

CHAPTER 14

CROSS CONNECTION / BACKFLOW PREVENTION

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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backflow Prevention Assemblies
2. Protective Enclosures

B. The specifications for backflow prevention described herein are specifically for metered water connections to the Charlotte Water system only.

C. Contractor shall ensure compliance with requirements from all other authorities having jurisdictional requirements for backflow requirements.

D. All backflow prevention assemblies shall be approved by the University of Southern California Foundation for Cross Connection Control and Hydraulic Research (USCFCCHR), The American Society of Sanitary Engineering (A.S.S.E.), conform to AWWA C506, and adhere to applicable ANSI and ASTM standards. All assemblies installed on fire lines shall have approval by Factory Mutual System (FM).

E. Backflow prevention assemblies must be approved by Charlotte Water. Charlotte Water will provide a list of approved assemblies.

1.2 RELATED DOCUMENTS

- A. Chapter 14, Cross Connection / Backflow Prevention Design Requirements.
- B. Chapter 10, Water Distribution Piping Specifications.
- C. Charlotte Water Water and Sewer Design and Construction Standard Details.

1.3 DEFINITIONS AND ABBREVIATIONS

- A. See Sections iii and iv of the Charlotte Water Water and Sewer Design and Construction Standards for common abbreviations and definitions.

1.4 LICENSING REQUIREMENTS FOR BACKFLOW ASSEMBLY INSTALLERS

A. For contractors and/or individuals installing outdoor backflow prevention assemblies (non-fire lines):

1. Public Utilities Contractor and/or individuals(s) licensed as such by the N.C. Licensing Board for General Contractors (in accordance with N.C. General Statute 87, Article 1), or
2. Plumbers(s) licensed by the N.C. State Board of Examiners of Plumbing, Heating and Fire Sprinkler Contractors (in accordance with N.C. General Statute 87, Article 2).

B. For contractors and/or individuals installing indoor backflow prevention assemblies (non-fire lines):

1. Plumbers(s) licensed by the N.C. State Board of Examiners of Plumbing, Heating and Fire Sprinkler Contractors (in accordance with N.C. General Statute 87, Article 2).

C. For contractors and/or individuals installing backflow prevention assemblies on fire lines (outdoor or indoor):

1. Fire Sprinkler Contractor licensed by the N.C. State Board of Examiners of Plumbing, Heating and Fire Sprinkler Contractors (in accordance with N.C. General Statute 87, Article 2).

1.5 SUBMITTALS

A. Required submittals for product approval include, but are not limited to, the following:

1. Product brochures
2. Catalog cut sheets
3. Shop drawings including dimensions and part/material lists
4. Certification of compliance with applicable reference standards
5. Prior product acceptance test reports
6. Reference contact data
7. Shipping tickets and purchase invoices

1.6 QUALITY ASSURANCE

A. Provide manufacturer's affidavit indicating product has been manufactured and tested in accordance with referenced standards.

B. Products to be permanently identified with manufacturer's name, pressure rating and size.

1.7 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall be responsible for the safe storage of materials furnished by or to them, and accepted by them and intended for the Work, until they have been incorporated in the completed project. Handling and storage of all project materials are to be in compliance with the manufacturer's recommendations for handling and storage. The interior of all pipes, fittings and other accessories shall be kept free from dirt and foreign materials at all times.

B. Transportation of Materials and Equipment: The Contractor and their Suppliers are directed to contact the North Carolina Department of Transportation (NCDOT) to verify axle load limits on State maintained roads (and bridges) which would be used for hauling of equipment and materials for this project. The Contractor and their Suppliers shall do all that is necessary to satisfy the Department of Transportation requirements and will be responsible for any damage to said roads which may be attributed to this project. Unless otherwise specified, all materials required to construct this project shall be furnished by the Contractor and shall be delivered and distributed at the site by the Contractor or their material supplier.

1.8 FIELD CONDITIONS

- A. Interruption of Existing Water Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted and then only after arranging to provide temporary service according to written requirements by Charlotte Water.

PART 2 - PRODUCTS

2.1 USE OF LEAD-FREE PIPES, FITTINGS, FIXTURES, SOLDER, AND FLUX FOR DRINKING WATER ("LEAD FREE")

- A. All products provided shall comply with the Safe Drinking Water Act, 42 U.S.C. 300f et seq. including sections 1417, 1445, 1450, and 1461 of the SDWA, 42 U.S.C. 300j-6, 300j-4, 300j-9, and 300j-21.

2.2 BACKFLOW PREVENTION ASSEMBLIES

- A. All internal parts shall be replaceable in line. All internal metal parts shall be bronze or stainless steel. There shall be a minimum of dissimilar metals in an assembly in order to prevent corrosion due to electrolysis. When there are dissimilar metals, the metals shall be electronically similar as possible and insulated if possible.
- B. All backflow prevention assemblies must comply with, at a minimum, the following standards:
1. Double Check Valve Assemblies: ASSE 1015, lead free
 2. Dual Check Valve Assemblies: ASSE 1024, lead free
 3. Reduced Pressure Zone Assemblies: ASSE 1013/ANSI C511, lead-free
- C. All assemblies shall have 1/4 turn ball valve test cocks with raised slotted operators or lever type operators. All assemblies shall have four resilient seated test cocks located in the following manner:
1. On the upstream side of the first shut off valve (upstream being the side closest to the property line)
 2. Between the first shut off valve and the first check valve
 3. Between the first and second check valve
 4. Between the second check valve and the second shut off valve
- D. All exterior control piping shall be flexible hose or standard size copper tubing with standard end connections.
- E. All interior control piping or passageways shall be corrosion resistant. All sensing tubes or passages shall be placed in a manner that prevents clogging or trapping of foreign materials or air.
- F. If special tools or devices are required to repair or maintain an assembly, they shall be supplied by the manufacturer at no extra cost.
- G. An assembly will be removed from the Charlotte Water approved list if it no longer meets Charlotte Water specifications or fails to operate satisfactorily in the field.

- H. Charlotte Water shall be notified in writing of any changes to the design, components, materials, or operation of an assembly. Charlotte Water shall also be notified of any failures, defects, or defective material. Failure to do so will result in removal from the Charlotte Water approval list.
- I. Any backflow prevention assembly not on the approved list may be submitted for review and approval by Charlotte Water. If an assembly was previously rejected, it shall not be submitted or resubmitted unless the design has been revised to meet Charlotte Water specifications. Two assemblies shall be submitted for a one-year field evaluation prior to being approved. Shop drawings and specifications of all materials must be furnished as well.
- J. The list of Charlotte Water approved Backflow Prevention Assemblies is located online at:
<https://www.charlottenc.gov/water/Commercial-Development/Backflow/Backflow-Construction-Guide>

2.3 PROTECTIVE ENCLOSURES

- A. Type: ASSE 1060 certified, Class I - Freeze Protection Enclosures anchored to concrete slab.
- B. Materials
1. RPZs up to and Including 4-inches in Diameter
 - a. Fiberglass Construction: Molded 1/8" thick Thixotropic polyester resin reinforced with fiberglass strand, smooth finish, protected with UV inhibited isophthalic polyester gel coat; continuous hinged or removable top. Color as selected by Charlotte Water from Manufacturer's standards.
 2. RPZs Larger than 4-inches in Diameter
 - a. Aluminum Construction: 3003 aluminum (.050"/18 gauge), continuous hinged or removable doors, stucco embossed finish, ASTM B209; sectionalized factory-assembled tongue and groove sections with four-point locking system. Color as selected by Charlotte Water from Manufacturer's standards.
 3. Bracing
 - a. 6063-T52 aluminum, ASTM B221. No wood or particle board should be used in the construction of the enclosure.
 - b. Load Rating: 100 lbs/sf.
 - c. Wind Speed Rating
 - 1) Up to 36" W x 105" L x 64" H: 120 mph
 - 2) All Larger Sizes: 80 mph
 4. Anchor pads: Galvanized steel, 3/8-16 unc. x 2¾ long zinc plated wedge anchors.
 5. Insulation: 1.5-inch unicellular, non-wicking, polyisocyanate foam sprayed in place to form a monolithic bond between the aluminum bracing and aluminum sheeting. Insulation properties:
 - a. R-Value: 10

- b. Dimensional Stability: less than 2% linear change
 - c. Compressive Strength: 51 psi
 - d. Flame Point: 325 degrees
 - e. Water Absorption: 0.037 psf
 - f. Porosity: 91 percent
- C. Heating Equipment
- 1. Provide heating equipment to protect the piping and equipment from exterior temperatures to -30°F. ETL-listed thermostatically controlled wall mounted air forced heaters or UL listed self-regulating cable(s) shall be furnished and designed by the Manufacturer of the enclosure to maintain the equipment at +40°F, in accordance with ASSE 1060 1.2.2.1.
 - 2. Heating equipment shall be wall mounted to the supplied heater plates and a minimum 8" above the slab unless it is UL or ETL-certified and NEC approved for submersion.
 - 3. Power source shall be 120V protected with a GFI receptacle, U.L. 943, NEMA 3R. Mounted a minimum of 8" from the bottom of the receptacle to the top of the slab. GFCI electrical receptacle shall be in accordance with NC Electrical Code for outdoor operation.
 - 4. Separate 20-amp circuits are recommended for each heater, so in the event a circuit fails all other circuits will remain powered. Installations must be in accordance with the local and national codes.
 - 5. The heaters shall be ETL listed for wet/damp locations.
- D. Drain Ports: One-way, sized for full flow discharge.
- E. Equipment Pad: Concrete Slab: Class I concrete; construct slab 12-inches larger than the interior dimensions of the enclosure.
- F. Manufacturers
- 1. Hot Box,
 - 2. Or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. The installation shall be in accordance with the Manufacturer's information, N.C. Building Code (latest version) and Charlotte Water. Installation of backflow prevention assemblies shall be upstream of the first branch line leading off the service line. If Charlotte Water determines that it is impossible or impractical for the backflow prevention assembly to be installed outside, it may be installed just inside the building.
- B. All backflow assemblies shall be installed in a horizontal direction. Vertical installations may be allowed with prior approval from Charlotte Water. Design Engineer shall certify design of vertical support systems if such support systems differ or deviate from the Standard Details of Charlotte Water's Water and Sewer Design and Construction

Standards. N.C Building Code may allow for differing pipe material than Charlotte Water standards. In which case, Design Engineer shall certify backflow assemblies are properly supported.

C. Fire line installations shall be as follows: High hazard fire line installations require a reduced pressure principle assembly (RPPA) as stated in the ordinance. Low hazard fire line installations require a double check valve assembly. Strainers shall not be installed on fire lines. If there is an existing booster pump, or one will be installed, Contractor is directed to follow pump Manufacturer's guidance for separation distance upstream and/or downstream between the pump and backflow assembly. Charlotte Water Required backflow prevention assembly must be on the supply side of the pump.

D. Fire line services with only one fire hydrant shall require a minimum of a double check valve backflow prevention assembly. All assemblies on a fire line, or combination domestic and fire, shall be fire line approved installations with OS & Y type shut-off valves. These valves shall be provided with supervisory tamper switches as required by current Building Code enforced by the Fire Marshal.

E. All fire line installations shall be protected to a min. of 40 degrees Fahrenheit or as required by applicable standards of the NC Building Code (latest version adopted). Heated enclosures are required for BFPs or RPs for fire installations.

3.2 INSTALLATION AND APPROVAL GUIDELINES

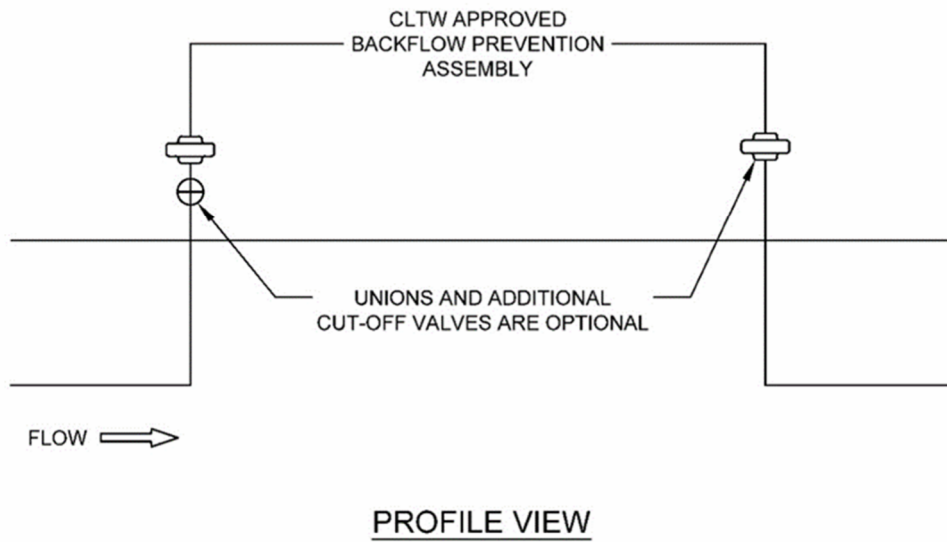
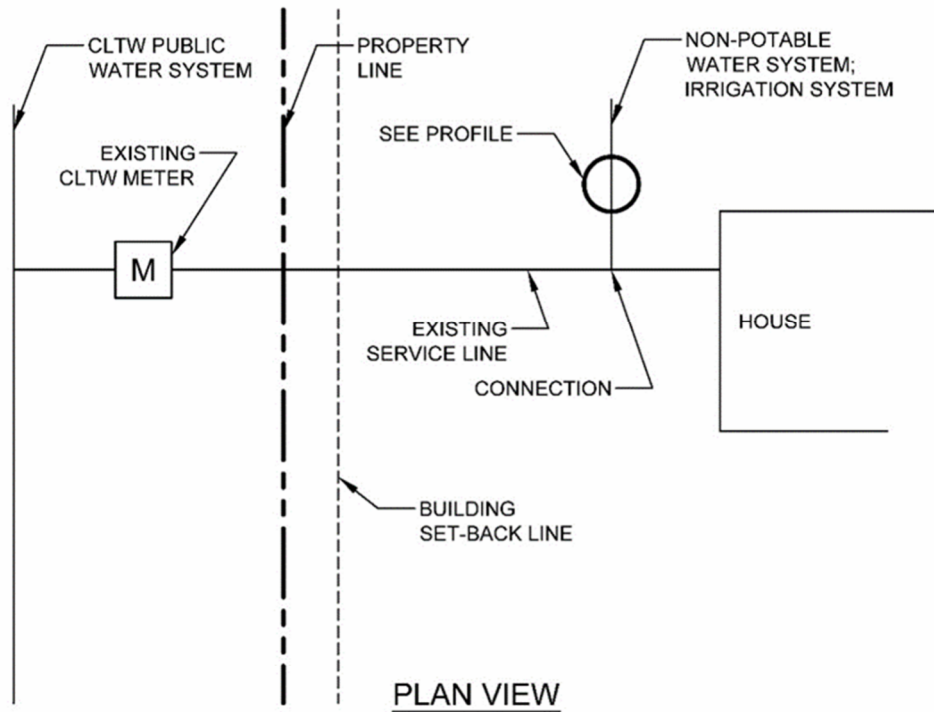
A. Existing Residential Domestic Service with New Lawn Irrigation System Tied to Existing Service Line (only allowed if property being irrigated was platted prior to July 1st, 2009)

1. Requirements for Backflow Prevention Assembly Installation

- a. Install RPPA assembly before any branches in new irrigation system outside zoning setback areas, per Charlotte Water Standard Details.
- b. Locate 12" above ground min. 30" max. in horizontal direction. 30" min. clear of any permanent obstruction.
- c. Use type "L" or "K" copper, galvanized steel pipe (1" diameter min.), or Schedule 80 PVC pipe (with Schedule 80 fittings), from 5' before to 5' past assembly.
- d. Protective enclosures are required in accordance with ASSE 1060 Class II. Insulation shall not be wrapped around assembly.
- e. Location of connection and backflow prevention assembly will be located outside and accessible to Charlotte Water at all times.
- f. If unions are used, caps must be provided and stored with assembly, for use any time the assembly is removed. It is required to cap remaining piping to service line and is subject to Charlotte Water inspection at any time assembly is removed.

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**Existing Residential Domestic Service with New Lawn
Irrigation System Tied to Existing Service Line**
(Only allowed if property being irrigated was platted prior to July 1st, 2009)

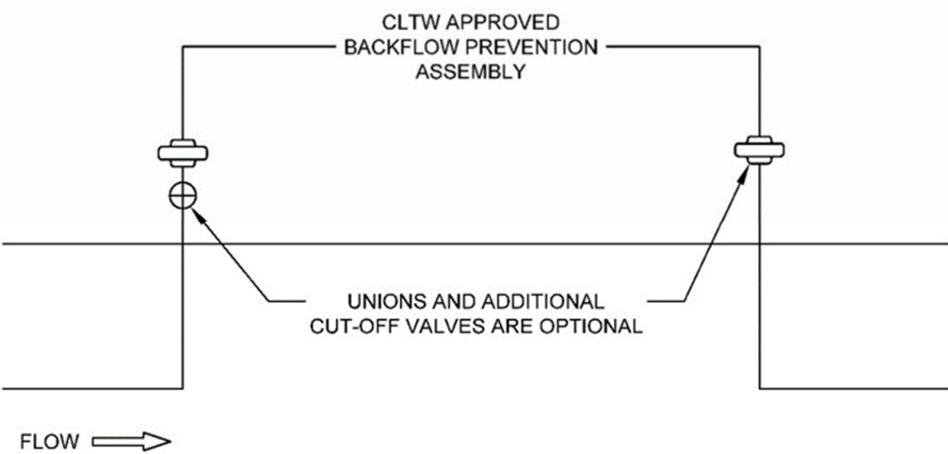
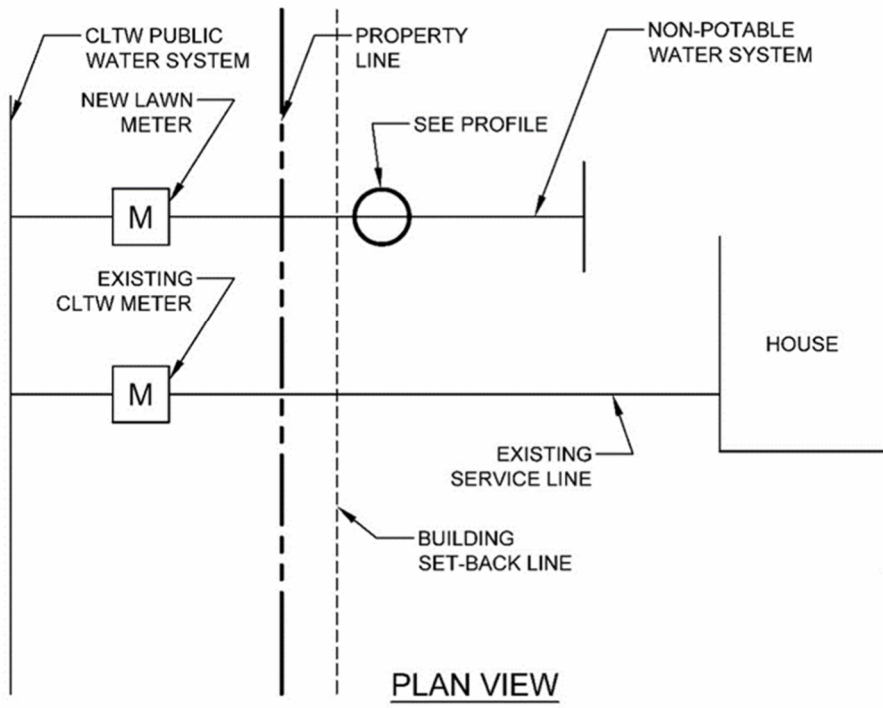


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- 1 B. New Residential Lawn Irrigation Service with New Lawn Irrigation System Tied to New
2 Lawn Meter
- 3 1. Requirements for Backflow Prevention Assembly Installation
- 4 a. Install RPPA assembly before any branches in new irrigation system outside
5 zoning set back areas, per Charlotte Water Standard Details.
- 6 b. Locate 12" above ground min. 30" max. in horizontal direction. 30" min. clear
7 of any permanent obstruction.
- 8 c. Use type "L" or "K" copper, galvanized steel pipe (1" diameter min.), or
9 Schedule 80 PVC pipe (with Schedule 80 fittings), from 5' before to 5' past
10 assembly.
- 11 d. Protective enclosures are required in accordance with ASSE 1060 Class II.
12 Insulation shall not be wrapped around assembly.
- 13 e. Location of connection and backflow prevention assembly will be located
14 outside and accessible to Charlotte Water at all times.
- 15 f. If unions are used, caps must be provided and stored with assembly, for use
16 any time the assembly is removed. It is required to cap remaining piping to
17 service line and is subject to Charlotte Water inspection at any time
18 assembly is removed.

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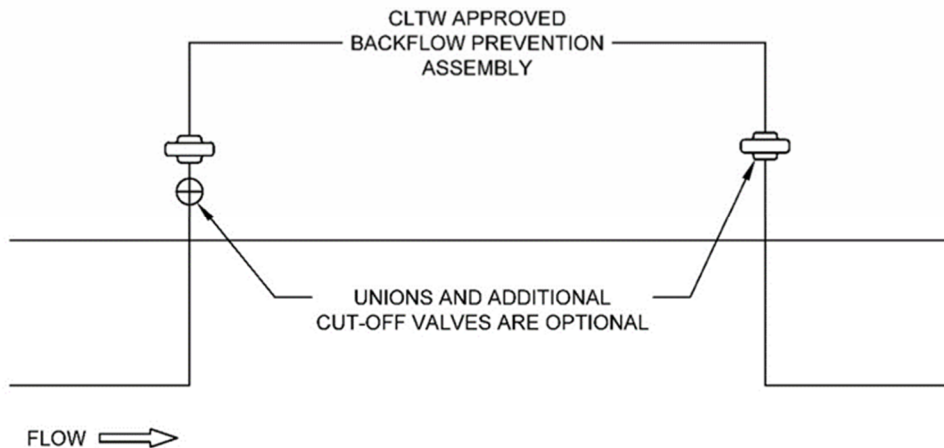
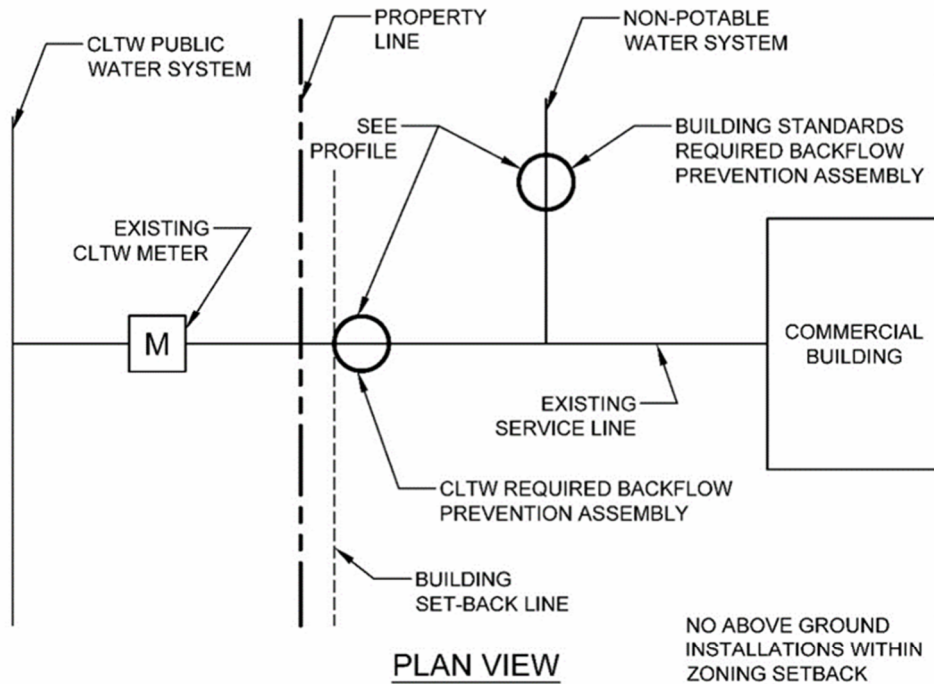
**New Residential Lawn Irrigation Service with
New Lawn Irrigation System Tied to New Lawn Meter**



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- 1 C. Existing Commercial Service with Lawn Irrigation or Fire System Tied to Existing Service
2 Line (Note: Lots platted after July 1st, 2009, must get a dedicated meter for irrigation)
- 3 1. All new water service connection 1-1/2" and larger must go through Capacity
4 Assurance program review prior to new service connection approval.
- 5 2. Requirements for Backflow Prevention Assembly Installation
- 6 a. Charlotte Water Requirements at Existing Meter
- 7 1) Install assembly before any branches in new system outside zoning
8 setback areas, per Charlotte Water Standard Details outside and
9 accessible to Charlotte Water at all times. On fire lines shut-off valves
10 must be OS&Y type and be provided with supervisory tamper switches
11 with trouble signal to go to the emergency control station as required
12 by current building code.
- 13 2) Locate 12" above ground min. 30" max. in horizontal direction. 30" min.
14 clear of any permanent obstruction. Strainers shall not be installed on
15 fire systems. See installation specifications for below ground
16 requirements.
- 17 3) Use type "L" or "K" copper, DIP (2-1/2" - 12" diameter), galvanized
18 steel pipe (1" diameter min.), or Schedule 80 PVC pipe (with Schedule
19 80 fittings), from 5' before to 5' past assembly.
- 20 4) Protective enclosures are required in accordance with ASSE 1060
21 Class II. Insulation shall not be wrapped around assembly. All
22 assemblies used on fire line services shall be protected to min. of 40
23 degrees Fahrenheit or as required by current building code.
- 24 5) If unions are used (3/4"-2"), caps must be provided and stored with
25 assembly, for use any time the assembly is removed. It is required to
26 cap remaining piping to service line and is subject to Charlotte Water
27 inspection at any time assembly is removed.
- 28 b. Mecklenburg County Code Enforcement Requirements for Backflow
29 Assembly at Connection of New Lawn Irrigation or Fire System
- 30 1) Locate 12" above ground min. 30" max. before any branches in new
31 system, 30" min. from any obstruction.
- 32 2) Protective enclosures are required in accordance with ASSE 1060.
33 Insulation shall not be wrapped around assembly. All assemblies used
34 on fire line services shall be protected to min. 40 degrees Fahrenheit
35 or as required by current building code.
- 36 3) If unions are used (3/4"-2"), caps must be provided and stored with
37 assembly, for use any time the assembly is removed.

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- Existing Commercial Service with Lawn Irrigation or
Fire System Tied to Existing Service Line**
- (Note: Lots platted after July 1st, 2009, must get a dedicated meter for irrigation)



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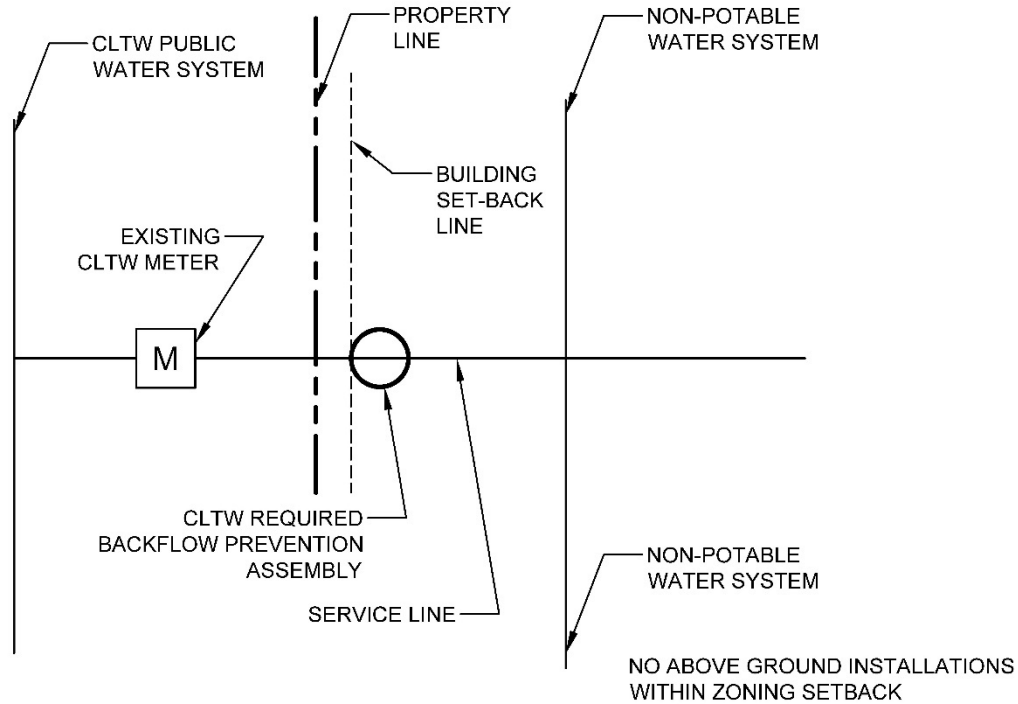
- 1 D. New Commercial, Lawn Irrigation, or Fire Line Service with New Service, Lawn, or Fire
2 System Tied to New Meter (Note: Lots platted after July 1st, 2009, must get a dedicated
3 meter for irrigation)
- 4 1. All new water service connections 1-1/2" and larger must go through Capacity
5 Assurance program review prior to new service connection approval.
- 6 2. Requirements for Backflow Prevention Assembly Installation
- 7 a. Charlotte Water Requirements
- 8 1) Install assembly before any branches in new system outside zoning
9 setback areas, per Charlotte Water Standard Details. On fire lines
10 shut-off valves shall be OS&Y type and be provided with supervisory
11 tamper switches with trouble signal to go to the emergency control
12 station as required by current building code.
- 13 2) Locate 12" above ground min. 30" max. in horizontal direction. 30" min.
14 clear of any permanent obstruction. No strainers shall be installed on
15 fire systems. See installation specifications for below ground
16 requirements.
- 17 3) Use type "L" or "K" copper, DIP (2-1/2" - 12" diameter), galvanized
18 steel pipe (1" diameter min.), or Schedule 80 PVC pipe (with Schedule
19 80 fittings), from 5' before to 5' past assembly.
- 20 4) Protective enclosures are required in accordance with ASSE 1060
21 Class II, or Fire Class I. Insulation shall not be wrapped around
22 assembly. All assemblies used on fire line services shall be protected
23 to min. of 40 degrees Fahrenheit or as required by current building
24 code.
- 25 5) Location of connection and backflow prevention assembly will be
26 located outside and accessible to Charlotte Water at all times.
- 27 6) If unions are used (3/4"-2"), caps must be provided and stored with
28 assembly, for use any time the assembly is removed. It is required to
29 cap remaining piping to service line and is subject to Charlotte Water
30 inspection at any time assembly is removed.
- 31 b. Mecklenburg County Code Enforcement Requirements for Backflow
32 Assembly at Connection of New Lawn Irrigation or Fire System
- 33 1) Locate 12" above ground min. 30" max. before any branches in new
34 system, in horizontal direction. 30" min. from any obstruction.
- 35 2) Protective enclosures are required in accordance with ASSE 1060.
36 Insulation shall not be wrapped around assembly. All assemblies used
37 on fire line services shall be protected to min. of 40 degrees Fahrenheit
38 or as required by current building code.
- 39 3) If unions are used (3/4"-2"), caps must be provided and stored with
40 assembly, for use any time the assembly is removed.

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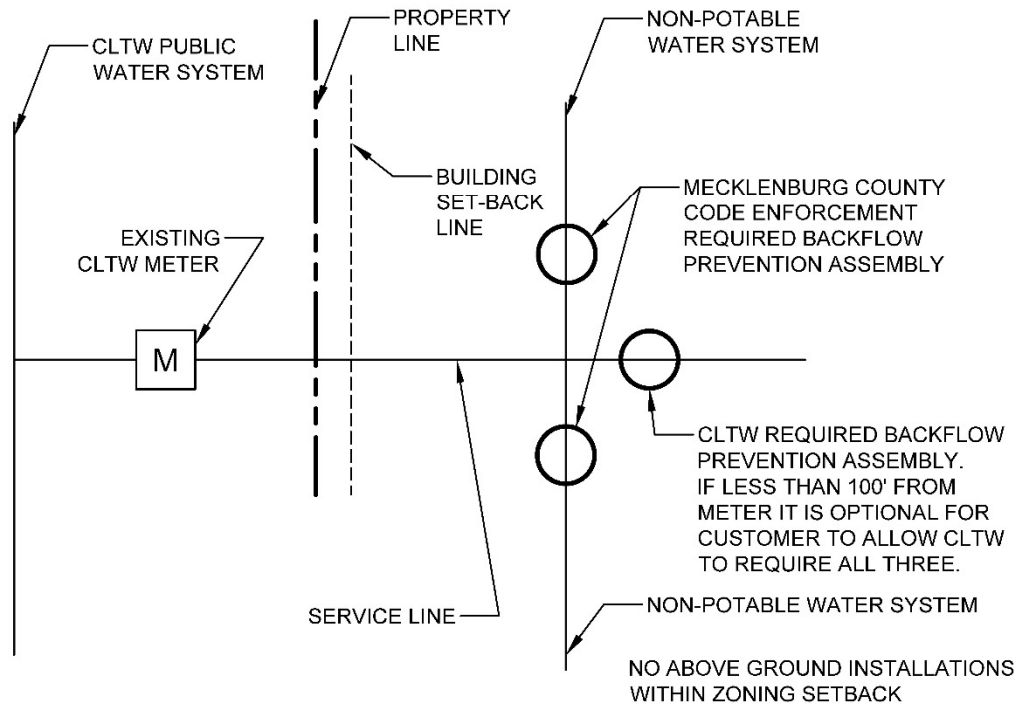
**New Commercial, Lawn Irrigation, or Fire Line Service with
New Service, Lawn, or Fire System Tied to New Meter**

(Note: Lots platted after July 1st, 2009, must get a dedicated meter for irrigation)

COMBINATION METER (OPTION 1)

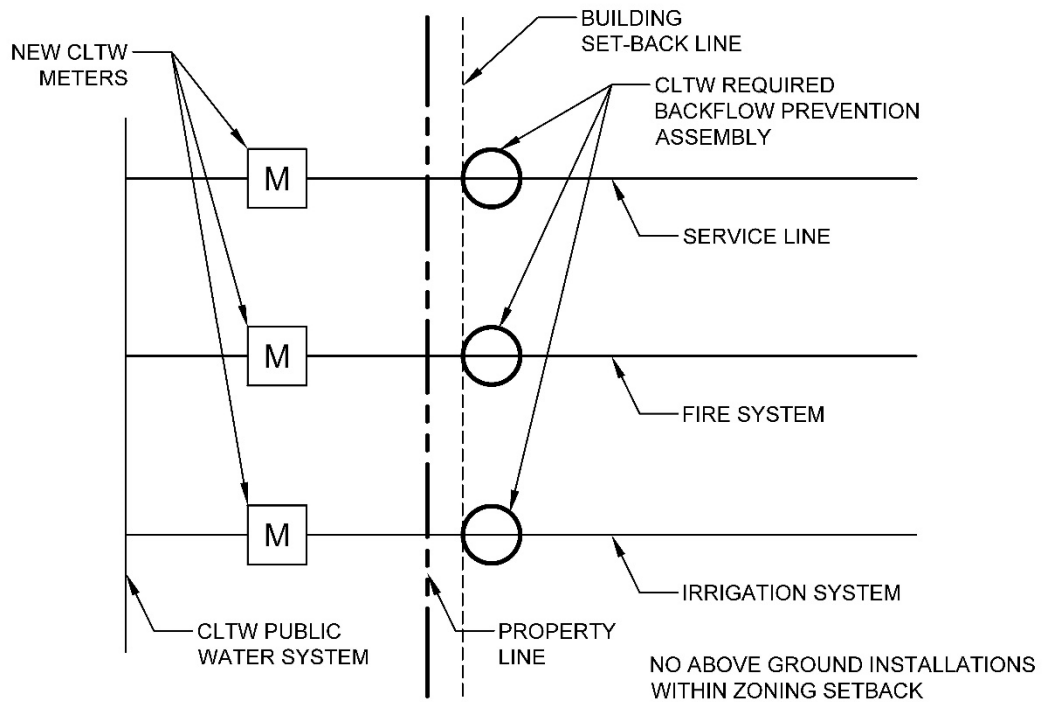


COMBINATION METER (OPTION 2)



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SEPARATE METERS



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E. Developer Installed Service Tied to New Developer Installed Meter

1. All new water service connection 1-1/2" and larger must go through Capacity Assurance program review prior to new service connection approval.

2. Requirements for Backflow Prevention Assembly Installation

a. On Customer Property for Private System

1) Installations must be installed outside the public road right-of-way, and outside zoning setback areas on customer property.

2) Install assembly before any branches in new service, per Charlotte Water Standard Details. On fire lines shut-off valves shall be OS&Y type and be provided with supervisory tamper switches with trouble signal to go to the emergency control station as required by current building code.

3) Locate 12" above ground min. 30" max. in horizontal direction. 30" min. clear of any permanent obstruction. No more than 100' upstream of new meter. No strainers shall be installed on fire systems. See installation specifications for below ground requirements.

4) Use type "K" copper, DIP (2-1/2" - 12" diameter), galvanized steel pipe (1" diameter min.), or Schedule 80 PVC pipe (with Schedule 80 fittings), from 5' before to 5' past assembly.

5) Protective enclosures are required in accordance with ASSE 1060 Class II, or Fire Class I. Insulation shall not be wrapped around assembly. All assemblies used on fire line services shall be protected to min. of 40 degrees Fahrenheit or as required by current building code.

6) All installations are required to be outside of site distance triangle.

b. Within Public Road Right-of-Way (Existing or Future) for Roadway Irrigation Systems

1) All construction activities, and materials in an existing or future public road right-of-way shall comply with the current NCDOT policies and procedures for accommodating utilities on highway rights of way, or CDOT policies and procedures and any additional requirements of active encroachment agreements.

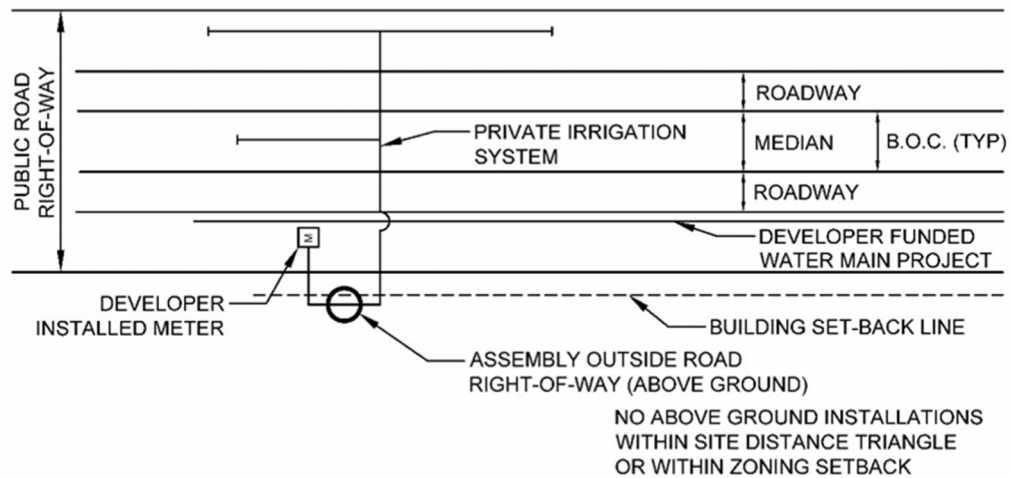
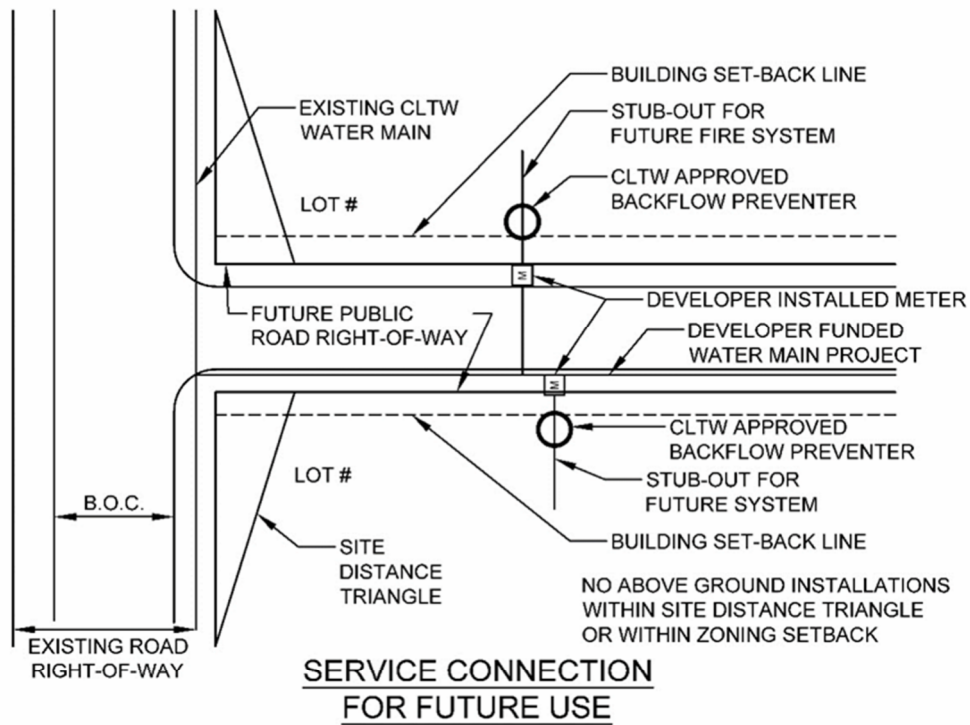
2) No backflow prevention assembly shall be installed in any fully controlled or limited controlled access roads.

3) No backflow prevention assembly shall be installed above ground in a public road right-of-way. Note all reduced pressure principle backflow prevention assembly are required to be installed above ground outside of the public road right-of-way, and outside zoning setback areas on customer property.

4) All construction shall conform to the requirements for water main construction within the jurisdiction of Charlotte Water, from the meter to and 5 feet beyond the backflow prevention assembly installation.

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Developer Installed Service Tied to New Developer Installed Meter



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F. New or Existing Irrigation Service for a Public Roadway

1. All new water service connections 1-1/2" and larger must go through Capacity Assurance program review prior to new service connection approval.

2. Requirements for Backflow Prevention Assembly Installation

a. Outside of Public Road Right-of-Way

1) Any above ground installations must be installed outside the public road right-of-way, and outside zoning setback areas on private property. All installations are required to be located outside area of site distance triangle. Any work in an existing public road right-of-way(r/w) requires an encroachment agreement with owner of r/w.

2) The assembly must be installed before any branches in new system, per Charlotte Water Standard Details.

3) Locate 12" above ground min. 30" max. in horizontal direction. 30" min. clear of any permanent obstruction. No more than 100' upstream of new meter.

4) Use type "K" copper, DIP (3" - 10" diameter), galvanized steel pipe (1" diameter min.), or Schedule 80 PVC pipe (with Schedule 80 fittings), from 5' before to 5' past assembly.

5) Protective enclosures are required in accordance with ASSE 1060 Class II. Insulation shall not be wrapped around assembly. All assemblies used on fire line services shall be protected to min. of 40 degrees Fahrenheit or as required by current building code.

6) Location of connection and backflow prevention assembly will be located outside and accessible to Charlotte Water at all times.

7) If unions are used (3/4"-2"), caps must be provided and stored with assembly, for use any time the assembly is removed. It is required to cap remaining piping to service line and is subject to Charlotte Water inspection at any time assembly is removed.

b. Within (Existing or Future) Public Road Right-of-Way

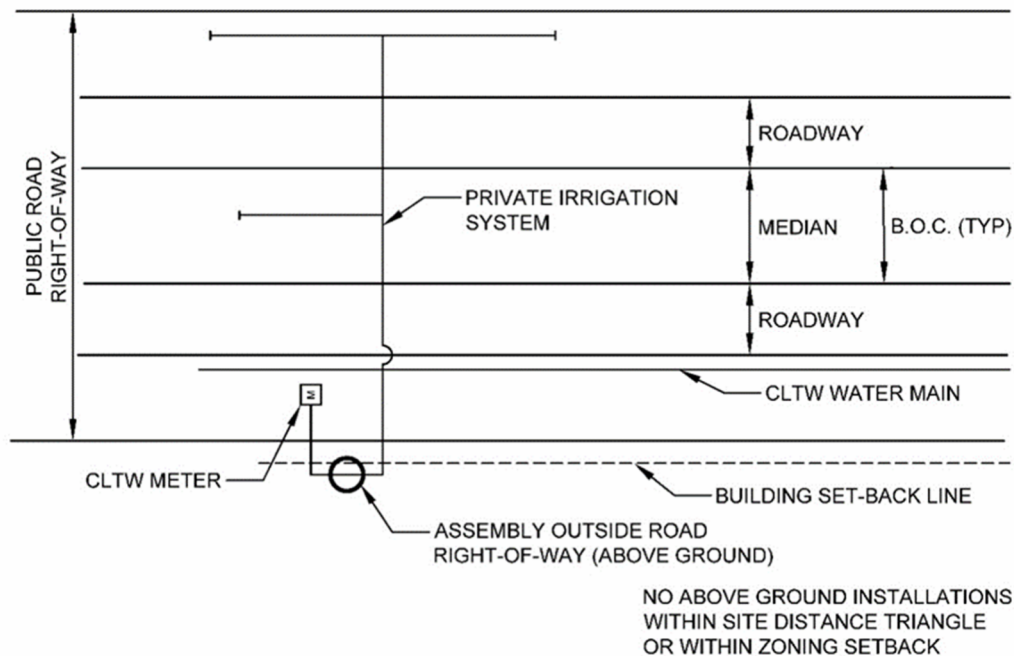
1) All construction activities, and materials in an existing or future public road right-of-way shall comply with the current NCDOT policies and procedures for accommodating utilities on highway rights of way, or CDOT policies and procedures and any additional requirements of active encroachment agreements.

2) No assemblies shall be installed in any fully controlled or limited controlled access roads.

3) No backflow prevention assembly shall be installed above ground in a public road right-of-way. Note all reduced pressure principle backflow prevention assembly are required to be installed above ground outside of the public road right-of-way, and outside zoning setback areas on private property.

4) All construction shall conform to the requirements for water main construction within the jurisdiction of Charlotte Water, from the meter to and 5 feet beyond the backflow prevention assembly installation.

New or Existing Irrigation Service for a Public Roadway



3.3 TESTING REQUIREMENTS

- A. The Construction Contractor shall procure the services of a Charlotte Water approved tester. See Chapter 14, Cross Connection / Backflow Prevention Design Requirements, of the Charlotte Water Water and Sewer Design and Construction Standards, for approved tester requirements.
- B. Unless otherwise directed by the Engineer, all testing and disinfection of mains and service lines connected to the new backflow assembly(s) will be completed prior to testing of the new backflow assembly(s). All testing and disinfection shall be performed in accordance with testing and inspection requirements of Chapter 10, Water Distribution Piping, of the Charlotte Water Water and Sewer Design and Construction Standards.
- C. Customer testing requirements after installation, approval, and acceptance are identified in Chapter 14, Cross Connection / Backflow Prevention Design Requirements, of the Charlotte Water Water and Sewer Design and Construction Standards.

END OF SECTION

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