

WATER DISTRIBUTION SYSTEM



INDEX

SECTION 1 - WATER DISTRIBUTION SYSTEM

		<u>PAGE #</u>	
SECTION	1.01	WATER SYSTEM EXTENSIONS	01 - 02
SECTION	1.02	WATER DISTRIBUTION PIPE	03 - 12
SECTION	1.03	FIRE HYDRANTS	12 - 14
SECTION	1.04	VALVES AND APPURTENANCES	14 - 18
SECTION	1.05	WATER SERVICES	18 - 20
SECTION	1.06	BACKFLOW PREVENTION	20 - 21
SECTION	1.07	TESTING AND INSPECTION	21 - 26

STANDARD DETAILS

1.01	THRUST BLOCKING
1.02	COMBINATION AIR VALVE MANHOLE (FOR WATER MAINS)
1.03	TYPICAL VALVE BOX INSTALLATION
1.04	FIRE HYDRANT ASSEMBLY
1.05	TAPPING SLEEVE AND VALVE DETAIL
1.06	STANDARD VALVE RODDING
1.07	STANDARD 3/4" & 1" BACKFLOW/METER ASSEMBLY & SERVICE CONNECTION DETAIL
1.08	2" METER INSTALLATION
1.09	STANDARD 3" & 4" METER INSTALLATION AND VAULT
1.10	DEAD-END LINE DETAIL FOR LINES 6" & GREATER
1.11	NON-FREEZE TYPE YARD HYDRANT
1.12	POST FLUSHING/BLOW-OFF HYDRANT
1.13	STANDARD CONCRETE ENCASEMENT FOR STREAM CROSSINGS
1.14	WATER LINE STEEL ENCASEMENT
1.15	PAVEMENT REPLACEMENT

Section 1

Water Distribution System

1.01 Water System Extensions

A. General

1. All new developments proposing to construct water system improvements for ownership and maintenance by the Town of Granite Falls shall conform to these Standard Specifications and Details, as well as, to the requirements of the N.C. Department of Environment and Natural Resources.
2. Plans and specifications for water line extension must be prepared and submitted by the developer's Engineer, licensed to practice in North Carolina, and must be approved prior to beginning construction.
3. Copies of all engineering design data, assumptions, calculations, etc., shall be submitted to the Town at the time the plans are submitted.
4. All proposed water line extensions must be approved by the North Carolina Department of Environment and Natural Resources.
5. Sufficient data shall be shown so as to accurately locate the facilities in the field.
6. When applicable, Owner/Developer will be responsible for preparing a soil erosion sedimentation control plan. This plan, along with appropriate fees, shall be submitted to the Land Quality Section of the N.C. Department of Environment and Natural Resources, Asheville Regional Office for approval.
7. Owner/Developer will be responsible for securing all required easements and rights-of-way needed for the construction and maintenance of the water lines.
8. Where applicable, Owner/Developer shall obtain appropriate encroachment approvals from the N.C. Department of Transportation.
9. All Contractors performing any construction activity involving the Town of Granite Falls' utility system shall be licensed to practice general contracting in the State of North Carolina. The Contractor shall be classified in the appropriate area of license for the type of construction to be performed and shall not perform construction activity which exceeds the limitations of the designated Contractor's license.
10. During construction the Contractor shall be responsible for all project safety

requirements. Additionally, the Contractor shall adhere to all State and Local Health Department regulations as they pertain to their employees.

11. After the installation of all improvements, the Owner/Developer or designee shall contact the Town and schedule a Completion (pre-final) Inspection. The Town will accept the improvements or respond with a punch list within 30 days of the request. The Owner/Developer or designee must complete all items indicated on the punch list, and any additional items noted, within 60 days or the punch list will be void. The Owner/Developer or designee must then request a Final Inspection. At this time the Owner/Developer must provide the Town with a complete set of As-builts that accurately reflects the improvements as they were installed.
12. Upon the acceptable completion of all punch list items and payment of any outstanding fees, the Owner/Developer or designee will receive an acceptance letter from the Town. This acceptance begins a warranty for materials and workmanship including pavement repairs for two (2) years from the date of acceptance. The warranty will be to the Town from the Owner/Developer or designee.
13. The Town will perform routine maintenance during the warranty period but all materials and workmanship are the responsibility of the Owner/Developer. If repairs resulting from faulty materials and/or workmanship are needed during the warranty period the Owner/ Developer or designee shall be notified by the Town. If the repairs are not made in a timely fashion or if the repairs are of an emergency nature, the Town may choose to make the repairs and bill the Owner/ Developer or designee for the total cost of the repairs.
14. Upon completion of, or just prior to the end of, the warranty period, the Owner/Developer or designee shall request a Final Warranty Inspection from the Town. The Town will respond with final acceptance or a punch list on workmanship or materials within 30 days of the request. The Owner/Developer or designee must complete all items indicated on the punch list, and any additional items noted within 60 days or the punch list will be void. The Owner/Developer or designee must then request another Final Warranty Inspection.
15. Upon the acceptable completion of all punch list items, the Owner/ Developer or designee will receive a Letter of Final Acceptance from the Town. The Town will assume all maintenance responsibility as of the date of the Letter of Final Acceptance.

1.02 Water Distribution Pipe

A. Design

1. Location

- a. All public water mains shall be located within dedicated rights-of-way or easements having a minimum width of 20 feet.
- b. Main extensions to a lot shall terminate at the furthestmost property line fronting the property.
- c. Water mains shall be at least ten (10) feet laterally from existing and proposed sewers. Where existing conditions prevent a ten (10) foot lateral separation, the following shall be followed with approval of the Town.
 - i) Lay water main in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.
 - ii) Lay water main in the same trench as the sewer with the water main located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.
- d. When crossing a water main over a sewer main, the bottom of the water main shall be at least 18 inches above the top of the sewer. Where existing conditions prevent an 18 inch vertical separation, construct both the water main and sewer of ferrous materials and with joints that are equivalent to water main standards for a distance of ten (10) feet on each side of the point of crossing.
- e. When it is necessary for a water main to cross under a sewer, construct both the water main and the sewer of ferrous materials and with joints equivalent to water main standards for a distance of ten (10) feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing.

2. Sizing

- a. Residential Areas
 - i) Mains shall be 6 inches and 8 inches in diameter. Six (6) inch mains shall be used only when an adequate grid exist. Should the grid be insufficient, line sizes shall be increased to

provide adequate fire flow as directed by the Town.

- ii) The maximum length of 6 inch and 8 inch line, without connecting to a larger main, is 1,200 feet and 2,000 feet respectfully.
- iii) Two (2) inch water mains are permitted in residential areas if the number of residences to be served is less than 20 for a dead-end line or less than 40 for a looped line.
- iv) Three (3) and four (4) inch mains shall not be permitted.

b. Business, Commercial, Industrial Areas

- i) 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 Town. In all cases, water mains shall be of such size as to maintain the minimum residual pressure of 20psi.

B. Material

1. Ductile Iron Pipe

- a. Pipe shall be designed and manufactured in accordance with AWWA C150 and C151 and shall be pressure class 350psi.
- b. Joints shall be of the push-on type as per AWWA C111.
- c. Pipe lining shall be cement mortar with a seal coat of bituminous material in accordance with AWWA Standard C104.
- d. Pipe shall be furnished in 18 or 20 foot lengths.

2. Polyvinyl Chloride (PVC) Pressure Pipe

a. General

- i) PVC materials shall comply with ASTM D1784 with a cell classification of 12454-B.
- ii) Pipe shall be tested and certified for potable water distribution products by the NSF Standard No. 14 and bear

the NSF seal on each section of pipe.

- b. PVC - C900
 - i) PVC pipe 6-inch thru 12-inch shall conform to AWWA C900.
 - ii) Pipe shall be pressure class 200 with a standard dimension ratio of DR 14.
 - iii) Outside diameter shall conform with ductile iron pipe.
 - iv) Pipe shall have plain end and elastomeric - gasket bell ends.
- c. PVC – Schedule 40
 - i) 2" PVC pipe shall conform to ASTM D1785.
 - ii) Pipe shall have a standard dimension ratio of SDR 13.5.
 - iii) Pipe shall have solvent welded joints.

C. Excavation

1. General

- a. All construction relating to the utility improvements must be performed by Contractors licensed by the State of North Carolina to perform the proposed activity.
- b. The Owner/Developer and the Contractor shall be responsible for Project Safety.
- c. All work shall be performed in accordance with applicable State and Federal Safety Regulations including, but not limited to the following:
 - i) N.C. Safety and Health Standards for the Construction Industry (29CFR 1926 Subpart P).
 - ii) NC OSHA Industry Guide No. 14 - Excavations.
 - iii) NC OSHA Industry Guide No. 20 - Crane Safety.
- d. Contractor shall provide barriers, warning lights and other protective devices at excavations as necessary for safety of workers and the public.

- e. Should it be necessary to close or partially close a street, the Contractor shall notify the Town and all other emergency response units at least 24 hours prior to closing the street.
- f. No work is to begin until the Plans and Specifications have been approved by the Town and the appropriate state agencies and all required permits, easements, etc. have been obtained.

2. Definitions

- a. Backfill: A specified material used in filling the excavated trench and placed at a specified degree of compaction.
 - i) Materials listed herein include processed materials plus the soil classifications listed under the Unified Soil Classification System, (USCS) (Method D2487 and Practice D2488). The soil materials are grouped into five broad categories according to their suitability for this application.
 1. Class I: Angular, 6 to 40-mm (1/4 to 1-1/2 in), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shell.
 2. Class II: Coarse sands and gravels with maximum particle size of 40 mm(1-1/2 in), including various graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil Types GW, GP, SW and SP are included in this class.
 3. Class III: Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil Types GM, GC, SM, and SC are included in this class.
 4. Class IV: Silt, silty clays, and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil Types MH, ML, CH and CL are included in this class. These materials shall not be used for bedding, haunching, or initial backfill.
 5. Class V: This class includes the organic soils OL, OH, and PT, as well as, soils containing frozen earth, debris, rock larger than 40 mm (1 1/2 in) in diameter, and other foreign materials. These materials shall not

be used for bedding, haunching, or initial backfill.

- b. Backfill Zones: Each backfill zone shall extend the full width of the trench bottom.
 - i) Foundation: Extending down the specified amount from 4-inches below the pipe bottom.
 - ii) Pipe Embedment
 - 1. Bedding: Extending from 4 inches below the pipe bottom to the pipe bottom.
 - 2. Haunching: Extending from the bedding (bottom of the pipe) to the pipe spring line.
 - 3. Initial Backfill: Extending from the haunching (pipe spring line) to 1 foot above the top of the pipe.
 - iii) Final Backfill: Extending from 1 foot above the top of the pipe to the finish ground elevation.
- c. Compaction: Process of mechanically stabilizing a material by increasing its density at a controlled moisture condition. “Degree of compaction” shall be expressed as a percentage of the maximum dry density obtained by the test procedure presented in ASTM D698 (Standard Proctor).
- d. Excavation: The removal of soil, or rock to obtain a specified depth or elevation.
- e. Hard Material: Solid, homogeneous material which are not included in the definition of “rock” but which usually require the use of heavy excavation equipment with ripper teeth or the use of jack hammers for removal. Amount must exceed 1 cubic yard in volume. Material having a standard penetration resistance, as determined by ASTM D1586 and 600 blows per foot is defined as “hard material”.

- f. Lift: Layer of soil placed on top of a previously prepared or placed soil.
- g. Rock: Solid, homogeneous material which cannot be removed without the systematic drilling and blasting exceeding 1 cubic yard in volume. Material having a standard penetration resistance as determined by ASTM D1586 greater than 600 blows per foot is defined as “rock”. Removal of “hard material” will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.
- h. Topsoil: Natural, friable soil, representative of productive soils in the vicinity of the site. Topsoil shall be free from roots, stones larger than 1 inch, objectionable weed seeds, toxic substances, and materials that hinder grading, planting, and maintenance operations.

3. Use of Explosives

- a. Obtain required permits for blasting from the Town and other applicable agencies.
- b. Store, handle, and use explosives in accordance with local and state regulations, or in the absence of such, in accordance with the provisions of the “Manual of Accident Prevention and Construction” of the Associated General Contractors of America, Inc.
- c. Conduct survey and document existing conditions of facilities prior to blasting. Provide seismographic monitoring during progress of blasting operations.
- d. Use explosives in such a way to minimize vibration to existing utilities and structures.
- e. Provide only experienced men for blasting in accordance with accepted practices. Project Foreman shall have a minimum of 2 years experience in the type of blasting activity being proposed.
- f. Contractor is responsible for safety of life and damage to property resulting from the use of explosives.

4. Excavating

- a. Excavation shall be by open cut. Short sections of trench may be tunneled or direct bored with the approval of the Town.
- b. Stockpile excavated material in such a manner that it will not obstruct

the flow of runoff, streams, endanger Work, impair the use or appearance of existing facilities, or be detrimental to the completed Work.

- c. Trench dimensions shall be as follows:
 - 1. Minimum width: Pipe outside diameter plus 18 inches.
 - 2. Maximum width: Pipe outside diameter plus 24 inches.
 - 3. Sides shall be vertical to a minimum of one foot above the top of pipe.
- d. Shape trench bedding to provide uniform bearing for the full pipe length. Bottom shall be free of protrusions which could cause point loading on pipe. Provide bell holes as required for properly making pipe joint.
- e. Excavation of trench shall not advance more than 200 feet ahead of the completed utility installation. In no case should the excavation extend beyond that which can be backfilled by the end of the work day.
- f. Excavate rock and hard material to a minimum depth of 4 inches below the pipe.
- g. Provide a minimum of three (3) feet of cover, unless indicated otherwise directed by the Town.

D. Installation

- 1. General
 - a. Lay pipe in the presence of the Town, unless specifically approved otherwise.
 - b. Handle pipe and accessories in accordance with manufacturer's recommendations. Care shall be taken to not damage pipe coatings.
 - c. Carefully inspect pipe immediately prior to laying. Do not use defective pipe. Replace pipe damaged during construction.
 - d. Lay pipe to grade and alignment indicated on the approved Drawings.
 - e. Provide proper equipment for lowering pipe into trench.

- f. Provide tight closure pipe ends when work is not in progress.
- g. Keep pipe interior free of foreign materials.
- h. Do not lay pipe in water or when the trench or weather conditions are unsuitable for the work.
- i. Clean bell and spigots before joining. Make joints and lubricate gasket in accordance with pipe manufacturer recommendation.
- j. Block fittings in pressure lines with concrete, or restrained as indicated in the standard details or as required to prevent movement.
- k. A 12-gauge insulated stranded wire shall be taped to the top of all PVC water mains and attached to all valves. The tracer wire color shall be blue. Tracer wire shall also be attached to all service lines ending in the meter box. The Town will test the tracer wire prior to acceptance of the line. Should any section of the line be undetectable, the contractor shall make the needed repairs.
- l. A three (3) inch wide polyethylene plastic tape manufactured for identification of utilities shall be installed 18 inches above the top of all water lines. The tape shall be blue with the wording "Caution - Buried Water Line Below" in bold black letters.

2. Ductile Iron Pipe

- a. Install pipe in conformance with AWWA C600 and the following:
 - i) For laying pipe in a vertical or horizontal curve, each full length pipe may be deflected by the following offset distance:
 - 1. Push-on joint
 - 3 to 12-inch pipe: 14-inch offset
 - 14 to 36-inch pipe: 8-inch offset

3. PVC Pressure Pipe

- a. Install PVC C900 pipe in conformance with AWWA C605.
- b. Clean bell and spigot ends prior to jointing. Ends of field cut pipe shall be beveled with file. Gasket shall be clean and lightly lubricated. Joint shall be made as recommended by the manufacturer.

E. Backfilling and Compaction

1. General

- a. Maintain backfill operation within 200 feet from pipe laying operation.
- b. Backfill trench to existing ground surface with select excavated material at the specified compaction.
- c. If excavated material is unsuitable to obtain specified compaction, provide suitable off-site borrow material for backfill.
- d. Re-excavate trenches improperly compacted. Backfill and compact as specified.
- e. Provide appropriate tamping equipment, and water to obtain proper moisture content, to achieve specified compaction of backfill.
- f. Conduct operation of heavy equipment above pipe installation so as to prevent damage to pipe.

2. Backfill in Pipe Embedment Zone

- a. Backfill with material as specified below. Material shall be free from objects larger than 2 inches.
- b. Where rock and hard material has been excavated below pipe bottom or where unstable material has been encountered, the entire Pipe Embedment Zone shall be backfilled with Class I material only.
- c. Place backfill material to assure placement of material under pipe haunches.
- d. No movement of the pipe shall occur during placement and compacting of material.
- e. Place pipe zone backfill in 6 inch maximum layers.
- f. Excavation in Class I, Class II, Class III and stable Class IV soils suitable for bedding, the bedding surface shall provide a firm foundation of uniform density. Backfill with select excavated material to pipe spring line and compact to 90 percent.
- g. Excavation in Class V, unstable Class IV soils, running water, and other unstable soil conditions, excavate a minimum of 4 inches below pipe bottom and provide Class I material for bedding and haunch zone.

3. Final Backfill

- a. Backfill with materials free of stones and debris larger than 6 inches in dimension. Place backfill in layers not exceeding the thickness and compacted to the minimum density specified below.
- b. Trench backfilled with non-cohesive materials may be compacted with water flooding; except under roadways, shoulders of roadways, and other areas subject to vehicular movement, provided the method of compaction is approved by the Town and provides the degree of compaction required.
- c. Lifts and Density:
 - i) Undeveloped areas (i.e., forest, fields, and crop lands): Trench may be filled with bulldozer blade provided material fall with not damage pipe. Mound soil over the trench area sufficiently to settle level over time. Degree of compaction shall be 85 percent density as per ASTM D698.
 - ii) Lawns: Backfill in 12 inch layers and compact to 90 percent. Top 12 inches shall be free of material with dimension over 2 inches.
 - iii) Roads (including Right-of-way), drives, parking areas (including areas within 20 feet), and adjacent to existing utilities: Backfill in 6 inch layers compact to 95 percent.
 - iv) Within 20 feet of foundations: Backfill in 6 inch layers compacted to 95 percent.

1.03 Fire Hydrants

A. Location

1. All hydrants to be installed only on 6" mains or larger.
2. There shall be at least one fire hydrant at each street intersection.
3. In residential areas the maximum spacing between fire hydrants, as measured along street center lines, shall be 500 feet.
4. In business, commercial, and industrial areas the maximum spacing between fire hydrants, as measured along street center lines, shall be 300 feet.
5. Location may be designated by the Town to meet specific needs. All locations will be approved by the Town's Fire Chief.

B. Specifications

1. Hydrants shall conform to AWWA C502 and to the following requirements:
 - a. Nozzles: Two (2) 2 ½ inch hose and One (1) 4 ½ inch pumper connections.
 - b. Nozzle threads: National Standard or Hickory Standard Thread as selected by the Town.
 - c. Main valve diameter: 4 ½ inch
 - d. Minimum depth of bury: 42 inches
 - e. Inlet connections: 6 inch mechanical joint
 - f. Open counter-clockwise
 - g. Traffic model with frangible sections near the ground line designed to break on impact.
 - h. Provide extension for hydrant standpipe as required to set center line of hydrant nozzle a minimum of 15 inches and a maximum of 24 inches above ground line.
 - i. Hydrant shall have a finish coat of silicone alkyd enamel and color coded to Owner's specifications.
 - j. Hydrants shall be Mueller "Centurion" (A-421), Clow "Medallion" or Dresser 129T.

C. Installation

1. Hydrant shall be set plumb on a 6 inch thick by 18 inch square slab of concrete with pumper nozzle facing the closest curb or edge of pavement.
2. The back of the hydrant shall be blocked, opposite the pipe connection, against the vertical face of the trench with 1/3 cubic yard of concrete. Care should be taken not to block any weep holes.
3. A minimum of 7 cubic feet of pea gravel stone shall be placed around the base of the hydrant.
4. The backfill around hydrants shall be thoroughly compacted.
5. Fire hydrant shall be restrained using grip rings as manufactured by Romac

Industries, Inc. or approved equals.

1.04 Valves and Appurtenances

A. Location

1. Valves shall be installed on all branches from feeder mains and on hydrant branches according to the following:
 - i) 3 valves at cross intersections
 - ii) 2 valves at tee intersections
 - iii) 1 valve on hydrant branches
2. Main line valves on straight runs between intersections shall be spaced at intervals distances not exceeding the following:

<u>Main Size</u>	<u>Maximum Spacing</u>
2"	400'
6"	600'
8"	800'
12"	1,200'
16"	1,600'

3. Gate valves shall be used for water mains through 12 inch size. For mains 16 inch and larger, butterfly valves shall be used.

B. Specifications

1. 2" Gate Valves
 - a. 2" valves shall conform to AWWA C500 for double disc gate valves.
 - b. Valves shall be non-rising stem (NRS) with a 2" square operating nut.
 - c. Valves shall be designed for 200psi working pressure.
 - d. Valves shall be manufactured by Mueller, Clow or Dresser.
2. Gate valves: 3" and larger
 - a. Valves shall conform to AWWA C509 for resilient-seated gate valves.
 - b. Valve shall be non-rising stem (NRS) with 2" square operating nut.

- c. Valve shall be designed for 200psi working pressure.
- d. Valves shall have mechanical joint ends.
- e. Valves shall be manufactured by Mueller, Clow or Dresser.

3. Butterfly Valves

- a. Butterfly valves shall conform to AWWA C504 for class 150-B.
- b. Butterfly valves shall be open-left manually operated with a 2 inch square operating nut.
- c. Butterfly valves shall have mechanical joint ends.
- d. Valves shall be manufactured by Mueller, Clow or Dresser.

4. Tapping Valves

- a. Tapping valves shall conform to the specifications for gate valves.
- b. The outlet end of the valve shall have mechanical joints as specified for gate valves.
- c. The mating end to the tapping sleeve shall be raised male surface to provide true alignment to the sleeve and tapping machine.
- d. Valves shall be manufactured by Mueller, Clow or Dresser.

5. Valve Boxes

- a. Box shall be the telescopic type made of high strength cast iron.
- b. Box shall consist of a base section, center extension as required, and a top section. The box shall have a 5" opening and the cover shall be marked "Water" in raised letters.
- c. Box shall be painted with a protective coat of asphaltic paint.
- d. Lid shall have the word WATER cast into it.

6. Blow-Off Assemblies

- a. Blow-off assemblies as shown in the Standard Details shall be installed at all dead-ends and at distinct low points as per detail.
- b. Fire hydrants shall be used as a blow-off for lines greater than 2".

7. Fittings

- a. Fittings for 6" thru 16" lines shall be ductile iron with mechanical joints and conform to AWWA C110 for standard fittings and AWWA C153 for compact fittings.
- b. Fittings shall be cement mortar lined with a bituminous seal coat in accordance with AWWA C104.
- c. 2 inch fittings shall be brass or as approved by the Town.
- d. All fittings shall have a minimum pressure rating of 350psi.

8. Tapping Sleeves

- a. In areas where the system working pressure is less than 150psi, the tapping sleeve shall be the single piece type, 304 stainless steel body with mechanical joints. In other areas, tapping sleeve type will be determined by the Town.
- b. Tapping sleeve shall be manufactured by Romac, Dresser or Ford and shall be compatible in all ways with the tapping valve.

9. Air Release Valves

- a. Air release shall be installed on water line at all high points and at other locations as determined by the Town.
- b. Air release valve shall conform to the requirements of AWWA C512.
- c. Valve shall be of the single housing style that combines the operation of both an air/vacuum and air release valve.
- d. Valve shall be manufactured for a 200psig working pressure.
- e. Air release valves shall be as manufactured by Val-Matic, CLA-Val or Crispin.

10. Check Valves

- a. Check valves shall be swing-check type conforming to AWWA C508.
- b. Valves shall be spring loaded and have flanged ends.
- c. Valves shall be manufactured by Mueller, Clow or Dresser.

11. Reaction Blocking

- a. All fittings or components subject to hydrostatic thrust shall be securely anchored by the use of poured in place concrete thrust blocks.
- b. Concrete shall be placed so as to not interfere with the removal of the fitting or components.
- c. Concrete for reaction blocking shall be 3,000psi.
- d. Alternative restraining methods may be approved by the Town.

C. Installation

1. Valves shall be installed on a firm foundation of crushed stone or concrete. Connection to the pipe shall be such that there shall be no stress at the joint caused by misalignment.
2. Maximum depth of valve nut shall be five (5) feet. When extension kits are used, they must be manufactured by the same company which manufactured the valve.
3. Where valves are located in paved areas, the valve box shall be adjusted to the finished street grade. A 2'x2'x6" concrete pad shall be placed around the box below the asphalt surface.
4. Valves located outside of paved areas shall have a pre-cast concrete collar placed around the box.
5. Valve boxes shall be centered over the wrench nut and seated on compacted fill without touching the valve assembly.
6. Air release valves shall be installed in a manhole.
7. Tapping valves and sleeves shall be installed in strict compliance with the manufacturer's recommendation. All bolts shall be properly torqued.

1.05 Water Services

A. General

1. A service tap shall be made for each lot by the Contractor after installation and pressure testing of the water main.
2. Water meters for 3/4" and 1" services shall be provided by the Town. All other items needed for a complete service, including but not limited to service saddle, corporation stop, service tubing valves, backflow preventer,

meter setters, boxes, vault, etc., shall be provided by the Contractor. Meters larger than 1" shall be provided by the Contractor.

3. Service saddles shall be used for taps in all 2 inch lines, all PVC water mains and in ductile iron pipe with a wall thickness less than 0.33 inch.
4. The maximum size of direct taps without a fitting, tapping sleeve or saddle for ductile iron water main shall be as follows:
 - a. 6" main - 1" tap
 - b. 8" main - 1 1/4" tap
 - c. 10" main - 1 1/2" tap
 - d. 12" main - 2" tap
5. Unless otherwise directed by the Town, meters shall be located at the right-of-way line.
6. Taps shall be located at 10:00 or 2:00 o'clock on the circumference of the pipe. Taps shall be staggered alternating from one side of the water main to the other and at least 12 inches apart. Taps must be a minimum of 24 inches apart, if they are on the same side of the pipe.
7. The water meter shall be sized based on water demand. Water meter size can be determined from the following table.

Water Meter Sizing

Supply Systems Predominately for Flush Tanks

<u>Meter Size (inches)</u>	<u>Load Range (Number of Fixtures)</u>	<u>Flow Range (GPM)</u>
5/8" PD	1 - 22	0 - 20
1" P.D.	22 - 140	20 - 50
1 1/2" PD	140 - 450	50 - 100
2" PD	450 - 1000	100 - 200
3" T or C	1000 - 2500	200 - 400
4" T or C	2500 - 5000	400 - 600

Supply Systems Predominately for Flush Valves

<u>Meter Size (inches)</u>	<u>Load Range (Number of Fixtures)</u>	<u>Flow Range (GPM)</u>
5/8" PD	1 - 8	0 - 20
1" PD	9 - 50	20 - 50
1 1/2" PD	50 - 275	50 - 100
2" PD	275 - 1000	100 - 200
3" T or C	1000 - 2500	200 - 400
4" T or C	2500 - 5000	400 - 600

- PD = Positive Displacement
- T = Turbine
- C = Compound (must be sized on a case by case basis)

B. Materials

1. Corporation Stops

- a. Corporation stops shall conform to the requirement of AWWA C800.
- b. Corporation stops shall be manufactured by Ford (F-600), Mueller (H-15000), or Rockwell.

2. Service Saddles

- a. Service saddle shall be all bronze with double bronze straps with a neoprene "O-ring" gasket attached to the body.
- b. Saddles shall be Ford S70 or S90, Rockwell No. 317, or Mueller H-16100 series.

3. Service Tubing

- a. Service lines 2" or less shall be polyethylene (PE) tubing. PE pipe shall be pressure class 200 with an IDR7, and shall meet the requirement of AWWA C901.
- b. Joints in service tubing shall be made with flared fittings.
- c. Service lines greater than 2" shall be PVC or Ductile Iron conforming to the specifications for water mains.

4. Meter Boxes/Vaults

- a. Meters 2" and less shall be installed in a meter box. Vaults shall be used for all meters greater than 2".
- b. Meter boxes and vaults for services shall be as shown in the standard details.

5. Meters

- a. Water meters shall comply with AWWA C700 for performance and materials.
- b. The meters shall have straight totalizing registers measuring in gallons.
- c. The register box, lid, and measuring chamber shall be constructed of

cast bronze.

- d. Meters shall be manufactured by Neptune, Rockwell International, or Badger Meter and shall be adaptable for remote detection without removing the meter from service.

6. Meter Setters

- a. Meter setter shall be copper with angle meter stop and an integral dual check valve.
- b. Meter setter shall be manufactured by Ford, Mueller or Rockwell.

1.06 Backflow Prevention

A. General

- 1. Backflow preventer shall be installed on all services. The type of backflow device required will be determined by the degree of the hazard.
 - a. For fire protection systems containing no anti-freeze chemicals, a double check valve assembly shall be installed on the fire protection line.
 - b. Fire protection lines containing chemicals and all irrigation systems shall be provided with reduce pressure zone backflow preventers.
- 2. Backflow prevention assemblies shall conform to USC Foundation for Cross Connection Control and Hydraulic Research.

B. Material

- 1. Double Check Valve Assembly
 - a. Assembly shall include 2 check valves, 2 valves and 4 test cocks.
 - b. Double check valve shall be in conformance with AWWA C510 and ASSE Standard 1015 (DCV).
 - c. Check valve assemblies shall be manufactured by Febco, Wilkins, Watts or approved equal.
 - d. Angle dual check assemblies for 3/4" and 1" services shall be manufactured by Ford, Mueller, Rockwell or approved equal.
- 2. Reduced Pressure Zone Assembly
 - a. Assembly shall be in accordance with AWWA C511 and ASSE Standard 1014 (RPZ).

- b. Reduced pressure zone backflow preventers shall be manufactured by Febco, Wilkins, Watts or approved equal.
3. Assembly Shut Off Valves shall be as follows:
 - a. 2" and under: 1/4 turn, full port, resilient seated, bronze ball valve.
 - b. Over 2": OS&Y resilient seated gate valves.
4. Valves shall be internally epoxy coated in accordance with AWWA C550.

1.07 Testing and Inspection

A. General

1. Prior to installation, all materials used must have a preliminary inspection by the Town.
2. The Contractor shall furnish all materials, labor and equipment to perform all testing and inspections to the satisfaction of the Town.
3. The Town will provide water for the initial testing of water mains and one additional re-test if necessary. If additional re-testing is required, the Contractor will be responsible for the cost of the additional water.
4. No valve on the existing system shall be operated without authorization from the Town.
5. Notify Town 24 hours prior to conducting any test.

B. Hydrostatic Testing

1. Pressure test in accordance with AWWA C600 for ductile iron pipe and AWWA C605 and M23 for PVC pipe and N.C. Regulations except as modified herein.
2. Before beginning hydrostatic testing, the line shall be flushed until clear water is discharged.
3. The pipe shall be tested between each valved section or 4,000 foot sections, whichever is longest in length. The pressure shall be measured at the point of testing.
4. After the pipe is laid, the joints completed, and the fire hydrants permanently

installed, the piping system or any valved sections of piping system shall be subjected for (2) hours to a hydrostatic pressure test equal to 200psi.

5. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged, or left in place at the discretion of the Town.
6. Where any section of main is provided with concrete reaction blocking for fittings or hydrants, the hydrostatic pressure test shall not be made until at least five days after installation of the concrete reaction blocking, unless otherwise approved.
7. Test pressure shall:
 - a. Equal test pressure specified at the highest points in the section tested.
 - b. Not exceed pipe or thrust restraint design pressures.
 - c. Not vary by more than +/-5.0psi.
 - d. Not exceed twice the rated pressure of the valves or hydrants when the pressure boundary of the test section includes closed gate valves or hydrants.
 - e. Not exceed the rated pressure of the valves if resilient-seated butterfly valves are used.
8. Do not paint or insulate exposed piping until successful performance of pressure test.
9. Repair defective joints, welds, pieces of pipe, jointing material, valves or other defective areas, and repeat pressure testing until pipe system meets test criteria.

C. Leakage Test

1. A leakage test shall be conducted concurrently with the pressure test.
2. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

3. No pipe installation will be acceptable if the leakage exceeds 10 gallons per inch of pipe diameter per mile of pipe per 24 hours.
4. Acceptance shall be determined on the basis of allowable leakage. If any test discloses leakage greater than that specified, the Contractor shall, at his own expense, locate and repair the defective material until the leakage is with the specified allowance.
5. Repair defective joints or other defective areas and repeat pressure testing until pipe system meets test criteria.
6. All visible leaks are to be repaired regardless of the amount of leakage.

D. Disinfection of Water System

1. All additions or replacements to the water system shall be chlorinated before being placed into service.
2. Chlorination activities shall take place under the supervision of the Town.
3. Highly chlorinated water shall not be allowed into the existing distribution system.
4. After favorable performance of pressure test and leakage test, thoroughly flush entire potable water piping system including supply, source and any appurtenant devices and perform disinfection as prescribed. Flush each segment of system to provide flushing velocity of not less than 2.5 feet per second. Contractor is responsible for proper disposal of flushing water. Do not drain flushing water to receiving stream. If there is any concern that the chlorinated discharge will cause any environmental damage, a reducing agent shall be applied to the water to neutralize the residual chlorine.
5. Perform work, including preventative measures during construction, in full compliance with AWWA C651.
6. Perform disinfection using sodium hypochlorite complying with AWWA B300, AWWA 601, and N.C. Regulations - Title 15A, Chapter 18C.1003. During disinfection procedure, ensure that the initial chlorine concentration is 50 mg/l throughout the system. The following chart shows the required quantity of 70% HTH compound contained in solution in each 1,000 feet of line to produce the desired concentration of 50 ppm.

<u>PIPE SIZE</u>	<u>POUNDS OF HIGH TEST HYPOCHLORITE (70%) PER 1,000 FEET OF LINE - TO PRODUCE 50 PPM</u>
6"	0.88
8"	1.56

10"	2.42
12"	3.50
16"	6.22

7. Use continuous feed method of application.
8. After 24-hour contact period, flush system to remove traces of heavily chlorinated water. Contractor is responsible for proper disposal of flushing water.
9. Open and close valves on the mains being disinfected a minimum of three (3) times during the chlorine contact period and a minimum of (3) times during flushing. Fire hydrants and other appurtenances should receive special attention to insure proper disinfection.
10. For Cut-In Construction use the following procedures for disinfecting of the new installation and the existing main at the cut-in point in accordance with AWWA C651, Section 9:
 - a. Apply liberal quantities of hypochlorite, in the form of tablets, to the open trench.
 - b. Interior of new pipe and fittings and the ends of the existing mains shall be swabbed or sprayed with a one percent hypochlorite solution before installation.
 - c. Install a two (2) inch tap downstream of the work area. Tap shall be used for blowing off the main. Or use the next fire hydrant downstream of the work area for blowing off the main.
 - d. Install a two (2) inch tap just upstream of the new installation. Control water from the existing system so as to flow slowly into the work area during the application of chlorine. After the line is thoroughly flushed, add chlorine solution at a concentration of 100 ppm by the continuous feed method and hold in the main for one (1) hour.

E. Bacteriological and Chlorine Residual Sampling and Testing

1. Test for free chlorine residual at required bacteriological test locations immediately after induction of highly chlorinated water and again after 24 hours, prior to flushing of the highly chlorinated water from the potable water system. Free residual chlorine after 24 hours shall be at least 10 ppm.
2. Obtain (2) samples at each location specified after the chlorination procedure is completed, and prior to placing the system in service. Take the first sample immediately after flushing of the chlorinated water and again in 24

hours. A set of samples shall be taken as a minimum at the following locations:

- a. Mains
 - i) Every 1,200 If
 - ii) End of each main
 - iii) A minimum of one from each branch
 - b. Mains at cut-in locations
 - i) Each side of work area.
 - ii) Time between samples to be determined by the Town.
3. Recommended additional samples. During the disinfection operation and the required sampling of water from the new system, it is recommended that samples be taken from water inflowing to the new work to determine if coliforms are present in the typical potable water source.
 4. No hose or fire hydrant shall be used for the collection of samples. Take samples from an approved sample tap consisting of a corporation stop installed in the main with copper tube gooseneck assembly. Operation shall be such as to ensure that the sample collected is actually from water that has been in the storage facility.
 5. Test samples for the presence of coliform organisms in accordance with the latest edition of Standard Methods for the Examination of Water and Wastewater. Testing method used shall be either the multiple-tube fermentation technique or the membrane-filter technique.
 6. Testing shall be performed by a laboratory certified for the required testing by the State of North Carolina.
 7. If samples show the presence of coliform, procedure 1 or 2 described below shall be followed, with the approval of the Town, before placing the unit or facility in service.
 - a. Take repeat samples at least 24 hours apart until consecutive samples do not show the presence of coliform.
 - b. Again subject the unit or facility to chlorination and sampling as described in this standard.

8. If samples are free of coliform, and with the approval of the Town, the potable water system may be placed in service following certification of the installation by the Developer's Engineer.
9. Test for odor. The water in the new system should also be tested to assure that no offensive odor exists due to chlorine reactions or excess chlorine residual.
10. Turbidity Measurement
 - a. Prior to placing the line in service, the Contractor shall take turbidity measurements. These measurements shall be made by the Nephelometric method in accordance with the recommendations set forth in "Standard Methods for Examination of Water and Wastewater", American Public Health Association.
 - b. The maximum allowable turbidity shall be 0.5TU.

F. Contamination

1. If, in the opinion of the Town, possible contaminants have entered the existing water system, or water samples show the water in the existing system to be unsafe on completion of the work, the existing water system shall be disinfected as specified herein and shall include all contaminated components. Disinfection of the existing system shall be coordinated with the Town.

END OF SECTION