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601 Water Distribution Pipe

A. Design

The following Standard Specifications and associated Standard Detail Drawings shall apply to all water system extensions and development of the Apex municipal water system. The Standard Specifications included herein shall apply to all aspects of the Apex water system that is owned, operated and maintained by the Town of Apex.

All utility extension permits must be obtained prior to construction. Refer to General Provisions in Section 0200 for further requirements.

1. Location: Water transmission lines shall be located and sized in accordance with the current "Water System Master Plan" or as directed by the Town, and shall extend to the adjacent properties to provide an adequate network. All public water mains shall be located within dedicated right of way of Town roads, outside of the right of way on NCDOT roads, or dedicated easements with a minimum width of 20 feet. Dedicated easements for water mains and appurtenances shall be recorded as "Town of Apex Public Waterline Easement." Town of Apex utility and pipeline easements shall contain only Town of Apex utilities unless otherwise approved by an approved site plan or encroachment agreement. Easements that are shared by water mains and greenway paths shall have a minimum width of 30 feet. Easements shall be acquired by the Developer (unless utility is designed as part of a Capital Improvement Project) prior to construction approval. All private water mains that connect to the Town's water system shall also be designed in accordance with these specifications. Any private commercial water connection shall be metered and protected by a reduce pressure assembly listed on the most current Manual of Cross-Connection Control issued by the USC Foundation for Cross-Connection Control and Hydraulic Research. See Section 620.

If the water main is located within the road right-of-way, a clear width equal to or greater than the easement width required must be available. If adequate width is not available within the right-of-way, additional easement outside of the right-of-way must be maintained. For example, if a water main normally requiring a 20 foot easement is installed 5 feet inside of the right-of-way, an additional 5 feet of easement must be obtained outside of the right-of-way to provide a clear total width of 10 feet on each side of the pipe.

All water main extensions and distribution facilities which connect to the water distribution system of the Town shall be considered as public facilities up to the metering point. Therefore, all such facilities must be installed in public street right-of-way (not alleys) or centered within an easement.

Extensions shall terminate at the furthestmost property line fronting the property.

Where deemed necessary to enhance water flow and/or pressures in the area, extensions may be required to be “looped” to an existing water main or “dead end” line within the area being developed.

If a proposed development site has a gap in road frontage, the development shall extend the water main along the road frontage to eliminate the gap in water service, unless otherwise approved by the Water Resources Director.

Mains shall not be installed under any part of water impoundments or area to be impounded. Mains shall not be installed through, above, or below any retained earth structure. Main location and depth shall not be within the theoretical 1:1 slope of any impoundment dam or structure, or shall maintain a minimum of 10’ horizontal separation from the toe of slope, whichever is greater. The entire easement shall be outside of the toe of slope, unless prior approval is obtained from the Water Resources Director.

Easement Areas: No permanent structures, equipment, retaining walls, embankments, impoundments, or other elements that would inhibit maintenance operations shall be constructed within a utility and pipeline easement. Fences may be allowed across easements provided that appropriate access gates or removable panels have been installed to allow utility maintenance. Fences shall not be installed parallel within utility easements. Fill or cut slopes greater than 4:1 are not allowed to extend into easements. Easements must be clearly labeled as public or private. If water main is located within road right-of-way or on Town owned property there shall be no permanent structures, equipment, retaining walls, embankments, impoundments, landscaping, or other elements that would inhibit maintenance operations unless approved by the Water Resources Director.

Where public water mains are installed within easements crossing private property, the Water Resources Department shall have the right to enter upon the easement for purposes of inspecting, repairing or replacing the water mains and appurtenances. Where paved private streets, driveways, parking lots, etc. have been installed over the public water mains, the Town of Apex shall not be responsible for the repair or replacement of pavement, curbing, etc. which must be removed to facilitate repairs. The Water Resources Department shall excavate as necessary to make the repair, and shall backfill the disturbed area to approximately the original grade. Replacement of privately owned pavement, curbing, walkways and any other private infrastructure shall be the responsibility of the property owner or Homeowner’s Association.

Easements shall be accessible from public rights-of-ways. If easement is not accessible perpendicular from right-of-way due to steep slope, environmental feature, or other obstacle, additional easement may be necessary.

Only one utility can be installed per easement, unless prior approval from the Water Resources Director is obtained.

All retaining walls shall have a separation from the easement boundary of at least a 1:1 ratio. For example, if the retaining wall is 10 feet tall, it shall be placed no closer than 10 feet from the adjacent easement boundary.

2. Sizing: Major transmission lines shall be sized in accordance with the "Water System Master Plan" or as directed by the Town. Six (6) inch mains may be used on a case by case basis when the Town has determined that a sufficient grid exists and the existing network supports using six (6) inch mains. The total maximum length of 6 inch and 8 inch lines, without connecting to a larger main, is 1200 feet and 2000 feet, respectively. Where the existing network is lacking connectivity, lines shall be upsized to provide adequate fire flow as directed by the Director of Water Resources. All lines shall be designed to maintain a minimum of 20 psi at maximum daily demand with applicable fire flow conditions. Water distribution facilities for Multi-Family Units, Apartments, Condominiums, and Townhouse Developments shall comply with the provisions for Business, Commercial, and Industrial Zoning Districts indicated below.

Business, Commercial, and Industrial Zoning Districts - Water mains shall be 8- inch and 12- inch minimum. Eight-inch shall be used only when it completes a good grid and the maximum length of 8-inch lines without connection to a larger feeder main is 1,200 feet unless special approval for deviation from this requirement is granted by the Director of Water Resources.

Where water mains dead end or are terminated for future extension, at least one full length stick of ductile iron pipe shall be installed with a thrust collar, main line valve, and blow-off assembly. This dead end shall terminate within a right-of-way or dedicated easement.

Dead end mains may be extended to existing mains in adjacent streets when it is practical to do so in order to enhance flow, water quality, and/or pressure in the affected area.

3. Restraint:

All valves and fittings shall be restrained. Pipe joints shall also be restrained an adequate length away from valves and fittings in accordance with AWWA

manual M41 (or the latest edition of *Thrust Restraint Design for Ductile Iron Pipe* as published by the Ductile Iron Pipe Research Association). The standard joint restraint method shall be to use manufacturer provided restrained joint pipe and fittings.

- a) 6" to 12" Diameter Pipe: For pipe 6-inches through 12-inches, the following table may be used to determine the required restrained length of pipe for single occurrences of valves or fittings within the pipe system. The table may not be used for combined bends or offsets where a series of fittings occur. In lieu of using the below table, a pipe restraint plan detailing all assumptions and calculations may be provided by the NC Professional Engineer sealing the plan drawings. In either case, the method of restraint to be used and the length of pipe to be restrained (if applicable) shall be clearly identified on the plans at all necessary locations.

Required Restrained Lengths for Single Fittings and Valves for Pipe 6-inches to 12-inches in Diameter (in Feet, Both Directions unless otherwise noted)

	6"	8"	10"	12"
45° Horizontal	34'	44'	53'	61'
45° Vertical Up	34'	44'	53'	61'
45° Vertical Down	53'	69'	82'	96'
22½° Horizontal	17'	21'	26'	30'
22½° Vertical Up	17'	21'	26'	30'
22½° Vertical Down	26'	33'	40'	47'
11¼° Horizontal	8'	11'	13'	15'
11¼° Vertical Up	8'	11'	13'	15'
11¼° Vertical Down	13'	17'	20'	23'
Tee (Restrained the Branch)	6" – 115'	6" – 111' 8" – 154'	6" – 107' 8" – 151' 10" – 186'	6" – 103' 8" – 148' 10" – 184' 12" – 220'
Reducer (Restrained Larger Pipe)	N/A	70'	10" x 8" – 67' 10" x 6" – 122'	12" x 10" – 68' 12" x 8" – 123' 12" x 6" – 169'
Dead Ends (Caps and Plugs) & Inline Valves	126'	165'	198'	232'

- b) All valves, pipe, and fittings: **Projects with pipe diameters greater than 12-inches, poly-wrapped pipe, or combined bends must have a pipe restraint plan with the method of restraint to be used and the length of pipe to be restrained clearly identified on the plans at all necessary locations.** The pipe restraint plan must be calculated in accordance with AWWA manual M41 (or the latest edition of *Thrust Restraint Design for Ductile Iron Pipe* as published by the Ductile Iron Pipe Research Association). The plan must also account for the actual soil types that exist at the project site. A minimum safety factor of 1.5 (2.0 if/when required by NCDOT) and a minimum pressure of 200 PSI must be used.
- c) Valves: Valves shall be restrained in a manner consistent with operation as a dead end. This includes restraining the valve to the pipe and restraining a sufficient number of pipe joints on both sides of the valve to accommodate dead end restraint. Valves located at waterline intersections (at tees and crosses) shall have no joints between the valve and fitting.
- d) Dead Ends: All MJ cap and plug fittings, including tapped caps, shall be restrained with approved wedge action retainer glands. The adjacent pipe shall be restrained the distances specified above (or on the sealed pipe restraint plan). Reaction blocking shall not be used to restrain caps and plugs.
- e) All pipe restraint systems shall be factory produced by the manufacturer. Approved wedge action retainer glands or bell restraints may be used for pipe/fittings up to (but not including) 16" in diameter. Restraint on mains 16" and larger shall be factory produced by the manufacturer.
- f) Restraining systems not included within this Specification shall require written approval prior to utilization. All joint restraint products that include the means of restraint within the joint gasket shall be prohibited in the Town of Apex water system.

4. Depth of Installation:

All water mains shall have a minimum cover of 3 feet measured from the top of the pipe to the finished grade. Water mains shall have a maximum cover of 8 feet measured from the top of the pipe to the finished grade. Installations requiring greater than 8 feet of cover due to road crossings, stream/wetland crossings, or other conflicts must have prior approval from the Water Resources Director.

When water lines are installed along a roadway they shall be installed at sufficient depth to maintain three (3) feet of cover to the subgrade of any future road improvements including potential vertical alignment changes.

5. Relation to Sanitary and Storm Sewers:

Separation between Potable Water Mains and Sanitary Sewer Mains or Storm Sewers.

- a) Parallel Installations: 10-ft lateral separation (pipe edge to pipe edge) or minimum 5-ft lateral separation and water line at least 18-inches above sanitary sewer line measured vertically from top of sewer pipeline to bottom edge of water main.
- b) Crossings (Water Main Over Sanitary or Storm Sewer): All water main crossings of sanitary sewer lines shall be constructed over the sewer line in conformance with Town of Apex Specifications. At a minimum, 18-inches of clearance shall be maintained between the bottom edge of the water main and the top edge of the sanitary sewer main, 24-inches of clearance shall be maintained between the bottom edge of the water main and the top edge of the storm sewer main. If 18-inches or 24-inches, respectively, of clearance is not achievable, the water main and sanitary/storm sewer main shall both be constructed of ductile iron pipe with joints in conformance with water main construction standards. The sanitary sewer pipe shall be ductile iron the entire run from manhole to manhole. When the separation between pipelines is 18-inches or less, the void space between the pipes shall be filled with minimum 500-psi, quick setting, non-excavatable flowable fill extending 3-ft on both sides of the crossing. Regardless of pipe material, at least 12-inches of vertical separation is required for both sanitary and/or storm sewer crossings of potable water mains.
- c) Crossings (Water Main Under Sanitary or Storm Sewer Line): Allowed only as approved by Town of Apex, when it is not possible to cross the water main above the sanitary or storm sewer line. At a minimum, 18-inches of separation shall be maintained, (measured from pipe edge to pipe edge) and both the water main and sanitary/storm sewer shall be constructed of ductile iron in conformance with water main construction standards. The sanitary sewer pipe shall be ductile iron the entire run from manhole to manhole. If local conditions prevent providing 18-inches of clearance, then at least 12-inches of clearance shall be provided and the void space between the pipes shall be filled with minimum 500-psi, quick setting, non-excavatable flowable fill extending at least 3-ft on both sides of the crossing.

B. Materials

General: All water main distribution pipe shall be ductile iron. The following table lists approved manufacturers of DIP, DIP fittings, and RJDIP that are allowable for installation within the Town's system.

Product Category	Approved Manufacturer	Model/Series	Pressure/Load Rating	Reference Standard	Requirements
Ductile Iron Pipe	US Pipe	Tyton Joint	250-350 psi	AWWA C150 and C151	Cement mortar lined with exterior bituminous coating. McWane pipe stamped "McWane by Atlantic States or Clow" only
	American (ACIPCO)	Fastite Joint			
	McWane	Tyton Joint			
Ductile Iron Fittings	Sigma	Mech. Joint	250-350 psi	AWWA C110/C111 and AWWA C153	Shall always meet or exceed pipe pressure rating
	Tyler Union	Mech. Joint			
	SIP Industries	Mech. Joint			
	Star	Mech. Joint			
	American	Mech. Joint			
Ductile Iron Restrained Joint Pipe	US Pipe	TR Flex	250-350 psi	AWWA C150 and C151	Boltless restraint unless otherwise specified
	American (ACIPCO)	Flex Ring			
	McWane	TR Flex (pipes 24" and smaller)			

1. Ductile Iron Pipe

- a) Ductile iron pipe shall be designed and manufactured in accordance with AWWA C150 and C151 and provided in nominal 20-ft lengths. The minimum required pressure ratings for ductile iron pipe and required laying conditions are tabulated below. For all other installations other than specified, the laying condition, bedding requirements or the minimum pressure class rating and/or thickness class shall be increased in accordance with AWWA C151. A pipe thickness design shall be submitted for external loading in all cases where the pipe depth exceeds the specified range of depths outlined in the following table.

Pressure Class, Max. Depth and Laying Condition for DI Water Mains

Pipe Diameter	AWWA C-150, Laying Condition	Pressure Class	Maximum Depth of Cover
6-8 -inch	type 1	350 psi	3-16 feet
6-8 -inch	type 4	350 psi	16-20 feet
10-12 -inch	type 1	350 psi	3-10 feet
10-12 -inch	type 4	350 psi	10-20 feet
14-20 -inch	type 4	250 psi	3-20 feet
24-30 -inch	type 4	250 psi	3-20 feet
36-42 -inch	type 4	300 psi	3-20 feet

*Any installation deeper than 20 feet must obtain approval from the Water Resources Director and no practical alternative must be proven.

Note: For cases not specified, a ductile iron pipe and bedding design certified by a Professional Engineer licensed in the State of North Carolina shall be required in compliance with AWWA C150 and the Ductile Iron Pipe Research Association.

- b) Pipe joints shall be mechanical joint or push-on type as per AWWA C111. Pipe lining shall be cement mortar with a seal coat of bituminous material in accordance with AWWA C104. All buried ductile iron pipe shall have a bituminous exterior coating in accordance with AWWA C151.
- c) Pipe manufacturer must have a supplier within 200 miles of the Town of Apex.

2. Ductile Iron Fittings

All ductile iron fittings shall be provided in conformance with AWWA C110 for standard ductile iron fittings and AWWA C153 for compact ductile iron fittings. All fittings shall be pressure rated for a minimum 350-psi through 24-inches in diameter and 250-psi for fittings greater than 24-inches in diameter. In cases where minimum pressure standards are less than the pipe specification, fittings shall always be pressured rated to meet or exceed the pressure ratings for the specified pipe. All fittings for potable water service shall be provided with cement mortar linings and asphaltic seal coats in accordance with AWWA C104. All ductile iron fittings shall have an asphaltic exterior coating in accordance with AWWA C151. All ductile iron fittings shall be provided with mechanical joint end connections or proprietary restrained joints from an approved manufacturer. Gaskets shall be provided in conformance with AWWA C111 with EPDM rubber gaskets preferred over SBR. Two 45 degree fittings shall be used in lieu of 90 degree fittings in all horizontal and vertical installations, with exception of reverse taps.

Fitting manufacturer must have a supplier within 200 miles of the Town of Apex.

3. Restrained Joint Ductile Iron Pipe

All restrained joint ductile iron pipe unless otherwise specified shall be of the boltless restrained joint type. For installations requiring welded locking rings, the rings shall be factory welded.

All proprietary pipe restraint systems shall be approved by the Town of Apex and provided in compliance with all standards for coatings, linings, pressure classes, etc. as required for ductile iron pipe. All restrained joint pipe shall be installed based on laying conditions, pressure class, etc. as required for typical ductile iron pipe.

Restraining systems not included within this Specification shall require written approval prior to utilization. All joint restraint products that include the means of restraint within the joint gasket shall be prohibited in the Town of Apex water system

Pipe manufacturer must have a supplier within 200 miles of the Town of Apex.

C. Installation

1. Ductile iron pipe shall be installed in accordance with the requirements of AWWA C600 and the Ductile Iron Pipe Handbook published by the Ductile Iron Pipe Research Association. Materials at all times shall be handled with mechanical equipment or in such a manner to protect them from damage. At no time shall pipe and fittings be dropped or pushed into ditches.
2. Pipe and fitting interiors shall be protected from foreign matter and shall be inspected for damage and defects prior to installation. In the event foreign matter is present in pipe and fittings, it shall be removed before installation. Open ends of pipe shall be plugged or capped when pipe laying is not in progress.
3. All pipe shall be constructed with at least 36 inches of cover below the finished surface grade or road subgrade. Pipe shall be laid on true lines as directed by the Engineer. Trenches shall be sufficiently wide to adjust the alignment. Bell holes shall be dug at each joint to permit proper joint assembly. The pipe shall be laid and adjusted so that the alignment with the next succeeding joint will be centered in the joint and the entire pipeline will be in continuous alignment both horizontally and vertically. Pipe joints shall be fitted so that a thoroughly watertight joint will result. All joints will be made in conformance with the manufacturer's recommendations for the type of joint selected. All transition joints between different types of pipe shall be made with transition couplings approved on shop drawings showing the complete assembly to scale.
4. Prior to beginning construction, the Contractor shall contact local utility companies and verify the location of existing utilities. The Contractor shall be completely and solely responsible for locating all existing buried utilities inside the construction

zone before beginning excavation. The Contractor shall be solely responsible for scheduling and coordinating the utility location work. When an existing utility is in conflict with construction, it shall be exposed prior to beginning construction to prevent damage to the existing utility.

5. All valves that are under the ownership and acceptance of the Town of Apex municipal water system shall be operated only by trained personnel of the Town of Apex. Existing valves in the Town of Apex water system will not be operated without a minimum notice of 24 hours. Contractor's personnel shall only be responsible for operating valves within new construction areas that are not directly connected with the existing municipal water supply. At such time when the valves in new construction areas are connected with the municipal water supply, the valves shall only be operated by Town of Apex personnel or in limited circumstances by Contractor's personnel after receiving authorization from the Operator in Responsible Charge of the water distribution system.
6. The unloading and loading of pipe, fittings, valves, and related accessories shall be performed with care so as to avoid any damage to these materials. All such materials shall not be stored directly on the ground, but shall be on pallets, or other suitable supports, so as to prevent the entry of mud and debris into the pipe or other materials. Contractor shall also endeavor to store these materials in accordance with any special practices as required by the manufacturer.
7. Fittings shall be installed at the location indicated on the drawings with care taken to insure that joints are fully homed and fully and properly supported.
8. Water mains shall not be installed within roundabouts or alleys.

602 Fire Protection

A. Fire Hydrants

1. Sizing of Mains
 - a) Water mains shall be sized in order to meet minimum fire flow conditions according to the type and classification of the proposed development. Mains shall be sized in accordance with conditions set forth within the Town's Water Distribution Extension permit application.
2. Location
 - a) All fire hydrants shall be installed on a minimum 6 inch water line. Only one fire hydrant may be installed when the line is served by a 6 inch tap and is not looped to another main. There shall be at least one fire hydrant at each street intersection. Hydrants at intersections shall be located in accordance with the Standard Details. Valves provided on the fire hydrant branch supply line shall

be located within 5-ft of the main line. The maximum length of a fire hydrant leg shall not exceed 50 feet.

- b) In residential districts the maximum distance between hydrants, measured along street centerlines, shall be 500 feet. When residential intersections are less than 700 feet apart, a hydrant is not required between the intersections. For single-family residential projects, a hydrant shall be located at the end of all cul-de-sacs.
- c) In business, office and institutional, and industrial zoning the maximum distance between hydrants, measured along street centerline, shall be in accordance with the latest version of the NC Fire Code. If a building is completely equipped with a fire sprinkler system and the project is developed with a private water distribution system, all parts of the building shall be within 300 feet of a hydrant. Hydrants positioned greater than 50 feet from the public water main shall occur on a looped water main.
- d) All premises where buildings or portions of the building are located at distances from a fire hydrant that exceed those specified by Fire Code shall be provided with approved on-site fire hydrants and water mains capable of supplying the fire flow required by the Fire Department.
- e) Residential developments which do not meet minimum fire flow requirements shall have individual fire protection systems designed and installed at each residence. Residential fire systems must be current Town Backflow Prevention Protection, listed under Section 620.
- f) On thoroughfares and collector streets with access points only at street intersections, hydrants shall be located at each street intersection and at 1000 foot intervals along the street. Where these intersections are less than 1200 feet apart, no hydrant is required between the intersections. Fire hydrants shall be placed in a staggered arrangement on both sides of any roadway classified as a major or minor thoroughfare with the hydrant spacing as referenced above.
- g) Where sprinkler systems are used, a fire department connection shall be within 50 feet of an accessible fire hydrant, unless otherwise permitted by the Fire Department.
- h) Any proposed, relocated, or replaced water main that includes new fire hydrants shall require submittal of fire flow calculations.
- i) Fire hydrant legs shall not be tapped from water service connections, they shall be tapped directly from the main line.

3. Specifications

Hydrants shall conform to AWWA C502 with a minimum valve opening of 4 1/2 inches. Hydrants shall be furnished with a 4.5 inch steamer and double 2 1/2 inch hose connections with caps and chains, National Standard Threads, mechanical joint, 1 1/2 inch pentagon operating nut, open left, painted fire hydrant red, bronze to bronze seating, a minimum 4 foot bury depth with a break away ground line flange and break away rod coupling. The hydrant bonnet will be designed with a sealed oil or grease reservoir with O-ring seals and a Teflon thrust bearing. Fire hydrant caps shall be attached to the body of the hydrant with a minimum 2/0 twist link, heavy duty, non-kinking, machine chain. All fire hydrants shall be designed and rated for a working pressure of 250-psi or greater.

4. Installation

Hydrants shall be set plumb, properly located with the pumper nozzle facing the closest curb of a fire lane or street, but not a parking space. The back of the hydrant opposite the pipe connection shall be firmly blocked against the vertical face of the trench with 1/3 cubic yard of concrete. Double bridle rods and collars shall be connected from the tee to the hydrant. All joints between the tee and the hydrant shall be mechanical joints restrained with wedge action retainer glands. Stainless steel rods not less than 3/4 inch diameter may also be used to restrain the assembly. A minimum of 8 cubic feet of stone shall be placed around the drains. The backfill around the hydrants shall be thoroughly compacted and closely match the elevation on the approved plans. Hydrant extensions will not be allowed on new or retrofit installations. Hydrant installation shall be in accordance with the Details. Hydrant tees may be used upon approval of the Water Resources Department. A clear level space of not less than 10 feet shall be provided and maintained on all sides of a fire hydrant for immediate access. Clearance from the ground surface to the steamer nozzle shall be between eighteen (18) inches and twenty-four (24) inches.

5. Depth of Bury:

Typical 90-Degree Hydrant Shoe Installations:

The maximum depth of bury for all new fire hydrants with 90-degree hydrant shoes shall be 5-ft from the breakaway flange connection. The breakaway flange or safety coupling shall be oriented vertically just above finished grading and bolted directly to the fire hydrant in compliance with manufacturer standards. The breakaway flange or safety coupling shall not be buried.

Vertical Shoe Hydrant Installations:

For installations requiring depth of bury greater than 5-ft, the fire hydrant shall be equipped with a vertical shoe arrangement that provides for full extension of the lower valve plate against a stopping mechanism located inside the vertical shoe to maximize hydraulic flow conditions through the hydrant. The vertical shoe shall

be equipped with flanged connections. The maximum depth of bury for vertical shoe installations shall not exceed 4-ft measured from the breakaway flange to the bottom of the vertical hydrant shoe. The vertical shoe and all piping included in the hydrant supply line shall be restrained with blocking and rodding or blocking with wedge action retainer glands or standard Aquagrip, Grip Ring, or Romac connections.

6. Hydrant Relocations: For installations where hydrants will be relocated, all hydrants with greater than 20-years of operational service, as indicated by the date of manufacture provided on the hydrant, shall be replaced with new fire hydrants. The existing fire hydrant shall be turned over to the Town of Apex Public Works Department.

For installations where the hydrant to be relocated has less than 20-years of operational service, the existing hydrant may be relocated. The existing hydrant shall still be disinfected, flushed and pressure tested.

All fire hydrants shall be initially tagged and/or bagged "NOT IN SERVICE". This tag or bag shall not be removed until approved by the Inspector.

B. Automatic Fire Sprinkler Systems

1. General: Four (4) complete sets of working plans and calculations for all fire sprinkler systems and standpipe systems shall be submitted as required by the Inspections and Permits Department for review and approval. If 20 sprinkler heads or more are modified or added to an existing sprinkler system, if any modifications occur in the hydraulically calculated remote area, or the hazard classification changes, a plan submittal including complete calculations and a permit will be required. All fire sprinkler systems shall be installed with an alarm check valve installed in each riser with all required appurtenances (example: retard chamber, water motor gong, pressure gauges, etc.). Exception: NFPA 13 D and 13 R residential sprinklers when approved by a fire official. All installations, minor repairs, or minor replacements shall be performed by a licensed fire sprinkler contractor. Contact the Inspections and Permits Department for a permit application.
2. Design: Approved working plans shall be in complete compliance with NFPA No. 13, 13D, 13R, 14, 231, 231C, 231D, 231F and Town Specifications. An NFPA above ground material and test certificate and NFPA underground material and test certificate are required after completion of designated, approved work.
3. Hydraulic Design: If a system is hydraulically designed, the following design criteria must be followed:

- a) Safety Margin: In all cases, a fixed minimum safety margin of at least 10-psi shall be applied to the design calculations. (Example: Demand = 70 psi, Supply \geq 80 psi)
 - b) Hose Allowances: Both exterior and interior hose allowances shall comply with NFPA 13 requirements.
 - c) Water Supply Pressure: The sprinkler system designer shall be responsible for verifying system pressure. Refer to Town of Apex Policy Statement 129 regarding Minimum Water Supply Pressure.
4. Backflow Prevention: When a fire protection system is proposed, with a Fire Dept. connection or as otherwise required by the Cross Connection Ordinance a reduced pressure principle detector assembly (RPDA), two and one half inch or greater, shall be installed on the supply side of the sprinkler fire protection line inside the riser room. A two inch or less reduced pressure principle assembly may be allowed if the site is designed for that size. At no time shall any fire backflow preventer outlet be smaller than the water pipe inlet. These backflow prevention devices must be UL listed and/or listed by Factory Mutual Research Corporation. Reduced pressure principle detector assemblies shall not be arranged vertically. For all RPDA's, a relief valve drip cup piped outside the building shall be provided. The relief valve drain may be piped to the main building drain but must meet current specification listed in Section 620 or the drain be sized per the manufacturer recommendations, whichever is more stringent.

~~5. Post Indicator Valve (PIV): A post indicator valve may be provided at the right of way or edge of easement at least 40 feet from the building if space permits. Each connection into the building shall have a post indicator valve. The top of the PIV shall be 30-42 inches above finished grade and 36 inches of unobstructed access perimeter shall be maintained around the PIV.~~

~~In urban settings, a wall mounted indicator valve may be used where there is no suitable location for a post mounted indicator valve. Wall mounted indicator valves shall be centered 30-42 inches above the finished grade. It shall be greater than 10 ft from any door, window, or other protected opening along the wall.~~

~~All indicator valves regardless of type shall have an electronically controlled tamper switch. All PIVs shall be made of ductile iron construction and shall be UL-listed and FM approved. The stand pipe of all PIV's shall be painted red.~~

6.5. Fire Department Connection: Where automatic fire sprinkler systems or standpipe systems are used, a fire department connection with National Standard threads shall be provided within 50-ft of a fire hydrant, except for town homes, apartment buildings, and within urban settings where greater lengths may be permitted. When a sprinkler system serves only part of a large structure, the fire

department connection shall be labeled, with minimum 2 inch letters on a permanent sign, as to which section of the structure that sprinkler riser serves.

7.6. Dedicated Riser Room: A dedicated sprinkler riser room is required providing an entry door to the room from the exterior of the building. All dedicated riser rooms shall be equipped with a floor drain sized appropriately to prevent flooding. The floor drain shall be piped to storm system or main building drain. The floor drain shall be provided with a circular raised ring/hub around the floor drain to prevent debris and/or chemicals from entering the drain during an emergency spill. The hub shall be fabricated of cast iron or other corrosion resistant material and extend at least 3-inches above floor elevation. All BFPs located inside of a building must have direct access to that room from the building exterior.

8.7. Alarm Communication: All sprinkler systems are to have alarm communication equipment to fully comply with NFPA 72. Equipment must be fully functional and reporting to a UL listed central receiving station before a Certificate of Occupancy is issued for the facility.

9.8. Access: All buildings which have an elevator, a fire alarm system monitored by a central receiving station, or a fire sprinkler protection system shall provide a "Knox Box" key entry system. This "Knox Box" shall be mounted on the exterior entrance to the dedicated riser room or at the normal fire department entrance when no fire sprinkler system is provided and there is no dedicated riser room. Mount "Knox Box" on wall at 5 feet A.F.F. on door handle side of dedicated riser room door or entrance door. This "Knox Box" shall be ordered through the Town Fire Department and shall be in place before a Certificate of Occupancy is issued. Keys to access the facility shall be provided to the Fire Department by the owner/manager. An access door directly to the mechanical room or mechanical storage area shall be provided.

10.9. Identification: The exterior door leading to the dedicated sprinkler riser room shall be labeled with minimum 2 inch lettering designating "SPRINKLER RISER ROOM" in a contrasting color. Durable vinyl lettering is suggested.

11.10. Fire Alarm Panel Location: When a building is protected by an automatic sprinkler system and has a fire alarm system, the fire alarm control panel or a remote annunciation of the fire alarm control panel shall be placed in the sprinkler riser room. This control panel shall have the capacity of silencing and resetting. Adjacent to the fire alarm control panel shall be a framed zone map. Nomenclature shall correspond with the zone map. Submit four complete sets of plans and specifications to the Inspections and Permits Department for approval prior to installation of equipment or wiring. When there is no sprinkler system in a building, the fire alarm control panel or remote annunciator shall be located at the normal fire department entrance.

C. Fire Protection During Construction

The fire protection water supply system, including fire hydrants, shall be installed and be in at least functional status prior to placing combustible materials on the project site. If phased construction is planned, coordinated installation of the fire protection water system is permitted. Coordination of the water system will be done through the Water Resources Department.

603 Valves and Appurtenances

A. Valves

1. General

- a) Valves shall be installed on all branches from feeder mains and hydrants according to the following schedule: 4 valves at crosses; 3 valves at tees; one valve on each hydrant branch and elsewhere as directed by the Director of Water Resources. When a loop section of water line is connected back into the feeder main within a distance of 200 feet or less, only one valve will be required in the feeder main. In all cases where new water mains are connected to an existing water distribution line, valves shall be located at all end points and at intermediate points throughout the new system extension to assure testing requirements can be met without interfering with the operation of the existing system. Valves are required regardless of whether tee connection is cut-in or made by tapping sleeve and valve. Valve requirements are not enforced unless the branch line serves more than one parcel or has more than one connected service.
- b) Where no water line intersections are existing, a main line valve shall be installed at every 100 feet per 1 inch diameter main up to a maximum distance of 2000 feet between valves.
- c) Valves shall be properly located, operable and at the correct elevation. The maximum depth of the valve nut shall be 5 feet without an extension kit. When valve extension kits are used, they must be manufactured by the same company which manufactured the valve.
- d) Valves shall be set at locations shown on the plans with care being taken to support the valve properly and to accurately position the valve box over the operating nut of the valve. When valves are located in street right-of-way, but out of pavement, the boxes shall be adjusted to finish grade and a concrete collar 2-foot square and 6-inches thick shall be poured around the box ½-inch from the top of the casting, in lieu of the poured in place concrete a pre-cast concrete collar may be used such as manufactured by Brooks, Inc. or Buckhorn Products. Valve boxes located in the pavement shall be set flush with the current pavement. If the pavement requires a future final lift, the valve

boxes shall be adjusted no more than 60 days prior to completion of the final lift. Stem extensions are allowed so that nut is within 30" of final grade.

When valves are located outside of street right-of-way, the boxes shall be adjusted 6 inches above the finished grade, and a concrete collar 2-foot square and 6-inches thick shall be poured around the casting or approved concrete donut with marker. ARV's must be located at high points with positive slope on the line to the ARV in both directions.

2. Combination Air Valves

- a) Combination air valves shall be provided to purge air from the system at startup, vent small pockets of air while the system is being pressurized and running, and prevent critical vacuum conditions during draining. Combination air valves rated for potable water use shall be installed at all high points of water lines 8 inches in diameter or larger and at other locations such as major changes in grade as directed by the Town. A high point shall be determined as any high location where the difference between the high elevation and adjacent low elevation exceeds 10-ft, unless otherwise determined by the Director of Water Resources based on special circumstances.

All combination air valves shall be provided in conformance with AWWA C-512. The water main shall be installed at a grade which will allow the air to migrate to a high point where the air can be released through an air valve. A minimum pipe slope of 1 foot in 500 feet should be maintained.

- b) The combination air valve shall be sized by the Engineer, and approved by the Town. Combination air valves shall be of the single housing style with Type 304 or 316 stainless steel body that combines the operation of both an air/vacuum and air release valve. The valve shall be rated for minimum 230 PSI working pressure. The combination air valve shall be provided with cylindrical shaped floats and anti-shock orifice made of high density polyethylene. Combination air valves with spherical floats shall not be accepted. All combination air valves shall be installed in accordance with the Details.
- c) 2 inch combination air valves shall be installed in a standard 4-foot diameter eccentric manhole. The 2 inch valve shall have a 2 inch male NPT inlet. Connection to the main shall be with a saddle tap in the same sizing as the combination air valve assembly and isolated with a gate valve also of the same size. The isolation gate valve shall be provided with NPT threads and connected with "no lead" brass (meeting UNS C89833 as per ASTM B584) or bronze piping. Brass or bronze ball valves may be used in lieu of gate valves for 2-inch installations. The isolation valve shall be rated for 200-psi service or greater.

- d) Combination air valves 3-inches and greater shall be installed in a flat top manhole sized according to the water main diameter. Mains less than or equal to 20" shall utilize a 5 foot diameter manhole and larger mains shall utilize a minimum 6 foot diameter manhole. All connections shall be by flange joints. Connection to the main shall be by an MJ x FLG tee with the branch diameter equal to at least half of the main diameter. If needed due to larger diameters, a flanged reducer shall be provided prior to the flanged gate valve sized equally to the flanged combination air valve.

Precast concrete manholes shall meet the requirements of the Standard Details.

3. Gate Valves, Less than 4-inches for Blowoff Assemblies

Gate valves for blowoff installations sized smaller than 4-inches, shall be resilient seated wedge type with a non-rising stem and a 2 inch operating nut in compliance with AWWA C509. The smaller diameter gate valves shall be provided with triple O-ring seals and threaded end connections in compliance with ANSI B2.1. Gate valves smaller than 2-inches shall be identified "no lead" and consist of brass components designated under UNS C89833 as per ASTM B584. The small diameter gate valves shall be rated for a minimum pressure rating of 200-psi.

4. Gate Valves, 6-inches to 12-inches

All valves for potable water applications, 6-inches in diameter to 12-inches in diameter shall be resilient seated wedge gate valves in conformance with the requirements of AWWA C509, (grey or ductile iron body) or AWWA C515, (reduced wall ductile iron body). All coating materials used in the construction of gate valves for potable water applications must comply with NSF 61 to assure lead free construction. All gate valves shall be designed for a working pressure of 250-psi with a minimum UL listing and FM approval rating of 200-psi. Gate valves shall be fusion bonded epoxy (FBE) coated both interior and exterior at a minimum of 10-mils and the FBE coating shall be provided in conformance with AWWA C550. All gate valves shall be assembled with stainless steel bolts.

All gate valves 6-inches in diameter to 12-inches in diameter shall be installed in the vertical position and shall be provided with mechanical joint fittings. Gate valves shall be restrained by wedge action retainer glands or other approved manufacturer provided restraining systems. All gate valves shall open left with a non-rising stem (NRS) and be provided with a 2-inch square operating nut. All gate valves shall be constructed with triple o-ring seals in which 2 o-rings are located above the thrust collar and 1 o-ring is located below the thrust collar. The two upper o-rings shall be replaceable with the valve fully open and subjected to full rated working pressure.

The gate valve wedge shall be fully encapsulated in rubber. All valves shall be rated for bi-directional flow. All sealing gaskets shall be made of EPDM rubber materials.

Valves shall be Mueller or approved equal.

5. Gate Valves, 14-inches through 48-inches

Gate valves 14-inches through 48-inches shall be resilient seated wedge gate valves in conformance with the requirements of AWWA C515, (reduced wall ductile iron body) and shall comply with all Specifications outlined for gate valves 6 through 12 inches. Gate valves installed vertically shall be provided with a minimum of 2-ft of overhead clearance between the top of the operator nut and the finished grade. All gate valves 18-inches and greater shall be provided with a geared actuator. Vertical gate valve installations shall have spur gear actuators and horizontal installations shall have bevel gears.

Gate valves 18 inches in diameter shall be provided with a gear operator at a minimum 2:1 ratio and larger valves through 24-inches shall be provided with a gear operator at a minimum 3:1 ratio.

Gate valves installed in a horizontal position shall only be provided as permitted by the Director of Water Resources for special circumstances where vertical alignment is not possible. All horizontal gate valves shall meet or exceed the Specifications outlined herein for vertical gate valves including the 250-psi pressure rating. All horizontal gate valves shall be equipped with bevel gears resulting in a minimum 4:1 turn ratio for valves 30 through 48-inches in diameter.

Valves shall be Mueller or approved equal.

6. Butterfly Valves: Butterfly Valves shall not be used in the Town of Apex water system unless permitted by the Director of Water Resources in unique cases where a gate valve cannot be installed. All butterfly valves shall meet the requirements of AWWA C504 with mechanical joints, 2 inch open left operating nut. Valves greater than 12-inches shall be installed in a manhole with the 2-inch nut accessible from above grade. Valves designated by the Town to potentially have a remote actuator shall also be installed in a manhole regardless of size. All butterfly valves shall be rated for a working pressure of 200-psi or greater. Butterfly valves shall be provided with a fusion bonded epoxy coating on both interior and exterior surfaces at a minimum of 10-mils with an NSF 61 approved epoxy. All rubber seals and gaskets shall be made of EPDM rubber.

7. Insertion Valves: Insertion valves shall only be used as permitted by the Water Resources Department. Insertion valves shall meet the requirements of AWWA C515, seat on the valve body and be rated for a working pressure of 250-psi or greater. All insertion valves shall be made of ductile iron in conformance with

ASTM A-536 Grade 65-45-12 and epoxy coated at a minimum of 10-mils. Insertion valves are available for pipe sizes through 12-inches in diameter. In cases where insertion valves are being installed to shut down water to a work zone area, the insertion valve shall be located a minimum of 100-ft from the work zone or greater as determined by the Engineer of Record to assure the insertion valve can safely operate as a dead end without dislodging from the pipeline or otherwise causing the existing pipeline to shift.

8. Valve boxes

a) Valve Boxes shall be cast iron, screw type, with a 5 inch opening and "water" stamped on the cover. The cover shall be 6-inches in depth. All valve box assemblies and covers shall be cast from Class 35 gray iron and domestically made and manufactured in the USA. Boxes shall be painted prior to shipment with a coat of protecting asphaltic paint.

b) Valve box ring adjustments will not be allowed. The valve box shall be centered over the wrench nut and seated on compacted backfill without touching the valve assembly. All valve boxes in pavement shall be flush with the top of the pavement or flush with the finished grade. Outside of paved areas precast concrete valve box encasements or a trowel finished 2' x 2' x 6" pad of 3000-psi concrete may be used for valve box encasement provided the assembly is buried flush with the surface grade and compacted properly to prevent movement of the precast encasement.

9. Actuators: All valves shall be provided with standard 2-inch operating nuts. Unless otherwise specified, the direction of rotation to open the valves shall be to the left, (counterclockwise), when viewed from the top. Each valve body or actuator shall have cast thereon the word "OPEN" and an arrow indicating the direction to open.

B. Appurtenances

1. Blowoffs:

a) Blowoffs shall be the same size as the water main installed on and installed at the end of all dead-end water lines.

b) Blowoff Assemblies shall be constructed as shown in the Details. The valves shall be gate type with a non-rising stem and a 2 inch operating nut, O-ring seals and screwed ends. A full size gate valve is required on water mains that are planned to be extended.

2. Reaction Blocking: Material for reaction blocking shall be 3000 psi concrete, poured in place. The reaction areas are shown in the Details. A minimum 6 mil plastic shall cover the fitting to ensure that no concrete will interfere with removal

of the fitting. Blocking shall be installed in addition to pipe restraint. Blocking shall be installed against solid, undisturbed earth.

3. Rodding: All rodding shall be constructed with type 304 stainless steel rods at the number and sizing specified in the following table. Rod coupling shall not be allowed. All hardware shall also be stainless steel type 304.

Stainless Steel Rod Requirements are as follows:

6-inch branch	2, 3/4-inch stainless steel rods
8-inch branch	4, 3/4-inch stainless steel rods
12-inch branch	6, 3/4-inch stainless steel rods
16-inch branch	8, 3/4-inch stainless steel rods

4. Wedge Action Retainer Glands:

All wedge action retainer glands shall be manufactured as a one piece retainer gland for use with mechanical joints and shall be rated to provide restraint up to 350-psi pressure rating for sizes through 16-inches. For sizing above 16-inches, the wedge action retainer gland shall be rated to provide restraint up to 250-psi. Approved wedge action retainer glands shall be made of ductile iron, coated with a manufacturer applied epoxy coating or polyester powder coating.

In cases where wedge action retainer glands are approved for pipe restraint of fire hydrant supply lines or other applications, the entire hydrant supply line shall be restrained.

Wedge action retainer gland connections to push on pipe are not approved.

5. Sampling Stations:

Sampling Stations shall be provided at all new residential and commercial development areas at the rate of 1 sampling station per development complex consisting of at least 200-homes or 1- per 10 acre or greater commercial complex or 1 per institutional facility with more than 100,000 square feet or as otherwise required by the Director of Water Resources. Padlocks for sampling stations shall be provided by the Town of Apex Public Works Dept. The sampling station requirement may be waived in cases where area sampling is already deemed sufficient by the Town.

Sampling stations shall be provided as a self-contained manufactured assembly with locking aluminum housing, copper drainage tube and unthreaded spigot.

6. Gaskets for Contaminated Installations

- a) Installation within contaminated areas should be avoided. If not possible or practical, and with prior approval from the Water Resources Director, water mains may be installed within some areas of contamination.

- b) The common type of gasket used for DIP is made of a synthetic rubber, which is a copolymer of styrene and butadiene (SBR). It is generally suitable for applications in fresh water, salt water and sanitary sewage environments. All gaskets for DIP shall meet the minimum requirements of AWWA C111/A21.11. Gaskets for all PVC sewer pipes shall meet the requirements of ASTM F477.
- c) Nitrile (NBR) or Buna-N gasket is another type of gasket made of synthetic rubber, which is a copolymer of butadiene and acrylonitrile. In general, this type of synthetic rubber has good resistance to refined petroleum products like gasoline, kerosene, jet fuel and lubricating oils. It may not be effective for use with aromatic hydrocarbons like benzene and toluene or chlorinated hydrocarbons like chloromethane and chlorobenzene.

7. Polyethylene Wrapping

When soils and/or field conditions require polyethylene wrapping of water mains, wrap shall be provided and installed in accordance with ANSI/AWWA C105/A21.5. When installed with restrained joint pipe, calculations for length of restrain must factor in the use of wrapping.

8. Marker Posts

Water main shall be marked with a plastic marker at every valve, every horizontal fitting, and spaced every 1,000 feet along the water main. The post shall have a minimum diameter of four inches and a minimum bury of thirty inches with a minimum of four feet exposed. The exposed portion shall be painted blue and label "Apex Water". Marker posts shall be installed through easements, all non-residential areas, and as directed by the Water Resources Director. Valves shall have marker posts only when they are installed outside of paved areas.

604 Water Main Taps and Services

A. Design

1. Individual water services shall be provided from the main to each water meter for single family residences in accordance with the Details. Gang meters are prohibited, with exception to installations at apartment buildings or multiple commercial units within a single building where metering individual dwelling units may be impractical. All connections shall be made by wet taps. Service connections shall be made perpendicular to the main and shall run straight to the meter. Any deviation from this standard must be approved by the Water Resources Director prior to implementing the change.

2. All water service lines shall be installed with a minimum depth of cover of 24-inches or greater.
3. All water meter boxes and vaults shall be located at the edge of the serviced lot's right of way or easement. Water meter boxes shall not be placed in streets, sidewalks, parking areas or obstructed by fencing or buildings. A 5-foot clear zone easement shall be maintained around meter boxes and vaults.
4. Provisions for backflow prevention shall be in accordance with existing Town standards and specifications as well as the NC Plumbing Code.
5. The water meter shall be sized based on water demand. All water service lines shall be minimum 3/4 inch diameter. Multiple branches up to a maximum of 2 potable water services per multiple branch assembly for a single residential use shall be sized by the Engineer of Record in accordance with AWWA M22, but shall not be less than 1.5-inches in diameter.
6. Service taps to new water lines shall be made by the Contractor/Developer in accordance with the Specifications after obtaining applicable permits and paying applicable fees.
7. No taps shall be made within 3-feet of the bell or spigot end of the pipe or within 20 feet of a dead end.
8. Water service supply lines shall be continuous from the water main to the meter, no connections or joints are allowed, for services up to and including 2-inch. No services shall be tapped on water transmission mains.
9. Multiple meters on branched services are acceptable for multi-family projects. Multiple meters and water services greater than 3/4" in size used in gang meter installations shall require design calculations certified by a professional engineer licensed in North Carolina and submitted to the Town prior to construction approval.

All multiple meter installations shall conform to the Standard Detail and shall contain a curb stop on the feeder line. The curb stop shall be buried and shall be equipped with a curb box.

10. Meter installation - The Town of Apex shall provide and install (3/4" – 2") water meters subject to the following conditions:
 - The Town has received a copy of the waterline purity test results and the Engineer' certification.
 - The Developer (or property owner) has paid all acreage fees.
 - The Developer (or property owner) has paid prescribed meter fee.
 - The Developer has installed all specified improvements or guaranteed their installation as prescribed in the Town Code.

11. No services shall be made directly to water mains that are 18" or larger. These connections must utilize a cut-in tee and appropriate reducers/fittings.
12. Service connections larger than 2" shall be made by means of a tapping sleeve and valve or cut in tee.
13. All new water services shall be equipped with a dual check valve which shall be located immediately downstream of the meter.
14. All meters shall register in gallons.
15. Multiple meters may be installed in accordance with the Standard Detail.
16. Taps shall be made only on lines under pressure, and after mains have been tested and chlorinated. No taps on dry lines shall be allowed.
17. Taps shall be made in accordance with the Standard Detail and shall be a continuous run from the main line to the metering point without intermediate connections and/or joints.
18. Each service shall be flushed and disinfected after installation, abiding to the same requirements as water mains.
19. There shall be no size-on-size taps allowed. All taps must be at least one size smaller than the main being tapped.

B. Materials

1. Full Body Tapping Sleeves: Mechanical Joint tapping sleeves shall be fabricated of ductile iron construction in a two-piece assembly with mechanical joint connections to the main line and flanged connection to the tapping valve. All MJ tapping sleeves shall be rated for a working pressure of 200-psi or greater and provided with a 3/4-inch test plug for testing. All tapping sleeves shall be hydrostatically tested up to 200-psi before a tap is made. Tapping sleeves shall not be air tested.

All mechanical joint tapping sleeves shall be manufacturer fabricated and approved for installation on the specific main line pipe material, whether ductile iron, plastic, cast iron or asbestos cement.

Full body tapping sleeves must be used when the main line is greater than 24-inches. Tapping sleeves fabricated of carbon steel in a two-piece assembly with mechanical joint connections to the main line and flanged connection to the tapping valve will be considered for approval on a case by case basis for mains that are greater than 24-inches. Carbon steel sleeves should be rated for a working

pressure of 250-psi or greater and be provided with a 3/4-inch test plug. A fusion bonded epoxy coating shall be applied to all carbon steel sleeves.

2. Stainless Steel Tapping Sleeves, 6-inch through 12-inch main lines:

Stainless steel tapping sleeves may be used in lieu of mechanical joint tapping sleeves for ductile iron or asbestos cement water mains through 12-inches in diameter with branch sizing as shown in the following table. All stainless steel tapping sleeves shall be manufactured in conformance with AWWA C223. All stainless steel tapping sleeves shall have a stainless steel flange and be provided in a two piece assembly with a full circumferential gasket with tabbed gasket holding assembly and 3/4-inch test plug. The back band shall be a minimum 14 gauge stainless steel and the front band (where the outlet is located) shall be a minimum 12 gauge stainless steel. The bolt bars shall be a minimum 7 gauge stainless steel. All stainless steel tapping sleeves shall be manufacturer rated for a working pressure of 200-psi or greater and hydrostatically tested to 200-psi before a tap is made. Stainless steel tapping sleeves shall not be air tested.

Stainless Steel Tapping Sleeve Sizes Allowed

Nominal Main Size (inches)	Nominal Branch Size (inches)
6	4
8	4
10	4
10	6
12	4
12	6
12	8

3. Stainless Steel Tapping Sleeves, 14-inch through 24-inch main lines:

For larger diameter water mains, stainless steel tapping sleeves approved by the Town may be used in lieu of a mechanical joint tapping sleeve for cases where the branch line is 50% or less in diameter than the main line diameter. All of the previous Specifications described for tapping sleeves from 6 to 12 inches shall be met for stainless steel tapping sleeves for larger diameter water mains. Additionally, the outlet band for stainless steel tapping sleeves 14-inches through 24-inches shall be a minimum 7 gauge stainless steel. The back half of the sleeve shall be a minimum 12 gauge stainless steel.

4. Tapping Saddles, 14-inch through 24-inch main lines:

Tapping Saddles may be used in lieu of mechanical joint tapping sleeves to tap mains 14 inches through 24-inches when the branch line is 50% or less in diameter than the main line diameter. 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. The minimum strap count for branch sizing from 4-12 inches is shown below.

Strap Requirements for Tapping Saddles

Nominal Saddle Outlet (inches)	Number of Straps
6	3
8	4
12	7

5. Corporation Stops:

- a) Corporation Stops shall be ball type, made of “no lead” brass (meeting UNS C89833 as per ASTM B584). Corp stops shall be complete with a compression 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 alternating from one side of the water main to the other and at least 12 inches apart. The taps must be a minimum of 24 inches apart if they are on the same side of the pipe. All corporation stops shall be rated for a working pressure of 300-psi.
- b) 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 line. No tapping shall be made where rodding is placed.

6. Service Saddles:

Service Saddles shall be used for service taps larger than 1-inch on all ductile iron water mains 14-inches and greater, or when direct taps cannot be made. Service saddles shall also be used for all taps on existing water mains other than ductile iron, such as asbestos cement, PVC, etc. Service Saddles shall be provided with brass body and fasteners (85-5-5-5 waterworks brass or “no lead” brass meeting UNS C89833 as per ASTM B584) conforming to AWWA C800 and double straps made of silicon bronze conforming to ASTM A98 and factory installed grade 60 rubber gaskets. Service saddles shall be provided with AWWA standard threads per AWWA C800.

7. Copper Service Tubing: Copper service tubing shall be type K soft copper tubing per ASTM B88. No union shall be used in the installation of the service connection of 100-feet or less. Service lines more than 100 feet shall use a three (3) piece compression coupling. Only one (1) compression coupling shall be used for each 100 feet or fraction thereof.

8. Meter boxes for ¾ and 1 inch services: ¾ and 1-inch meter boxes shall be high density polyethylene (black). Meter boxes shall provide a cover opening of at least 7.5 X 13 inches and boxes shall measure at least 18 inches in depth. Lids may be designed with an internal housing for the ERT device, or with mounting bracket. They shall also be lockable. Lids shall be provided with a 2 inch (maximum) diameter hole to accommodate a transmitter. All meter boxes and lids shall be installed as shown in the Details and shall meet AASHTO HS20 load bearing capacity.

Meter boxes shall have 45 degree compression connections outside the box on the inlet side. There shall be a lockable ball valve inside the box on both the inlet and outlet which shall be permanently affixed to ensure proper spacing and alignment for the meter. Meter boxes shall also be provided with an ASSE 1024 approved inline, dual check valve located behind the meter. For boxes not utilizing a 1 inch meter, adapters shall be provided to accommodate a 5/8 x 3/4 inch meter. All fittings and connections shall be “no lead” brass conforming to UNS C89833 as per ASTM B584.

A “no lead” brass curb stop with compression connections shall be installed within 2 feet of the inlet connection. The curb stop may be buried without a box above it.

One 2 inch or 6 inch grade adjuster may be used when needed to meet final grade, however, no grade adjusters are permitted on new construction projects. Grade adjusters shall be cast iron. Grade adjuster and box shall be by the same manufacturer.

9. 1 ½ and 2 inch Water Services: 1 1/2” and 2” meter boxes shall be concrete or light weight polymer concrete as indicated in the Standard Details. Meter boxes for 1 ½ and 2 inch water services shall provide a cover opening of 24 X 36 inches and boxes shall measure at least 30-inches in depth and provided in straight wall arrangement. Standard meter box covers shall bolt down to the box, and all polymer cement covers shall be provided in solid configuration with a 2 inch diameter transmitter hole, and with the words, “Water Meter” cast into the lid. The meter box covers shall be provided with 2 stainless steel bolts in penta head configuration for security. To ensure positive discharge, the box should be tied into the existing storm drain system, or shall have an open bottom to allow drainage through a 6-inch stone base. All meter box covers for potable water service shall be provided in standard concrete gray or black color.

Custom setter piping and fittings for 1 ½ and 2 inch water meters shall be constructed from “no lead” brass (meeting UNS C89833 as per ASTM B584) and copper tubing and shall be equipped with a lockable by-pass flanged ball valve and flanged angle meter ball valves. All applications shall have a separate above ground backflow preventer.

10. Water services greater than 2-inches: Water services greater than 2-inches shall have the meter and bypass line located within a precast concrete vault. All piping and valves shall have flanged connections. There shall be isolation gate valves on both sides of the meter as well as one on the bypass line. Gate valves within the vault shall meet the above requirements of AWWA C509 for non-rising stem gate valves, but shall be provided with hand wheel operators. A standard buried gate valve with 2-inch nut shall be provided between the main and the vault. Link seals shall be used where the pipe enters and exits the vault.
11. Meter Vaults: Meter vaults and access doors shall meet HS-20 loading requirements and shall be located outside of travel areas. Pedestrian rated covers shall not be used regardless of where they are located. The access double doors shall be aluminum 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. Vaults shall be approximately 9-feet by 12-feet. To ensure positive drainage, the vault shall be tied into the existing storm drainage system. If positive drainage is unobtainable, a sump pump shall be located and operated in the vault.

605 Irrigation Systems

1. All irrigation systems shall be provided with privately maintained lead free reduced pressure principle backflow prevention installed in accordance with the NC Plumbing Code and the Foundation for Cross Connection Control and Hydraulic Research. Reduced pressure zone backflow preventers shall be installed above ground in an insulated box as shown by the details.
2. All irrigation systems within public street right of way require an encroachment agreement from the Town or NCDOT prior to installation. Plans designating the location, size, material, and depth shall be submitted with the agreement application to the Inspection & Permits Department. If there is an approved site plan, it shall be referenced with the encroachment submittal to the State.
3. Pipe material for the mainline proposed to be used within the public right of way shall be Schedule 40 PVC or greater. A distance of at least 3-feet shall be provided from the back of curb or edge of asphalt in a ditch section. A minimum depth of 2-feet of cover shall be provided and all heads shall spray away from the street.
4. All street crossings of irrigation systems shall be encased in ductile iron or steel conduit. Irrigation systems installed in the medians of Town maintained roadways must also have French drains installed behind the curb and gutter which are piped to a storm system.
5. There shall be no interconnections between the Town's water system and any private water sources (wells).

606 Testing and Inspections

A. General

1. All materials must be approved by the Infrastructure Inspector prior to installation. Materials rejected by the Infrastructure Inspector shall be immediately removed from the job site.
2. The Contractor shall furnish all materials, labor, and equipment to perform all testing and inspections to the satisfaction of the Infrastructure Inspector or Water Quality representative. The Town shall provide water for testing purposes on water mains in accordance with Town Standard Procedure 4, Control and Monitoring of Water System Flow Activity.

B. Testing

1. Pigging of Water Mains
 - a) All new water mains shall be pigged as a part of the testing procedure. Pigging shall take place at the conclusion of pipe installation utilizing the initial water fill or loading of the pipe. Pigging shall take place prior to any introduction of chlorine solution to the pipe. The Contractor shall use a 5 pounds/cubic foot density polyethylene pig and shall write their company name and the street name where the work is taking place in a permanent manor on the pig. A minimum velocity of 2 feet per second shall be maintained during pigging operations. In larger water mains, a swab may be utilized with prior approval from the Water Resources Director.
2. Hydrostatic Testing
 - a) No valve in the Town water system shall be operated without authorization in accordance with the Town and by a Town employee. Advance notice of at least 24 hours shall be provided prior to testing. A section of line that is to be hydrostatically tested, shall be slowly filled with water at a rate which will allow complete evacuation of air from the line. Hand pumps shall not be used for the pressure testing of water mains. Taps used for testing purposes shall be removed after testing and repaired using a "no lead" brass plug.
 - b) When filling the pipeline, it is very important to fill the line slowly to avoid undue impacts associated with surge and to allow air to evacuate the pipeline. After all air has been expelled from the water main, the line shall be tested to a pressure of 200 psi as measured at the lowest elevation of the line for a duration of 2 hours. The testing period shall not commence until all air has been evacuated and the pressure has stabilized. The pressure gauge used in the hydrostatic test shall be calibrated in increments of 20-psi or less. The pressure gauge shall be liquid-filled and indexed for an operating range of 300-psi or

less with a minimum dial size of 4 inches. At the end of the test period, the leakage shall be measured with an accurate water meter.

- c) No leakage shall be allowed. If leakage is present, repair of the water main and additional testing shall be conducted until the standards are met.
- d) Once testing and sampling have been completed, Contractor shall verify with Town that all valves have been opened.

3. Disinfection

- a) All additions or replacements to the water system shall be disinfected with chlorine in conformance with AWWA C651 before being placed in service under the supervision of the Town’s Infrastructure Inspector in the following manner:
 - 1) Taps shall be made at the control valve at the upstream end of the line and at all extremities of the line including valves.
 - 2) A solution of water containing 70% High Test Hypochlorite (HTH) available chlorine shall be introduced into the line by regulated pumping at the control-valve tap. The solution shall be of such a concentration that the line shall have a uniform concentration of not less than 50-ppm and not more than 100-ppm total chlorine immediately after chlorination. The chart below shows the required quantity of 70% HTH compound to be contained in solution in each 1000 feet section of line to produce the desired concentration from 50-ppm to 100 ppm.

Required Hypochlorite Concentration

Pipe Size (inches)	Pounds of High Test Hypochlorite (70%) to reach 50-ppm <i>per 1,000 feet of line</i>	Pounds High Test Hypochlorite (70%) to reach 100-ppm <i>per 1000 feet of line</i>
6	0.88	1.76
8	1.56	3.12
10	2.42	4.84
12	3.50	7.00
14	4.76	9.52
16	6.22	12.44
20	9.76	19.52
24	14.00	28.00
30	21.86	43.72
36	31.47	62.94
42	42.85	85.70

- 3) The HTH Solution shall be circulated in the main by opening the control valve and systematically manipulating hydrants and taps at the line extremities. The HTH solution must be pumped in at a constant rate for each discharge rate so a uniform concentration will be produced in mains.
- 4) HTH solution shall remain in lines for no less than 24 hours or as directed by the Town's Infrastructure Inspector.
- 5) Extreme care shall be exercised at all times to prevent the HTH solution from entering existing mains.
- 6) Free residual chlorine after 24 hours shall be at least 10 ppm or the Infrastructure Inspector will require that the lines be re-chlorinated.

4. Flushing

- a) Flushing of lines may only proceed after 24 hours of disinfection contact time and as directed by Town staff, provided the free residual chlorine analysis is satisfactory.
- b) At the completion of disinfection, chlorinated water flushed from the water main shall be disposed of in conformance with all Federal, State and local regulations.
- c) In accordance with all applicable regulations, a neutralizing chemical shall be applied to minimize chlorine residual in the flushing water before discharging from the water main, unless an alternate plan is submitted in writing and approved by the Town.
- d) Water used for disinfection shall be flushed from the water main until the chlorine residual concentration is below 5-ppm before initiating sampling.

5. Bacteriological and Turbidity Sampling

- a) Bacteriological sampling shall be utilized to verify disinfection prior to placing a newly constructed water main in operational service. Bacteriological sampling shall consist of 2 consecutive sets of acceptable samples taken at least 24-hours apart and collected from each 1,200-ft section of water main and all dead ends and branches as outlined by ANSI/AWWA C651.
- b) For the first round of sampling, the requested laboratory analysis shall be specified as follows: "Bacteriological Test and Turbidity." For the second round of testing, the laboratory analysis shall be specified as, "Bacteriological Test Only."

- c) Samples for laboratory analysis shall be collected by a Town Representative after flushing is completed. The Contractor shall set up sampling stations. A Town Seal sticker shall be placed on the sample bottle. The Town is responsible for the delivery of the sample(s) to a testing laboratory certified by the North Carolina Department of Human Resources, Division of Health Services. The testing lab will document the condition of the seal upon receipt. The Town shall furnish the Contractor with a copy of the results prior to tapping any services. All costs for laboratory testing shall be borne by the Contractor. Samples shall be taken at 2000 feet intervals, at the end of the main, at each branch connection, and each side of all cut-in connections.
- d) The laboratory secured for testing shall be certified by the State Laboratory of Public Health. All sample bottles for bacteriological sampling provided by the laboratory shall be sterilized and treated with a dechlorinating agent, such as sodium thiosulfate. Samples for turbidity shall be taken in plain sterilized bottles from the lab, which are separate from the bottles provided for bacteriological testing. The sample bottles shall be provided with tamper proof seals that will be adhered to the bottles by the Town's Infrastructure Inspector. The Infrastructure Inspector shall provide a sample identification number, job title and an identification of Phase 1 or Phase 2 sampling that will be provided on the tamper proof custody seal. The bottles and tamper proof custody seals shall be accompanied by a chain of custody form provided by the certified laboratory conducting the testing. All sample identification numbers, job titles, and Phase 1 or Phase 2 testing identification from the custody seal shall be recorded on the chain of custody forms by the Infrastructure Inspector.
- e) All samples shall be collected in compliance with the sampling protocols provided by the certified laboratory. The samples shall be kept in a cooler provided by the Contractor at approximately 40-degrees Fahrenheit or 4-degrees Celsius and delivered to the certified lab for testing as soon as possible. The time at which the sample is taken shall be recorded on the chain of custody form by the Infrastructure Inspector. Any samples processed at the laboratory more than 30-hours following collection shall be declared invalid, i.e. samples shall be submitted to the lab within 24-hours of collecting them.
- f) All first round samples shall be tested for bacteriological quality and turbidity in accordance with standards established by NCDEQ and AWWA. If turbidity exceeds 1.0 NTU, the sample shall fail and the system shall be re-flushed before initiating a new round of testing.
- g) If the phase 1 sample results for bacteriological quality and turbidity are acceptable, then a second set of samples can be collected at least 24-hours following the first sample collection. No additional flushing other than required to obtain a representative sample will be allowed prior to collecting the second set of samples.

- h) The second set of samples shall be tested for bacteriological quality only. All custody seals and chain of custody forms shall identify the second round samples as "Phase 2" testing to notify the lab that the first set of samples have already been evaluated and received a satisfactory laboratory analysis.
- i) At the completion of sampling, the total chlorine concentration shall be at least 2-mg/L and no higher than 4-mg/L before the system can be made operational.
- j) If three successive test results are unsatisfactory, the Contractor shall immediately re-chlorinate lines and proceed with such measures as are necessary to properly disinfect the lines.
- k) The new water system shall be valved off from the existing system until a satisfactory bacteriological laboratory analysis has been obtained and the Infrastructure Inspector has authorized the use of the new water system.
- l) Water mains shall be placed into service within 72 hours of passing bacteriological analysis requirements. If no activity is anticipated on a water main after it is placed into service, the contractor shall notify the Town's Operations Manager.
- m) If the Inspector or any Town representative does not approve of the sampling location, equipment, or setup then the sample shall not be taken. Contractor shall only take samples when approved by the Inspector or Town Representative.

6. Tracer Wire and Marker Tape Testing

Testing of the tracer wire and tape shall be performed by the Contractor at the completion of the project to assure they are all working properly. It is the Contractor's responsibility to provide the necessary equipment to test the markers. Any defective, missing, or otherwise non-locatable units shall be replaced. The Contractor shall submit a report of all tracer wire and marker tape testing. The Town reserves the right to require a third-party testing company at any time, at the expense of the Contractor.

607 Repair and Abandonment

1. Joint leaks of Ductile Iron Pipe shall be repaired by using a bell joint leak repair clamp approved by the Town or otherwise replacing the damaged pipe and reconnecting with a mechanical joint sleeve connection.
2. Line Breaks or Punctures shall be repaired by a full circle repair clamp as approved by the Town or otherwise replacing the damaged pipe and reconnecting with a mechanical joint sleeve connection.

3. Line Splits or Blow Outs shall be repaired by replacing the damaged section with ductile iron pipe with a restrained sleeve connection at each end.
4. Asbestos Cement Pipe to PVC or Ductile Iron Pipe transitions shall use a Krausz Hymax or Romac Macro HP coupling with different end diameters sized specifically for the pipe materials and pipe outside diameter at each end.
5. All water main point repairs shall be replaced with DIP in accordance with these Specifications and backfilled with crush and run stone compacted to 95% maximum dry density as specified elsewhere in the Standard Specifications.
6. Water Service Line Repairs
 - a) A water service line severed between the water main and the water meter shall be repaired using new type K copper tubing and bronze or “no lead” brass 3 piece compression unions.
 - b) A corporation stop pulled out of a PVC pipe water main shall have a new service saddle and a new “no lead” brass corporation stop installed on the water main.
 - c) A corporation stop pulled out of a ductile iron pipe shall have a full circle repair clamp placed over the old tap hole. A new tap shall be made and a new “no lead” brass corporation stop installed on the water main.
7. Abandonment of Existing Water Mains
 - a) Existing water mains located outside of road sections shall be removed, unless otherwise directed by the Town. All materials and labor shall be provided by the contractor.
 - b) Grout filling and abandoning in place may be allowed with prior approval from the Director of Water Resources.
8. Abandonment of Existing Water Services

Contractors abandoning water services shall remove the entire service stub. When available, a mechanical plug shall be used to abandon the corporation stop. If equipment necessary to plug the main is not available, the corporation stop shall be turned off and capped. A ½” PVC pipe shall extend a minimum of 12” above the capped corporation stop, wrapped at least 3 times with caution tape to identify an abandoned tap. All remaining portions of the service stub shall be removed from the main to the right of way line and shall be disposed of properly.