

GENERAL 1.1 PROJECT CONDITIONS: SEPARATION OF WATER LINES AND SANITARY SEWERS 1.1.1 FOLLOW VDH STANDARDS FOR THE SEPARATION OF SANITARY SEWER AND WATER DISTRIBUTION SYSTEMS. 1.1.2 PARALLEL INSTALLATION 1.1.2.1 NORMAL CONDITIONS: SEWER LINES AND MANHOLES SHALL BE CONSTRUCTED AT LEAST 10 FEET HORIZONTALLY FROM A WATER LINE WHENEVER POSSIBLE. THE DISTANCE SHALL BE MEASURED EDGE-1.1.2.2 UNUSUAL CONDITIONS: WHEN LOCAL CONDITIONS PREVENT A HORIZONTAL SEPARATION OF AT LEAST 10 FEET, THEN MAXIMUM HORIZONTAL SEPARATION SHALL BE PROVIDED WITH VERTICAL SEPARATION OF BOTTOM OF WATER LINE AT LEAST 18 INCHES ABOVE TOP OF SEWER, WHERE THIS VERTICAL SEPARATION CANNOT BE OBTAINED, THE SEWER SHALL BE CONSTRUCTED OF AWWA APPROVED WATER PIPE PRESSURE-TESTED IN PLACE TO 50 PSI WITHOUT LEAKAGE PRIOR TO BACKFILLING. THE SEWER MANHOLE SHALL BE OF WATERTIGHT CONSTRUCTION AND TESTED IN PLACE. 1.1.3.1 NORMAL CONDITIONS: SEWERS CROSSING UNDER WATER LINES SHALL BE LAID TO PROVIDE A SEPARATION OF AT LEAST 18 INCHES BETWEEN THE BOTTOM OF WATER LINE AND THE TOP OF THE 1.1.3.2 UNUSUAL CONDITIONS: WHEN LOCAL CONDITIONS PREVENT A VERTICAL SEPARATION DESCRIBED IN "CROSSING, NORMAL CONDITIONS," PARAGRAPH ABOVE, THE FOLLOWING CONSTRUCTION SHALL BE 1.1.3.2.1 SEWERS PASSING OVER WATER LINES SHALL BE LAID TO PROVIDE: 1.1.3.2.1.1 VERTICAL SEPARATION OF AT LEAST 18 INCHES BETWEEN BOTTOM OF SEWER AND TOP OF WATER LINE. 1.1.3.2.1.2 ADEQUATE STRUCTURAL SUPPORT FOR THE SEWERS TO PREVENT EXCESSIVE DEFLECTION OF THE JOINTS AND SETTLING ON AND BREAKING THE 1.1.3.2.1.3 MAXIMUM SEPARATION OF WATER AND SEWER LINE JOINTS. 1.1.3.2.1.4 SEWERS PASSING OVER OR UNDER WATER LINES SHALL BE CONSTRUCTED OF CAST OR DUCTILE IRON WITH MECHANICAL JOINTS AS DESCRIBED IN "PARALLEL INSTALLATION, UNUSUAL CONDITIONS," PARAGRAPH ABOVE. 1.1.4 SANITARY SEWERS OR SEWER MANHOLES: NO WATER PIPES SHALL PASS THROUGH OR COME IN CONTACT WITH ANY PART OF A SEWER OR SEWER MANHOLE. 1.1.5 DRINKING WATER WELLS: NO SANITARY SEWER LINE SHALL PASS WITHIN 50 FEET OF A DRINKING WATER SUPPLY WELL, SOURCE, OR STRUCTURE UNLESS THE SANITARY SEWER IS ENCASED IN A MINIMUM 6-INCH THICK LAYER OF VDOT CLASS A3 CONCRETE. 1.2 SUBMITTALS: PROVIDE THE FOLLOWING SHOP DRAWING SUBMITTALS AS ONE COMPLETE PACKAGE. APPROVED AND SIGNED BY THE DEVELOPER'S ENGINEER, FOR APPROVAL BY THE TOWN MANAGER. A TOTAL OF FOUR (4) COPIES OF THE COMPLETE SHOP DRAWING PACKAGE SHALL BE SUBMITTED FOR APPROVAL; ONE (1) REVIEWED COPY WILL BE RETURNED STANDARDS SPECIFIED HEREIN. 1.2.2 PIPE RESTRAINT DEVICES 1.2.3 VALVES: CATALOG CUTS AND CERTIFICATES OF COMPLIANCE FOR VALVES. 1.2.4 VALVE BOXES 1.2.5 FLEXIBLE COUPLINGS 1.2.6 CASING SPACERS/END SEALS 1.2.7 PRECAST CONCRETE MANHOLE SECTION DETAILS 1.2.8 MANHOLE FRAMES AND COVERS 1.2.9 MANHOLE STEPS 1.2.10 PIPE TO MANHOLE CONNECTION DETAILS 1.2.11 CERTIFICATION REPORTS FOR MANHOLE AND SANITARY SEWER/FORCE MAIN PIPING TESTING 1.3 THE CONTRACTOR SHALL PHYSICALLY VERIFY THE LOCATION AND ELEVATION OF THE EXISTING UTILITIES, WHETHER INDICATED OR NOT, PRIOR TO STARTING CONSTRUCTION. THE CONTRACTOR SHALL CONTACT MISS UTILITY (TELEPHONE: 811) AND RESPECTIVE UTILITY OWNERS FOR EXACT LOCATIONS PRIOR TO ANY EXCAVATION NEAR UTILITIES. 1.4 CONSTRUCTION ACTIVITIES WHICH INVOLVE THE TEMPORARY INTERRUPTION OF ESSENTIAL SERVICES OR TRAFFIC PATTERNS SHALL BE SCHEDULED IN CONSULTATION WITH THE TOWN OF AMHERST AND VDOT OR THEIR REPRESENTATIVES, SHALL NOT BE OF LONGER DURATION THAN ESSENTIAL TO ACCOMPLISH THE PURPOSE FOR SUCH INTERRUPTIONS, AND SHALL BE COORDINATED TO GIVE THE TOWN OF AMHERST THE ABILITY TO MAINTAIN SANITARY SEWER SERVICE. THE CONTRACTOR SHALL COORDINATE ANY INTERRUPTION OF SANITARY SEWER SERVICE WITH THE TOWN AT LEAST 1 WEEK IN ADVANCE OF SUCH WORK. UPDATED CONSTRUCTION SCHEDULES SHALL BE SUBMITTED TO THE TOWN EACH WEEK TO COORDINATE UPCOMING CONSTRUCTION ACTIVITIES. 2.1 PIPING APPLICATION 2.1.1 THE FOLLOWING PIPING SYSTEMS, 4-12 INCHES IN DIAMETER, SHALL BE CONSTRUCTED OF PRESSURE CLASS 350 DUCTILE IRON PIPE UNLESS OTHERWISE INDICATED: 2.1.1.1 BELOW GRADE FORCE MAIN PIPING. PIPE RESTRAINT SHALL BE PROVIDED AS SPECIFIED HEREIN UNLESS OTHERWISE INDICATED 2.1.2 THE FOLLOWING PIPING SYSTEMS, 4-12 INCHES IN DIAMETER, SHALL BE CONSTRUCTED OF SDR 35 SOLID WALL POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE OR PRESSURE CLASS 350 DUCTILE IRON PIPE UNLESS 2.1.2.1 BELOW GRADE SANITARY SEWER PIPING 2.1.2.2 BELOW GRADE SANITARY SERVICE LATERALS 2.1.3 THE FOLLOWING PIPING SYSTEMS, 4-6 INCHES IN DIAMETER, SHALL BE CONSTRUCTED OF SCHEDULE 80 POLYVINYL CHLORIDE (PVC) PIPE OR PRESSURE CLASS 350 DUCTILE IRON PIPE UNLESS OTHERWISE INDICATED: 2.1.3.1 BELOW GRADE SANITARY SERVICE LATERALS AND CLEANOUTS 2.1.4 THE FOLLOWING PIPING SYSTEMS, 4-12 INCHES IN DIAMETER, SHALL BE CONSTRUCTED OF PRESSURE CLASS 350 DUCTILE IRON PIPE. ALL PIPE JOINTS FOR THESE SECTIONS OF PIPING SHALL BE RESTRAINED: 2.1.4.1 BELOW GRADE SANITARY SEWER AND FORCE MAIN PIPING AT ROAD AND STREAM CROSSINGS 2.1.4.2 BELOW GRADE PIPING BENEATH STRUCTURES 2.1.4.3 BELOW GRADE PIPING NOT OTHERWISE SPECIFIED 2.1.5 THE FOLLOWING PIPING SYSTEMS, 4-12 INCHES IN DIAMETER, SHALL BE CONSTRUCTED OF FLANGED JOINT SPECIAL THICKNESS CLASS 53 DUCTILE IRON PIPE 2.1.5.1 ABOVE GRADE PIPING ON PIER SUPPORTS 2.1.5.2 ABOVE GRADE PIPING NOT OTHERWISE SPECIFIED 2.1.6 THE FOLLOWING PIPING SYSTEMS, SMALLER THAN 4 INCHES IN DIAMETER, SHALL BE CONSTRUCTED OF ASTM B 88, TYPE K COPPER TUBING: 2.1.6.1 PIPING INSIDE AIR RELEASE VALVE MANHOLES 2.1.6 PROVIDE ADEQUATE LENGTH SECTIONS OF ABOVE GRADE DUCTILE IRON PIPING TO SPAN THE HORIZONTA DISTANCE BETWEEN THE CENTERLINE OF REINFORCED CONCRETE PIPE SUPPORT PIERS OR BRIDGE ABUTMENTS WHILE SIMULTANEOUSLY MAINTAINING A 2-FOOT MAXIMUM DISTANCE BETWEEN THE PIPE BELL AND THE CENTERLINE OF THE SUPPORT AS INDICATED ON THE CONTRACT DRAWINGS. 2.1.7 ACCESSORIES: PROVIDE FLANGES, JOINT RESTRAINTS, CONNECTING PIECES, TRANSITION GLANDS, TRANSITION SLEEVES, TAPPING SADDLES, AND OTHER ADAPTERS AS REQUIRED FOR COMPLETE AND OPERABLE PIPING SYSTEMS FOR SERVICE INDICATED. PROVIDE RESTRAINED JOINTS WHERE INDICATED ON THE DRAWINGS AND AS SPECIFIED HEREIN. 2.2.1 DUCTILE IRON PIPE 2.2.1.1 DUCTILE IRON PIPE SHALL BE PRESSURE CLASS 350 UNLESS OTHERWISE INDICATED AND SHALL MEET REQUIREMENTS OF ANSI/AWWA C150 AND C151. FLANGED PIPE SHALL BE SPECIAL THICKNESS CLASS 53 UNLESS OTHERWISE INDICATED AND SHALL MEET REQUIREMENTS OF ANSI/AVW/A C115. NOT LESS THAN THAT OF THE PIPE 2.2.1.3 PROVIDE MECHANICAL JOINTS OR PUSH-ON JOINTS FOR UNDERGROUND PIPING. JOINTING MATERIALS SHALL MEET REQUIREMENTS OF ANSI/AWWA C111.

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2.2.1.4 MECHANICAL JOINT RETAINER GLANDS SHALL BE ASTM A536 DUCTILE IRON, "MEGA LUG" SERIES MANUFACTURING DIVISION OF DRESSER INDUSTRIES OR APPROVED EQUAL BY SMITH-BLAIR PRODUCTS OF ROCKWELL PRESSURE. PEENING OF WELDED JOINTS TO CORRECT LEAKS WILL NOT BE PERMITTED. BRAZED OR SOLDERED JOINTS
                                                                                                                 1100 MANUFACTURED BY EBAA IRON, INC, OR APPROVED EQUAL BY AMERICAN CAST IRON PIPE INTERNATIONAL. ALL COUPLINGS SHALL BE PROVIDED WITH TIE ROD RESTRAINT.
                                                                                                                 COMPANY, CLOW CORPORATION, FORD METER BOX COMPANY, STAR PIPE PRODUCTS, OR ROMAC
                                                                                                                                                                                                                  2.9.1 DETECTABLE TAPE SHALL BE PROVIDED FOR ALL BELOW GRADE PIPING SYSTEMS AND SHALL HAVE A
                                                                                                                2.2.1.5 RESTRAINED PUSH-ON JOINTS SHALL BE "FLEX-RING" AS MANUFACTURED BY AMERICAN CAST
                                                                                                                IRON PIPE COMPANY, "TR FLEX" AS MANUFACTURED BY U.S. PIPE AND FOUNDRY COMPANY, "SNAP-LOK"
                                                                                                                AS MANUFACTURED BY GRIFFIN PIPE PRODUCTS COMPANY, OR APPROVED EQUAL, JOINTING MATERIALS
                                                                                                                                                                                                                  THAT A SEWER LINE IS BURIED BENEATH THE TAPE.
                                                                                                                SHALL MEET REQUIREMENTS OF ANSI/AWWA C111.
                                                                                                                2.2.1.6 PUSH-ON JOINT AND RUBBER GASKET SHALL MEET REQUIREMENTS OF ANSI/AWWA C111.
                                                                                                                                                                                                                  2.10.1 PRECAST REINFORCED CONCRETE MANHOLE SECTION
                                                                                                                RESTRAINED PUSH-ON JOINTS MAY BE USED WHERE RESTRAINED JOINTS ARE REQUIRED.
                                                                                                                2.2.1.7 PROVIDE FLANGED JOINTS FOR ALL ABOVEGROUND PIPING AND AS INDICATED ON THE
                                                                                                                 DRAWINGS, FLANGES SHALL MEET REQUIREMENTS OF CLASS 125 ANSI B16.1.
                                                                                                                2.2.1.8 FLANGED JOINT GASKETS SHALL BE FULL FACE, MADE OF RUBBER, AND SHALL MEET
                                                                                                                 REQUIREMENTS OF ANSI/AWWA C111/A21.11 EXTERIOR ABOVE GRADE LONG-SPAN INSTALLATIONS
                                                                                                                USING FLANGED DUCTILE IRON PIPING SHALL USE FULL FACE, BLACK MOLDED SBR RUBBER "TORUSEAL"
                                                                                                                FLANGE GASKETS AS MANUFACTURED BY AMERICAN CAST IRON PIPE COMPANY OR APPROVED EQUAL
                                                                                                                DESIGNED SPECIFICALLY FOR LONG-SPAN INSTALLATIONS.
                                                                                                                2.2.1.9 CEMENT MORTAR LINING WITH BITUMINOUS SEAL COAT FOR DUCTILE IRON PIPE AND CAST IRON
                                                                                                                FITTINGS SHALL MEET REQUIREMENTS OF ANSI/AWWA C104. CEMENT MORTAR LINING SHALL BE
                                                                                                                STANDARD THICKNESS.
                                                                                                                2.2.1.10 EXTERIOR, BITUMINOUS COATING SHALL MEET REQUIREMENTS OF ANSI/AWWA C110, C115, C151,
                                                                                                                 AND C153, AS APPLICABLE.
                                                                                                                                                                                                                  FRAMES AND COVERS TO PREVENT RATTLING. FRAMES SHALL BE PROVIDED WITH HOLES FOR BOLTING IT DOWN.
                                                                                                        2.2.2 SCHEDULE 80 POLYVINYL CHLORIDE (PVC) PIPING
                                                                                                                                                                                                                  DIAMETER CLEAR OPENINGS SUCH AS NEENAH FOUNDRY COMPANY TYPE R-1642 WITH TYPE "C" COVER, OR
                                                                                                                                                                                                                  APPROVED EQUAL BY U.S. FOUNDRY OR EAST JORDAN IRON WORKS. THE FRAME AND COVER SHALL WEIGH A
                                                                                                                 2.2.2.1 PIPE, COUPLINGS, AND FITTINGS SHALL BE SCHEDULE 80 MEETING THE REQUIREMENTS OF ASTM
                                                                                                                  D 1785, MANUFACTURED OF MATERIAL MEETING THE REQUIREMENTS OF ASTM D 1784, TYPE 1120
                                                                                                                                                                                                                  LEAST 277 POUNDS.
                                                                                                                 PROVIDE ASTM D 2467 SCHEDULE 80 FITTINGS, ASTM D 2564 SOLVENT CEMENT. JOINTS SHALL BE
                                                                                                                                                                                                                  2.10.3 WATERPROOF MANHOLE FRAMES AND COVERS SHALL BE GRAY IRON CASTINGS MEETING REQUIREMENTS
                                                                                                                SOLVENT WELDED, MEETING REQUIREMENTS OF ASTM D 2855.
                                                                                                                                                                                                                   OF ASTM A 48, CLASS 30, AND HAVE 24-INCH DIAMETER CLEAR OPENINGS SUCH AS NEENAH FOUNDRY COMPANY
                                                                                                                                                                                                                  TYPE R-1916-F WITH TYPE "C" COVER AND BOLT HOLES FOR FOUR ANCHOR BOLTS, OR APPROVED EQUAL BY U.S.
                                                                                                                2.2.2.2 PROVIDE SCREWED JOINTS AND FLANGES AS REQUIRED TO CONNECT DISSIMILAR PIPE
                                                                                                                                                                                                                  FOUNDRY OR EAST JORDAN IRON WORKS. FRAMES SHALL BE PROVIDED WITH HOLES FOR BOLTING IT DOWN TO
                                                                                                                MATERIALS, VALVES, EQUIPMENT, AND APPURTENANCES.
                                                                                                                                                                                                                  MANHOLE RISER SECTION. THE FRAME AND COVER SHALL WEIGH AT LEAST 330 POUNDS.
                                                                                                        2.2.3 POLYVINYL CHLORIDE (PVC) PLASTIC GRAVITY SEWER PIPING SHALL MEET REQUIREMENTS OF ASTM D 3034
                                                                                                                                                                                                                  2.10.4 MANHOLE FRAMES SHALL BE ANCHORED TO THE TOP OF THE MANHOLE RISER SECTIONS WITH %-INCH
                                                                                                        AND BE INTEGRAL BELL, GASKETED JOINT PIPE WITH DIMENSION RATIO (DR) OF 35 AND MINIMUM PIPE STIFFNESS
                                                                                                                                                                                                                  EXPANSION BOLTS. TWO PASSES OF "CONSEAL" BITUMASTIC SEALANT IN 1-INCH ROPE FORM SHALL BE USED TO
                                                                                                        (PS) OF 46 PSI.
                                                                                                                                                                                                                  PROVIDE WATERTIGHT SEAL BETWEEN FRAME AND MANHOLE RISER SECTION. CLEAN MANHOLE RISER AND
                                                                                                                2.2.3.1 PIPE JOINT SHALL MEET REQUIREMENTS OF ASTM D 3212.
                                                                                                                                                                                                                  FRAME THOROUGHLY PRIOR TO INSTALLATION.
                                                                                                                                                                                                                  2.10.5 MANHOLE STEPS SHALL BE "SUREFOOT" STEP CONSTRUCTED OF A NO. 4 STEEL REINFORCING ROD
                                                                                                                2.2.3.2 RUBBER GASKETS SHALL MEET PHYSICAL REQUIREMENTS SPECIFIED IN ASTM F 477 IN ALL
                                                                                                                                                                                                                  2.10.6 PIPE TO MANHOLE CONNECTION SHALL BE SEALED WITH A FLEXIBLE BOOT, GASKET, SLEEVE, OR AS
                                                                                                        2.2.4 COPPER TUBING
                                                                                                                                                                                                                  DETAILED ON DRAWINGS AND MEET REQUIREMENTS OF ASTM C 923
                                                                                                                  2.2.4.1 COPPER TUBING AND ASSOCIATED FITTINGS SHALL BE ASTM B 88, TYPE K.
                                                                                                                  2.2.4.2 FITTINGS SHALL BE SOLDER JOINT, ANSI B16.18 OR B16.22, USING ASTM B 32, 95-5 TIN-
                                                                                                                  ANTIMONY SOLDER.
                                                                                                  2.3 STEEL CASING PIPE FOR BORING OR JACKING UNDER HIGHWAYS OR CROSSING UNDER STREAMS SHALL MEET
1.2.1 PIPE AND FITTINGS: CATALOG CUTS AND CERTIFICATES OF COMPLIANCE FOR PIPE, FITTINGS, LININGS, AND REQUIREMENTS OF ASTM A 139, GRADE B. NOMINAL PIPE DIAMETER AND WALL THICKNESS SHALL BE AS INDICATED ON
MATERIALS FOR APPROVAL. CERTIFICATES SHALL STATE THAT MATERIALS FURNISHED COMPLY WITH THE THE DRAWINGS. NO PROTECTIVE COATING OR LINING, NOR HYDROSTATIC TESTING WILL BE REQUIRED.
                                                                                                  2.4 CASING SPACERS/END SEALS
                                                                                                         2.4.1 CASING SPACERS SHALL BE BOLT-ON STYLE WITH A TWO-PIECE SHELL MADE FROM T-304 STAINLESS STEEL
                                                                                                         OF A MINIMUM 14-GAUGE THICKNESS. THE SHELL SHALL BE LINED WITH A RIBBED PVC EXTRUSION WITH A
                                                                                                         RETAINING SECTION THAT OVERLAPS THE EDGE OF THE SHELL AND PREVENTS SLIPPAGE. BEARING SURFACES
                                                                                                         (RUNNERS) MADE FROM UHMW POLYMER WITH A STATIC COEFFICIENT OF FRICTION OF 0.11-0.13 SHALL E
                                                                                                        ATTACHED TO SUPPORT STRUCTURES (RISERS) AT APPROPRIATE POSITIONS TO PROPERLY SUPPORT THE
                                                                                                        CARRIER WITHIN THE CASING AND TO EASE INSTALLATION. CASING SPACERS SHALL BE MODEL $12G-2 AS
                                                                                                                                                                                                          2.11 PIPE TO SLEEVE SEALANT SHALL BE GROUTING COMPOUND. GROUTING COMPOUND SHALL BE AS MANUFACTURED BY
                                                                                                        MANUFACTURED BY PIPELINE SEAL AND INSULATOR, INC, 6525 GOFORTH STREET, HOUSTON, TEXAS 77021,
                                                                                                                                                                                                           3M COMPANY OR BE AN EQUIVALENT PRODUCT HAVING TENSILE STRENGTH OF 80 PSI AND ELONGATION PROPERTY OF
                                                                                                         TELEPHONE NUMBER: (800) 423-2410, OR APPROVED EQUAL.
                                                                                                                                                                                                           700% IN ACCORDANCE WITH ASTM D 3574 TEST E, AND LINEAR DIMENSION CHANGE SHALL NOT EXCEED 18% WHEN
                                                                                                                                                                                                          SUBJECT TO WET AND DRY CYCLES IN ACCORDANCE WITH ASTM D 756, PROCEDURE G AND ASTM D 1042.
                                                                                                        2.4.2 END SEALS SHALL BE MODEL C AS MANUFACTURED BY PIPELINE SEAL AND INSULATOR, INC., OR APPROVED
                                                                                                                                                                                                          2.12 SEWER SERVICE SADDLES FOR CONNECTING NEW SEWER SERVICES TO EXISTING SANITARY SEWERS SHALL BE "CB
                                                                                                                                                                                                          SEWER SADDLE" AS MANUFACTURED BY ROMAC INDUSTRIES, INC. OR APPROVED EQUAL.
                                                                                                 2.5 VALVES
                                                                                                        2.5.1 PLUG VALVES
                                                                                                                                                                                                          3.1. TAKE ALL PRECAUTIONS NECESSARY TO INSURE THAT PIPE, VALVES, FITTINGS, AND RELATED ITEMS ARE NOT
                                                                                                                 2.5.1.1 PLUG VALVES SHALL BE TIGHT CLOSING, RESILIENT FACED, NON-LUBRICATING VARIETY, AND
                                                                                                                                                                                                         DAMAGED IN UNLOADING, HANDLING, AND PLACING IN TRENCH. EXAMINE EACH PIECE OF MATERIAL JUST PRIOR TO
                                                                                                                SHALL BE OF ECCENTRIC DESIGN SUCH THAT THE PLUG RISES OFF THE BODY SEAT CONTACT AREA
                                                                                                                                                                                                          INSTALLATION TO DETERMINE THAT NO DAMAGE HAS OCCURRED. REMOVE ANY DAMAGED MATERIAL FROM THE SITE AND
                                                                                                                IMMEDIATELY UPON SHAFT ROTATION DURING THE OPENING MOVEMENT. VALVES SHALL BE
                                                                                                                 THROTTLING SERVICE, AS WELL AS FREQUENT OR INFREQUENT ON-OFF SERVICE. THE VALVE-CLOSING
                                                                                                                MEMBER SHALL ROTATE APPROXIMATELY 90° FROM THE FULL-OPEN TO THE FULL-CLOSED POSITION AND
                                                                                                                                                                                                                3.1.1 KEEP PIPE CLEAN, EXERCISE CARE TO KEEP FOREIGN MATERIAL AND DIRT FORM ENTERING PIPE DURING
                                                                                                                                                                                                                STORAGE, HANDLING, AND PLACING. CLOSE ENDS OF IN-PLACE PIPE AT THE END OF ANY WORK PERIOD TO
                                                                                                                VICE VERSA. ALL PLUG VALVES SHALL PROVIDE WATERTIGHT SHUTOFF SERVICE
                                                                                                                                                                                                                PREVENT ENTRY OF ANIMALS AND FOREIGN MATERIAL.
                                                                                                                2.5.1.2 THE VALVE BODY SHALL BE CONSTRUCTED OF CAST-IRON CONFORMING TO ASTM A 126, CLASS B.
                                                                                                                VALVES FOR BELOWGRADE SERVICE SHALL BE MECHANICAL JOINT MEETING THE REQUIREMENTS OF
                                                                                                                                                                                                               3.1.2 BED PIPE AS DETAILED ON THE DRAWINGS, AND IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN
                                                                                                                  AVWWA C111/ANSI A21.11. VALVES FOR ABOVEGRADE SERVICE SHALL BE FLANGED MEETING THE
                                                                                                                                                                                                                RECOMMENDATIONS.
                                                                                                                REQUIREMENTS OF ANSI B16.1, UNLESS OTHERWISE INDICATED ON THE DRAWINGS
                                                                                                                                                                                                               3.1.3 DO NOT LAY PIPE WHEN WEATHER OR TRENCH CONDITIONS ARE UNSUITABLE.
                                                                                                                2.5.1.3 VALVES 3 TO 12 INCHES SHALL HAVE 175-PSI NONSHOCK WORKING PRESSURE RATING. EACH
                                                                                                                PLUG VALVE SHALL BE TESTED AGAINST THE SEAT AT THE FULL RATED WORKING PRESSURE AND A 3.2 LAY GRAVITY SEWERS SO AS TO MAINTAIN A TRUE ALIGNMENT AND GRADE AS INDICATED ON DRAWINGS. AFTER
                                                                                                                 HYDROSTATIC SHELL TEST AT TWICE THE RATED WORKING PRESSURE.
                                                                                                                 2.5.1.4 ECCENTRIC PLUG VALVES SHALL HAVE A RECTANGULAR SHAPED PORT. PORT AREAS FOR 3 TO
                                                                                                                 20-INCH VALVES SHALL BE A MINIMUM OF 80% OF FULL PIPE AREA.
                                                                                                                                                                                                                3.2.1 COMMENCE LAYING GRAVITY SEWERS AT THE LOWEST POINT ON A SECTION OF LINE AND LAY PIPE WITH THE
                                                                                                                                                                                                               BELL ENDS UPHILL.
                                                                                                                2.5.1.5 VALVE SEAT SURFACE SHALL WELDED-IN OVERLAY, CYLINDRICALLY SHAPED OF NOT LESS THAN
                                                                                                                90% PURE NICKEL. SEAT AREA SHALL BE RAISED, WITH RAISED AREA COMPLETELY COVERED WITH
                                                                                                                                                                                                                3.2.2 PIPE JOINT: PREPARATORY TO MAKING PIPE JOINTS ON GRAVITY SEWER LINES, CLEAN AND DRY ALL
                                                                                                                 WELD TO ENSURE PROPER SEAT CONTACT. THE MACHINED SEAT AREA SHALL BE A MINIMUM OF
                                                                                                                                                                                                                SURFACES OF JOINT PIPE AND JOINTING MATERIAL, USE LUBRICANTS, PRIMERS, ADHESIVES, AND SIMILAR
                                                                                                                 1/8-INCH THICK AND 1/2-INCH WIDE.
                                                                                                                                                                                                                MATERIALS AS RECOMMENDED BY THE MANUFACTURERS, PLACE, FIT, JOIN, AND ADJUST THE JOINTING MATERIALS
                                                                                                                                                                                                                OR FACTORY FABRICATED JOINTS AS RECOMMENDED BY MANUFACTURER TO OBTAIN THE DEGREE OF
                                                                                                                2.5.1.6. THE VALVE PLUG SHALL BE CONSTRUCTED OF CAST IRON CONFORMING TO ASTM A 126. CLASS B
                                                                                                                                                                                                                WATERTIGHTNESS REQUIRED. AS SOON AS POSSIBLE AFTER THE JOINT IS MADE. PLACE SUFFICIENT BACKFIL
                                                                                                                 THE ENTIRE PLUG SHALL BE 100% ENCAPSULATED WITH BUNA-N RUBBER IN ALL VALVE SIZES. THE
                                                                                                                                                                                                                MATERIAL ALONG EACH SIDE OF PIPE TO RESIST FORCES THAT MIGHT TEND TO MOVE PIPE OFF LINE AND GRADE.
                                                                                                                 RUBBER COMPOUND SHALL BE APPROXIMATELY 70 SHORE A DUROMETER HARDNESS. THE RUBBER TO
                                                                                                                 METAL BOND MUST WITHSTAND 75-POUND PULL UNDER TEST PROCEDURE ASTM D 429, METHOD B. THE
                                                                                                                                                                                                               3.2.3 BACKFILL AS INDICATED ON THE DRAWINGS. PLACE BACKFILL OVER THE PIPE IMMEDIATELY AFTER THE PIPE
                                                                                                                PLUG SHALL HAVE A CYLINDRICAL SEATING AREA THAT IS OFFSET FROM THE CENTER OF THE PLUG
                                                                                                                SHAFTS. THE PLUG SHAFTS SHALL BE INTEGRAL
                                                                                                                                                                                                          3.3 LAY PRESSURE PIPING WITH BELL ENDS FACING THE DIRECTION OF LAYING, WHERE GRADE IS 10 PERCENT OR
                                                                                                                2.5.1.7 UPPER AND LOWER SHAFT BEARINGS SHALL BE SLEEVE TYPE METAL BEARINGS, SINTERED, OIL-GREATER, PIPE SHALL BE LAID UPHILL WITH BELL ENDS UPGRADE. LAY PRESSURE PIPING WITH A MINIMUM COVER OF 42
                                                                                                                  MPREGNATED, AND PERMANENTLY LUBRICATED 316 STAINLESS STEEL CONFORMING TO ASTM A 743, INCHES UNLESS OTHERWISE INDICATED.
                                                                                                                 GRADE CF-8M. THRUST BEARINGS SHALL BE NYLATRON.
                                                                                                                                                                                                          3.4 JOIN MECHANICAL JOINT PIPE AS FOLLOWS:
                                                                                                                2.5.1.8 PLUG VALVE SHAFT SEALS SHALL BE MULTIPLE V-RING TYPE AND SHALL BE ADJUSTABLE. ALL
                                                                                                                PACKING SHALL BE REPLACEABLE WITHOUT REMOVING THE BONNET OR ACTUATOR AND WHILE THE
                                                                                                                VALVE IS IN SERVICE. SHAFT SEALS SHALL BE CONSTRUCTED OF BUNA-N RUBBER.
                                                                                                                 2.5.1.9 VALVES 3 TO 6 INCHES IN DIAMETER SHALL HAVE A 2-INCH SQUARE NUT AND REMOVABLE LEVER
                                                                                                                FOR ABOVE GRADE SERVICE, SIZED FOR 75-PSI (MINIMUM) PRESSURE DROP ACROSS VALVE, VALVES 8
                                                                                                                INCHES AND LARGER SHALL HAVE TOTALLY ENCLOSED GEAR OPERATORS. INCLUDING ADJUSTABLE
                                                                                                                MEMORY STOPS WITH HANDWHEEL ACTUATORS FOR ABOVE GRADE SERVICE.
                                                                                                                 2.5.1.10 PLUG VALVES SHALL HAVE PORT POSITIONS INDICATED ON THE OPERATING NUT OR VALVE
                                                                                                                 CASING. EXTERIOR VALVES SHALL BE SUITABLE FOR UNDERGROUND SERVICE AND HAVE A STANDARD 2-
                                                                                                                INCH SQUARE OPERATING NUT THAT EXTENDS WITHIN 12 INCHES OF THE PREVAILING GROUND
                                                                                                                 2.5.1.11 VALVES SHALL BE MANUFACTURED BY CLOW VALVE, DEZURIK WATER CONTROLS, M&H DIVISION
                                                                                                                  OF DRESSER INDUSTRIES, HENRY PRATT COMPANY, OR APPROVED EQUAL
                                                                                                        2.5.2 BALL VALVES: BALL VALVES SHALL BE CLASS 150, MEETING REQUIREMENTS OF ANSI B16.34. VALVES SHALL
                                                                                                                                                                                                               3.4.3 TIGHTEN NUTS ON ALTERNATE SIDES OF THE GLAND UNTIL PRESSURE ON THE GLAND IS EQUALLY
                                                                                                        HAVE ANSI CARBON STEEL BODIES AND BALLS. VALVES SHALL HAVE STAINLESS STEEL STEMS AND TRIM. AND
                                                                                                        VITON OR TEFLON SEATS, BODY SEALS, AND STEM SEALS, VALVES SHALL BE LEVER OPERATED. VALVES SHALL BE
                                                                                                         MANUFACTURED BY VELAN VALVE CORPORATION, ITT-GRINNELL, WORCHESTER, INC., OR APPROVED EQUAL.
                                                                                                        2.5.3 SEWAGE COMBINATION AIR VALVES
                                                                                                                2.5.3.1 SEWAGE COMBINATION AIR VALVES SHALL BE APCO MODEL 445 SEWAGE COMBINATION AIR
                                                                                                                VALVES AS MANUFACTURED BY VALVE AND PRIMER CORPORATION, 1420 SOUTH WRIGHT BLVD.,
                                                                                                                SCHAUMBURG, ILLINOIS 60193 OR APPROVED EQUAL. VALVES SHALL HAVE THE FOLLOWING DIMENSIONS:
                                                                                                                              INLET DIAMETER: 2-INCH NPT
                                                                                                                             OUTLET DIAMETER: 2-INCH NPT
                                                                                                                             SMALL ORIFICE DIAMETER: 7/32-INCH
                                                                                                                 2.5.3.2 VALVES SHALL HAVE CAST IRON BODY AND COVER, BRONZE MECHANISM AND SEAT, BUNA-N
                                                                                                                 NEEDLE, AND STAINLESS STEEL FLOAT AND LEVER PINS. VALVES SHALL BE EQUIPPED WITH VALVED
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QUICK DISCONNECT COUPLING FOR BACKFLUSHING, INLET AND BLOWOFF VALVES, AND MINIMUM OF 10

2.6 VALVE BOXES SHALL BE ADJUSTABLE CAST IRON VALVE BOXES OF THE THREE-PIECE TYPE, CONSISTING OF LID, TWO-

PIECE SLIDING EXTENSION, AND BASE. BASE SHALL BE PROPER TYPE AND SIZE FOR THE VALVE WITH WHICH IT IS USED.

CONSIST OF A STEEL MIDDLE RING, TWO STEEL FOLLOWERS, TWO RUBBER COMPOUNDED WEDGE SECTION GASKETS, AND

SUFFICIENT GALVANIZED TRACK HEAD STEEL BOLTS TO PROPERLY COMPRESS THE GASKETS. COUPLINGS SHALL BE OF THE TYPE TO MATCH PIPING IN WHICH INSTALLED. COUPLINGS SHALL BE STYLE 38 MANUFACTURED BY DRESSER

VALVE BOXES SHALL BE MANUFACTURED BY MUELLER COMPANY, DEWEY BROTHERS, TYLER, OR BINGHAM-TAYLOR.

FEET OF HOSE FOR BACKFLUSHING.

3.4.1 THOROUGHLY CLEAN INSIDE OF THE BELL AND 8 INCHES OF THE OUTSIDE OF THE SPIGOT END OF THI JOINING PIPE TO REMOVE OIL, GRIT, EXCESS COATING, AND OTHER FOREIGN MATTER FROM THE JOINT. PAINT THI BELL AND THE SPIGOT WITH SOAP SOLUTION. SLIP CAST-IRON GLAND ON SPIGOT END WITH LIP EXTENSION OF GLAND TOWARD END OF PIPE. PAINT RUBBER GASKET WITH OR DIP INTO SOAP SOLUTION AND PLACE ON SPIGOT END WITH THICK EDGE TOWARD GLAND 3.4.2 PUSH THE SPIGOT END FORWARD TO SEAT IN THE BELL. THEN CAREFULLY PRESS THE GASKET INTO THE BELL SO THAT IT IS LOCATED EVENLY AROUND THE JOINT. MOVE THE GLAND INTO POSITION, INSERT BOLTS, AND SCREW NUTS UP FINGER TIGHT. THEN TIGHTEN ALL NUTS TO TORQUE LISTED BELOW.

BOLTS SIZE – INCHES TORQUE FEET – POUNDS 40-60

443. JOINTS MAY ALSO BE SEALED WITH FLEXIBLE BUTYL RESIN SEALANT AS MANUFACTURED BY

PAINT "COAL CAT 97-640/97-641" OR MANUFACTURED WITH CALCAREOUS AGGREGATE SO THAT THE

2.10.6.1 WHEN THE BOOT IS USED, THE PORT SHALL BE CORED TO THE SIZE, SHAPE, SURFACE FINISH

AND LOCATION REQUIRED AND NOT CAST IN THE MANHOLE. ANGULAR ADJUSTMENTS THROUGH 20°

SHALL BE ALLOWED. THE FLEXIBLE BOOT SHALL BE A 3/8-INCH THICK NEOPRENE COMPOUND MEETING

ASTM C 443 SPECIFICATIONS. THE BOOT SHALL BE SECURED TO THE PORT WITH AN INTERNAL

EXTERNAL BAND. BOOT SEAL SHALL BE "KOR-N-SEAL" AS MANUFACTURED BY NATIONAL POLLUTION

2.10.6.2 WHEN GASKET IS USED, THE GASKET SHALL BE A RUBBER PRESSED WEDGE GASKET CAST

INTO THE MANHOLE WITH A MAXIMUM DEFLECTION OF 15° AS MANUFACTURED BY PRESS-SEAL

2.10.6.3 WHEN SLEEVE IS USED, THE SLEEVE SHALL BE A FLEXIBLE RUBBER SLEEVE CAST INTO THE

MANHOLE COMPLETE WITH STAINLESS STEEL STRAP AS MANUFACTURED BY INTERPACE

ALUMINUM EXPANDING BAND AND TO THE PIPE WITH A NONMAGNETIC CORROSION RESISTANT STEEL

FINISHED PRODUCT SHALL HAVE AN AZ FACTOR EQUAL TO 90.

3.4.4 PERMISSIBLE DEFLECTION OF MECHANICAL JOINT PIPE SHALL NOT BE GREATER THAN LISTED IN AWWA C600. 3.5 JOIN PUSH-ON JOINT PIPE AS FOLLOWS: 3.5.1 THOROUGHLY CLEAN INSIDE OF THE BELL AND 8 INCHES OF THE OUTSIDE OF THE SPIGOT END OF THE

JOINING PIPE TO REMOVE OIL, GRIT, EXCESS COATING, AND OTHER FOREIGN MATTER. FLEX RUBBER GASKET AND INSERT IN THE GASKET RECESS OF THE BELL SOCKET. APPLY A THIN FILM OF GASKET LUBRICANT SUPPLIED BY PIPE MANUFACTURER TO EITHER THE GASKET OR THE SPIGOT END OF THE JOINING PIPE. 3.5.2 START SPIGOT END OF PIPE INTO SOCKET WITH CARE. THE JOINT SHALL THEN BE COMPLETED BY FORCING

THE PLAIN END TO THE BOTTOM OF THE SOCKET WITH A FORKED TOOL OR JACK TYPE DEVICE. FIELD CUT PIPE SHALL HAVE THE END FILED TO MATCH THE MANUFACTURED SPIGOT END. 3.5.3 JOIN RESTRAINED PUSH-ON JOINTS AS RECOMMENDED IN WRITING BY THE MANUFACTURER.

3.5.4 PERMISSIBLE DEFLECTION OF PUSH-ON JOINT PIPE SHALL NOT BE GREATER THAN LISTED IN AWWA C600. 3.5.5 PERMISSIBLE DEFLECTION IN RESTRAINED PUSH-ON JOINT PIPE SHALL BE AS RECOMMENDED IN WRITING BY 3.6 JOIN RESTRAINED PUSH-ON JOINT DUCTILE IRON PIPE AS RECOMMENDED IN WRITING BY THE MANUFACTURER

2.2.1.2 FITTINGS SHALL MEET REQUIREMENTS OF ANSI/AWWA C110 AND C153 WITH PRESSURE RATING OF DAVISON, MICHIGAN.

2.2.1.2 FITTINGS SHALL MEET REQUIREMENTS OF ANSI/AWWA C110 AND C153 WITH PRESSURE RATING OF DAVISON, MICHIGAN.

2.2.1.2 FITTINGS SHALL MEET REQUIREMENTS OF ANSI/AWWA C110 AND C153 WITH PRESSURE RATING OF DAVISON, MICHIGAN. 3.7 JOIN POLYVINYL CHLORIDE (PVC) PIPE USING RUBBER RING GASKETS IN BELL JOINTS AS RECOMMENDED IN WRITING 2.8 FLEXIBLE COUPLINGS FOR DUCTILE IRON PIPING SHALL BE OF A GASKETED, SLEEVE TYPE. EACH COUPLING SHALL BY THE MANUFACTURER. JOIN AND ASSEMBLE SOLVENT WELDED PVC PIPE JOINTS IN ACCORDANCE WITH THE REQUIREMENTS OF ASTM D 2855

3.8 WELDED, SOLDERED, OR BRAZED JOINTS BETWEEN SECTIONS OF COPPER PIPE AND BETWEEN PIPE AND FITTINGS SHALL BE IN COMPLIANCE WITH ANSI B31.1. MAKE JOINTS IN PIPING SYSTEM TIGHT AND LEAKPROOF AGAINST THE DESIGN

THAT LEAK SHALL BE DISASSEMBLED, CLEANED, AND MADE AGAIN. 3.9 JOIN PIPE OF DIFFERENT MATERIALS BY USING FERNCO COUPLINGS IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN RECOMMENDATIONS.

METALLIC CORE PROTECTED BY A PLASTIC JACKET. THE TAPE SHALL BE CONTINUOUSLY MARKED INDICATING 3.10 SET VALVES AND VALVE BOXES AS FOLLOWS: 3.10.1 EQUIP ALL UNDERGROUND VALVE OPERATORS WITH VALVE BOXES. SET BOX IN ALIGNMENT WITH VALVE STEM CENTERED ON VALVE NUT. SET VALVE BOX TO PREVENT TRANSMITTING SHOCK OR STRESS TO THE VALVE.

SET BOX COVER FLUSH WITH THE FINISHED GROUND SURFACE OR PAVEMENT. 3.11 INSTALL COMBINATION AIR VALVES AT LOCATIONS INDICATED ON THE DRAWINGS AND AT ALL HIGH POINTS ON 2.10.1.1 PRECAST REINFORCED CONCRETE MANHOLE SECTIONS SHALL MEET REQUIREMENTS OF PRESSURE PIPING IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN RECOMMENDATIONS. INSTALL BALL VALVE ASTM C 478. SECTION ENDS SHALL HAVE O-RING GASKET GROOVE PROVIDED DURING BETWEEN PIPING AND AIR VALVE. USE TAP, TAPPING SADDLE, TEE, OR OTHER FITTINGS AS REQUIRED FOR COMPLETE AND MANUFACTURING PROCESS. GASKETS FOR SECTION JOINTS SHALL MEET REQUIREMENTS OF ASTM C OPERABLE INSTALLATION.

CONCRETE SEALANTS. INC. SEALANT SHALL BE INSTALLED IN ACCORDANCE WITH THE 3.12 CONSTRUCT MANHOLES USING PRECAST REINFORCED CONCRETE MANHOLE SECTIONS EXCEPT AS OTHERWISE MANUFACTURER'S WRITTEN RECOMMENDATIONS. TOP SECTIONS FOR ALL MANHOLES SHALL BE NOTED, INSTALL MANHOLE FRAMES AND COVERS AND MANHOLE STEPS USING MATERIALS SPECIFIED UNDER PRODUCTS.

3.13 CONSTRUCT MANHOLE CHANNEL WITH SMOOTH SEMICIRCULAR BOTTOMS MATCHING INSIDE DIAMETERS OF THE 2.10.1.2 PROTECTIVE COATING FOR CONCRETE MANHOLE SECTION INTERIOR SHALL BE TWO COATS CONNECTING SEWERS. CHANGE DIRECTIONS OF FLOW WITH A SMOOTH CURVE OF AS LARGE A RADIUS AS THE MANHOLE OF COAL TAR SOLUTION SUCH AS INTERNATIONAL PROTECTIVE COAT "INTERTUF 100" OR PITTSBURGH SIZE WILL PERMIT. CHANGE SIZE AND GRADE OF CHANNELS GRADUALLY AND EVENLY. CHANNELS MAY BE FORMED DIRECTLY IN THE CONCRETE MANHOLE BOTTOM. MADE OF CHANNEL PIPE, LAID IN CONCRETE, OR CONSTRUCTED BY LAYING FULL SECTION SEWER PIPE THROUGH THE MANHOLE AND BREAKING OUT THE TOP HALF WHEN THE SURROUNDING CONCRETE HAS HARDENED. MANHOLE FLOORS OUTSIDE THE CHANNELS SHALL BE SMOOTH AND SHALL HAVE SLOPE 2.10.2 MANHOLE FRAMES AND COVERS SHALL BE ROADWAY TYPE WITH DEEP SOCKET COVERS. MACHINE BETWEEN 2 AND 4 INCHES PER FOOT TOWARD THE CHANNELS.

TO MANHOLE RISER SECTION. PROVIDE COVER WITH TWO %-INCH DIAMETER HOLES FOR VENTILATION. 3.14 CONSTRUCT CONCRETE CAP OR CRADLE IN ACCORDANCE WITH THE LATEST EDITION OF THE VDOT ROAD AND CASTINGS SHALL BE GRAY IRON MEETING REQUIREMENTS OF ASTM A 48, CLASS 30, AND HAVE 24-INCH BRIDGE STANDARDS AT LOCATIONS WHERE THE VERTICAL SEPARATION BETWEEN THE NEW SANITARY SEWER AND ADJACENT UTILITIES IS LESS THAN 6 INCHES.

3.15 ENCASE SANITARY SEWER/FORCE MAIN PIPING CROSSING UNDER HIGHWAYS IN A LARGER PIPE OR CONDUIT CALLED

A CASING PIPE. THE CASING PIPE SHALL BE OF THE DIAMETER AND WALL THICKNESS INDICATED ON THE DRAWINGS. JOINING OF STEEL CASING PIPE SHALL MEET REQUIREMENTS OF AWWA C206 "STANDARD FOR FIELD WELDING OF STEEL WATER PIPE JOINTS." INSTALL CASING PIPE BY JACKING OR BORING

3.15.1 INSTALLATION UNDER HIGHWAYS SHALL MEET REQUIREMENTS OF VDOT ROAD AND BRIDGE SPECIFICATIONS PROVIDE END SEALS ON CASING PIPE ENDS TO PROTECT AGAINST FOREIGN MATTER. NOTIFY VDOT PRIOR TO

3.15.2 THE CONTRACTOR SHALL DETERMINE FOR HIMSELF THE EXISTING CONDITIONS BOTH ABOVE AND BELOW GROUND AND SHALL PHYSICALLY VERIFY THE LOCATION AND ELEVATION OF THE EXISTING UTILITIES, WHETHER INDICATED OR NOT, PRIOR TO INSTALLATION. THE CONTRACTOR SHALL CONTACT MISS UTILITY AND RESPECTIVE UTILITY OWNERS FOR EXACT LOCATIONS PRIOR TO ANY CASING INSTALLATION NEAR UTILITIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING THE CASING PIPE AND THE CARRIER PIPE TO THE REQUIRED LINES AND GRADES.

3.15.3 THE CARRIER PIPE SHALL BE CENTERED AND RESTRAINED WITHIN THE CASING PIPE BY THE USE OF CASING SPACERS. PLACEMENT INTERVALS FOR CASING SPACERS SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN RECOMMENDATIONS

3.16 FOR BURIED PRESSURE PIPING, PROVIDE REACTION ANCHORS OF CONCRETE BLOCKING, RETAINER GLAND TYPE DEVICES, RESTRAINING DEVICES, OR RESTRAINED JOINT TYPE PIPE AT ALL CHANGES IN DIRECTION OF PRESSURE PIPING, AT DEAD ENDS, AND AS SHOWN ON THE DRAWINGS.

3.16.1 CONCRETE REACTION ANCHORS SHALL BEAR AGAINST UNDISTURBED EARTH AND SHALL BE OF THE SIZE AND SHAPE SHOWN ON STANDARD WATER DETAIL W-2. 3.16.2 RESTRAIN ALL JOINTS WITH RETAINER GLANDS/DEVICES IN ACCORDANCE WITH THE WRITTEN 3.20 MANHOLE TESTING RECOMMENDATIONS OF THE RETAINER GLAND/DEVICE MANUFACTURER. ALL PIPE JOINTS SHALL BE RESTRAINED

WITH RETAINER GLANDS/DEVICES A MINIMUM OF 60 FEET EACH SIDE OF A FITTING OR VALVE. 3.16.3 WHERE RETAINER GLANDS/DEVICES ARE USED, EXTREME CARE SHALL BE TAKEN SO THAT EACH SET SCREW IS TIGHTENED AS RECOMMENDED BY THE MANUFACTURER BEFORE THE PIPE IS BACKFILLED AND TESTED.

3.17 INSTALL DETECTABLE TAPE IN TRENCH ABOVE ALL PIPE PER THE MANUFACTURER'S WRITTEN RECOMMENDATIONS.

3.18 INSTALL SEWER SERVICE SADDLE PER THE MANUFACTURE'S WRITTEN RECOMMENDATIONS. 3.19 PRESSURE PIPE TESTS SHALL BE AS FOLLOWS:

3.19.1 SUPPLY THE PUMPS, POTABLE WATER, CALIBRATED GAUGES AND METERS, AND ALL THE NECESSARY

3.19.2 HYDROSTATIC PRESSURE TEST: AFTER THE LINE HAS BEEN BACKFILLED. A HYDROSTATIC PRESSURE TEST SHALL BE PERFORMED USING POTABLE WATER. CAREFULLY FILL THE SYSTEM WITH POTABLE WATER AT A VELOCITY OF APPROXIMATELY 1 FOOT PER SECOND WHILE NECESSARY MEASURES ARE TAKEN TO ELIMINATE ALL AIR. AFTER THE SYSTEM HAS BEEN FILLED, RAISE THE PRESSURE BY PUMP TO A MINIMUM OF 150 PSIG, OR 1.5 TIMES THE WORKING PRESSURE, WHICHEVER IS GREATER. MEASURE PRESSURE AT LOWEST POINT IN THE SYSTEM WITH GAUGE COMPENSATED FOR ELEVATION. MAINTAIN THIS PRESSURE FOR AT LEAST 1 HOUR. IF PRESSURE CANNOT BE MAINTAINED, DETERMINE THE CAUSE, REPAIR, AND REPEAT THE TEST UNTIL SUCCESSFUL.

3.18.3 FOLLOWING THE HYDROSTATIC PRESSURE TEST, SUBJECT THE SYSTEM TO A LEAKAGE TEST. USE CALIBRATED METER TO DETERMINE LEAKAGE. LEAKAGE SHALL BE DEFINED AS THE QUANTITY OF POTABLE WATER THAT MUST BE SUPPLIED INTO THE PIPE TO MAINTAIN WORKING PRESSURE. AFTER ALL AIR IN THE PIPE LINE HAS BEEN EXPELLED AND THE PIPE HAS BEEN FILLED WITH POTABLE WATER. DURATION OF LEAKAGE TEST SHALL BE 2 HOURS, LEAKAGE SHALL NOT EXCEED THE QUANTITY DETERMINED BY THE FORMULA, FIND AND REPAIR THE LEAKS AND REPEAT THE TEST UNTIL SUCCESSFUL. THE FORMULA IS AS FOLLOWS.

> $L = SD(\sqrt{P})/133,200$ L = ALLOWABLE LEAKAGE IN GALLONS/HOUR S = LENGTHS OF PIPELINE TESTED IN FEET

D = NOMINAL DIAMETER OF THE PIPE IN INCHES P = AVERAGE TEST PRESSURE DURING LEAKAGE TEST IN PSIG 3.18.4 REPAIRS: IF PIPING OR VALVES FAIL TO MEET TEST REQUIREMENTS, OR IF ANY LEAKS, CROOKED PIPE, OR OTHER DEFECTS ARE VISIBLE BY INSPECTION, THE CONTRACTOR SHALL REPAIR OR REBUILD AT HIS EXPENSE THOSE PORTIONS OF PRESSURE PIPING WHICH ARE FAULTY. THE TESTS AND REPAIRS SHALL BE CONTINUED UNTIL

THE PRESSURE PIPING IS DEEMED ACCEPTABLE. 3.19 TESTING GRAVITY SEWER LINES

3.19.1 LOW PRESSURE AIR TESTING IN ACCORDANCE WITH UNI-B-6 MAY BE USED ON POLYVINYL CHLORIDE (PVC) SANITARY SEWER LINES, LOW PRESSURE AIR TESTING IN ACCORDANCE WITH ASTM C 924 MAY BE USED ON ALL OTHER SANITARY SEWER LINES 24 INCHES OR LESS IN DIAMETER. ALL MANHOLES SHALL BE TESTED USING THE INFILTRATION METHOD. EXFILTRATION METHOD. OR VACUUM TESTING. TESTS SHALL BE CONDUCTED ON SHORT SECTIONS OF SEWER LINE: I.E., BETWEEN MANHOLES, OR AT THE END OF EACH DAY'S WORK, INSTALLATION OF SEWERS WILL NOT BE PERMITTED AT A POINT MORE THAN 2,000 FEET AHEAD OF ANY SECTION OF SEWER OR ANY MANHOLE WHICH HAS NOT BEEN GIVEN THE FINAL TEST AND ACCEPTED. THE CONTRACTOR SHALL PROVIDE AL LABOR, MATERIALS, TOOLS, AND EQUIPMENT NECESSARY TO MAKE THE TESTS. ALL MONITORING GAUGES SHALL BE SUBJECT TO CALIBRATION, IF DEEMED NECESSARY. ALL SEWER LINES, REGARDLESS OF SIZE, THAT CROSS UNDER STREAMS SHALL BE TESTED FOR AND EXHIBIT ZERO INFILTRATION.

3.19.2 LOW PRESSURE AIR TEST

3.19.2.1 SUMMARY OF METHOD: AFTER THE BACKFILL HAS BEEN PLACED AND COMPACTED TO A MINIMUM DEPTH OF 1 FOOT OVER THE PIPE, PLUG THE SECTION OF THE SEWER LINE TO BE TESTED. INTRODUCE LOW-PRESSURE AIR INTO THE PLUGGED LINE

3.19.2.2 PREPARATION OF THE SEWER LINE: FLUSH AND CLEAN THE SEWER LINE PRIOR TO TESTING. THUS SERVING TO WET THE PIPE SURFACE AS WELL AS CLEAN OUT ANY DEBRIS. A WETTED INTERIOR PIPE SURFACE WILL PRODUCE MORE CONSISTENT RESULTS. PLUG ALL PIPE OUTLETS USING APPROVED PNEUMATIC PLUGS WITH A SEALING LENGTH EQUAL TO OR GREATER THAN THE DIAMETER OF THE LINE BEING TESTED. GIVE SPECIAL ATTENTION TO LATERALS.

3.19.2.3 GROUNDWATER DETERMINATION: INSTALL A 1/2-INCH CAPPED GALVANIZED PIPE NIPPLE, APPROXIMATELY 12 INCHES LONG, THROUGH THE MANHOLE. IMMEDIATELY PRIOR TO THE LINE TEST THE GROUNDWATER ELEVATION SHALL BE DETERMINED BY REMOVING THE PIPE CAP AND BLOWING AIR THROUGH THE PIPE NIPPLE INTO THE GROUND SO AS TO CLEAR IT, AND THEN CONNECTING A CLEAR PLASTIC HOSE TO THE PIPE NIPPLE. THE HOSE SHALL BE HELD VERTICALLY AND A MEASUREMENT OF THE HEIGHT IN FEET OF WATER OVER THE INVERT OF THE PIPE SHALL BE TAKEN AFTER THE WATER HAS STOPPED RISING IN THE PLASTIC HOSE.

3.19.2.4 PROCEDURES

3.19.2.4.1 DETERMINE THE TEST DURATION FOR THE SECTION UNDER TEST BY COMPUTATION FROM THE APPLICABLE FORMULAS SHOWN IN ASTM C 924, OR FROM THE FOLLOWING "AIR TEST TABLE." THE PRESSURE-HOLDING TIME IS BASED ON AN AVERAGE HOLDING PRESSURE OF 3 PSI (21 KPA) GAUGE OR A DROP FROM 3.5 PSI (24 KPA) TO 2.5 PSI (17 KPA) GAUGE. THE TESTS SHALL BE CONDUCTED BETWEEN TWO CONSECUTIVE

3.19.2.4.2 THE TEST SECTION OF THE SEWER LINE SHALL BE PLUGGED AT EACH END. ONE OF THE PLUGS USED AT THE MANHOLE SHALL BE TAPPED AND EQUIPPED FOR THE AIR INLET CONNECTION FOR FILLING THE LINE FROM THE AIR COMPRESSOR.

3.19.2.4.3 ALL SERVICE LATERALS, STUBS, AND FITTINGS INTO THE SEWER TEST SECTION SHALL BE PROPERLY PLUGGED AND CAREFULLY BRACED AGAINST THE INTERNAL PRESSURE TO PREVENT AIR LEAKAGE BY SLIPPAGE AND BLOWOUTS. 3.19.2.4.4 CONNECT AIR HOSE TO TAPPED PLUG SELECTED FOR THE AIR INLET. THEN

CONNECT THE OTHER END OF THE AIR HOSE TO THE PORTABLE AIR CONTROL EQUIPMENT

WHICH CONSISTS OF VALVES AND PRESSURE GAGES USED TO CONTROL THE AIR ENTRY RATE TO THE SEWER TEST SECTION AND THE AIR PRESSURE IN THE PIPE LINE. 3.19.2.4.5 MORE SPECIFICALLY, THE AIR CONTROL EQUIPMENT SHALL INCLUDE A SHUTOFF VALVE, PRESSURE REGULATING VALVE, PRESSURE REDUCTION VALVE, AND A MONITORING PRESSURE GAUGE HAVING A PRESSURE RANGE FROM 0 TO 10 PSI. THE GAUGE SHALL HAVE MINIMUM DIVISIONS OF 0.10 PSI AND AN ACCURACY OF PLUS OR MINUS 0.04 PSI.

3.19.2.4.6 CONNECT ANOTHER AIR HOSE BETWEEN THE AIR COMPRESSOR (OR OTHER SOURCE OF COMPRESSED AIR) AND THE AIR CONTROL EQUIPMENT. THIS COMPLETES THE TEST EQUIPMENT SETUP, TEST OPERATIONS MAY COMMENCE.

3.19.2.4.7 SUPPLY AIR TO THE TEST SECTION SLOWLY, FILLING THE PIPE LINE UNTIL A CONSTANT PRESSURE OF 4.0 PSIG IS MAINTAINED. THE AIR PRESSURE SHALL BE 3 19 2 4 8 WHEN CONSTANT PRESSURE OF 4 0 PSIG IS REACHED THROTTLE THE AIR

SUPPLY TO MAINTAIN THE INTERNAL PRESSURE ABOVE 3.5 PSIG FOR AT LEAST 5 MINUTES. THIS TIME PERMITS THE TEMPERATURE OF THE ENTERING AIR TO EQUALIZE WITH THE EMPERATURE OF THE PIPE WALL. DURING THIS STABILIZATION PERIOD, CHECK ALL PLUGGED FITTINGS WITH A SOAP SOLUTION TO DETECT ANY LEAKAGE AT THESE CONNECTIONS, IF LEAKAGE IS DETECTED AT ANY PLUG, RELEASE THE PRESSURE IN THE LINE AND TIGHTEN ALL LEAKY PLUGS THEN START THE TEST OPERATION AGAIN BY SUPPLYING AIR. WHEN IT IS NECESSARY TO BLEED OFF THE AIR TO TIGHTEN OR REPAIR A FAULTY PLUG. A NEW 5-MINUTE INTERVAL SHALL BE ALLOWED AFTER THE PIPE LINE HAS

3.19.2.4.9 AFTER THE STABILIZATION PERIOD, SHUT OFF OR DISCONNECT THE AIR SUPPLY. BEFORE STARTING THE TEST, THE PRESSURE MAY BE ALLOWED TO DROP TO 3.5 PSIG. RECORD THE DROP IN PRESSURE FOR THE TEST PERIOD. IF THE PRESSURE HAS DROPPED MORE THAN 1.0 PSI (7 KPA) GAUGE DURING THE TEST PERIOD, THE LINE SHALL BE PRESUMED TO HAVE FAILED. THE TEST MAY BE DISCONTINUED WHEN THE PRESCRIBED TEST TIME HAS BEEN COMPLETED EVEN THOUGH THE 1.0 PSIG DROP HAS NOT OCCURRED.

3.19.2.4.10 IF THE PIPE TO BE TESTED IS SUBMERGED IN GROUNDWATER, THE TEST PRESSURE SHALL BE INCREASED 1.0 PSI FOR EVERY 2.31 FEET THE GROUNDWATER LEVEL IS ABOVE THE INVERT OF THE SEWER.

> EXAMPLE: IF THE VERTICAL HEIGHT OF WATER FROM THE SEWER INVERT TO THE TOP OF THE WATER COLUMN MEASURES 4.62 FEET, THE ADDITIONAL AIR PRESSURE REQUIRED WOULD BE 4.62 DIVIDED BY 2.31 EQUALS 2 PSI.

> 5.5 PSIG, AND THE 1.0 PSIG DROP WOULD BE TO 4.5 PSIG. THERE IS NO CHANGE IN THE ALLOWABLE DROP (1.0 PSIG) OR IN THE TIME REQUIREMENTS ESTABLISHED FOR THE BASIC AIR TEST.

THEREFORE, THE STARTING PRESSURE OF THE TEST WOULD BE 3.5 PLUS 2 OR

3.19.2.5 SAFETY: THE AIR TEST MAY BE DANGEROUS IF, BECAUSE OF LACK OF UNDERSTANDING OR CARELESSNESS, A LINE IS IMPROPERLY PREPARED.

3.19.2.5.1 IT IS EXTREMELY IMPORTANT THAT THE VARIOUS PLUGS BE INSTALLED AND BRACED IN SUCH A WAY AS TO PREVENT BLOWOLTS. A FORCE OF 250 POLINDS IS EXERTED. ON AN 8-INCH (203 MM) PLUG BY AN INTERNAL PIPE PRESSURE OF 5 PSI (34 KPA). IT SHOULD BE REALIZED THAT SUDDEN EXPULSION OF A POORLY INSTALLED PLUG OR OF A PLUG THAT IS PARTIALLY DEFLATED BEFORE THE PIPE PRESSURE IS RELEASED CAN BE DANGEROUS. 3.19.2.5.2 AS A SAFETY PRECAUTION, PRESSURIZING EQUIPMENT SHALL INCLUDE A REGULATOR OR RELIEF VALVE SET AT 10 PSI (69 KPA) TO AVOID OVER-PRESSURIZING AND DAMAGING AN OTHERWISE ACCEPTABLE LINE. NO ONE SHALL BE ALLOWED IN THE

3.19.2.6 TABLE: THE AIR TEST TABLE AT THE END OF THIS SECTION HAS BEEN PREPARED UTILIZING APPLICABLE FORMULAS FROM ASTM C 924.

3.20.1 ALL MANHOLES SHALL BE TESTED USING THE INFILTRATION METHOD, EXFILTRATION METHOD, OR VACUUM

3.20.2 INFILTRATION OR EXFILTRATION METHOD: ALL PIPES LEADING TO AND FROM A MANHOLE SHALL BE

PLUGGED, PLUGS SHALL BE INSERTED INTO THE PIPES A DISTANCE GREATER THAN THE LENGTH OF THE PLUGS USED TO TEST EACH RESPECTIVE SECTION OF SEWER LINE TO INSURE THE MANHOLE AND SEWER LINE TESTS OVERLAP. PLUGS SHALL BE SECURED TO THE MANHOLE STRUCTURE. THE MANHOLE SHALL BE FILLED WITH POTABLE WATER TO THE TOP OF FRAME AND ALLOWED TO SOAK FOR A MINIMUM OF 2 HOURS AND A MAXIMUM OF 12 HOURS TO PERMIT THE MANHOLE TO ABSORB WATER. THE COVER SHALL BE ON THE MANHOLE DURING THE SOAKING PERIOD. AT THE END OF THE SOAKING PERIOD. POTABLE WATER SHALL BE ADDED UNTIL THE MANHOLE OVERFLOWS. AFTER 30 MINUTES, CHECK DIFFERENCE IN LEVEL AND CONVERT TO GALLONS. MANHOLE LEAKAGE SHALL NOT EXCEED 1/4-GALLON PER HOUR. UPON COMPLETION OF THE TEST, THE WATER SHALL BE REMOVED FROM THE MANHOLE

3.20.3 VACUUM TESTING: THE VACUUM TEST SHALL BE MADE USING AN INFLATABLE COMPRESSION BAND, VACUUM PUMP. AND APPURTENANCES SPECIFICALLY DESIGNED FOR VACUUM TESTING MANHOLES. TEST PROCEDURES SHALL BE IN ACCORDANCE WITH ASTM C 1244, EXCEPT THE MORE RESTRICTIVE REQUIREMENTS SPECIFIED HEREIN. EQUIPMENT SHALL BE MANUFACTURED BY PETER A. GLAZIER, INC., P.O. BOX 1002, WORCESTER, MASSACHUSETTS 01613, TELEPHONE: (508) 755-3849, TOLL-FREE: (800) 822-6488. 3.20.3.1 MANHOLES MAY BE TESTED BY VACUUM TEST IMMEDIATELY AFTER ASSEMBLY OF THE MANHOLE, FRAMES, AND CONNECTING PIPES AND BEFORE ANY BACKFILL IS PLACED AROUND THE

MANHOLES. HOWEVER, THE FINAL TEST AND ACCEPTANCE SHALL BE BASED ONLY UPON A TEST AFTER THE MANHOLE IS BACKFILLED AND THE COVER FRAME CASTINGS ARE SET IN PLACE. 3.20.3.2 ALL LIFT HOLES SHALL BE PLUGGED WITH NONSHRINK GROUT AND ALL PIPES SHALL BE PLUGGED, TAKING CARE TO SECURELY BRACE THE PLUGS AND PIPE.

3.20.3.3 AFTER THE TESTING EQUIPMENT IS IN PLACE. A VACUUM OF 10 INCHES OF MERCURY SHALL BE DRAWN ON THE MANHOLE. THE MANHOLE WILL BE CONSIDERED TO HAVE PASSED THE TEST IF THE VACUUM DOES NOT DROP MORE THAN 1-INCH OF MERCURY WITHIN 60 SECONDS FOR MANHOLES 7 FEET IN DEPTH OR LESS AND 90 SECONDS FOR MANHOLES OVER 7 FEET DEEP.

3.20.3.4 IF THE MANHOLE FAILS THE INITIAL TEST, THE CONTRACTOR SHALL LOCATE THE LEAKAGE AND ${\it MAKE PROPER REPAIRS, AND RETEST UNTIL A SATISFACTORY TEST RESULT IS OBTAINED.}$

3.20.3.5 AFTER THE MANHOLES HAVE BEEN BACKFILLED AND THE COVER FRAME CASTING SEALED IN PLACE, AND PRIOR TO FINAL ACCEPTANCE OF THE PROJECT, ANY SIGNS OF LEAKS OR WEEPING VISIBLE FROM THE INSIDE OF THE MANHOLE SHALL BE REPAIRED, AND THE MANHOLE MADE WATERTIGHT AND

3.21 TEST FOR LEAKAGE OF GRAVITY SEWERS INCLUDING MANHOLES, USING EITHER THE INFILTRATION OR EXFILTRATION METHOD. MAXIMUM ALLOWABLE LEAKAGE SHALL BE LIMITED TO 2,400 GALLONS PER DAY PER MILE OR 100 GALLONS PER DAY PER INCH DIAMETER PER MILE, WHICHEVER IS LESS. SEWER LINES CROSSING ABOVE OR BELOW STREAMS SHALL EXHIBIT ZERO INFILTRATION.

3.21.1 USE INFILTRATION TEST WHEN GROUNDWATER IS AT LEAST 4 FEET ABOVE TOP OF THE PIPE FOR THE ENTIRE LENGTH OF LINE TO BE TESTED. PLUG THE PIPE AT THE UPPER MANHOLE. INSTALL SUITABLE MEASURING DEVICE AT THE NEXT LOWEST MANHOLE. MEASURE THE AMOUNT OF WATER FLOWING THROUGH THE MEASURING DEVICE OVER A 30-MINUTE PERIOD.

3.21.2 USE EXFILTRATION TEST WHEN GROUNDWATER IS LESS THAN 4 FEET ABOVE TOP OF PIPE, PLUG THE PIPE AT THE LOWER MANHOLE. FILL THE LINE AND MANHOLE WITH POTABLE WATER TO 4 FEET ABOVE TOP OF PIPE, OR TOP OF MANHOLE WHICHEVER IS LESS. LET THE WATER STAND UNTIL PIPE HAS REACHED MAXIMUM ABSORPTION AND

UNTIL ALL TRAPPED AIR HAS ESCAPED. 12-HOUR MINIMUM, AFTER MAXIMUM ABSORPTION IS REACHED. REFILL MANHOLE TO ORIGINAL LEVEL. AFTER 30 MINUTES, RECORD DIFFERENCE IN LEVEL AND CONVERT TO GALLONS. 3.21.3 GROUNDWATER DETERMINATION: USE SAME PROCEDURE AS "LOW PRESSURE AIR TEST" ABOVE.

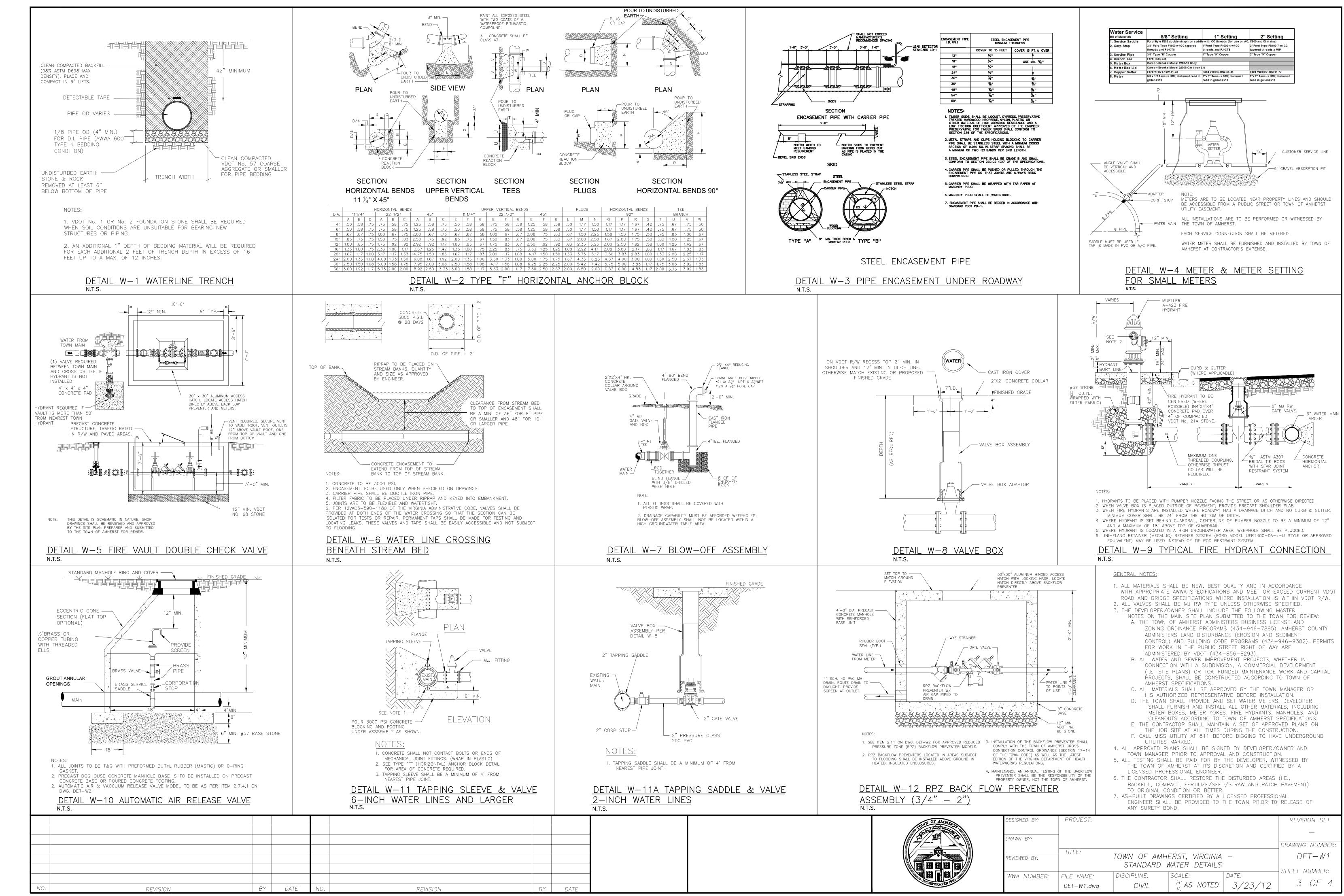
3.22 REPAIRS: IF SEWER LINES OR MANHOLES FAIL TO MEET TEST REQUIREMENTS OR IF ANY LEAKS, CROOKED PIPE, OR OTHER DEFECTS ARE VISIBLE BY INSPECTION. THE CONTRACTOR SHALL REPAIR OR REBUILD AT HIS EXPENSE THOSE PORTIONS OF SEWER LINES WHICH ARE FAULTY. THE TESTS AND REPAIRS SHALL BE CONTINUED UNTIL THE SEWER LINE IS DEEMED ACCEPTABLE.

> AIR TEST TABLE BASED ON FORMULAS FROM ASTM C 924

MINIMUM TEST TIME IN MINUTES: SECONDS FOR PRESSURE DROP FROM 3.5 TO 2.5 PSIG LINE LENGTH IN FEET

PIPE SIZE INCHES	10	50	100	150	200	250	300	350	400	450	500
4	0:02	0:09	0:18	0:27	0:36	0:45	0:54	1:03	1:12	1:21	1:30
6	0:04	0:21	0:42	1:03	1:24	1:45	2:06	2:27	2:48	3:09	3:30
8	0:07	0:36	1:12	1:48	2:24	3:00	3:36	4:12	4:48	5:24	6:00
10	0:09	0:45	1:30	2:15	3:00	3:45	4:30	5:15	6:00	6:45	7:30
12	0:11	0:54	1:48	2:42	3:36	4:30	5:24	6:18	7:12	8:06	9:00

SIGNED BY: PROJECT REVISION SE RAWN BY: RAWING NUMBER TOWN OF AMHERST, VIRGINIA -EVIEWED BY: STANDARD SANITARY SEWER SPECIFICATIONS SHEET NUMBER: VWA NUMBER: FILE NAME. 2 OF 4 !: AS NOTED | 3/23/12 DET-S2.dwg DATE



1. GENERAL 1.1 PROJECT CONDITIONS: SEPARATION OF WATER LINES AND SANITARY SEWERS. 1.1.1 FOLLOW VDH STANDARDS FOR SEPARATION OF WATER MAINS AND SEWER LINES. 1.1.2 PARALLEL INSTALLATION 1.1.2.1 NORMAL CONDITIONS: WATER LINES SHALL BE CONSTRUCTED AT LEAST 10 FEET HORIZONTALLY FROM A SEWER OR SEWER MANHOLE WHENEVER POSSIBLE, THE DISTANCE SHALL BE MEASURED EDGE-TO-EDGE. 1.1.2.2 UNUSUAL CONDITIONS: WHEN LOCAL CONDITIONS PREVENT A HORIZONTAL SEPARATION OF AT LEAST 10 FEET, THE WATER LINE MAY BE LAID CLOSER TO A SEWER OR SEWER MANHOLE PROVIDED THAT: 1.1.2.3 THE BOTTOM OF THE WATER LINE IS AT LEAST 18 INCHES ABOVE THE TOP OF THE SEWER. 1.1.2.3.1 WHERE THIS VERTICAL SEPARATION CANNOT BE OBTAINED, THE SEWER SHALL BE CONSTRUCTED OF AWWA APPROVED WATER PIPE PRESSURE-TESTED IN PLACE TO 50 PSI WITHOUT LEAKAGE PRIOR TO BACKFILLING. THE SEWER MANHOLE SHALL BE OF WATERTIGHT CONSTRUCTION AND TESTED IN PLACE 1131 NORMAL CONDITIONS: WATER LINES CROSSING OVER SEWERS SHALL BE LAID TO PROVIDE A SEPARATION OF AT LEAST 18 INCHES BETWEEN THE BOTTOM OF THE WATER LINE AND THE TOP OF THE SEWER 1.1.3.1.1 UNUSUAL CONDITIONS: WHEN LOCAL CONDITIONS PREVENT A VERTICAL SEPARATION DESCRIBED IN CROSSING, NORMAL CONDITIONS, PARAGRAPH ABOVE, THE FOLLOWING CONSTRUCTION SHALL BE USED. 1.1.3.1.2 SEWERS PASSING OVER OR UNDER WATER LINES SHALL BE CONSTRUCTED OF THE MATERIALS DESCRIBED IN PARALLEL INSTALLATION, UNUSUAL CONDITIONS, AS SPECIFIED ABOVE. 1.1.3.1.3 WATER LINES PASSING UNDER SEWERS SHALL, IN ADDITION, BE PROTECTED BY PROVIDING: A VERTICAL SEPARATION OF AT LEAST 18 INCHES BETWEEN THE BOTTOM OF THE SEWER AND THE TOP OF THE WATER LINE. ADEQUATE STRUCTURAL SUPPORT FOR THE SEWERS TO PREVENT EXCESSIVE DEFLECTION OF THE JOINTS AND SETTLING ON AND BREAKING WATER LINE, THAT THE LENGTH OF THE WATER LINE BE CENTERED AT THE POINT OF THE CROSSING SO THAT JOINTS SHALL BE EQUIDISTANT AND AS FAR AS POSSIBLE FROM THE SEWER. 1.1.4 SANITARY SEWERS OR SEWER MANHOLES: NO WATER PIPES SHALL PASS THROUGH OR COME IN CONTACT WITH ANY PART OF A SEWER OR SEWER MANHOLE. 1.2 SUBMITTALS: PROVIDE THE FOLLOWING SHOP DRAWING SUBMITTALS AS ONE COMPLETE PACKAGE, APPROVED AND SIGNED BY THE DEVELOPER'S ENGINEER, FOR APPROVAL BY THE TOWN MANAGER. A TOTAL OF FOUR (4) COPIÉS OF THE COMPLETE SHOP DRAWING PACKAGE SHALL BE SUBMITTED FOR APPROVAL; ONE (1) REVIEWED COPY WILL BE RETURNED TO THE 1.2.1 PIPE AND FITTINGS: CATALOG CUTS AND CERTIFICATES OF COMPLIANCE FOR PIPE, FITTINGS, LININGS, AND MATERIALS FOR APPROVAL. CERTIFICATES SHALL STATE THAT MATERIALS FURNISHED COMPLY WITH THE STANDARDS SPECIFIED IN THIS SECTION. 1.2.2 PIPE RESTRAINT DEVICES 1.2.3 VALVES: CATALOG CUTS AND CERTIFICATES OF COMPLIANCE FOR VALVES. 1.2.4 AIR RELEASE VALVES 1.2.5 CASING SPACERS/END SEALS 1.2.6 FIRE HYDRANTS 1.2.7 VALVE AND METER BOXES 1.2.8 PRECAST CONCRETE MANHOLE AND VAULT DETAILS 1.2.9 MANHOLE STEPS 1.2.10 PIPE TO MANHOLE CONNECTION DETAILS 1.2.11 WATER PIPING FIELD TEST CERTIFICATION REPORTS 1.2.12 BACTERIOLOGICAL TEST REPORTS (SUBMIT TO TOWN) 1.3 THE CONTRACTOR SHALL PHYSICALLY VERIFY THE LOCATION AND ELEVATION OF THE EXISTING UTILITIES, WHETHER INDICATED OR NOT, PRIOR TO STARTING CONSTRUCTION. THE CONTRACTOR SHALL CONTACT MISS UTILITY (TELEPHONE: 811) AND RESPECTIVE UTILITY OWNERS FOR EXACT LOCATIONS PRIOR TO ANY EXCAVATION NEAR UTILITIES. 1.4 CONSTRUCTION ACTIVITIES WHICH INVOLVE THE TEMPORARY INTERRUPTION OF ESSENTIAL SERVICES OR TRAFFIC PATTERNS SHALL BE SCHEDULED IN CONSULTATION WITH THE TOWN OF AMHERST AND VDOT OR THEIR REPRESENTATIVES, SHALL NOT BE OF LONGER DURATION THAN ESSENTIAL TO ACCOMPLISH THE PURPOSE FOR SUCH INTERRUPTIONS, AND SHALL BE COORDINATED TO BIVE THE TOWN OF AMHERST THE ABILITY TO MAINTAIN WATER SERVICE. THE CONTRACTOR SHALL COORDINATE AN INTERRUPTION OF WATER SERVICE WITH THE TOWN AT LEAST 1 WEEK IN ADVANCE OF SUCH WORK. UPDATED CONSTRUCTION SCHEDULES SHALL BE SUBMITTED TO THE TOWN EACH WEEK TO COORDINATE UPCOMING CONSTRUCTION ACTIVITIES. 2.1 PIPING APPLICATION: WATER MAIN PIPING SHALL BE 2-INCH, 6-INCH, 8-INCH, 10-INCH, OR 12-INCH IN DIAMETER UNLESS OTHERWISE APPROVED BY THE TOWN OF AMHERST. THE FOLLOWING PIPING SYSTEMS, 6-12 INCHES IN DIAMETER, SHALL BE CONSTRUCTED OF PRESSURE CLASS 350 DUCTILE IRON PIPE UNLESS OTHERWISE INDICATED 2.1.1.1 BELOW GRADE WATER MAIN PIPING. PIPE RESTRAINT SHALL BE PROVIDED AS SPECIFIED HEREIN UNLESS 2.1.1.2 BELOW GRADE WATER PIPING NOT OTHERWISE SPECIFIED 2.1.2 THE FOLLOWING PIPING SYSTEMS, 6 INCHES AND LARGER IN DIAMETER, SHALL BE CONSTRUCTED OF RESTRAINED JOINT PRESSURE CLASS 350 DUCTILE IRON PIPE. ALL PIPE JOINTS FOR THESE SECTIONS OF PIPING SHALL BE 2.1.2.1 BELOW GRADE WATER MAIN PIPING AT ROAD CROSSINGS AND STREAM CROSSINGS 2.1.2.2 BELOW GRADE PIPING BENEATH STRUCTURES 2.1.2.3 BELOW GRADE PIPING NOT OTHERWISE SPECIFIED 2.1.3 THE FOLLOWING PIPING SYSTEMS, 6 INCHES AND LARGER IN DIAMETER, SHALL BE CONSTRUCTED OF FLANGED JOINT SPECIAL THICKNESS CLASS 53 DUCTILE IRON PIPE UNLESS OTHERWISE INDICATED 2.1.3.1 ABOVE GRADE PIPING AT BLOWOFF ASSEMBLIES 2.1.3.2 ABOVE GRADE PIPING NOT OTHERWISE SPECIFIED 2.1.4 THE FOLLOWING PIPING SYSTEMS, 2 INCHES IN DIAMETER, SHALL BE CONSTRUCTED OF RESTRAINED JOINT PRESSURE CLASS 200 ASTM D2241 POLYVINYL CHLORIDE (PVC) PIPE UNLESS OTHERWISE INDICATED: 2.1.4.1 BELOW GRADE WATER MAIN PIPING 2.1.5 THE FOLLOWING PIPING SYSTEMS, SMALLER THAN 2 INCHES IN DIAMETER, SHALL BE CONSTRUCTED OF ASTM B 88 TYPE K FLEXIBLE COPPER PIPE UNLESS OTHERWISE INDICATED: 2.1.5.1 PIPING INSIDE AIR RELEASE VALVE MANHOLES. FITTINGS SHALL MEET THE REQUIREMENTS SPECIFIED IN PARAGRAPHS 2.2.3.1 AND 2.2.3.2. 2.1.5.2 BELOW GRADE WATER SERVICE LATERAL PIPING 2.1.5.3 BELOW GRADE WATER PIPING NOT OTHERWISE SPECIFIED 2.1.6 THE MINIMUM SIZE PIPE FOR WATER DISTRIBUTION SHALL BE SIX INCHES IN DIAMETER EXCEPT THAT TWO INCH PIPE ' BE USED WHEN THE RUN IS LESS THAN 300 FEET AND FUTURE USES ARE NOT A STRONG CONSIDERATION. OTHE DEPARTURES MAY BE JUSTIFIED BY A HYDRAULIC ANALYSIS THAT CONSIDERS FUTURE WATER USES IN SPECIAL CIRCUMSTANCES. THE MINIMUM SIZE OF PIPE WHERE FIRE HYDRANTS OR OTHER FIRE CONNECTIONS ARE TO B PROVIDED OR REQUIRED SHALL BE SIX INCHES IN DIAMETER. WATER MAINS NOT SIZED TO CARRY FIRE FLOWS SHALL NOT 2.1.7 ACCESSORIES: PROVIDE FLANGES, JOINT RESTRAINTS, CONNECTING PIECES, TRANSITION GLANDS, TRANSITION SLEEVES, TAPPING SADDLES, AND OTHER ADAPTERS AS REQUIRED FOR COMPLETE AND OPERABLE PIPING SYSTEMS FOF THE SERVICE INDICATED. PROVIDE RESTRAINED JOINTS WHERE INDICATED ON THE DRAWINGS AND AS SPECIFIED IN THIS 2.2.1 DUCTILE IRON PIPE 2.2.1.1 DUCTILE IRON PIPE SHALL BE PRESSURE CLASS 350 UNLESS OTHERWISE INDICATED AND SHALL MEET REQUIREMENTS OF ANSI/AWWA C150 AND C151. FLANGED PIPE SHALL BE SPECIAL THICKNESS CLASS 53 UNLESS OTHERWISE INDICATED AND SHALL MEET REQUIREMENTS OF ANSI/AWWA C115 2.2.1.2 FITTINGS SHALL MEET REQUIREMENTS OF ANSI/AWWA C110 AND C153 WITH PRESSURE RATING NOT LESS THAN THAT OF THE PIPE. 2.2.1.3 PROVIDE MECHANICAL JOINTS OR PUSH-ON JOINTS FOR UNDERGROUND PIPING, JOINTING MATERIALS SHALL MEET REQUIREMENTS OF ANSI/AWWA C111. 2.2.1.4 MECHANICAL JOINT RETAINER GLANDS SHALL BE ASTM A536 DUCTILE IRON AND SHALL BE MANUFACTURED BY EBAA IRON, INC, OR APPROVED EQUAL BY AMERICAN CAST IRON PIPE COMPANY, FORD METER BOX COMPANY, OR ROMAC INDUSTRIES, INC. 2.2.1.5 RESTRAINED JOINTS SHALL BE "FLEX-RING" AS MANUFACTURED BY AMERICAN CAST IRON PIPE COMPANY. R FLEX" AS MANUFACTURED BY U.S. PIPE AND FOUNDRY COMPANY, "SNAP-LOK" AS MANUFACTURED BY GRIFFIN PIPE PRODUCTS COMPANY, OR APPROVED EQUAL. JOINTING MATERIALS SHALL MEET REQUIREMENTS 2.2.1.6 PUSH-ON JOINT AND RUBBER GASKET SHALL MEET REQUIREMENTS OF ANSI/AWWA C111. RESTRAINED PUSH-ON JOINTS MAY BE USED WHERE RESTRAINED JOINTS ARE REQUIRED. 2.2.1.7 PROVIDE FLANGED JOINTS FOR ALL ABOVEGROUND PIPING AND AS INDICATED ON THE DRAWINGS. FLANGES SHALL MEET REQUIREMENTS OF CLASS 125 ANSI B16.1

2.2.1.8 FLANGED JOINT GASKETS SHALL BE FULL FACE, MADE OF RUBBER, AND SHALL MEET REQUIREMENTS OF 2.2.1.9 CEMENT MORTAR LINING WITH BITLIMINOLIS SEAL COAT FOR DUICTILE IRON PIPE AND CAST IRON FITTINGS SHALL MEET REQUIREMENTS OF ANSI/AWWA C104. CEMENT MORTAR LINING SHALL BE STANDARD THICKNESS. 2.2.1.10 EXTERIOR, BITUMINOUS COATING SHALL MEET REQUIREMENTS OF ANSI/AWWA C110, C115, C151, AND C153. AS APPLICABLE 2.2.2 POLYVINYL CHLORIDE (PVC) PRESSURE PIPING 2.2.2.1 POLYVINYL CHLORIDE (PVC) PRESSURE PIPING, 2 INCHES IN DIAMETER, SHALL MEET REQUIREMENTS OF ASTM D 2241 AND CSA B 137.3. FITTINGS SHALL MEET REQUIREMENTS OF CSA B 137.2. PIPE AND FITTINGS SHALL BE SDR 21, PRESSURE CLASS 200. PIPE CONNECTION SHALL BE PLAIN END AND RUBBER GASKETED BELL ENI MEETING REQUIREMENTS OF ASTMID 3139. PIPE SHALL CONFORM TO IRON PIPE SIZE (IPS) OUTSIDE DIMENSION 2.2.2.2 RESTRAINING DEVICES FOR PIPE FITTINGS SHALL BE UNI-FLANGE SERIES 1300 BY FORD METER BOX COMPANY, INC., OR APPROVED EQUAL BY EBAA IRON, INC., OR ROMAC INDUSTRIES, INC. RESTRAINING DEVICES FOR PIPE JOINTS SHALL BE UNI-FLANGE SERIES 1390 BY FORD METER BOX COMPANY, INC., OR APPROVED EQUAL BY EBAA IRON, INC., OR ROMAC INDUSTRIES, INC. 2.2.3 COPPER TUBING 2.2.3.1 COPPER TUBING AND ASSOCIATED FITTINGS SHALL BE ASTM B 88, TYPE K FLEXIBLE. 2.2.3.2 BRASS FITTINGS SHALL BE COMPRESSION JOINT BY FORD METER BOX COMPANY, INC. 2.3 CONCRETE FOR THRUST BLOCKS AND BULKHEAD ANCHORS SHALL BE CLASS A3 AS SPECIFIED IN SECTION 217 OF THE VDOT ROAD AND BRIDGE SPECIFICATIONS. THRUST BLOCKS AND ANCHORS SHALL BE IN ACCORDANCE WITH THE STANDARD DETAIL, BEARING ON UNDISTURBED EARTH. THE PIPING SYSTEM SHALL NOT BE PRESSURE TESTED FOR 14 DAYS AFTER THRUST BLOCKS ARE POURED 2.4 PIPE LABELING 2.4.1 DETECTABLE TAPE SHALL BE PROVIDED FOR ALL BELOW GRADE PIPING SYSTEMS AND SHALL HAVE A METALLIC CORE PROTECTED BY A PLASTIC JACKET. THE TAPE SHALL BE CONTINUOUSLY MARKED INDICATING THAT A WATER MAIN

2.5 STEEL CASING PIPE FOR BORING OR JACKING UNDER HIGHWAYS, RAILROADS, OR STREAMS SHALL MEET REQUIREMENTS OF ASTM A 139, GRADE B. NOMINAL PIPE DIAMETER AND WALL THICKNESS SHALL BE AS INDICATED ON THE DRAWINGS. NO PROTECTIVE COATING OR LINING, NOR HYDROSTATIC TESTING WILL BE REQUIRED.
2.6 CASING SPACERS/END SEALS
2.6.1 CASING SPACERS SHALL BE BOLT-ON STYLE WITH A TWO-PIECE SHELL MADE FROM T-304 STAINLESS STEEL OF A MINIMUM 14-GAUGE THICKNESS. THE SHELL SHALL BE LINED WITH A RIBBED PVC EXTRUSION WITH A RETAINING SECTION THAT OVERLAPS THE EDGE OF THE SHELL AND PREVENTS SLIPPAGE. BEARING SURFACES (RUNNERS) MADE FROM UHMW

POLYMER WITH A STATIC COEFFICIENT OF FRICTION OF 0.11-0.13 SHALL BE ATTACHED TO SUPPORT STRUCTURES (RISERS) AT APPROPRIATE POSITIONS TO PROPERLY SUPPORT THE CARRIER WITHIN THE CASING AND TO EASE INSTALLATION. CASING SPACERS SHALL BE MODEL S12G-2 BY PIPELINE SEAL AND INSULATOR, INC, 6525 GOFORTH STREET, HOUSTON, TEXAS 77021, TELEPHONE NUMBER: (800) 423-2410, OR APPROVED EQUAL.

2.6.2 END SEALS SHALL BE MODEL C AS MANUFACTURED BY PIPELINE SEAL AND INSULATOR, INC., OR APPROVED EQUAL.

LVES

2.7.1 GATE VALVES

2.7.1.1 NONRISING STEM GATE VALVES 3 INCHES AND LARGER SHALL MEET REQUIREMENTS OF AWWA C500 "AWWA STANDARD FOR GATE VALVES FOR WATER AND SEWERAGE SYSTEMS," OR VALVES 3 INCHES THROUGH 12 INCHES SHALL MEET REQUIREMENTS OF AWWA C509 "AWWA STANDARD FOR RESILIENT SEATED GATE VALVES FOR WATER AND SEWERAGE SERVICE." WORKING PRESSURE SHALL BE AT LEAST 200 PSI FOR VALVE SIZES 3 THROUGH 12 INCHES, AT LEAST 150 PSI FOR VALVE SIZES GREATER THAN 12 INCHES, OR AT THE PRESSURE RATING SPECIFIED FOR ADJACENT PIPING, WHICHEVER IS GREATER. VALVE ENDS SHALL BE COMPATIBLE WITH PIPING SYSTEMS IN WHICH VALVES ARE INSTALLED. VALVE SHALL BE CAST IRON BODY, BRONZE MOUNTED. VALVES SHALL HAVE O-RING SEALS AND SHALL OPEN COUNTERCLOCKWISE. ASBESTOS PACKING WILL NOT BE ACCEPTABLE.

2.7.1.2 VALVES LISTED ABOVE SHALL BE MANUFACTURED BY KENNEDY VALVE MANUFACTURING COMPANY, INC., OR AMERICAN FLOW CONTROL.

2.7.1.3 2-INCH GATE VALVES SHALL BE NONRISING STEM, CAST IRON BODY, TAPERED SEAT, RESILIENT WEDGE CONSTRUCTION, WITH THREADED ENDS AND 2-INCH OPERATING NUT. WORKING PRESSURE SHALL BE AT LEAST 200 PSI. VALVES SHALL BE MANUFACTURED BY WATTS REGULATOR, OR APPROVED EQUAL.

2.7.2 TAPPING SLEEVES AND VALVES

2.7.2.1 TAPPING SLEEVES SHALL MEET REQUIREMENTS OF ANSI/AWWA C110 FOR PRESSURE RATING OF PIPING

2.7.2.2 TAPPING SLEEVES SHALL MEET REQUIREMENTS OF ANSI/WWW CTIO FOR PRESSURE RATING OF PIPING.
SLEEVES SHALL BE CONSTRUCTED IN TWO SECTIONS AND SHALL BE MECHANICAL JOINT TYPE WITH FLANGED
OUTLET. THE TAPPING SLEEVE SHALL BE FOR THE SIZE AND TYPE OF PIPING SHOWN ON THE DRAWINGS AND
SPECIFIED HEREIN. TAPPING SLEEVES SHALL BE FORD METER BOX COMPANY "FAST," ROMAC INDUSTRIES, INC.
"SST," MUELLER COMPANY "H30" OR "H304," OR APPROVED EQUAL.

2.7.2.2 TAPPING VALVES SHALL MEET REQUIREMENTS OF GATE VALVES SPECIFIED IN THIS SECTION, EXCEPT
THAT SEAT OPENING SHALL BE LARGER THAN NOMINAL SIZE AND VALVE OUTLET END SHALL BE MECHANICAL

2.7.3.3 TAPPING SADDLES FOR 2-INCH WATER LINE CONNECTIONS SHALL BE MANUFACTURED BY MUELLER COMPANY, FORD METER BOX COMPANY, OR ROMAC INDUSTRIES, INC.

2.7.3 BALL VALVES: BALL VALVES SHALL BE CLASS 150, MEETING REQUIREMENTS OF ANSI B16.34. VALVES SHALL HAVE

ANSI CARBON STEEL BODIES AND BALLS. VALVES SHALL HAVE STAINLESS STEEL STEMS AND TRIM, AND VITON OR TEFLON SEATS, BODY SEALS, AND STEM SEALS. VALVES SHALL BE LEVER OPERATED. VALVES SHALL BE MANUFACTURED BY VELAN VALVE CORPORATION, CONBRACO INDUSTRIES, INC., ITT-GRINNELL, WORCHESTER, INC., OR APPROVED EQUAL.

2.7.4 AIR RELEASE VALVES

2.7.4.1 AIR RELEASE VALVES SHALL BE APCO MODEL 145C COMBINATION AIR VALVES AS MANUFACTURED BY VALVE AND PRIMER CORPORATION, 1420 SOUTH WRIGHT BLVD., SCHAUMBURG, ILLINOIS 60193 OR APPROVED EQUAL BY CLA-VAL COMPANY. VALVES SHALL HAVE THE FOLLOWING DIMENSIONS:

INLET DIAMETER: 2-INCH NPT
OUTLET DIAMETER: 2-INCH NPT

SMALL ORIFICE DIAMETER: 3/32-INCH
2.7.4.2 VALVES SHALL HAVE ASTM A126 GRADE B CAST IRON BODY, COVER, AND LEVER FRAME, ASTM B124

LARGE ORIFICE DIAMETER: 2-INCH

BRONZE PLUG, BUNA-N NEEDLE AND SEAT, AND ASTM A240 STAINLESS STEEL FLOAT.

2.8 CORPORATION STOPS SHALL BE ONE-PIECE BRONZE BODY WITH INTEGRAL WRENCH FLATS, CC INLET TAPER THREADS, O-RING SEALED, BALANCED PRESSURE, PLUG TYPE VALVE, HAVING A ROUND, FULL OPEN UNOBSTRUCTED FLOW WAY, AND MEETING REQUIREMENTS OF AWWA C800, "UNDERGROUND SERVICE LINE VALVES AND FITTINGS." CORPORATION STOPS SHALL BE MANUFACTURED BY FORD METER BOX COMPANY AS INIDCATED ON STANDARD WATER DETAIL W-4, OR APPROVED EQUAL BY A.Y.

2.9 WATER METERS, METER BOXES, AND SERVICE LATERAL ACCESSORIES SHALL BE AS INDICATED ON THE TOWN OF AMHERST STANDARD WATER DETAIL W-4.

2.10 VALVE BOXES SHALL BE ADJUSTABLE CAST IRON VALVE BOXES OF THE TWO-PIECE SCREW-TYPE. BASE SHALL BE PROPER TYPE AND SIZE FOR THE VALVE WITH WHICH IT IS USED. VALVE BOXES SHALL BE MANUFACTURED BY MUELLER COMPANY, DEWEY

BROTHERS, TYLER, OR BINGHAM-TAYLOR.

2.11 BACKFLOW PREVENTERS

2.11.1 FIRE VAULT BACKFLOW PREVENTERS SHALL BE PROVIDED WITH NSF 61 LISTED-FDA APPROVED EPOXY COATED CAST IRON CHECK VALVE BODIES WITH REPLACEABLE BRONZE SEATS AND STAINLESS STEEL RELIEF VALVE SEAT, EPOXY COATED Y-STRAINER, NON-RISING STEM RESILIENT SEATED GATE VALVES, AND BACKFLOW PREVENTER TEST KIT. RELIEF VALVE SHALL BE EQUIPPED WITH AIR GAP. BACKFLOW PREVENTERS SHALL BE SUITABLE FOR 175-PSI SUPPLY PRESSURE AND MEET AWWA C511 REQUIREMENTS. FIRE VAULT BACKFLOW PREVENTERS SHALL BE DOUBLE DETECTOR CHECK TYPE, MANUFACTURED BY WATTS REGULATOR, OR APPROVED EQUAL.

2.11.2 BACKFLOW PREVENTERS FOR LAWN SPRINKLER SYSTEMS SHALL BE BRONZE BODY CONSTRUCTION, CELCON CHECK SEATS, STAINLESS STEEL RELIEF VALVE SEATS AND SHAFTS, RUBBER CHECK VALVE AND RELIEF VALVE ASSEMBLIES, BRONZE STRAINER AND TEST COCKS, AND QUARTER-TURN, FULL PORT RESILIENT SEAT BALL VALVES. RELIEF VALVE SHALL BE EQUIPPED WITH 1-INCH AIR GAP. BACKFLOW PREVENTERS SHALL BE SUITABLE FOR 175-PSI SUPPLY PRESSURE AND MEET REQUIREMENTS OF AWWA C511. LAWN SPRINKLER SYSTEM BACKFLOW PREVENTERS SHALL BE WATTS SERIES 909-QT-S REDUCED PRESSURE ZONE TYPE, MANUFACTURED BY WATTS REGULATOR, OR APPROVED EQUAL.

2.12 FIRE HYDRANTS SHALL BE THE SAFETY FLANGE, BREAKAWAY TOP TYPE, MEETING REQUIREMENTS OF AWWA C502, "AWWA STANDARD FOR DRY-BARREL FIRE HYDRANTS." HYDRANTS SHALL HAVE A BARREL DIAMETER OF NO SMALLER THAN 7 INCHES, A HYDRANT VALVE DIAMETER NO SMALLER THAN 5½ INCHES, AND SHALL BE EQUIPPED WITH TWO 2½-INCH HOSE NOZZLES AND ONE 4½-INCH PUMPER CONNECTION. HOSE AND PUMPER OUTLET THREADS SHALL MATCH LOCAL FIRE DEPARTMENT EQUIPMENT. FIRE HYDRANTS SHALL BE MUELLER MODEL A-423.

2.13.1 PRECAST REINFORCED CONCRETE MANHOLE SECTION

2.13.1.1 PRECAST REINFORCED CONCRETE MANHOLE SECTIONS SHALL MEET REQUIREMENTS OF ASTM C 478. SECTION ENDS SHALL HAVE GASKET GROOVE PROVIDED DURING MANUFACTURING PROCESS. GASKETS FOR SECTION JOINTS SHALL MEET REQUIREMENTS OF ASTM C 443. JOINTS MAY ALSO BE SEALED WITH FLEXIBLE BUTYL RESIN SEALANT MEETING THE REQUIREMENTS OF ASTMC443 OR ASTMC990 WHICH SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN RECOMMENDATIONS. TOP SECTIONS FOR ALL MANHOLES SHALL BE DESIGNED TO WITHSTAND HS-20 TRAFFIC LOADING.

2.13.1.2 MANHOLE FRAMES AND COVERS SHALL BE ROADWAY TYPE WITH DEEP SOCKET COVERS. MACHINE FRAMES AND COVERS TO PREVENT RATTLING. FRAMES SHALL BE PROVIDED WITH HOLES FOR BOLTING IT DOWN TO MANHOLE RISER SECTION. PROVIDE COVER WITH TWO %-INCH DIAMETER HOLES FOR VENTILATION. CASTINGS SHALL BE GRAY IRON MEETING REQUIREMENTS OF ASTM A 48, CLASS 30, AND HAVE 24-INCH DIAMETER CLEAR OPENINGS SUCH AS NEENAH FOUNDRY COMPANY TYPE R-1642 WITH TYPE "C" COVER OR APPROVED EQUAL BY U.S. FOUNDRY OR EAST JORDAN IRON WORKS. THE FRAME AND COVER SHALL WEIGH AT LEAST 277 POUNDS.

2.13.1.3 MANHOLE FRAMES SHALL BE ANCHORED TO THE TOP OF THE MANHOLE RISER SECTIONS WITH 3%-INCH EXPANSION BOLTS. TWO PASSES OF "CONSEAL" BITUMASTIC SEALANT IN 1-INCH ROPE FORM SHALL BE USED TO PROVIDE WATERTIGHT SEAL BETWEEN FRAME AND MANHOLE RISER SECTION. CLEAN MANHOLE RISER AND FRAME THOROUGHLY PRIOR TO INSTALLATION.

2.13.1.4 MANHOLE STEPS SHALL BE "SUREFOOT" STEP CONSTRUCTED OF A NO. 4 STEEL REINFORCING ROD ENCASED IN CORROSION-RESISTANT RUBBER BY OLIVER TIRE & RUBBER COMPANY OR APPROVED EQUAL.

2.14 PRECAST REINFORCED CONCRETE VALVE VAULTS

2.14.1 VALVE VAULTS SHALL BE MANUFACTURED BY ROTONDO PRECAST, 5115 MASSAPONAX CHURCH ROAD, FREDERICKSBURG, VIRGINIA 22407, THE CLEAR FLOW COMPANY, 1321 NORTH DELPHINE AVENUE, WAYNESBORO, VIRGINIA 22980, OR APPROVED EQUAL. VAULTS SHALL MEET REQUIREMENTS OF ASTM C 890 AND ASTM C 913. TOP SECTIONS FOR ALL VALVE VAULTS SHALL BE DESIGNED TO WITHSTAND HS-20 TRAFFIC LOADING, VAULTS SHALL BE MANUFACTURED AS INDICATED ON THE DRAWINGS AND SHALL BE WATERTIGHT. PROVIDE WALL SLEEVES, ALUMINUM ACCESS HATCHES, ALUMINUM ACCESS LADDER, VENTS, AND OTHER APPURTENANCES AS SPECIFIED HEREIN AND INDICATED ON THE DRAWINGS TO ENSURE COMPLETE ASSEMBLY.

2.14.2 CONCRETE/REINFORCING STEEL REQUIREMENTS: PROVIDE AN AIR CONTENT OF 6%, ±2% AND A MINIMUM WALL THICKNESS OF 6 INCHES. ASTM A 615 REINFORCING BARS, ASTM A 497 WELDED WIRE FABRIC, ASTM C 443 GASKETS FOR JOINT CONNECTIONS. VAULTS SHALL BE MANUFACTURED WITH CALCAREOUS AGGREGATE SO THAT THE FINISHED PRODUCT SHALL HAVE AN AZ FACTOR EQUAL TO 90. SLEEVES THROUGH CONCRETE OR MASONRY WALLS OR SLABS SHALL BE CAST IRON OR SCHEDULE 40 STEEL. PROVIDE SLEEVES THROUGH WALLS, FLOORS, AND CEILINGS FOR ALL PIPE PENETRATIONS EXCEPT WHERE WALL PIPES ARE INDICATED.

2.15 PIPE TO SLEEVE SEALANT SHALL BE GROUTING COMPOUND. GROUTING COMPOUND SHALL BE AS MANUFACTURED BY 3M COMPANY OR BE AN EQUIVALENT PRODUCT HAVING TENSILE STRENGTH OF 80 PSI AND ELONGATION PROPERTY OF 700% IN ACCORDANCE WITH ASTM D 3574 TEST E, AND LINEAR DIMENSION CHANGE SHALL NOT EXCEED 18% WHEN SUBJECT TO WET AND DRY CYCLES IN ACCORDANCE WITH ASTM D 756, PROCEDURE G AND ASTM D 1042.

2.16 MECHANICAL TYPE PIPE TO WALL SLEEVE SEALS: MECHANICAL TYPE PIPE TO WALL SLEEVE SEALS SHALL BE "LINK-SEAL" PIPE TO WALL CLOSURES MANUFACTURED BY THUNDERLINE CORPORATION, WAYNE, MICHIGAN. SEALS SHALL BE MODULAR MECHANICAL TYPE, CONSISTING OF INTERLOCKING SYNTHETIC RUBBER LINKS SHAPED TO FILL ANNULAR SPACE BETWEEN PIPE AND WALL OPENING AND SHALL PROVIDE WATERTIGHT SEAL BETWEEN PIPE AND WALL OPENING.

3. EXECUTION

3.1 PIPE LAYING

3.3 JOIN MECHANICAL JOINT PIPE AS FOLLOWS:

3.1.1 TAKE ALL PRECAUTIONS NECESSARY TO INSURE THAT PIPE, VALVES, FITTINGS, AND OTHER ACCESSORIES ARE NOT DAMAGED IN UNLOADING, HANDLING, AND PLACING IN TRENCH. EXAMINE EACH PIECE OF MATERIAL JUST PRIOR TO INSTALLATION TO DETERMINE THAT NO DAMAGE HAS OCCURRED. REMOVE ANY DAMAGED MATERIAL FROM THE SITE AND REPLACE WITH UNDAMAGED MATERIAL.

3.1.2 EXERCISE CARE TO KEEP FOREIGN MATERIAL AND DIRT FROM ENTERING PIPE DURING STORAGE, HANDLING, AND PLACING IN TRENCH. CLOSE ENDS OF IN-PLACE PIPE AT THE END OF ANY WORK PERIOD TO PRECLUDE THE ENTRY OF ANIMALS AND FOREIGN MATERIAL.

3.1.3 BEDDING OF PIPE SHALL BE AS DETAILED ON THE DRAWINGS.

3.1.4 DO NOT LAY PIPE WHEN TRENCH BOTTOM IS MUDDY OR FROZEN, OR HAS STANDING WATER.

3.1.5 USE ONLY THOSE TOOLS SPECIFICALLY INTENDED FOR CUTTING THE SIZE AND MATERIAL AND TYPE PIPE INVOLVED. MAKE CUT TO PREVENT DAMAGE TO PIPE OR LINING AND TO LEAVE A SMOOTH END AT RIGHT ANGLES TO THE AXIS OF THE

3.2 LAY WATER MAIN PIPING WITH BELL ENDS FACING THE DIRECTION OF LAYING. WHERE GRADE IS 10 PERCENT OR GREATER, PIPE SHALL BE LAID UPHILL WITH BELL ENDS UPGRADE. LAY WATER MAIN PIPING WITH A MINIMUM COVER OF 36 INCHES UNLESS OTHERWISE INDICATED.

3.3.1 THOROUGHLY CLEAN INSIDE OF THE BELL AND 8 INCHES OF THE OUTSIDE OF THE SPIGOT END OF THE JOINING PIPE TO REMOVE OIL, GRIT, EXCESS COATING, AND OTHER FOREIGN MATTER FROM THE JOINT. PAINT THE BELL AND THE SPIGOT WITH SOAP SOLUTION. SLIP CAST-IRON GLAND ON SPIGOT END WITH LIP EXTENSION OF GLAND TOWARD END OF PIPE. PAINT RUBBER GASKET WITH OR DIP INTO SOAP SOLUTION AND PLACE ON SPIGOT END WITH THICK EDGE TOWARD

3.3.2 PUSH THE SPIGOT END FORWARD TO SEAT IN THE BELL. THEN CAREFULLY PRESS THE GASKET INTO THE BELL SO THAT IT IS LOCATED EVENLY AROUND THE JOINT. MOVE THE GLAND INTO POSITION, INSERT BOLTS, AND SCREW NUTS UP FINGER TIGHT. THEN TIGHTEN ALL NUTS TO TORQUE LISTED BELOW.

BOLTS SIZE – INCHES 7 40-60 3/4 60-90 1 70-100

3.3.3 TIGHTEN NUTS ON ALTERNATE SIDES OF THE GLAND UNTIL PRESSURE ON THE GLAND IS EQUALLY DISTRIBUTED.
3.3.4 PERMISSIBLE DEFLECTION OF MECHANICAL JOINT PIPE SHALL NOT BE GREATER THAN LISTED IN AWWA C600.
3.4 JOIN PUSH-ON JOINT PIPE AS FOLLOWS:

3.4.1 THOROUGHLY CLEAN INSIDE OF THE BELL AND 8 INCHES OF THE OUTSIDE OF THE SPIGOT END OF THE JOINING PIPE TO REMOVE OIL, GRIT, EXCESS COATING, AND OTHER FOREIGN MATTER. FLEX RUBBER GASKET AND INSERT IN THE GASKET RECESS OF THE BELL SOCKET. APPLY A THIN FILM OF GASKET LUBRICANT SUPPLIED BY PIPE MANUFACTURER TO EITHER THE GASKET OR THE SPIGOT END OF THE JOINING PIPE.

3.4.2 START SPIGOT END OF PIPE INTO SOCKET WITH CARE. THE JOINT SHALL THEN BE COMPLETED BY FORCING THE PLAIN END TO THE BOTTOM OF THE SOCKET WITH A FORKED TOOL OR JACK TYPE DEVICE. FIELD CUT PIPE SHALL HAVE THE END FILED TO MATCH THE MANUFACTURED SPIGOT END.

3.4.3 JOIN RESTRAINED PUSH-ON JOINTS ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS.3.4.4 PERMISSIBLE DEFLECTION OF PUSH-ON JOINT PIPE SHALL NOT BE GREATER THAN LISTED IN AWWA C600.

3.4.5 PERMISSIBLE DEFLECTION IN RESTRAINED PUSH-ON JOINT PIPE SHALL BE AS RECOMMENDED IN WRITING BY THE MANUFACTURER.

3.5 JOIN POLYVINYL CHLORIDE (PVC) PIPE USING RUBBER RING GASKETS IN BELL JOINTS AS RECOMMENDED IN WRITING BY THE MANUFACTURER.
3.6 WELDED, SOLDERED, OR BRAZED JOINTS BETWEEN SECTIONS OF COPPER PIPE AND BETWEEN PIPE AND FITTINGS SHALL BE IN COMPLIANCE WITH ANSI B31.1. MAKE JOINTS IN PIPING SYSTEM TIGHT AND LEAKPROOF AGAINST THE DESIGN PRESSURE. PEENING OF WELDED JOINTS TO CORRECT LEAKS WILL NOT BE PERMITTED. BRAZED OR SOLDERED JOINTS THAT LEAK SHALL BE

DISASSEMBLED, CLEANED, AND MADE AGAIN.

3.7 INSTALL DETECTABLE TAPE IN TRENCH ABOVE ALL PIPE PER THE MANUFACTURER'S WRITTEN RECOMMENDATIONS.

3.8.1 EQUIP ALL UNDERGROUND VALVE OPERATORS WITH VALVE BOXES. SET BOX IN ALIGNMENT WITH VALVE STEM CENTERED ON VALVE NUT. SET VALVE BOX TO PREVENT TRANSMITTING SHOCK OR STRESS TO THE VALVE. SET BOX COVER FLUSH WITH THE FINISHED GROUND SURFACE OR PAVEMENT.

3.9 INSTALLATION OF TAPPING SLEEVES AND TAPPING VALVES
3.9.1 ALL TAPPING SLEEVES SHALL BE SET TO AVOID INTERFERENCE WITH EXISTING PIPE JOINTS.
3.9.2 ALL TAPPING SLEEVES, TAPPING VALVES, AND TAPPING SADDLES SHALL BE INSTALLED IN ACCORDANCE WITH THE

MANUFACTURER'S WRITTEN INSTRUCTIONS.

3.9.3 AFTER ALL TAPPING SLEEVES/SADDLES AND VALVES HAVE BEEN SET IN PLACE, A 150-PSI PRESSURE TEST SHALL BE PERFORMED TO INSURE THAT THERE ARE NO LEAKS AROUND THE SLEEVE/SADDLE OR THROUGH THE VALVE PRIOR TO TAPPING. ALL LEAKAGE SHALL BE CORRECTED.

3.9.4 ACTUAL TAPS SHALL BE MADE IN THE PRESENCE OF THE TOWN'S REPRESENTATIVE. THE TOWN SHALL BE GIVEN A MINIMUM OF 48 HOURS NOTICE BEFORE TAPPING OPERATIONS COMMENCE.

FOR BURIED PRESSURE PIPING PROVIDE REACTION ANCHORS OF CONCRETE BLOCKING RETAINER GLAND TYPE DEVICES.

3.10 FOR BURIED PRESSURE PIPING, PROVIDE REACTION ANCHORS OF CONCRETE BLOCKING, RETAINER GLAND TYPE DEVICES, RESTRAINING DEVICES, OR RESTRAINED JOINT TYPE PIPE AT ALL CHANGES IN DIRECTION OF PRESSURE PIPING, AT DEAD ENDS, AND AS SHOWN ON THE DRAWINGS.

3.10.1 CONCRETE REACTION ANCHORS SHALL BEAR AGAINST UNDISTURBED EARTH AND SHALL BE OF THE SIZE AND SHAPE SHOWN ON STANDARD WATER DETAIL W-2.

3.10.2 RESTRAIN ALL JOINTS WITH RETAINER GLANDS/DEVICES IN ACCORDANCE WITH THE WRITTEN RECOMMENDATIONS OF THE RETAINER GLAND/DEVICE MANUFACTURER. ALL PIPE JOINTS SHALL BE RESTRAINED WITH RETAINER GLANDS/DEVICES A MINIMUM OF 60 FEET EACH SIDE OF A FITTING OR VALVE.

3.10.3 WHERE RETAINER GLANDS/DEVICES ARE USED, EXTREME CARE SHALL BE TAKEN SO THAT EACH SET SCREW IS TIGHTENED AS RECOMMENDED BY THE MANUFACTURER BEFORE THE PIPE IS BACKFILLED AND TESTED.

3.11 INSTALL WATER SERVICE LATERALS, WATER METERS, AIR RELEASE VALVES, MANHOLES, FIRE HYDRANTS, AND BLOWOFF ASSEMBLIES AS INDICATED ON THE TOWN OF AMHERST STANDARD WATER DETAIL DRAWINGS. INSTALL BACKFLOW PREVENTERS IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN RECOMMENDATIONS.

3.12 LOCATE FIRE HYDRANTS AT SUCH A DISTANCE FROM THE CURB OR EDGE OF PAVEMENT TO PROVIDE READY ACCESS AND MANUFACTURER'S PROMOTE FROM VEHICLES AND MANUFACTURER OF PAVEMENT TO PROVIDE READY ACCESS AND PAVEMENT T

3.12 LOCATE FIRE HYDRANTS AT SUCH A DISTANCE FROM THE CURB OR EDGE OF PAVEMENT TO PROVIDE READY ACCESS AND MINIMIZE THE POSSIBILITY OF DAMAGE FROM VEHICLES. MAXIMUM HORIZONTAL SEPARATION BETWEEN FIRE HYDRANT AND BUILDING SHALL BE 500 FEET. LOCATE FIRE HYDRANTS IN DRY, STABLE AREAS OUTSIDE OF HIGH GROUNDWATER TABLES TO PREVENT POTENTIAL CROSS CONNECTION. ORIENT THE HYDRANT SO THAT THE PUMPER NOZZLE FACES THE ROAD. SET HYDRANT PLUMB AND WITH THE BURY LINE ON THE HYDRANT AT GRADE. PROVIDE ANCHORAGE AND AT LEAST 7 CUBIC FEET OF CRUSHED STONE UNDER THE BASE TO ALLOW DRAINAGE FROM THE HYDRANT DRAIN VALVE, AS INDICATED ON THE DRAWINGS.

3.13 INSTALL COMBINATION AIR VALVES AT LOCATIONS INDICATED ON THE DRAWINGS AND AT ALL HIGH POINTS ON PRESSURE PIPING IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN RECOMMENDATIONS. INSTALL GATE VALVE BETWEEN PIPING AND AIR VALVE. USE TAP, TAPPING SADDLE, TEE, OR OTHER FITTINGS AS REQUIRED FOR COMPLETE AND OPERABLE INSTALLATION.
3.14 CONSTRUCT MANHOLES USING PRECAST REINFORCED CONCRETE MANHOLE SECTIONS EXCEPT AS OTHERWISE NOTED.

INSTALL MANHOLE FRAMES AND COVERS AND MANHOLE STEPS USING MATERIALS SPECIFIED UNDER PRODUCTS.

LESS THAN 6 INCHES.

3.15 INSTALL PRECAST CONCRETE VALVE VAULTS IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN RECOMMENDATIONS. PROVIDE A 12-INCH LAYER OF CLEAN VDOT NO. 68 COARSE AGGREGATE FILL BENEATH EACH VAULT.

3.16 CONSTRUCT CONCRETE CAP OR CRADLE IN ACCORDANCE WITH THE LATEST EDITION OF THE VDOT ROAD AND BRIDGE STANDARDS AT LOCATIONS WHERE THE VERTICAL SEPARATION BETWEEN THE NEW WATER MAIN PIPING AND ADJACENT UTILITIES IS

3.17 ENCASE WATER MAIN PIPING CROSSING UNDER HIGHWAYS IN A LARGER PIPE OR CONDUIT CALLED A CASING PIPE. THE CASING PIPE SHALL BE OF THE DIAMETER AND WALL THICKNESS INDICATED ON THE DRAWINGS. JOINING OF STEEL CASING PIPE SHALL MEET REQUIREMENTS OF AWWA C206 "STANDARD FOR FIELD WELDING OF STEEL WATER PIPE JOINTS." INSTALL CASING PIPE BY JACKING OR BORING.

3.17.1 INSTALLATION UNDER HIGHWAYS SHALL MEET REQUIREMENTS OF VDOT ROAD AND BRIDGE SPECIFICATIONS. PROVIDE END SEALS ON CASING PIPE ENDS TO PROTECT AGAINST FOREIGN MATTER. NOTIFY VDOT PRIOR TO BEGINNING WORK.

3.17.2 THE CONTRACTOR SHALL DETERMINE FOR HIMSELF THE EXISTING CONDITIONS BOTH ABOVE AND BELOW GROUND AND SHALL PHYSICALLY VERIFY THE LOCATION AND ELEVATION OF THE EXISTING UTILITIES, WHETHER INDICATED OR NOT, PRIOR TO INSTALLATION. THE CONTRACTOR SHALL CONTACT MISS UTILITY AND RESPECTIVE UTILITY OWNERS FOR EXACT LOCATIONS PRIOR TO ANY CASING INSTALLATION NEAR UTILITIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING THE CASING PIPE AND THE CARRIER PIPE TO THE REQUIRED LINES AND GRADES.

3.17.3 THE CARRIER PIPE SHALL BE CENTERED AND RESTRAINED WITHIN THE CASING PIPE BY THE USE OF CASING SPACERS. PLACEMENT INTERVALS FOR CASING SPACERS SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN RECOMMENDATIONS.

3.18 USE SLEEVES WHERE PIPES, VALVES, STEM EXTENSIONS, OR EQUIPMENT PARTS PASS THROUGH CONCRETE OR MASONRY WALLS OR SLABS. SLEEVES SHALL BE OR SUFFICIENT SIZE TO ALLOW SEALING AROUND PIPES AND CLEARANCE FOR VALVE STEM OR EQUIPMENT. EXTEND VERTICAL SLEEVES THROUGH SLABS 1-INCH ABOVE TOP SURFACE.

3.18.1 USE CAST IRON OR STEEL SLEEVES WITH INTERMEDIATE COLLARS TO ANCHOR AND PROVIDE WATER STOPS ON SLEEVES THAT PASS THROUGH EXTERIOR WALLS BELOW GRADE, SEAL AROUND PIPES USING GROUTING COMPOUND OR "LINK-SEAL" PIPE TO WALL CLOSURES MANUFACTURED BY THUNDERLINE CORPORATION, WAYNE, MICHIGAN. SEALS SHALL BE MODULAR MECHANICAL TYPE, CONSISTING OF INTERLOCKING SYNTHETIC RUBBER LINKS SHAPED TO FILL ANNULAR SPACE BETWEEN PIPE AND WALL OPENING AND SHALL PROVIDE WATERTIGHT SEAL BETWEEN PIPE AND WALL OPENING. GROUTING COMPOUND SHALL BE MIXED AND PLACED IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE MANUFACTURER. MECHANICAL PIPE TO WALL SEAL SHALL BE INSTALLED IN ACCORDANCE WITH THE WRITTEN RECOMMENDATIONS OF THE MANUFACTURER.

3.19 ACCEPTANCE TESTS

3.19.1 AFTER THE LINE HAS BEEN BACKFILLED AND AT LEAST 14 DAYS AFTER THE LAST CONCRETE REACTION ANCHOR HAS BEEN POURED, SUBJECT THE LINE OR ANY VALVED SECTION OF THE LINE TO A HYDROSTATIC PRESSURE TEST. FILL THE SYSTEM WITH WATER AT VELOCITY OF APPROXIMATELY 1 FOOT PER SECOND WHILE NECESSARY MEASURES ARE TAKEN TO ELIMINATE ALL AIR. AFTER THE SYSTEM HAS BEEN FILLED, RAISE THE PRESSURE BY PUMP TO 150 PSI, OR 1.5 TIMES THE WORKING PRESSURE, WHICHEVER IS GREATER. MEASURE PRESSURE AT THE LOW POINT ON THE SYSTEM COMPENSATING FOR GAGE ELEVATION. MAINTAIN THIS PRESSURE FOR 2 HOURS. IF PRESSURE CANNOT BE MAINTAINED, DETERMINE CAUSE, REPAIR, AND REPEAT THE TEST UNTIL SUCCESSFUL.

3.19.2 A LEAKAGE TEST SHALL BE CONDUCTED CONCURRENTLY WITH THE PRESSURE TEST. LEAKAGE SHALL BE DETERMINED WITH A CALIBRATED TEST METER FURNISHED BY THE CONTRACTOR. LEAKAGE WILL BE DEFINED AS THE QUANTITY OF WATER REQUIRED TO MAINTAIN A PRESSURE WITHIN 5 PSI OF THE SPECIFIED TEST PRESSURE, AFTER AIR HAS BEEN EXPELLED, AND THE PIPE FILLED WITH WATER. LEAKAGE SHALL NOT EXCEED THAT QUANTITY OBTAINED BY THE FORMULA BELOW. IF LEAKAGE EXCEEDS THAT DETERMINED BY THE FORMULA, FIND AND REPAIR THE LEAKS AND REPEAT THE TEST UNTIL SUCCESSFUL. THE LEAKAGE FORMULA SHALL BE AS FOLLOWS:

L = SD(√P)/148,000

WHERE L = ALLOWABLE LEAKAGE IN GALLONS/HOUR
S = LENGTH OF PIPELINE TESTED IN FEET
D = NOMINAL DIAMETER OF THE PIPER IN INCHES

P = AVERAGE TEST PRESSURE DURING LEAKAGE TEST IN PSIG

3.19.3 ALL VISIBLE LEAKS SHALL BE REPAIRED REGARDLESS OF THE AMOUNT OF LEAKAGE.

3.20 DISINFECT AND TEST WATER MAINS AND ACCESSORIES IN ACCORDANCE WITH AWWA STANDARDS AND AS SPECIFIED HEREIN.

3.20.1 PRELIMINARY FLUSHING: THE MAIN SHALL BE FLUSHED PRIOR TO DISINFECTION, EXCEPT WHEN THE TABLET METHOD IS USED. FLUSHING SHALL BE AT A VELOCITY OF NOT LESS THAN 2.5 FEET PER SECOND. ADEQUATE PROVISIONS SHALL BE MADE FOR DRAINAGE OF FLUSHING WATER.

3.20.2 FORM OF CHLORINE FOR DISINFECTION

3.20.2.1 LIQUID CHLORINE SHALL BE USED ONLY WHEN SUITABLE EQUIPMENT IS AVAILABLE AND ONLY UNDER THE DIRECT SUPERVISION OF A PERSON FAMILIAR WITH THE PHYSIOLOGICAL, CHEMICAL, AND PHYSICAL PROPERTIES OF THIS ELEMENT AND WHO IS PROPERLY TRAINED AND EQUIPPED TO HANDLE ANY EMERGENCY THAT MAY ARISE. INTRODUCTION OF CHLORINE-GAS DIRECTLY FROM THE SUPPLY CYLINDER IS UNSAFE AND SHALL NOT BE PERMITTED.

3.20.2.2 CALCIUM HYPOCHLORITE CONTAINS 70% AVAILABLE CHLORINE BY WEIGHT. IT SHALL BE EITHER GRANULAR OR TABULAR IN FORM. THE TABLETS, SIX TO EIGHT TO THE OUNCE, ARE DESIGNED TO DISSOLVE SLOWLY IN WATER. A CHLORINE-WATER SOLUTION SHALL BE PREPARED BY DISSOLVING THE GRANULES OR TABLETS IN WATER IN THE PROPORTION REQUISITE FOR THE DESIRED CONCENTRATION.

3.20.2.3 SODIUM HYPOCHLORITE IS SUPPLIED IN STRENGTHS FROM 5.25% TO 16% AVAILABLE CHLORINE. THE

CHLORINE-WATER SOLUTION SHALL BE PREPARED BY ADDING HYPOCHLORITE TO WATER.

3.20.2.4 APPLICATION: THE HYPOCHLORITE SOLUTIONS SHALL BE APPLIED TO THE WATER MAIN WITH A GASOLINE OR ELECTRICALLY POWERED CHEMICAL FEED PUMP DESIGNED FOR FEEDING CHLORINE SOLUTIONS.

FOR SMALL APPLICATIONS, THE SOLUTIONS MAY BE FED WITH A HAND PUMP; FOR EXAMPLE, A HYDRAULIC TEST PUMP. FEED LINES SHALL BE OF SUCH MATERIAL AND STRENGTH AS TO WITHSTAND SAFELY THE MAXIMUM PRESSURES THAT MAY BE CREATED BY THE PUMPS. ALL CONNECTIONS SHALL BE CHECKED FOR TIGHTNESS BEFORE THE HYPOCHLORITE SOLUTION IS APPLIED TO THE MAIN.

3.20.3 METHODS OF CHLORINE APPLICATION

3.20.3.1 CONTINUOUS FEED METHOD: WATER FROM THE EXISTING DISTRIBUTION SYSTEM OR OTHER APPROVED SOURCES OF SUPPLY SHALL BE MADE TO FLOW AT A CONSTANT, MEASURED RATE INTO THE NEWLY LAID PIPELINE. THE WATER SHALL RECEIVE A DOSE OF CHLORINE, ALSO FED AT A CONSTANT, MEASURED RATE. THE TWO RATES SHALL BE PROPORTIONED SO THAT THE CHLORINE CONCENTRATION IN THE WATER IN THE PIPE IS MAINTAINED AT A MINIMUM OF 50 MG/L AVAILABLE CHLORINE. TO ASSURE THAT THIS CONCENTRATION IS MAINTAINED, THE CHLORINE SHALL BE MEASURED AT INTERVALS NOT EXCEEDING 1,200 FEET IN ACCORDANCE WITH THE PROCEDURES DESCRIBED IN THE CURRENT EDITION OF "STANDARD METHODS" AND AWWA M12 – "SIMPLIFIED PROCEDURES FOR WATER EXAMINATION." IN THE ABSENCE OF A METER, THE RATE MAY BE DETERMINED EITHER BY PLACING A PITOT GAGE AT THE DISCHARGE OR BY MEASURING THE TIME TO FILL A CONTAINER OF KNOWN VOLUME.

DURING THE APPLICATION OF THE CHLORINE, VALVES SHALL BE MANIPULATED TO PREVENT THE TREATMENT DOSAGE FROM FLOWING BACK INTO THE LINE SUPPLYING THE WATER. CHLORINE APPLICATION SHALL NOT

THE LINE SUPPLYING THE WATER. CHLORINE APPLICATION SHALL NOT CEASE UNTIL THE ENTIRE MAIN IS FILLED WITH THE CHLORING SOLUTION. THE CHLORINATED WATER SHALL BE RETAINED IN THE MAIN FOR AT LEAST 24 HOURS, DURING WHICH TIME ALL VALVES AND HYDRANTS IN THE SECTION TREATED SHALL BE OPERATED IN ORDER TO DISINFECT THE APPURTENANCES. AT THE END OF THIS 24-HOUR PERIOD, THE TREATED WATER SHALL CONTAIN NO LESS THAN 25 MG/L CHLORINE THROUGHOUT THE LENGTH OF THE MAIN.

3.20,3.2 TABLET METHOD: USE ONLY WHEN ALLOWED BY THE ENGINEER. DO NOT USE THIS METHOD IF TRENCH WATER OR FOREIGN MATERIAL HAS ENTERED THE MAIN OR IF THE WATER IS BELOW 41°F (5°C). THIS METHOD MAY BE USED FOR MAINS UP TO 12 INCHES IN DIAMETER, AND WHERE THE TOTAL LENGTH OF THE MAIN IS LESS THAN 2.500 FEET.

PLACE TABLETS IN EACH SECTION OF PIPE AND ALSO IN HYDRANTS, HYDRANT BRANCHES, AND OTHER APPURTENANCES. ENOUGH TABLETS SHALL BE USED TO ENSURE THAT A CHLORINE CONCENTRATION OF 25 MG/L IS PROVIDED IN THE WATER. ATTACH TABLETS USING PERMATEX NO. 1 ADHESIVE OR OTHER APPROVED ADHESIVE, EXCEPT FOR THE TABLETS PLACED IN HYDRANTS AND IN THE JOINTS BETWEEN THE PIPE SECTIONS. TABLETS SHALL BE FREE OF ADHESIVE EXCEPT ON THE ONE BROAD SIDE TO BE ATTACHED. PLACE ALL TABLETS AT THE TOP OF THE MAIN. IF THE TABLETS ARE ATTACHED BEFORE THE PIPE SECTION IS PLACED IN THE TRENCH, MARK THE POSITION OF THE TABLET IN THE PIPE AND ASSURE THAT THE PIPE IS PLACED WITH THE TABLET AT THE TOP.

WHEN INSTALLATION IS COMPLETED, FILL THE MAIN WITH WATER AT A VELOCITY OF LESS THAN 1 FOOT PER SECOND. THE WATER SHALL REMAIN IN THE PIPE FOR AT LEAST 24 HOURS. OPERATE VALVES SO THAT THE STRONG CHLORINE SOLUTION WILL NOT FLOW BACK INTO THE LINE SUPPLYING THE WATER.

3.20.4 FINAL FLUSHING: AFTER THE APPLICABLE RETENTION PERIOD, THE HEAVILY CHLORINATED WATER SHALL BE FLUSHED FROM THE MAIN UNTIL THE CHLORINE CONCENTRATION IN THE WATER LEAVING THE MAIN IS NO HIGHER THAN THAT GENERALLY PREVAILING IN THE SYSTEM, OR LESS THAN 1 MG/L CHLORINE RESIDUAL DETERMINATION SHALL BE MADE TO ASCERTAIN THAT THE HEAVILY CHLORINATED WATER HAS BEEN REMOVED FROM THE PIPELINE. CONTRACTOR SHALL PROVIDE DECHLORINATION OF ALL FLUSHED WATER PRIOR TO DISCHARGE.

3.20.5 BACTERIOLOGIC TESTS

3.20.5.1 AFTER FINAL FLUSHING AND BEFORE THE WATER MAIN IS PLACED IN SERVICE, SAMPLES SHALL BE COLLECTED AND TESTED FOR BACTERIOLOGIC QUALITY AND SHALL SHOW THE ABSENCE OF COLIFORM ORGANISMS. AT LEAST TWO SAMPLES SHALL BE COLLECTED AT LEAST 24 HOURS APART AT INTERVALS NOT EXCEEDING 2,000 FEET, AND TESTED BY A STATE CERTIFIED LABORATORY AND RESULTS SUBMITTED TO THE

3.20.5.2 SAMPLES FOR BACTERIOLOGICAL ANALYSIS SHALL BE COLLECTED IN STERILE BOTTLES TREATED WITH SODIUM THIOSULFATE. IF LABORATORY RESULTS INDICATE THE PRESENCE OF COLIFORM BACTERIA, THE SAMPLES ARE UNSATISFACTORY, AND DISINFECTION SHALL BE REPEATED UNTIL THE SAMPLES ARE

3.20.5.3 A SAMPLING TAP CONSISTING OF A CORPORATION COCK WITH METAL PIPE SHALL BE INSTALLED WITHIN 2 FEET OF VALVES. THE CORPORATION STOP INLET SHALL BE MALE, 1-INCH IN SIZE, AND THE OUTLET SHALL

3.20.6 CLEANING, DISINFECTION, AND TESTING WILL BE THE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR SHALL FURNISH THE WATER REQUIRED FOR THESE OPERATIONS AT HIS OWN COST AND EXPENSE. NO SEPARATE PAYMENT, OTHER THAN THAT INCLUDED IN THE CONTRACT LUMP SUM, WILL BE ALLOWED.

3.20.7 TESTING AND DISINFECTION OF THE COMPLETED SECTIONS SHALL NOT RELIEVE THE CONTRACTOR OF HIS RESPONSIBILITY TO REPAIR OR REPLACE ANY CRACKED OR DEFECTIVE PIPE. ALL WORK NECESSARY TO SECURE A TIGHT LINE SHALL BE DONE AT THE CONTRACTOR'S EXPENSE.

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4 OF 4

AMHERST, VIRGINIA -

WATER SPECIFICATIONS

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