhole sections. Concrete shall be 4,000 PSI. Circumferential reinforcement will be placed at a minimum of 0.12 sq. ins. per lineal foot.

Butyl rubber gasket under ring and all grade rings

Forskeda 114 or butyl rubber gasket in all joints. Joints on outside of manhole to be wrapped with 6" wide butyl adhesive tape. All lift holes shall be completely filled with non-shrink grout after manhole is set.

Riser section

Flexible connector

Base section

City of Winston-Salem
Department of Public Works
Engineering Division

N.T.S. Revised 9-1-08

Approved
FLAT TOP SECTIONS USED SHALL BE DESIGNED TO SUPPORT AN H-20 WHEEL LOAD. USE OF A FLAT TOP MUST BE APPROVED BY THE ENGINEER.

TYPE 1 OR 2 RING AND COVER—TYPE 2 TO BE BOLTED TO CONE W/4-TYPE 304 STAINLESS STEEL EXPANSION ANCHORS (3/4" HILTI KWIK BOLT II OR APPROVED EQUAL)

MAX. 3 COURSES OF BRICK (8 IN.) OR 2-5" GRADE RINGS MAY BE ADDED VERTICALLY. (NOT ALLOWED W/TYPE 2 RING AND COVER)

MAX 24" FROM TOP OF RING & COVER TO TOP STEP—TOP STEP MUST BE IN CONE SECTION

ECCENTRIC CONE SECTION

STEPS NOT TO BE PLACED OVER INFUENT OR EF-FLUENT PIPES. STEPS TO BE ALONG VERTICAL WALL SURFACE FROM SHELF TO TOP OF CONE.

NOTE: DO NOT BOLT RING TO CONE IF DIRT OR CONCRETE SURROUNDS THE RING (EX: YARD, SHOULDER, ETC.)

FIVE FOOT MANHOLE TO BE USED FOR PIPE WITH A DIAMETER OF 18" OR GREATER, UNLESS OTHERWISE SPECIFIED BY THE ENGINEER.

PRECAST CONCRETE MANHOLES SHALL CONFORM TO ASTM C-478. MANHOLES MUST BE ALLOWED TO CURE A MINIMUM OF 3 DAYS PRIOR TO SHIPMENT. THE DATE OF MANUFACTURE AND NAME OF MANUFACTURER SHALL BE ON ALL MANHOLE SECTIONS. CONCRETE SHALL BE 4,000 PSI. CIRCUMFERENTIAL REINFORCEMENT WILL BE PLACED AT A MINIMUM OF 0.15 SQ. INS. PER LINEAL FOOT.

MAX 3 COURSES OF BRICK (8 IN.) OR 2-5" GRADE RINGS MAY BE ADDED VERTICALLY. (NOT ALLOWED W/TYPE 2 RING AND COVER)

BUTYL RUBBER GASKET UNDER RING AND ALL GRADE RINGS

O-RING OR BUTYL RUBBER GASKET IN ALL JOINTS. JOINTS ON OUTSIDE OF MANHOLE TO BE WRAPPED WITH 6" WIDE BUTYL ADHESIVE TAPE. ALL LIFT HOLES SHALL BE COMPLETELY FILLED WITH NON-SHRINK GROUT AFTER MANHOLE IS SET.

RISER SECTION—MIN. 6' FROM SHELF TO 5' X 4' TRANSITION CONE.

FLEXIBLE CONNECTOR

BASE SECTION

CITY OF WINSTON-SALEM

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 9-1-08

APPROVED

VII-9
TYPE "B" 4' & 5' PRECAST REINFORCED CONCRETE MANHOLE

RING & COVER, TYPE 3 CAST IN MH TOP AT CONCRETE PLANT.

WALL PIPE TO BE CAST IN MH TOP AT CONCRETE PLANT.

2 FEET ABOVE THE 100 YEAR FLOOD ELEVATION

2-FLANGED 90° D.I. BENDS (SHORT RADIUS) OR FLANGED D.I. RETURN BEND.

FLANGED JOINTS

FLAT TOP

MIN. 6"

COMPANION FLANGE WITH 4" OPENING.

4" D.I. PIPE.

O RING JOINT OR FORSHEDA 114 OR BUTYL RUBBER.

4" I.D.D.I. WALLPIPE CAST IN MH TOP

1'-0"

4'-0" OR 5'-0"

MANHOLE TO CONFORM TO CITY STANDARD DETAILS FOR 4' AND /OR 5' PRECAST CONCRETE MANHOLES.

NOTE: ALL MANHOLES SHALL HAVE WALL PIPE INSTALLED. IF NO VENT IS SHOWN ON ENGINEERS DRAWING, WALL PIPE SHALL BE CAPPED WITH 4" D.I. BLIND FLANGE.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 9-1-08

APPROVED

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1. PLACE HORSESHOE MH BASE IN WET CONCRETE (4000 PSI).
2. AFTER CONCRETE SETS CORE HOLE & SET NEW SEWER LINE.
3. CUT OUT TOP HALF OF EXISTING PIPE, FINISH INVERTS & WATERPROOF ALL COLD JOINTS & AROUND ALL PIPE.
4. POUR CONCRETE COLLARS.

STABILIZATION STONE EXTENDED 12" PAST CONCRETE BASE OR TO THE UNDISTURBED EARTH.

CITY OF WINSTON–SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
OUTSIDE DROP MANHOLE

MANHOLE TO BE BUILT IN ACCORDANCE WITH CITY STANDARD DETAILS FOR 4' AND/OR 5' MANHOLES.

MAX. 3 COURSES OF BRICK (8") OR 2-5" GRADE RINGS MAY BE ADDED VERTICALLY.

MONOLITHIC BASE SECTION

D.I.M.J. TEE

1 JOINT OF D.I. PIPE (MAX. 8% SLOPE)

STABILIZATION STONE

V.C. PIPE (MAX. 8% SLOPE)

D.I. PIPE (1 PIECE OR FLANGED PIECES).

FERNCO COUPLING (OR APPROVED EQUAL)

CONCRETE COLLAR

D.I. NIPPLE (18" LONG) INSIDE FLEXIBLE CONNECTOR.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 9-1-08

APPROVED
INSIDE DROP MANHOLE

NOTES:
1. SPECIAL APPROVAL BY ENGINEER IS REQUIRED PRIOR TO INSTALLATION OF INSIDE DROP MANHOLE.
2. PVC PIPE SHALL CONFORM TO ASTM D1785, SCHEDULE 40. PVC FITTINGS SHALL CONFORM TO ASTM D2665.

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DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISION 9-1-08

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VII-13
PRECAST REINFORCED CONCRETE MANHOLE WITH PRECAST INVERT

NOTES:

1) MANHOLE SHALL BE MANUFACTURED AS PER THE REQUIREMENTS OF ASTM C-478.

2) STANDARD FALL THROUGH MANHOLE IS 1" (.08") (INCLUDING 4" AND 6" CONNECTIONS INTO MANHOLE).

FLEXIBLE CONNECTOR (ALL INFLUENT AND EFFLUENT PIPES)

35' MIN. ANGLE

PLAN

RISER SECTIONS AND CONE TO BE ADDED AS PER DETAIL DRAWINGS FOR 4 FOOT AND 5 FOOT PRECAST REINFORCED CONCRETE MANHOLES.

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ENGINEERING DIVISION

N.T.S. REVISED 9-1-08

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FLEXIBLE MANHOLE CONNECTOR

NOTE: FLEXIBLE MANHOLE CONNECTORS SHALL CONFORM TO ASTM C923. CONNECTORS BY PRESS-SEAL GASKET CORPORATION, HAMILTON KENT OR NPC, INC. ARE ACCEPTABLE. MAXIMUM DEFLECTION FOR CONNECTOR IS 7° (12%). SLOPES GREATER THAN 12% MUST HAVE CONNECTORS DESIGNED FOR HIGHER DEFLECTION.

MIN. WALL

ALL STAINLESS STEEL EXPANSION RING

STAINLESS STEEL CLAMP (2 REQUIRED FOR 15" V.C. AND ABOVE)

FLEXIBLE CONNECTOR

MONOLITHIC MANHOLE BASE

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

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MANHOLE RING & COVER
TYPE 1

NOTE: TWO HOLES TO BE SPACED OPPOSITE TO EACH OTHER IN THE OUTER RING AS SHOWN. (HOLES TO BE 1" DIAMETER)

NOTE:
RING AND COVER WILL HAVE MACHINED SEAT AND WILL CONFORM TO ASTM A48, CLASS 35B. RING AND COVER WILL BE DESIGNED TO SUPPORT AN H-20 WHEEL LOAD.

MINIMUM AVERAGE WEIGHTS
RING 190 LBS.
COVER 120 LBS.
310 LBS.

SECTION
CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
N.T.S. REVISED 9-20-01

utility_spec_drawings/mh_r&c_type1.dwg
MANHOLE RING & COVER
TYPE 2

2 - 1/2" x 1 3/4" HEXHEAD, STAINLESS STEEL BOLTS AT 180° COUNTERSUNK. BOLTS TO BE TYPE 316 STAINLESS STEEL.

NOTE:
TWO HOLES TO BE SPACED OPPOSITE TO EACH OTHER IN THE OUTER RING AS SHOWN. (HOLES TO BE 1" DIAMETER)

NOTE:
RING AND COVER WILL HAVE MACHINED SEAT AND WILL CONFORM TO ASTM A48, CLASS 35B. RING AND COVER WILL BE DESIGNED TO SUPPORT AN H-20 WHEEL LOAD.

MINIMUM AVERAGE WEIGHTS
RING 190 LBS.
COVER 120 LBS.
310 LBS.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 9-20-01
APPROVED
MANHOLE RING & COVER

TYPE 3

NOTE:
RING AND COVER WILL HAVE
MACHINED SEAT AND WILL CONFORM
TO ASTM A48, CLASS 35B.

DETAIL "C C"

MATCH GROOVES

TOP OF COVER

BOTTOM OF COVER

2 - NON-PENETRATING PICK HOLES

4-1/2"x 1 3/4" HEXHEAD STAINLESS STEEL BOLTS
AT 90° COUNTERSUNK.
BOLTS TO BE TYPE 316 STAINLESS STEEL.

CONTINUOUS RUBBER
GASKET (1/8" THICK)
GLUED TO RING SEAT.

MINIMUM AVERAGE WEIGHTS
RING 136 LBS.
COVER 120 LBS.
256 LBS.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 9-20-01

APPROVED
POLYPROPYLENE MANHOLE STEP

MIN. 5" WALL

3" MIN. 5 1/2" MIN.

1/2" GRADE 60 STEEL REINFORCEMENT

SECTION A-A

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 9-20-01
APPROVED
NOTE:
CLEANOUT SHALL BE LOCATED WITHIN THE GRASS STRIP WHEN APPLICABLE. IF THERE IS NO GRASS STRIP THEN THE CLEANOUT SHALL BE PLACED A MINIMUM OF 5 FEET FROM THE R/W OR EASEMENT LINE. IN NO CASE SHALL CLEANOUT BE PLACED WITHIN SIDEWALK, DRIVEWAY, OR INSIDE A FENCE.

NOTE:
IN LIEU OF WYE’S THE LATERAL MAY BE CONNECTED TO THE MAIN USING A TAPPING MACHINE AND SADDLE APPROVED BY THE ENGINEER, OR THE CONNECTION MAY BE MADE INTO A MANHOLE.

CONCRETE BLOCK TO BE POURED 180' FROM WHERE CONNECTION ENTERS THE MAIN (NOT REQUIRED IF WYE IS USED). BLOCK WILL PROTECT MAIN WHEN RODDING.

NOTE:
CONTRACTOR MAY BE REQUIRED TO LAY CONNECTION AS SHOWN BY DASHED LINES IF ELEVATION IS CRITICAL.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
4" SEWER CONNECTION

N.T.S. REVISED 11-18-13

APPROVED
NOTES:
1. INSTALLATION TO BE THE SAME AS FOR 4" SEWER CONNECTION (DETAIL DRAWING ON PAGE 20).
2. CONTRACTOR MAY BE REQUIRED TO LAY CONNECTIONS AT 1% (REGARDLESS OF DEPTH) IN ORDER TO SERVE CUSTOMER. IN THIS CASE, 1/8 BEND WILL NOT BE USED.
3. CONNECTIONS INTO MANHOLES MAY COME IN AT ANY ELEVATION AS LONG AS IT IS DEEP ENOUGH TO SERVE CUSTOMER. (4' MIN. COVER)

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

4" SEWER CONNECTION FOR DEEP MAINS

N.T.S. REvised 11-6-13
STANDARD 4' OR 5' MANHOLE

CONCRETE TROUGH TO BE BUILT TO DIRECT FLOW FROM 6" CONNECTION TO EFFLUENT PIPE.

4" C.I. SOIL PIPE SERVICE WEIGHT.

FLEXIBLE CONNECTOR

JENTS SHALL BE RUBBER GASKET

6" C.I. SOIL PIPE, SERVICE WEIGHT

MIN. 1% SLOPE MAX. 2% SLOPE

COMBINATION WYE AND 1/8 BEND.

BRASS CLEANOUT (SEE 4" SEWER CONNECTION DRAWING)

PLUG AS PER 4" SEWER CONNECTION DRAWING

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

6" SEWER CONNECTION

N.T.S. REVISED 9-1-08

APPROVED
NOTE: CLEANOUT SHALL BE LOCATED WITHIN THE GRASS STRIP WHEN APPLICABLE. IF THERE IS NO GRASS STRIP THEN THE CLEANOUT SHALL BE PLACED A MINIMUM OF 5 FEET FROM THE R/W OR EASEMENT LINE. IN NO CASE SHALL CLEANOUT BE PLACED WITHIN SIDEWALK, DRIVEWAY, OR INSIDE A FENCE.

NOTE: IN LIEU OF WYE'S THE LATERAL MAY BE CONNECTED TO THE MAIN USING A TAPPING MACHINE AND SADDLE APPROVED BY THE ENGINEER, OR THE CONNECTION MAY BE MADE INTO A MANHOLE.

PLUG - USE ONE OF METHODS BELOW:
1. BRASS CLEANOUT.
2. C.I. PLUG WITH NO-HUB COUPLING.
3. QUICK SEAL PLUG (BY FERNCO).
5. C.I. PLUG WITH RUBBER GASKET.

CONCRETE BLOCK TO BE Poured 180° FROM WHERE CONNECTION Enters the MAIN (NOT REQUIRED IF WYE IS USED). BLOCK WILL PROTECT MAIN WHEN RODDING.

NOTE: CONTRACTOR MAY BE REQUIRED TO LAY CONNECTION AS SHOWN BY DASHED LINES IF ELEVATION IS CRITICAL.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

4" RESTAURANT SEWER CONNECTION

APPROVED
NOTES:
1. INSTALLATION TO BE THE SAME AS FOR 4" RESTAURANT SEWER CONNECTION (DETAIL DRAWING ON PAGE 23).
2. CONTRACTOR MAY BE REQUIRED TO LAY CONNECTIONS AT 1% (REGARDLESS OF DEPTH) IN ORDER TO SERVE CUSTOMER. IN THIS CASE, 1/8 BEND WILL NOT BE USED.
3. CONNECTIONS INTO MANHOLES MAY COME IN AT ANY ELEVATION AS LONG AS IT IS DEEP ENOUGH TO SERVE CUSTOMER. (4' MIN. COVER)

CITY OF WINSTON—SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

4" RESTAURANT SEWER CONNECTION FOR DEEP MAINS

N.T.S. 11-12-13
CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

6" RESTAURANT SEWER CONNECTION

MIN. 1% SLOPE
MAX. 2% SLOPE

FLEXIBLE CONNECTOR
Joints shall be rubber gasket

6" SDR 26 PVC GASKETED PIPE

6" X 4" SDR 26 PVC GASKETED COMBINATION WYE AND 1/8 BEND.

4" SDR 26 PVC GASKETED PIPE

CONCRETE TROUGH TO BE BUILT TO DIRECT FLOW FROM 6" CONNECTION TO EFFLUENT PIPE.

STANDARD 4' OR 5' MANHOLE

4'-0" OR 5'-0"

BRASS CLEANOUT (SEE 4"
RESTAURANT SEWER CONNECTION DRAWING)

6" RSTURA MT SEW CONNEC TION DRAWING

4" CI. DOUBLE HUB.

PLUG AS PER 4"
RESTAURANT SEWER CONNECTION DRAWING

N.T.S. 11-12-13

APPROVED
STANDARD 4' OR 5' MANHOLE

CONCRETE TROUGH TO BE BUILT TO DIRECT FLOW FROM 6" CONNECTION TO EFFLUENT PIPE.

6" SDR 26 PVC GASKETED PIPE

MIN. 1% SLOPE

MAX. 2% SLOPE

FLEXIBLE CONNECTOR

Joints shall be rubber gasket

4" PRIVATE FORCE MAIN SEWER CONNECTION

6" X 4" SDR 26 PVC GASKETED COMBINATION WYE AND 1/8 BEND.

BRASS CLEANOUT (SEE 4" RESTAURANT SEWER CONNECTION DRAWING)

4" C.L. DOUBLE HUB

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

4" PRIVATE FORCE MAIN SEWER CONNECTION

N.T.S. 12-28-13

APPROVED
STEEL PILE DETAIL

CLASS 52 MECH-LOK D.I. PIPE (RIGID RESTRAINED JOINT PIPE)
1/2" THICK X 3" WIDE STEEL STRAP
3/4" THREADED BOLT WITH NUT & 2 WASHERS EACH SIDE (ALL TO BE STAINLESS STEEL)

WELD STRAP TO PLATE BOTH SIDES. CENTER STRAP ON PLATE.
1/2" X 3" STEEL BRACE WELDED TO STEEL STRAP AND STEEL PILE. CENTER BRACE ON PILE.
3/4" x 5" x 12" STEEL PLATE FIELD WELDED TO PILE. CENTER PLATE ON PILE WEB.

STEEL PILE (MINIMUM 58 LBS/FT)

PIPE CRADLE ASSEMBLY

NOTES:
1. DRIVE PILES TO BEARING CAPACITY OF 20 TONS WITH PILE HAMMER APPROVED BY ENGINEER. (MIN. 10' BELOW GROUND OR AS DIRECTED BY ENGINEER).
2. ENTIRE SURFACE OF PILES SHALL BE DOUBLE COATED WITH COAL TAR EPOXY (KOP-COAT BITUMASTIC 300 M OR APPROVED EQUAL) PRIOR TO INSTALLATION.
3. ENTIRE CRADLE ASSEMBLY SHALL BE DOUBLE COATED WITH COAL TAR EPOXY (KOP-COAT BITUMASTIC 300 M OR APPROVED EQUAL) AFTER ASSEMBLY.
4. PILES TO BE DRIVEN ONLY WHEN ENGINEER IS PRESENT.
5. PILES SHALL HAVE POINT REINFORCEMENT TO PREVENT TWISTING OR BENDING OF PILES WHILE DRIVING.
6. SHOP DRAWINGS OF CRADLE ASSEMBLY SHALL BE SUBMITTED TO ENGINEER PRIOR TO MANUFACTURE.
7. CONTRACTOR TO SUBMIT PILE HAMMER SPECIFICATIONS AND PILE RESISTANCE VALUES TO ENGINEER PRIOR TO INSTALLATION.
8. PILES TO BE CENTERED ON EACH PIECE OF PIPE-JOINTS TO BE CENTERED BETWEEN CREEK BANKS.

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ENGINEERING DIVISION

N.T.S. REVISED 9-1-08

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VII-28
CONCRETE PIER DETAIL

NOTE: DO NOT USE CONCRETE PIERS IN A STREAM CHANNEL.
2-TYPE 304 STAINLESS STEEL EXPANSION ANCHORS. (3/4" HILTI KWIK BOLT II OR APPROVED EQUAL).

MINIMUM 2" COVER ON ALL REINFORCEMENT

NO.3 TIES 12" O.C.

NO.4 BARS 6" O.C.

NO.4 BARS 9" O.C.

NO.4 BARS 10" O.C.

CONCRETE PIER DETAIL

NOTE: DO NOT USE CONCRETE PIERS IN A STREAM CHANNEL.
NOTE: 2" MINIMUM COVER ON ALL REINFORCEMENT.

24"D.I. PIPE MAXIMUM

3" WIDE X 1/2" THICK STAINLESS STEEL STRAP

NO.4 BARS 4" O.C.

NO.3 TIES 12" O.C.

NO.4 BARS 18" O.C.

NO.4 BARS 8" O.C.

NO.3 TIES 12" O.C.

NO.4 BARS 6" O.C.

NO.4 BARS 11" O.C.

NOTE: DO NOT USE CONCRETE PIERS IN A STREAM CHANNEL.
CONCRETE PIER DETAIL

NOTE: DO NOT USE CONCRETE PIERs IN A STREAM CHANNEL.
SANITARY SEWER MAINS
ON 18–22% SLOPE

GRADE CALCULATED FROM CENTER OF 11½° BENDS

GRADED 11½° BEND

FLEXIBLE CONNECTOR

STABILIZATION STONE (4" MIN.) FROM BOTTOM OF THE PIPE TO UNDISTURBED SOIL (TYP.)

6'-0" VARIIES 6'-0"

ALL PIPE AND BENDS SHALL BE DUCTILE IRON

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DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 9–1–08
R:\Data\Utility\Utility Spec Drawings/sanitary sewer mains on 18–22%slope.dwg

APPROVED

VII–33
SERIES 35 FLANGED CHECK VALVE BY RED VALVE CO. (WITH STAINLESS STEEL BACKUP RINGS)

NOTE: BOLTS FOR FLANGES TO BE TYPE 316 STAINLESS STEEL
FENCING (OUTFALLS)

4" x 4" PRESSURE TREATED TIMBER POST

6' O.C.

4' - 0"

(TYP.)

2" x 4" WOVEN WIRE FENCE

CLASS "B" CONCRETE

16"

MIN.

(TYP.)

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ENGINEERING DIVISION

N.T.S. REVISED 9-20-01

R:\Data\Utility\Utility Spec Drawings/fencing (outfalls).dwg

VII-36
CAST IRON VALVE BOX

1. VALVE BOX WILL CONFORM TO ASTM A48, CLASS 30 B

2. MINIMUM WEIGHTS:
   COVER..................... 29 LBS.
   TOP SECTION............ 60 LBS.
   BOTTOM SECTION........ 49 LBS.
   TOTAL.................... 138 LBS.

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ENGINEERING DIVISION

N.T.S. REVISED 9-20-01

APPROVED
VALVE BOX INSTALLATION

PAVEMENT (INCLUDING GRAVEL AND DIRT STREETS)

CONCRETE PAD

4" 4"

TOP SECTION

BOTTOM SECTION (OPTIONAL)

NOTES:

1. WHEN VALVE IS IN PAVEMENT, TOP OF CONCRETE PAD TO BE AT ELEVATION OF BOTTOM OF SURFACE COURSE.

2. WHEN VALVE IS ON GRAVEL OR DIRT STREET, TOP OF CONCRETE PAD TO BE AT FINISH GRADE.

3. VALVE BOX WILL CONFORM TO ASTM A48, CLASS 30B. SEE SECTION VII, PG 37.

4. TWO (2) BRICKS ARE TO BE PLACED AS SHOWN UNDER PIPE @ 180°. BRICKS SHALL NOT REST ON VALVE BONNET. (PLACE BRICKS ON FLAT SIDE OF BONNET).

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DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 1-7-14

R:\Data\Utility\Utility Spec Drawings\valve box installation.dwg

VII-38
NOTES:

1. HYDRANTS, VALVES AND THEIR ACCESSORIES ARE TO BE FURNISHED AS SPECIFIED IN THE TECHNICAL SPECIFICATIONS OF THE ENGINEERING DIVISION OF THE CITY OF WINSTON-SALEM, N.C.

2. ANY JOINTS BETWEEN THE VALVE AND HYDRANT MUST HAVE RETAINER GLANDS.

CITY OF WINSTON—SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 1–7–14
APPROVED

R:\Data\Utility\Utility Spec Drawings/hydrant and valve installation.dwg
2 1/2" HOSE NOZZLE FOR HYDRANTS

THREAD DATA

7 1/2 THREADS PER INCH
.1333 PITCH
RIGHT HAND
NATIONAL FORM

MAX 2.940" O.D. OF THREADS
MIN 2.910" O.D. OF THREADS

MAX 2.854" PITCH DIAMETER
MIN 2.838" PITCH DIAMETER

2.767" ROOT DIAMETER

2.468" BORE DIAMETER

3.375"

875"

1.25"

2.625"

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 9-20-01

APPROVED
4 1/4" STEAMER NOZZLE FOR HYDRANTS

THREAD DATA

4 THREADS PER INCH
.250 PITCH
RIGHT HAND
V FORM

5.078" O.D. OF THREADS
4.688" ROOT DIAMETER
4.250" BORE DIAMETER
5.563"
STUB OUT INSTALLATION

ANY JOINTS OR FITTINGS BETWEEN TEE AND VALVE MUST HAVE RETAINER GLANDS.

18" NIPPLE

RETAINER GLAND

NOT REQUIRED IF RESTRAINED HYDRANT TEE IS USED

LENGTH OF PIPE FROM VALVE TO PLUG VARIES—SEE ENGINEERS DRAWINGS

PUSH ON JOINT OR MECHANICAL JOINT

PLUG

CONCRETE THRUST BLOCK

CITY OF WINSTON–SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 9–20–01
APPROVED
CONCRETE THRUST BLOCKS

BEND
(PLAN VIEW)

SECTION FOR ALL FITTINGS

HYDRANT BASE
(SECTION VIEW)

PLUG
(PLAN VIEW)

PIPE SIZE

TEE
(PLAN VIEW)

UNDISTURBED SOIL

UNDISTURBED SOIL

PIPE SIZE

TEE
(PLAN VIEW)

UNDISTURBED SOIL

MINIMUM "A" DIMENSION (FEET)

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<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
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<td>3.5</td>
<td>5.0</td>
<td>6.5</td>
<td>8.0</td>
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<td>12.0</td>
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<tr>
<td>45° BEND</td>
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<td>2.0</td>
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<td>5.0</td>
<td>6.0</td>
<td>7.0</td>
<td>9.0</td>
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<tr>
<td>22 1/2° BEND</td>
<td>0.5</td>
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<td>1.5</td>
<td>2.0</td>
<td>3.0</td>
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<td>4.5</td>
<td>5.0</td>
<td>6.5</td>
<td>7.5</td>
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<tr>
<td>11 1/4° BEND</td>
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<td>2.5</td>
<td>3.0</td>
<td>4.0</td>
<td>4.5</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td>PLUG/TEE</td>
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<td>1.5</td>
<td>2.5</td>
<td>3.0</td>
<td>4.5</td>
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<td>7.0</td>
<td>8.0</td>
<td>10.0</td>
<td>12.0</td>
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</table>

NOTE: ABOVE DIMENSIONS BASED ON THE FOLLOWING: 250 PSI WATER PRESSURE AND 2000 LB/SQ FT SOIL BEARING CAPACITY (SOFT CLAY)

CITY OF WINSTON–SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 11–7–13

R:\Data\Utility\Utility Spec Drawings/conc_thrust_blocks2013.dwg
BLOW-OFF ASSEMBLY

R/W

PAINT COVER BLUE

2" BOTTOM OF COVER TO TOP OF COUPLING

4" BOTTOM OF COVER TO TOP OF 6" PIPE

1" METER BOX

6" PVC, SCH.40, 180 PSI
ASTM D1785 OR 6" D.I. PIPE

COPPER TRACER WIRE
(ONLY PVC MAINS)

COPPER PIPE

COMPRESSION FITTING

CORPORATION COCK WITH SADDLE

WATER MAIN PIPE

COMPRESSION TO MALE IRON PIPE THREAD COUPLING (C84-G-NL BY FORD)

4" OF 57 STONE

BRICK

COPPER PIPE

COMPRESSION ELL
(L44-G-NL BY FORD OR H-15526N BY MUELLER)

COPPER PIPE

COMPRESSION BALL VALVE CURB STOP (B44-G-NL BY FORD OR B-25209N BY MUELLER)

PIPE SIZE  CORP. COCK SIZE
2"       3/4"
4"       1"
6"       1 1/2"
8"       2"

CITY OF WINSTON—SALEM
DEPARTMENT OF PUBLIC WORKS
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N.T.S. REVISED 10-9-13

APPROVED

R:\Data\AutoCad Stuff\Utility Spec Drawings\blow_off.dwg
STANDARD OR VALLEY CURB & GUTTER.

PAVEMENT

STANDARD METER BOX (SEE NOTE 1 FOR LOCATION)

R/W OR EASEMENT LINE

IF NO GRASS STRIP EXTEND TO R/W OR EASEMENT LINE
(WHICHEVER IS FURTHEST FROM MAIN)
(MINIMUM 1' BEYOND SIDEWALK)

NOTES:
1—METER BOX SHALL BE LOCATED WITHIN THE GRASS STRIP WHEN APPLICABLE. IF THERE IS NO GRASS STRIP THEN THE METER BOX SHALL BE PLACED AS CLOSE TO THE R/W OR EASEMENT LINE AS POSSIBLE. IN NO CASE SHALL METER BOX BE PLACED WITHIN SIDEWALK, DRIVEWAY OR INSIDE A FENCE.

2—ANGLE VALVES AND YOKE TO BE 3/4" OR 1" - SIZE TO BE DETERMINED BY THE ENGINEER.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

3/4" & 1" WATER CONNECTION w/CURB & GUTTER
(SINGLE FAMILY DWELLINGS ONLY)

N.T.S. REVISED 1-13-14

APPROVED
CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

3/4" & 1" WATER CONNECTION WITHOUT CURB & GUTTER
(SINGLE FAMILY DWELLINGS ONLY)

N.T.S. REVISED 1-13-14
APPROVED
CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

3/4" & 1" WATER CONNECTION
(NON-SINGLE FAMILY DWELLINGS)

METER YOKE

ANGLE VALVE EXPANSION CONN.

STANDARD METER BOX

EXTEND TO R/W OR EASEMENT LINE
(MINIMUM 1' BEYOND SIDEWALK)

R/W OR EASEMENT LINE
(DO NOT INSTALL METER BOX INSIDE A FENCE OR WITHIN SIDEWALK OR DRIVEWAY)

CRIMP

WATER MAIN

TYPE "K" SOFT COPPER PIPE

DEPTH OF WATER MAIN OR 30" MINIMUM

18" MINIMUM
24" MAXIMUM

12" MINIMUM
18" MAXIMUM

24" MINIMUM
30" MAXIMUM

BRASS CORPORATION COCK
(MAX. 30' FROM HORIZONTAL)

METEOROLOGICAL
CAST IRON METER BOX FOR 5/8" AND 1" METERS

NOTES:
1. MINIMUM WEIGHTS:
   A- 5/8" BOX w/Cover....103 LBS.
   B- 1" BOX w/Cover....120 LBS.
2. METER BOX WILL CONFORM TO
   ASTM A48, CLASS 30B.
3. 5/8" BOX DIMENSIONS ARE SHOWN
4. 1" METER BOX IS 6" LONGER THAN
   5/8" BOX. ALL OTHER DIMENSIONS
   ARE SAME AS SHOWN.

HOLE FOR METER
BOX HOOK w/ 1/4" STEEL PIN.

SECTION
A-A

TOP OF
OPENING
FOR PIPE

HOLE FOR PIPE

SECTION
B-B

CITY OF WINSTON-SALEM
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ENGINEERING DIVISION

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R:\Data\Utility\Utility Spec Drawings/meter box.dwg

VII-48
POLYMER CONCRETE METER BOX
FOR 1 1/2” AND 2” METERS

COVER
SKID RESISTANT SURFACE
PULL SLOTS (1” WIDE)

MOUSE HOLES (2) 4” X
4” OPENING WITH 4” X
4” KNOCKOUT ABOVE
OPENING

STEEL FRAME
METER LID (STEEL)
LID MUST OPEN TO AT LEAST
THE VERTICAL POSITION.

CLASS “A” CONCRETE COLLAR-
TO BE Poured FOR TRAFFIC
BEARING INSTALLATION—PAD
TO BE FORMED & TROWELLED
TO A SMOOTH FINISH.

DIMENSIONS (INCHES)

<table>
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CITY OF WINSTON—SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S.  REVISED 9-1-08
R:\Data\Utility\Utility Spec Drawings/polymer concrete meter box.dwg

APPROVED

VII-49
1 1/2" & 2" WATER CONNECTION

TEMPORARY CONSTRUCTION SPOOL SHALL BE INSTALLED BY THE CONTRACTOR. SPOOL TO BE INSTALLED WITH GASKETS AND BOLTS, AND TESTED TO THE INLET VALVE. CITY TO PROVIDE SPOOL, GASKETS AND BOLTS.

BY-PASS VALVE AND OUTLET VALVE SHALL BE PADLOCKED BY THE INSPECTOR. SPOOL AND PADLOCKS SHALL REMAIN INTACT UNTIL A PERMANENT METER IS INSTALLED. CITY TO PROVIDE PADLOCKS.

NOTE: INLET AND OUTLET VALVES SHALL HAVE METER SUPPORT BRACKETS.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 9-1-08

APPROVED
NOTE:
MANHOLE SHALL CONFORM TO
ASTM C-478 SPECIFICATION.
JOINTS SHALL BE THE SAME AS
FOR 4' & 5' PRECAST REINFORCED
CONCRETE MANHOLES. TOP SLAB
TO BE DESIGNED TO SUPPORT AN
H-20 WHEEL LOAD.

NOTE:
ROTATE TOP SLAB TO
CENTER 2'-0" OPENING
OVER BOTH CURB STOPS.

NOTE:
MANHOLE COVER SHALL BE CAST
WITH THE WORD "WATER" OR
"SANITARY SEWER" ACROSS THE
TOP AND SHALL HAVE TWO HOLES
SPACED OPPOSITE TO EACH OTHER
IN THE OUTER RING OF THE COVER.

SECTION

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

Sheet 1 of 2
N.T.S. REVISED 1-7-14
R:\Data\Utility\Utility Spec Drawings\air_release_valve_center.dwg

APPREOVED
VII-51
NOTE:
MANHOLE SHALL CONFORM TO
ASTM C-478 SPECIFICATION.
JOINTS SHALL BE THE SAME AS
FOR 4" & 5" PRECAST REINFORCED
CONCRETE MANHOLES. TOP SLAB
TO BE DESIGNED TO SUPPORT AN
H-20 WHEEL LOAD.

NOTE:
ROTATE TOP SLAB TO CENTER
2'-0" OPENING OVER BOTH
CURB STOPS.

NOTE:
MANHOLE COVER SHALL BE CAST
WITH THE WORD "WATER" OR
"SANITARY SEWER" ACROSS THE
TOP AND SHALL HAVE TWO HOLES
SPACED OPPOSITE TO EACH OTHER
IN THE OUTER RING OF THE COVER.

PLAN

SECTION

CITY OF WINSTON—SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

R:\Data\Utility\Utility Spec Drawings/air_release_valve_offset.dwg
2" WATER MAIN TAP
TO 6" OR LARGER WATER MAIN

NOTES:
1. TWO (2) BRICKS ARE TO BE PLACED
   AS SHOWN UNDER PIPE @ 180.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S.  DATE: 10-9-13
APPROVED

R:\Data\Utility\Utility Spec Drawings\2inch water main tap.dwg