

BRUNSWICK REGIONAL WATER AND SEWER H2GO



WATER SYSTEM STANDARDS & SPECIFICATIONS

Revised 2022

Standards and Specifications contained herein are approved only for water main extensions. These Standards and Specifications are not applicable to booster pumps, storage tanks, treatment devices or facilities, and other systems not specifically addressed.

Table of Contents

1	SIZING MAINS	4
2	RELATION TO SANITARY SEWERS AND STORM WATER PIPES	4
3	WATER MAINS.....	4
4	VALVES AND APPURTENANCES	5
5	HYDRANTS.....	7
6	AUTOMATIC FIRE SPRINKLER SYSTEMS.....	8
7	TRENCHING AND BACKFILL.....	Error! Bookmark not defined.
8	LAYING PIPE.....	9
9	PIPE FITTINGS	9
10	REDUCERS	9
11	PLASTIC IDENTIFICATION TAPE AND STRANDED TRACING WIRE	9
12	JOINTING.....	9
13	THRUST RESTRAINT	10
14	BLOW OFFS.....	10
15	CUTTING DUCTILE IRON PIPE	10
16	TAPPING SLEEVES AND VALVES.....	10
17	WATER SERVICES.....	11
18	IRRIGATION SYSTEMS.....	13
19	BACKFLOW PREVENTION.....	13
20	TESTING	13
21	DISINFECTION	14
22	REPAIR OF WATER MAINS.....	16
23	PLANS AND SPECIFICATIONS	16

1 SIZING MAINS

- 1.1 Major transmission mains shall be sized in accordance with BRWS H2GO master plan or as directed by BRWS H2GO. Six (6) inch mains may be used only when interconnections at six hundred (600) foot intervals are provided. The total maximum length of six (6) inch or eight (8) inch lines, without connecting to a larger main, is one thousand two hundred (1200) feet and two thousand (2000) feet, respectively. Four (4) inch water mains are permitted on residential cul-de-sacs less than four hundred (400) feet long. Where needed, lines shall be upsized to provide adequate fire flow as directed by BRWS H2GO. Water mains should be sized to maintain a residual pressure of at least 30 psi during peak domestic demands and at least 20 psi during fire flow demands.

2 RELATION TO SANITARY SEWERS AND STORM WATER PIPES

- 2.1 When installing a water main, the horizontal separation between water and sewer shall be ten (10) feet. If this separation cannot be maintained due to existing conditions, the only variation allowed is the water main in a separate trench with the elevation of the water main at least eighteen (18) inches above the top of the sewer and must be approved by BRWS H2GO. All distances are measured from outside diameter to outside diameter. When a water main crosses over a sewer main, there must be eighteen (18) inches of vertical separation. If a water main must cross over a sewer main with less than eighteen (18) inches of vertical separation or cross under a sewer main, both these lines must be constructed with a twelve (12) inch minimum vertical separation and be constructed using joints conforming to water main standards with one joint of the water pipe centered at the sewer main. All crossings within these vertical clearances shall be filled with #67 stone. All distances are measured from outside diameter to outside diameter. When a water line passes over or under a storm sewer, vertical separation of eighteen (18) inches shall be maintained unless both lines are of ductile iron or encased in concrete for a distance of one (1) foot beyond the OD of the pipe on each side of the crossing or as directed by BRWS H2GO. If not encased in concrete, a concrete pad shall be poured between the two pipes. Distances are measured outside diameter to outside diameter. All crossings should be as near to ninety (90) degrees as practicable.

3 WATER MAINS

- 3.1 Distribution system piping shall be ductile iron (DIP), polyvinyl chloride (PVC) plastic, or polyethylene (PE) pipe. All water system piping sixteen (16) inches in diameter and larger shall be ductile iron pipe. All water system piping less than sixteen (16) inches in diameter shall be PVC plastic (conforming to AWWA C900) (DR-18) or ductile iron or polyethylene pipe.
- 3.2 Ductile iron pipe (DIP) shall be cement-mortar lined and enamel lined ductile iron pipe, in accordance with AWWA C104. Joints shall be push on or mechanical joint type conforming to AWWA C111 and ANSI A21.11, latest edition. Fittings shall be cast or ductile iron conforming to ANSI A21.10. All pipe which must be field cut to install fittings and other appurtenances shall be "gauged full length" to assure a uniform circular cross section. Machining, jacking, or other modifications will not be allowed in the field. When using ductile iron pipe, soil shall be tested for corrosivity as prescribed by the Engineer or by BRWS H2GO. If soil is found to be corrosive, the pipe shall be wrapped in polyethylene sheeting as required and in accordance with AWWA C105. Ductile Iron Pipe shall be designed and manufactured in accordance with AWWA C150 and C151 (thickness class 50) for a laying condition Type 2 and a working pressure as follows:

Diameter	Pressure
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3"-12"	350 psi
14"-20"	250 psi
24"	200 psi
30"-54"	150 psi

- 3.3 Polyvinyl chloride (PVC) pipe shall be two hundred (200) psi PVC pipe conforming to ASTM D2241 or AWWA C900, NSF approved. Pipe material shall be PVC 1120. Joints shall be rubber ring type conforming to ASTM D3139. Bells shall be formed integrally with the pipe or may be made using cylindrical PVC couplings with two rubber rings. Fittings shall be molded PVC with joints similar to the pipe. Fabricated fittings using solvent welded joints will not be acceptable. Fittings may be ductile iron specially designed for use with PVC pipe.
- 3.4 Polyethylene (PE) pipe shall be high density polyethylene pipe conforming to AWWA C906. Pipe material shall be PE 4710. Joints shall be heat fused. Pipe shall be two hundred and fifty-two (252) psi, SDR-9.

4 VALVES AND APPURTENANCES

- 4.1 GENERAL: Valves installed on water lines shall be gate valves unless approved by BRWS H2GO. Valves shall be installed on all branches from feeder mains and hydrants according to the following schedule: three (3) valves at crosses; two (2) valves at tees; and one (1) valve on each hydrant branch. When a loop section of water line is connected back into the feeder main within a distance of two hundred (200) feet or less, only one (1) valve will be required in the feeder main. On distribution mains, where no water line intersections exist, a main line valve shall be installed at every one hundred (100) feet per one (1) inch diameter main up to a maximum distance of two thousand (2000) feet between valves. For transmission lines, a main line valve shall be installed at every two hundred (200) feet per one (1) inch diameter main up to a maximum distance of five thousand (5000) feet between valves. Valves shall be installed on both sides of all horizontal directional drills. Place main line valves adjacent to or in close proximity of fire hydrants whenever possible. Valves shall be properly located, operable and at the correct elevation. All valves and reducers shall be rodded to the tee or cross if one is located within ten (10) feet. If reducers cannot be rodded, concrete blocking or other restraining methods, as approved, shall be required. The valve box shall be centered over the wrench nut and seated on compacted backfill without touching the valve assembly. The maximum depth of the valve nut shall be five (5) feet. When valve extension kits are used, they must be manufactured by the same company that manufactured the valve.
- 4.2 GATE VALVES (GV): Valves shall be designed for operation at working water pressure not less than two hundred (200) psi for three (3) through twelve (12) inch size and one hundred and fifty (150) psi for sixteen (16) inch. All materials and parts shall meet the requirements of "Resilient Seated Gate Valves for Water Supply Service", AWWA C509. Valves shall be made to open to the left and shall have a two (2) inch square head nut upon the end of the stem with the direction arrow clearly and plainly cast thereon. They shall generally be type known as a Resilient Seat Gate Valves. The materials strength shall be not less than that required by the specifications of AWWA. In every case, they shall be factory tested to three hundred (300) psi, in such manner as to assure tight fitting gates and shall be so certified by their manufacturer. Valve ends shall be constructed for use with mechanical joints or push on joints. Gate valves, up to and including twelve (12) inches, shall be installed in a vertical position. Gate valves sixteen (16) inches and larger shall be approved by BRWS H2GO or by BRWS H2GO's engineer prior to installation. They may be installed horizontally and equipped with bevel gears, grease case, rollers,

tracks scrapers, and a bypass located on the side of the body (fully revolving disc valves shall not require rollers), or vertically and be equipped with spur gears enclosed in a grease case and with a bypass located on the side of the body. In either case, the roller and scraper operators shall be installed in a manhole. Valves shall be Mueller, Clow, or American Darling.

- 4.3 BUTTERFLY VALVES (BFV): Butterfly valves shall be installed in water lines sixteen (16) inches or larger. Butterfly valves shall meet the requirements of AWWA C504 with mechanical joints and two (2) inch open left operating nut. All valves twenty-four (24) inches and larger shall be installed in a manhole. Butterfly valves shall be designed for a working pressure of 250 psi and tested to a hydrostatic pressure equivalent to twice the rated pressure.
- 4.4 AIR RELEASE VALVES: Air release valves shall be installed at all crest locations wherein an elevation change of ten (10) feet or greater is incurred and at other locations as directed by the Engineer or BRWS H2GO. The water main shall be installed at a grade that will allow air to migrate to a high point where the air can be released through an air release valve. A minimum pipe slope of one (1) foot in five hundred (500) feet should be maintained. Automatic air valves shall be infinitely variable automatic air valves designed to allow escape of air for an operating range starting from pressure range: 0 through 250 psi (0-17.2 bar), close watertight when liquid enters the valve even when the fluid is rising without pressure (no minimum operating pressure required) and soft working behavior as water hammer inhibition realized by roll-on diaphragm and spring mechanism. When the sealing device of the valve is closed an air cushion is trapped between the fluid and sealing area, a mud deflector made of PE allows no contact between fluid and sealing area. The valve body shall be epoxy coated steel. The spindle spring shall be stainless steel grade 316Ti, designed to facilitate disassembly for cleaning and maintenance. The float shall be Delrin (Polyoximethylene, POM); the valve seat and all working parts shall be of corrosion-resistant materials. Valves shall be equipped with the necessary attachments, including ball valve, to permit back flushing after installation without dismantling the valve. Valves shall meet or exceed the requirements of AWWA C512. Air valves shall be manufactured by Hawle or an approved equal. All air valves shall be located inside an approved polymer concrete box as shown in the details. Drainage from the polymer concrete box shall not connect directly to any storm drain or sanitary sewer. Air valves shall not be located in flood prone areas or in areas where the drainage pipe cannot daylight to a slope.
- 4.5 CHECK VALVES (CV):
 - 4.5.1 Single-Check. Spring-checks only, no swing checks allowed.
 - 4.5.2 Double-Check.
- 4.6 PRESSURE REDUCING VALVES (PRV) AND PRESSURE SUSTAINING VALVES (PSV): Pressure reducing and/or sustaining stations shall be installed when directed by BRWS H2GO to connect to high and low pressure systems. The pressure reducing valve shall allow enough flow from the high side to maintain a specified pressure on the low side and will not reduce the high side below a certain amount. This type of valve will be a piston type globe pressure sustaining/pressure reducing valve.
- 4.7 VALVE BOXES: Valve boxes shall be gray cast iron conforming to ASTM A48-48, Class 30, with twelve (12) inch top section (screw or telescopic) and bottom section length as required for valve bury. Box shall have a five (5) inch opening with "Water" stamped on the cover. Concrete collar two (2) foot x two (2) foot square or two and one-half (2.5) foot diameter round shall be poured flush with the cover having minimum thickness of six (6) inches as shown in the detail. A prefabricated, round "slip" form may be used only outside of traffic bearing areas (i.e., back side of ditches, etc.).

- 4.8 VALVE SETTING: Valves shall be set with stems vertical. Valves shall be set in two-section cast iron valve boxes as specified hereinbefore. Valves installed on two (2) legs of a tee, or three (3) legs of a cross shall be rodded or "mega-lugged" to the fitting with a minimum of two three-quarter (3/4) inch galvanized "all thread" rods. Valves installed at the end of the line shall be rodded back to a suitable thrust collar with a minimum of two three-quarter (3/4) inch galvanized all thread rods or mega-lugged. A minimum of one (1) joint of ductile iron pipe is required between valve and thrust collar. Hydrant valves shall be installed as near the main line as possible. Welding three-quarter (3/4) inch rods shall be prohibited. Only three-quarter (3/4) inch ductile iron or Black Iron threaded couplings shall be used. All bolts and nuts shall be hardened steel with black oxide finish. Sufficient suitable rock or stone shall be placed around all buried valves and valve boxes in such a manner that sand will not infiltrate the valve box. Plugs installed at the end of the line shall be rodded to a sufficient thrust collar as described above.
- 4.9 VALVE MARKERS: Valve markers shall be used and shall be constructed of fiberglass (blue) marked with letters, either MV (main valve), AV (air release valve), or BO (blow off) and shall specify a telephone number to contact to report problems or to request water main locates. Valve markers shall be required only for valves on transmission mains or as otherwise designated by BRWS H2GO.

5 HYDRANTS

- 5.1 All hydrants shall be installed on a minimum six (6) inch water line and should be installed in close proximity to road intersections whenever possible. Hydrant valves shall be installed as close to the mainline as possible with an approved cast iron valve box. Only one (1) fire hydrant may be installed when the line is served by a six (6) inch tap and is not looped to another main. When placed at intersections, hydrants shall be offset from the top of the intersection so as to not allow a vehicle running through said intersection to strike the hydrant. The minimum acceptable flow for fire hydrants is seven hundred and fifty (750) gpm with twenty (20) psi residual pressure for residential and one thousand five hundred (1500) gpm with twenty (20) psi residual pressure for all other areas, unless otherwise specified by the County and/or Leland's fire marshal. The Engineer shall contact the local fire department(s) and/or County's fire marshal during the design phase to coordinate the proper location of all fire hydrants within the project area. Once a hydrant flow test has been requested and all required forms have been filled out and fees have been paid, BRWS H2GO inspectors have a maximum of 5 business days to perform the requested test and submit data.
- 5.2 In residential areas the maximum distance between hydrants, measured along street centerlines, shall be five hundred (500) feet, unless otherwise approved by the County's fire marshal.
- 5.3 In commercial, business, office, institutional and industrial zoning the maximum distance between hydrants, measured along street centerlines, shall be five hundred (500) feet, unless otherwise approved by the County's fire marshal. New buildings, or additions that result in a total building area of ten thousand (10,000) square feet, require hydrants to be installed at three hundred (300) foot intervals along sides of the building that are accessible to the largest vehicle operated by the local fire department. These hydrants shall be at least forty (40) feet away from the building. Where sprinkler systems are used, a fire department connection (FDC) shall be within fifty (50) feet of an accessible fire hydrant.
- 5.4 Hydrants shall be the Traffic Type, Dry Barrel, conforming to AWWA Standard C502, latest revision, and shall have a barrel size of 4.5 inches or 5.25 inches as directed by BRWS H2GO, two – two and one-half (2.5) inch hose nozzles and four and one-half (4.5) inch pumper connection with National Standard threads. All new hydrants shall have an integral Storz connection. Hydrant shall have breakable barrel

and operating stem with barrel length for three (3) foot main cover and shall be equipped with six (6) inch bottom hub and with strapping lugs and one and one-half (1.5) inch solid operation nut and "O" ring seals. Main valve seat shall have bronze to bronze threads into the hydrant shoe. Hydrant shall be grease lubricated with a thrust bearing to reduce operating torque or may be oil lubricated. Hydrants shall be left open and be rated at one hundred and fifty (150) psi working pressure and three hundred (300) psi test pressure. Hydrants shall be shop painted chrome red Tnemec paint or approved equal and shall be touched up after installation and given one (1) field coat of chrome red enamel, if hydrant comes from manufacturer painted red. If hydrant is painted with a color other than red from the manufacturer, there shall be three (3) field coats of chrome red paint applied by the Contractor after installation. Hydrant shall be dry bonnet type and be provided with not less than two (2) drain outlets for draining when the valve is closed. Manufacturer shall furnish complete literature with detailed shop drawings of hydrant showing materials, construction and assembly and operating characteristics. This shall include friction loss characteristics for varying flows through the pumper and both hose connections by an approved National Underwriter's Laboratory. All fire hydrant legs shall be constructed with ductile iron pipe from the water main to the fire hydrant. Hydrants shall be Mueller "Centurion", American Darling (MK-73-5), Clow, or approved equal. Hydrants shall be restrained with stainless steel tie rods extending from the main line tee to the hydrant, or by combination of tie rods and blocking or by Megalug, or approved equal, retainer glands at each joint per manufacturer's requirements. Hydrants shall be installed on a suitable solid foundation, as indicated on the drawings, and with one-fourth (1/4) cubic yard rock or stone as shown on the drawings. There shall be adequate pea gravel for the weep outlets to drain. Hydrants shall be installed plumb one-eighth (1/8) inch per foot and set so that the pumper nozzle is eighteen (18) inches (+3 inches) (-1 inch) above the surrounding grade.

6 AUTOMATIC FIRE SPRINKLER SYSTEMS

- 6.1 Approval. All automatic fire sprinkler systems shall be approved by the County's fire marshal and or the town fire department.
- 6.2 Backflow Prevention. When a fire protection system is proposed, a reduced pressure zone (RPZ) assembly including two (2) check valves, two (2) OS&Y gate valves and four (4) test cocks shall be installed on the supply side of the sprinkler fire protection line. Only devices approved of manufacture and models approved by the State of North Carolina and the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research shall be used within the BRWS H2GO system.
- 6.3 Location. The backflow prevention assembly shall be installed on the back side of the right-of-way on the customer's side of the water service and shall be installed above ground in an insulated enclosure and shall be operated, tested, and maintained by the customer at his or her expense.
- 6.4 Post Indicator Valve (PIV). A PIV shall be provided at the right-of-way or edge of easement. The top of the PIV shall be thirty-six (36) inches above the finished grade. BRWS H2GO shall maintain up to and including the PIV but not beyond. No shutoff valves shall be installed between the PIV and the sprinkler riser assembly.
- 6.5 Fire Department Connection (FDC). Where automatic fire sprinkler systems are used, a FDC shall be provided. When a sprinkler system serves only a part of a large structure, the FDC shall be labeled, with minimum two (2) inch letters on a permanent sign, as to which section of the structure that sprinkler riser serves.

7 LAYING PIPE

- 7.1 Laying pipe and fittings, and the installation of all appurtenances shall be in accordance with AWWA C600 or AWWA C605, as applicable, or as specified by the manufacturer. Backfill with materials free of stones and debris larger than 6 inches in dimension. Pipe barrels shall be laid in trenches and jointed without disturbing the pipe bed, jointing and alignment. Laying condition shall be Type 3 as set out in AWWA C600 and C605. Any pipe that has grade or joint disturbed after laying shall be taken up and relaid. The interior of the pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench and shall be kept clean all during laying operations by means of plugs or other approved methods. The pipe shall not be laid in water or when trench or weather conditions are unsuitable for the work; when work is not in progress open ends of pipes and fittings shall be securely closed so that no trench water, earth, or other foreign substance will enter the parts. All water pipe sixteen (16) inches nominal diameter and larger shall be pigged at BRWS H2GO's discretion. BRWS H2GO reserves the right to require new lines less than sixteen (16) inches nominal diameter to be pigged, if deemed necessary. Any section of pipe, or fittings, found to be defective before or after laying shall be replaced with new parts at the Contractor's expense. All bends, fittings, and plugs shall be securely restrained by blocking or by installation of restraining rods and thrust collars. Pipe deflection for twelve (12) inch nominal diameter and larger pipe shall be no more than three (3) degrees or according to manufacturer's specification, whichever is less. Pipe deflection for pipe less than twelve (12) inch nominal diameter shall be no more than five (5) degrees or according to manufacturer's specifications, whichever is less. Appropriate bends shall be used as required. Depth of cover of pipe shall be as given in 8. TRENCHING AND BACKFILLING – L. TRENCH EXCAVATION.

8 PIPE FITTINGS

- 8.1 Pipe fittings shall be cast or ductile iron designed and manufactured as per AWWA C110. Sizes of fittings up to and including twelve (12) inches shall be designed for an internal pressure of two hundred and fifty (250) PSI. Compact ductile iron mechanical joint fittings shall be designed and manufactured as per AWWA C111 are also acceptable. Joints for fittings shall be mechanical and lined with cement mortar with a seal coat of bituminous material, all in accordance with AWWA C104.

9 REDUCERS

- 9.1 All reducers shall be cast in a bell shape to minimize turbulence in the transition. Reducers shall be rodded or Megalugged, or approved equal, to another fitting installed with thrust restraint or thrust collar.

10 PLASTIC IDENTIFICATION TAPE AND STRANDED TRACING WIRE

- 10.1 Twelve (12) gauge stranded copper tracer wire coated in blue insulation shall be used to mark all PVC and PE pipe. Any main transmission lines shall have a marker pole placed every 1000 feet with an emergency contact/ call before dig number for BRWS H2GO applied to the pole.

11 JOINTING

- 11.1 Jointing shall be accomplished in accordance with the pipe manufacturer's recommendations, subject to approval of the Engineer. For mechanical joints, the normal range of bolt torque of three-quarter (3/4) inch bolts shall be between sixty (60) and ninety (90) foot pounds. When tightening bolts, it is essential that the gland be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. This shall be done by partially tightening the bottom bolt first, and then the top bolt, next the bolts at either side, and last the remaining bolts; repeat this cycle until all bolts are within the above range of torques. If effective sealing

is not attained at the maximum torque indicated above, the joint shall be disassembled, cleaned thoroughly, and reassembled. Bolts shall not be over stressed to compensate for poor installation. Joints in plastic piping shall be made in conformance with the manufacturer's recommendations. Do not thread plastic pipe, make threaded connections with adapters.

12 THRUST RESTRAINT

12.1 Reaction blocking for all fittings or components subject to hydrostatic thrust shall be securely anchored using concrete thrust blocks poured in place. No concrete shall interfere with the removal of fittings. Material for reaction blocking shall be three thousand (3000) PSI concrete (minimum). A minimum of four (4) mil polyethylene sheeting shall cover the fittings to ensure that no concrete will interfere with removal of the fittings. Alternative restraining methods and mechanical joint restraints may be used upon approval by BRWS H2GO.

13 BLOW OFFS

13.1 Blow offs shall be a minimum of two (2) inches and installed at the end of all dead-end lines, unless otherwise specified by BRWS H2GO. Where there is not sufficient pressure or fire hydrants to thoroughly flush the system, a larger blow off shall be required. All permanent blowoff assemblies on 2-inch mains shall be Eclipse style hydrant configuration. The valves shall be gate type with a non-rising stem and a two (2) inch operating nut.

13.2 All water main stub outs for future development shall have a full pipe size temporary blow off brought up with a 45-degree bend with appropriate restraint. Pipe should extend no more than 3 feet above ground and have a blind flange. The stub out extension should be no more than 20 feet past the property boundary and a full-size isolation valve should be installed at the property boundary or utility right-of-way.

13.3 Blow offs shall not be installed in concrete.

14 CUTTING DUCTILE IRON PIPE

14.1 Where necessary to cut a length of ductile iron pipe, such cutting must be done with a three-wheel pipe cutter or as directed by the Engineer. In any case, pipe broken or cracked or otherwise made unfit for use by the cutting shall be replaced by the Contractor. After the pipe has been cut, it shall not be installed until the Engineer, or authorized representative, has given his approval of the cut piece of pipe proposed for use. It will not be necessary (except where directed by the Engineer because of peculiar circumstances) to band the cut ends of the pipe as called for in the AWWA specifications.

15 TAPPING SLEEVES AND VALVES

15.1 Tapping sleeves (Romac, Ford, or Mueller) approved for specific composite shall be used. For ductile iron, a tapping sleeve or approved tapping saddle shall be used. Tapping valves shall be No. 125 class, have one (1) flanged and one (1) MJ (mechanical joint) end, and shall allow a drilling machine to be attached directly to the valve. Valves shall meet the pressures shown in the table below.

Valve Size	Working Pressure	Test Pressure
2"-12"	200 psi	400 psi
14"-24"	150 psi	300 psi

- 15.2 Valves shall have a two (2) inch operating nut. All tapping sleeves and valves shall be air tested at 1.5 times the working pressure for a minimum of five (5) minutes in the presence of BRWS H2GO inspector prior to drilling or tapping the main. No taps are allowed without a BRWS H2GO representative present.
- 15.3 Tapping sleeves connecting pipes of equal diameter may be allowed at the discretion of BRWS H2GO inspectors based upon review comments and field conditions. They shall be installed in accordance with the manufacturer's instructions and only on clean, defect free pipe. Tapping sleeves shall be installed no closer than four (4) feet from any other fitting, valve or joint along the main to be tapped.
- 15.4 Tapping Saddles shall only be used on mains 16 inches and larger. Saddles shall be made of ductile iron providing a factor of safety of 2.5 with a working pressure of 250 psi. Saddles shall be equipped with an AWWA C110 flange connection on the branch. Sealing gaskets shall be O-ring type, high quality molded rubber having an approximate 70 durometer hardness, placed into a groove on the curved surface of the saddles. Straps shall be alloy steel.

16 WATER SERVICES

- 16.1 Water services shall be installed at the edge of the utility right-of-way or where directed by BRWS H2GO and in accordance with the detail on the plans. Water service shall have a minimum horizontal separation of 5' from the sewer service. No water services shall be installed in concrete, paved areas, or brick landscaping pavers. All connections shall be made by wet taps except in new development construction in which case these connections will be made dry. Each service to be installed shall be shown on the construction drawings and then on the record drawing, as installed. There shall be one (1) tap for each service and the tap shall be made perpendicular to the main and shall run straight to the meter, unless otherwise approved by BRWS H2GO in advance. Any tap shall have a minimum diameter of one (1) inch.
- 16.2 Unions will not be allowed on any water services from the tap to the meter.
- 16.3 All gang meter assemblies are to serve no more than 5 individual units. Each individual meter shall have an isolation valve for servicing and repairs. Dual boxes may be used to serve these units but must not exceed 10 units served off one assembly. A main isolation valve of the appropriate size shall be installed at the front side to allow a total shut down of all services.
- 16.4 Inserts for water line services shall be plastic only. No stainless steel inserts will be allowed.
- 16.5 Corporation stop shall be made with AWWA inlet threads. Provide saddles with PVC pipe and ductile iron pipe, unless otherwise approved by BRWS H2GO in advance. Corporations shall be ball type, made of brass and complete with compression connections with set screw for use with polyethylene pipe or flared coupling and AWWA Standard threads as per AWWA C800. Taps shall be located at 10:00 or 2:00 o'clock on the circumference of the pipe. Service taps shall be staggered from one side of the water main to the other and at least eighteen (18) inches apart. The taps must be a minimum of twenty-four (24) inches apart if they are on the same side of the pipe. No burned taps will be allowed, and each corporation stop will be wrapped with Teflon tape for ductile iron pipe water mains. No taps are allowed on a fire hydrant leg. No tapping shall be made where rodding is placed.
- 16.6 Service saddles shall be bronze body (85-5-5 waterworks brass) and double strap for taps over one (1) inch with silicon bronze nuts conforming to ASTM A98 and factory installed grade 60 rubber gaskets.
- 16.7 Service pipe shall be polyethylene plastic pipe (CTS) SDR-9, conforming to ASTM D-2239, as applicable to PE 4710, Class 252 psi, NSF approved.

- 16.8 All meters shall be a BRWS H2GO approved manufacturer and will be reviewed by the TRC.
- 16.9 Meters two (2) inches and larger shall be of the compound type with magnetic driven and bronze body conforming to AWWA Standard C701, latest revision and shall be Sensus Combination Meter or approved equal, by BRWS H2GO in advance, with encoder and pit pad installed, all to be provided to BRWS H2GO by the Developer or the Developer's Contractor.
- 16.10 Three-quarter (3/4) inch and one (1) inch meter boxes shall be Ford Double Gulf cast iron type or approved equal, with locking cover and cast iron self closing meter lid placed on two 8"x16"x2" concrete blocks.
- 16.11 Two (2) inch meters are the largest meter allowed in cast iron boxes.
- 16.12 Meters three (3) inches and larger shall be installed in a pre-cast concrete vault with lateral bypass configuration. All meter vaults and access doors within the road rights-of-way shall meet HS-20 loading requirements and shall be aluminum (4" meters and larger) with a flush drop lift handle, stainless steel hinges and bolts, a stainless steel slam lock, an automatic hold open arm, and compression springs to allow for easy opening. To ensure positive drainage, the vault shall be tied into the existing storm drainage system, if available. If positive drainage is unobtainable, a sump pump shall be located and operated in the vault. The associated electrical service shall be provided by the Developer or the Developer's Contractor according to BRWS H2GO specifications.
- 16.13 All meter boxes and vaults shall be located at the edge of the serviced lot's right-of-way or easement, unless otherwise approved by BRWS H2GO in advance. Water meter boxes shall not be placed in streets, driveways, sidewalks, parking areas, or obstructed by fencing or buildings. BRWS H2GO reserves the right to remove, or have removed, fencing, buildings or other obstructions after proper notification has been issued to the property owner asking them to do the same.
- 16.14 Service taps to existing water lines shall be made by BRWS H2GO or by a North Carolina licensed utility contractor. Service taps to new water lines shall be made by the Contractor in accordance with the specifications.
- 16.15 Service taps larger than two (2) inches shall be made by a North Carolina licensed utility contractor in the presence of a BRWS H2GO representative. A strainer shall be provided upstream of the meter for meters two (2) inches and larger.
- 16.16 An accessible shutoff valve shall be provided on the customer's side of the service ahead of the first outlet or branch connection to the service or distribution pipe of each dwelling, dwelling unit, and buildings other than dwellings and dwelling units. When such shutoff valve is located in the service line outside the building, it shall be located and accessible in a manufactured, approved valve box with a readily removable access cover that extends to grade level. When drain valves are provided for the distribution lines or other portion of the water supply system, such drains shall be above grade or otherwise located to prevent the possibility of backflow into the piping system after the system has been drained. (NC Building Code, Plumbing, Section 608.13, 2009)
- 16.17 Water pressure reducing valves or regulators are required where water pressure within a building exceeds eighty (80) psi static, an approved water pressure regulator conforming to ASSE 1003 with strainer shall be installed to reduce pressure in the building water distribution piping system to eighty (80) psi static or less, whichever is consistent with good engineering practice. (NC Building Code, Plumbing, Section 604.8, 2009). All pressure reducing valves and regulators shall be placed on the

customer's side of the water service (downstream from the meter) and shall be operated and maintained by the customer at his or her expense. BRWS H2GO reserves the right to permanently remove any existing pressure reducing regulator, located on the utility side of the water service, at the time of its failure.

- 16.18 BRWS H2GO reserves the right to withhold any meters from sections where the Contractor has not completed repairs for any issues found in the eleven months walk through. Contractors must notify BRWS H2GO when warranty issues are repaired and ready for re-inspection.

17 IRRIGATION SYSTEMS

- 17.1 If an irrigation service is being installed simultaneously with the installation of a potable water service, both of which will serve the same single-family, residential property, a Ford Double Gulf Box or approved equal shall be used. All irrigation systems shall be provided with privately maintained reduced pressure principle backflow prevention assemblies (RP) installed in accordance with the NC Plumbing Code and the USCFCCCHR. Reduced pressure principle backflow assemblies shall be installed above ground in an insulated box.

18 BACKFLOW PREVENTION

- 18.1 All assemblies used to prevent backflow into BRWS H2GO's public water supply system shall be USC approved (University of Southern California Foundation of Cross-Connection Control and Hydraulic Research or USCFCCCHR). All irrigation, commercial, institutional, and industrial facilities shall be required to install an USC approved backflow prevention assembly in accordance with BRWS H2GO's Cross-Connection Control Program (latest version). All backflow prevention assemblies shall be placed on the customer's side of the water service just behind the right-of-way or easement and shall be installed above ground in an ASSE 1060 approved insulated enclosure. These assemblies shall be operated and maintained by the customer at his or her expense. All backflow prevention assemblies shall be tested in accordance with the BRWS H2GO's Cross-Connection and Control Program, (latest version) with all test results being submitted to BRWS H2GO. Assemblies must be installed, with a minimum 12" clearance below the unit, before the irrigation meter can be set. A visual inspection will be completed by BRWS H2GO field technician and a passing/failing inspection will be noted on the work order.

19 TESTING

- 19.1 After pipe has been laid and all connections jointed, the system shall be pressure tested for leakage. Any discrepancy in the system which does not conform to the specifications shall be remedied in an approved way and retested until the system is acceptable. All water services shall be marked prior to any testing and the style of marker and placement will be at the discretion of BRWS H2GO field inspectors. Testing of service lines shall not be completed until meter boxes & meter yokes are installed and services are set to their final grade. Care shall be taken in tightening of joints insofar that no parts of the system are damaged. Any damage occurring shall be remedied by replacing the damaged part with an approved new part. Tests shall be made in sections from valve to valve unless otherwise approved by the Engineer and BRWS H2GO. Furnish suitable test plugs where line ends in "free flow." All testing shall be performed only in the presence of BRWS H2GO staff or authorized representative(s) thereof. Contractor must provide BRWS H2GO inspectors a minimum 48-hour notice for scheduling all testing procedures. Any testing performed without BRWS H2GO staff, or authorized representative, being present shall be considered a failed test and shall be retested.

- 19.2 To prevent pipe movement, sufficient backfill shall be placed prior to filling the pipe with water and field testing. When local conditions require the trenches be backfilled immediately after the pipe has been laid, the testing may be carried out after backfilling has been completed but before placement of the permanent surfacing. The Contractor shall ensure that thrust blocking or other types of restraining systems will provide adequate restraint prior to pressurizing the pipeline.
- 19.3 When existing water mains are used to supply test water, they should be protected from backflow contamination by temporarily installing a double check valve assembly between the test and supply main or by other means approved by BRWS H2GO. Prior to pressure and leakage testing, the temporary backflow protection should be removed and the main under test isolated from the supply main.
- 19.4 Hydrostatic Testing on water mains prior to installation of services shall be successfully completed by the Contractor as described below:
- 19.4.1 Each section of pipeline shall be subjected to and successfully meet a pressure of one hundred and fifty (150) psi (minimum).
- 19.4.2 The line shall be slowly filled with potable water and all air expelled through air valves or other suitable means.
- 19.4.3 A suitable test pump shall be connected to the line by means of a tap in the line, or by other suitable and approved means, and the proper test pressure slowly applied to the line.
- 19.4.4 A minimum line pressure of one hundred and fifty (150) psi shall be maintained for a minimum of two (2) consecutive hours with no allowable leakage. During this testing period there shall be no loss of pressure.
- 19.4.5 If pressure loss is realized, the test is failed, and the Contractor shall locate and repair all leaks and reschedule testing.

20 DISINFECTION

- 20.1 After pipes are laid and tested, all water piping shall be disinfected in accordance with AWWA Standard C651, continuous feed method, as modified hereinafter. The entire system shall be flushed thoroughly to remove all algae, deposits, and other foreign substances, and the system shall deliver clear water at all outlets. The water lines shall be tapped on top at the far end and air cock installed of sufficient size to release any air that may be entrapped in the line when filled. The valve at the end of the line should then be closed and the valve between the new pipeline and the supply opened slightly to allow water to enter the new pipe slowly. BRWS H2GO shall operate valves connected to the existing water system. Chlorine is then applied under pressure by ejector pump or equal to the water entering the pipeline through the tap located in the pipe at the influent valve in a concentration that will give an overall chlorine residual to the water of at least seventy (70) ppm (parts per million or milligrams per liter).
- 20.2 After the chlorine has been applied to the water, the pipeline is to be valved off and the chlorinated water allowed to remain in the line for twenty-four (24) hours; at the end of this period, the chlorine residual should be at least ten (10) ppm. The line should then be thoroughly flushed until there is only a normal chlorine residual present, as determined by the orthotolidine test. If there is any question that the chlorinated discharge will cause damage to the environment, a reducing agent shall be applied to the water to neutralize the residual chlorine. Open and close valves on the mains being disinfected a minimum of three (3) times during the chlorine contact period and a minimum of three (3) times during

flushing. Fire hydrants and other appurtenances should receive special attention to insure proper disinfection.

20.3 For Cut-In Construction: Use the following procedures for disinfecting of the new installation and the existing main at the cut-in point in accordance with AWWA C651, Section 9:

20.3.1 Apply liberal quantities of hypochlorite, in the form of tablets, to the open trench.

20.3.2 Interior of new pipe and fittings and the ends of the existing mains shall be swabbed or sprayed with a one percent hypochlorite solution before installation.

20.3.3 Install a 2-inch tap downstream of the work area. Tap shall be used for blowing off the main or use the next fire hydrant downstream of the work area for blowing off the main.

20.3.4 Install a 2-inch tap just upstream of the new installation. Control Water from the existing system so as to flow slowly into the work area during the application of chlorine. After the line is thoroughly flushed, add chlorine solution at a concentration of 70 ppm by the continuous feed method and hold in the main for one (1) hour.

20.4 Samples of water should be collected from various points along the line and forwarded to an approved laboratory for bacteriological analysis according to the procedure below. Testing laboratory shall send all original lab results directly to BRWS H2GO.

20.4.1 Required location for obtaining water samples:

A. Every 2,000 linear feet.

B. End of each main.

C. A minimum of one from each branch.

D. Mains at cut-in locations: Each side of work area. Time between samples to be determined by Engineer in field.

20.4.2 An independent testing laboratory, certified for the required testing by the State of North Carolina and pre-approved by BRWS H2GO, shall collect the sample and perform the testing. The laboratory shall be the same for both sampling and testing.

20.4.3 Obtain two water samples at each specified location for the bacteriological testing. Take the first sample immediately after flushing of the chlorinated water and again in 24-hours.

20.4.4 Recommended additional samples. During the required sampling of water from the new system, it is recommended that samples be taken from the existing potable water source to determine if coliforms are present.

20.4.5 Care in sampling. No hose or fire hydrant shall be used for the collection of samples. Take samples from an approved sample tap consisting of a corporation stop installed in the main with a copper tube gooseneck assembly. Operation shall be such as to ensure the sample collected is actually from water that has been in the new system. Copper tube gooseneck assembly shall be removed and sample tap corporation stop shut off upon completion of testing bacteriological testing is requirements.

- 20.4.6 Test samples for the presence of coliform organisms in accordance with the latest edition of Standard Methods for the Examination of Water and Wastewater. Testing method used shall be the multiple-tube fermentation technique, the membrane filter technique, or presence/absence.
- 20.4.7 Test for odor. The water in the new system should also be tested to assure that no offensive odor exists due to chlorine reactions or excess chlorine residual.
- 20.4.8 If samples show the presence of coliform, procedure 1 or 2 described below shall be followed, with the approval of BRWS H2GO, before placing the unit or facility in service.
- A. Take repeat samples at least 24 hours apart until consecutive samples do not show the presence of coliform.
- B. Again, subject the system to chlorination and sampling as described in this section.
- 20.4.9 If samples are free of coliform, and with the approval of BRWS H2GO, the potable water system may be placed in service.
- 20.4.10 Contamination: If, in the opinion of the Engineer, possible contaminants have entered the existing water system, or water samples show the water in the existing system to be unsafe on completion of the work, the existing water system shall be disinfected as specified herein and shall include all contaminated components. Disinfection of the existing system shall be coordinated with BRWS H2GO.
- 20.5 If satisfactory results are obtained, the line or lines may then be placed in service upon meeting all satisfactory requirements by BRWS H2GO. All water for flushing, testing, and disinfecting shall be furnished by the Contractor from approved sources, such as existing public systems.

21 REPAIR OF WATER MAINS

- 21.1 Joint Leaks of Ductile Iron Pipe and PVC pipe shall be repaired by use a bell joint leak repair clamp as manufactured by Rockwell or other approved equal.
- 21.2 Line Breaks or Punctures shall be repaired by a full circle repair clamp as manufactured by Rockwell, Mueller, or approved equal.
- 21.3 Line Splits or Blow Outs shall be repaired by replacing the damaged section with ductile iron pipe with a cast iron coupling at each end. The following cast pipe couplings shall be used for each pipe material indicated:
- 21.3.1 Asbestos Cement (AC) - Pipe-Rockwell 441 cast coupling or other approved equal.
- 21.3.2 Ductile Iron Pipe (DIP) - Pipe-Rockwell 431 cast coupling or other approved equal.
- 21.3.3 Polyvinyl Chloride (PVC) - Mechanical Joint coupling, PVC Knock-On coupling and/or full circle repair clamps or other approved equal.

22 PLANS AND SPECIFICATIONS

- 22.1 The above specifications do not cover all criteria or water line installations. The Design Engineer shall issue detailed Specifications and the uses of the above are guidelines and/or minimum. Brunswick Regional Water and Sewer H2GO shall be furnished one (1) full set of the construction plans and a full set of specifications for review. If changes are required one (1) full-sized set and two (2) half-sized sets of the revised plans marked for construction shall be submitted. If no changes are required two (2) half-

sized sets marked "For Construction" are required. Upon completion of the project Brunswick Regional Water and Sewer H2GO shall be furnished one (1) full-sized set, two (2) half-sized sets and a CD Rom in AutoCad or .DXF AutoCad file format of the "As Built" plans. Replaced with a CD Rom in Arc View 10.0 or .DWG AutoCad on the NC Grid Horizontal 83 file format of the "AsBuilt" plans.