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SECTION 15 11 13

PUBLIC WATER MAINS

PART 1.00 - GENERAL

1.01 Description

The work in this Section covers the requirements for furnishing and installation of all pipe required to complete the water distribution system(s) as shown on the drawings, as described in these specifications, and as directed by the Engineer.

1.02 Quality Assurance

- A. The Contractor shall use sufficient workmen and competent supervisors in the execution of this portion of the work to ensure adequate and proper installation throughout.
- B. The pipe class numbers or pressure ratings shall be clearly shown on the pipe.
- C. Loading, unloading, inspection, storage and handling shall be in accordance with AWWA C600 and AWWA C605 and as specified herein.
- D. Storage: Store pipe, fittings, valves and appurtenances off the ground using sound wood blocks, placed on stable foundation or using other appropriate means. Allow space between rows, individual pieces and bundles with clearance below and above to allow full view for inspection purposes.
 - 1. Store in well-drained area away from brush and accessible for inspection.
 - 2. Do not stack pipe higher than 54 inches high
 - 3. Keep spigot ends of pipe clean and clear for dimensioning purposes
 - 4. Don not place excavated or other material over or against stored material.
 - 5. PVC pipe shall be stored so that it does not deform or bend. Pipe stored outdoors or otherwise exposed to direct sunlight shall be covered with canvas or other opaque material with provision for adequate air circulation.
- E. Handling: unload and handle materials with crane, backhoe, or equipment of adequate capacity, equipped with appropriate slings or padding to protect materials from damage.

1.03 Submittal

- A. Prior to the installation of any pipe, the Contractor shall submit and receive the Engineer's approval of shop drawings and/or manufacturer's material certification of compliance with specifications.
- B. Submittals shall be in five (5) copies and shall be provided to the Engineer at least 15 days prior to the planned installation time.

PART 2.00 - PRODUCTS

Product requirements for pipe, service pipe, valves, fittings and other materials for this

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work are included elsewhere in these specifications.

Allowable materials on this project are as follows:

A. Polyvinyl Chloride (PVC) Pipe - C900, C905 Class 150 or 200

1. Pipe 12 inch and smaller shall be in accordance with AWWA C900 and shall be DR18, Class 150 with DIP equivalent outside diameters, except as noted on the plans, suitable for potable water use.
 - i. Exception to above is for dedicated fire mains serving sprinklered buildings. Mains located between the Fire Department Connection (FDC) and the building shall be DR14, Class 200.
 - ii. PVC Pipe manufactured more than 12 months from installation will not be accepted.
 - iii. Potable water use: NSF61
 - iv. Pipe lengths: The PVC pipe shall be furnished in standard laying lengths of 20 feet and shall have integral bell and spigot joints.
 - v. Pipe joints: Utilize elastomeric gasket push on joints following AWWA C900 and AWWA C905 except where otherwise noted.
2. Fittings shall be ductile iron, mechanical joint compact fittings and shall conform with ANSI/AWWA C153/A21.53 unless otherwise noted.
 - i. Mechanical joint solid sleeves shall be in accordance with AWWA C110.
 - ii. Bolts: High Strength low alloy steel tee head bolts.
 - iii. Unless shown otherwise, furnish fittings 3 inch through 24 inch diameter having minimum pressure rating of 350 psi, and furnish fittings larger than 24 inch diameter having a minimum pressure rating of 250 psi.
 - iv. Coatings: Ductile iron fittings shall be bituminous coated outside and cement mortar lined in accordance with ANSI/AWWA Standard C104/A 21.4.
3. Tracer Wire: All PVC piping shall be installed with a continuous, insulated, solid #10 gauge copper wire for water main location purposes by means of an electronic tracer.
 - i. The wire shall be solid color blue in accordance and must be zip-tied or securely taped along the pipe every 10 feet. Sections of wire shall be spliced together using Buchanon connectors or a similar approved method for splicing (no twisting of wires). Further detail is explained under installation.

B. Ductile Iron (DI) Pipe (Mechanical or Push on Joints, standard application)

1. Pipe shall be manufactured in accordance with AWWA C150 and C151 and shall be a minimum Pressure Class of 350 and Thickness Class 50, except as noted on the plans, suitable for potable water use.

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- i. Pipe joints: Pipe shall be either the “push-on” or “mechanical joint” in accordance with AWWA C111 unless otherwise shown on the plans and specified herein
 - ii. Coatings: Ductile iron pipe shall be bituminous coated outside and cement mortar lined in accordance with ANSI/AWWA Standard C104/A 21.4.
 - iii. Pipe lengths: 18 to 20 feet
2. Fittings shall be ductile iron, mechanical joint compact fittings and shall conform with ANSI/AWWA C153/A21.53 unless otherwise noted.
 - i. Mechanical joint solid sleeves shall be in accordance with AWWA C110.
 - ii. Bolts: High Strength low allow steel tee head bolts.
 - iii. Unless shown otherwise, furnish fittings 3 inch through 24 inch diameter having minimum pressure rating of 350 psi, and furnish fittings larger than 24 inch diameter having a minimum pressure rating of 250 psi.
 - iv. Coatings: Ductile iron fittings shall be bituminous coated outside and cement mortar lined in accordance with ANSI/AWWA Standard C104/A 21.4.
 - v. All watermain fittings shall be installed with thrust restraint. Reaction blocking shall be transit-mixed concrete of 2500 psi 28-day compressive strength placed in adequate quantities for the size and shape of the fitting being installed. Reaction blocking shall be formed and poured such that mechanical joints bolts remain accessible and the blocking shall be backed by firm, solid earth.

C. Ductile Iron (DI) Pipe (Flanged Pipe)

1. Where specified by the engineer and as required herein for certain applications, flanged pipe shall be used and in accordance with AWWA C115 and the requirements above.
2. Fittings shall be in accordance with AWWA C110. Flanges shall be cast integrally with body and have uniform thickness over their entire circumference.
 - i. Faces: Perpendicular to the access of pipe.
 - ii. Bolt Holes: Equally centered and spaced
 - iii. Flange bolts, nuts and washers: Carbon steel, ASTM A307, Grade B.
 - iv. Nuts: Cold punched, hexagonal, trimmed and chamfered.
 - v. Heads, nuts and threads; ANSI B1.1.
 - vi. Bolts: ¼ inch projection beyond nut when joint and gasket is assembled.
 - vii. Gaskets: Full faced, 1/8 inch thick rubber
 - viii. When flange joints are required for connecting to Class 250 gate valves with flanges, follow ANSI B16.1, Class 250, flat face flanges, unless

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otherwise specified.

D. Valves, Hydrants and Miscellaneous Appurtenances

Valves, Hydrants and Miscellaneous Appurtenances shall be in accordance with Section 15 12 16

E. Water Service Connections

Water Service Connections shall be in accordance with Section 15 12 13

PART 3.00 - EXECUTION

3.01 Preparation

- A. Contact appropriate utility locating agency(ies) prior to any earthwork
- B. Dig test pit to determine size, type, composition and exact location of existing pipe which the proposed pipe network will connect to.
- C. Excavate sufficient trench in advance and test pit all existing underground utilities or structures, whether shown on the drawings or visually identified in the field to verify:
 1. Field verify actual locations
 2. Make reasonable adjustments to line and grade to avoid conflict, with Engineer's approval.
 3. Furnish Engineer with location and elevation information when previously unknown or different underground utilities and structures are encountered.
 4. Additional work performed because above mentioned precautions were not taken will not be compensated by the owner.

3.02 Relation of Water Mains to Sewers

- A. Lateral Separation of Sewers and Water Mains - Water mains shall be laid at least 10 feet laterally from existing or proposed sewers, unless local conditions or barriers prevent a 10-foot lateral separation--in which case:
 1. The water main is laid in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer; or
 2. The water main is laid 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.
- B. Crossing a Water Main Over a Sewer - Whenever it is necessary for a water main to cross over a sewer, the water main shall be laid at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer, unless local conditions or barriers prevent an 18 inch vertical separation in which case both the water main and sewer shall be constructed of ferrous materials and with joints that are equivalent to water main standards for a distance of 10 feet on each side of the point of crossing.
- C. Crossing a Water Main Under a Sewer - Whenever it is necessary for a water main to

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cross under a sewer, both the water main and the sewer shall be constructed of ferrous materials and with joints equivalent to water main standards for a distance of 10 feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing.

Where it is impossible to maintain a minimum of 10 feet of horizontal clearance between the water and sewer installations, a vertical separation of 18 inches (water main above sewer) must be maintained.

3.03 Trench Excavation

A. General

1. Open no more trench in advance of pipe laying than is necessary to expedite the work.

Excavate trenches to a width that will provide adequate working space, but not more than maximum design width so not to undercut trench walls.

Excavate bell holes at each joint to provide full-length barrel support of the pipe and to prevent point loading at the bells or couplings.

Unless trench banks above the top of the pipe are cut back on a stable slope, sheet and brace trenches as necessary to prevent caving and sliding, to provide protection for workmen and the pipe, and to protect adjacent structures and facilities. Do not remove trench sheeting unless the pipe strength is sufficient to support the external loads. The width of the trench at any point below the top of the pipe should not be greater than that necessary to provide adequate room for joining the pipe and compacting the haunching and initial backfill.

During the course of construction, should the trench be over-excavated below a point 6 inches below the bottom of the pipe, fill that area of over-excavation with an acceptable class of embedment material and compact to a minimum of 90 percent.

2. Where trench construction conditions require the use of a trench box, the trench box shall be sufficient length to extend four (4) feet beyond both ends of one (1) joint of pipe in order to allow the workmen to make-up the pipe joint inside the protection of the trench box. The workmen required to work inside the trench shall:

- i. Enter and leave the trench box from the ground surface only
- ii. Not travel along the trench bottom outside the protection of the trench box

The trench box shall conform to current OSHA regulations and shall have been designed by a Registered Professional Engineer. The Contractor shall furnish proof of such design to the Engineer upon request.

B. Trench Width

Trench width at the ground surface may vary width and depend upon depth, type of soils, positions of surface structures, or other conditions authorized by the engineers.

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The maximum clear width of the trench excluding sheeting shall not exceed the outside diameter of the pipe plus one foot (1') on each side at the top of the area of initial backfill and one foot (1') above the outside top of pipe. The minimum width of the trench at the top of the pipe when placed shall be a width that will permit the proper construction of joints and compaction of backfill around the pipe, but shall be at least equal to the largest outside diameter of the pipe plus eight inches (8") on each side of the pipe. The sides of the trenches shall be vertical unless otherwise approved by the Engineer. In no case shall the vertical walls project less than two inches (2") above the top of the pipe line laid to a grade unless the finished grade fill depth is less than two feet (2'). The maximum allowable width of trench on each side of the pipe shall not exceed twelve inches (12") for pipe which is twelve inches (12") in diameter or smaller; eighteen inches (18") for pipe which is between fourteen inches (14") and thirty-six inches (36") in diameter; and twenty-four inches (24") for pipe diameters greater than thirty-six inches (36"), unless otherwise approved by the Engineer.

C. Parallel Roadway Trenches

Where utility installation is to take place upon the shoulder of any paved street or highway, excavate trench to a width that will provide adequate working space but in no case shall the hard surfaced, traveled portion of roadway be damaged. Where the structural integrity of the roadway pavement is jeopardized, proper sheeting and bracing shall be installed to provide adequate protection to adjacent roadway and structures, and to afford the necessary protection to the workmen and pipe.

Excavation material shall not be stored on the pavement if it can be reasonably handled otherwise. In cases where storing of excavated material on pavement is absolutely necessary, same shall be moved as quickly as practical and the pavement shall be thoroughly cleaned.

Excavation in the immediate vicinity of drainage structures shall be made with special care so as not to damage or interfere with the use of the existing drainage facilities.

Drainage facilities that are inadvertently damaged must be repaired or replaced immediately.

Parallel open trench installations that involve possible damage in event of rain or other falling weather, or which may be hazardous to traffic due to open trench, should be closed without undue delay. In no case should a trench remain open longer than a 24- hour period, except with approval of the Engineer.

D. Trenching Within Pavement

Where it is necessary to open-cut asphalt or concrete pavements surface cuts shall be made with a concrete saw with a maximum width of five (5) feet.

Where excessive depths of pipe installations are encountered and the structural integrity of the roadway surface and/or the safety of the workmen is in doubt, proper sheeting and bracing of the trench shall be required.

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Handling and placement of the excavated material within this area shall be handled as in Paragraph 3.03 B.

All excess excavated material shall be removed and disposed of outside the limits of the right-of-way in such a manner as not to interfere with the drainage of highways unless otherwise permitted or directed by the Engineer or his representative.

Compaction test(s) for open-cut crossings may be required at the discretion of the engineer in addition to any supplemental or more stringent testing requirements are specified in the approved North Carolina Department of Transportation Encroachment Agreement. All geotechnical testing required as specified above to meet the compaction requirements within Section 15 05 02 shall be the responsibility of the Contractor, the cost of which shall be included in the price bid for asphalt roadway (remove & replace).

E. Rock Excavation

Rock excavation methods and payment shall be in accordance with Section 15 05 01.

3.05 Preparation of Pipe Foundation

A. General

The pipe foundation shall be true to line and grade and uniformly firm. Where bell and spigot type pipe is used, recesses shall be excavated to receive the pipe bells.

B. Unsuitable Foundation Material

Where the foundation material is found to be of poor supporting value or of rock, the Engineer may make minor adjustment in the location of the pipe to provide a more suitable foundation.

Where this is not practical, the Contractor shall act upon the directions of the Engineer to stabilize the trench bottom by undercutting and installing: (a) soil stabilization woven fabric; and (b) NCDOT Class VI Stone (clean #57) or (c) approved select or borrow material and compacting to a minimum density of ninety (90%) as directed by the Engineer. Compensation for the undercut will be included in the cost of the foundation material furnished. Approved bedding and backfill material is further specified within Section 15 05 02.

C. Placement of Bedding Material

In such case as a stone bedding as specified is used, a sufficient depth (minimum six (6) inches, maximum six (8) inches) of the material shall be placed in the trench bottom of pipe to be installed. For depths greater than sixteen feet (16') the engineer shall direct the depth of bedding.

In order to ensure that adequate and uniform support is provided along the entire length of pipe, the Contractor shall carefully bring the bedding material to grade along the entire length of pipe prior to installation. Material used for the

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formation of the pipe bedding and haunch shall be carefully placed by hand shoveling to ensure that sufficient material has been worked under the pipe to form the haunch and to ensure that the pipe does not become dislodged during backfilling. Contractor's workmen shall fill evenly on both sides of the pipe to the centerline and shall compact the fill using hand shoveling or mechanical tamps. Extreme care shall be taken when using mechanical tamps adjacent to the pipe, when removing sheeting, and removing trench boxes so as to avoid disturbing the pipe.

3.06 Laying Pipe

A. Inspection

After delivery alongside the trench, all pipeline material shall be carefully examined for both soundness and specifications compliance.

B. Installation of Pipe

Watermain piping shall be installed in accordance with AWWA C600. Pipe shall be installed on even grades and straight alignments and all joints shall be properly fitted. All pipe, fittings and appurtenances shall be properly lowered into the trench so as to prevent damage to material.

Clean joint contact surfaces immediately prior to jointing. Use lubricants, primers, or adhesives as recommended by the pipe or joint manufacturer. All pipe shall be laid on the prepared foundation, bell end up grade with each joint being checked for proper alignment and grade as the work proceeds. Excavate bell holes for each pipe joint. When jointed in the trench, the pipe shall form a true and smooth line. Whenever practicable, start pipe laying at the lowest point.

Pipe jointing shall be accomplished according to manufacturer recommendations. Joint deflection shall not exceed 90% of the manufacturer's maximum allowable joint deflection.

Fittings shall be installed in the locations shown on the approved plans. Mechanical joint and restrained joint fittings shall be properly and tightly installed per the manufacturer's instructions and adequate thrust restraint shall be employed as shown in the plans and described in these specifications.

Pipe section(s) that are stubbed for future connection shall have a mechanical joint plug at the end which shall be rodded back to a thrust collar located midway along the section. In addition, gate valves for pipe stubs shall be rodded to the thrust collar as well. Rods shall be 5/8" or 3/4" steel.

C. Tracing Wire

Tracing wire shall be installed in the trench with the polyvinyl chloride and ductile iron transmission piping. The wire shall be installed on top of the pipe and attached to the pipe with a vinyl or plastic strap spaced no greater than 10 feet on center to prevent the tracing wire from moving during backfilling of the trench. The wire shall run continuous from valve box to valve box with a minimum of splices. The tracing wire shall terminate at the top of each valve box. The tracing

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wire shall be No. 10 gauge solid copper wire with UL insulation for direct bury rated for 600 volts. At each main line valve box location, the tracing wire shall be turned upward and installed to the top of the valve box.

Tracing wire shall also be run continuous along all plastic water services from the corporation stop and shall terminate at the top of each meter box. The service tracing wire shall be integrated into the main pipe wiring scheme. Further details for service lines are found within Section 15 12 13.

Upon completion of a run or pipe agreeable to the Engineer and Contractor, after backfill and prior to substantial completion, the Contractor shall demonstrate continuity in the wire along the main and services with an electronic locator. Any repair of wire or restoration of continuity along the pipe and services shall be at the Contractor's cost.

D. Dewatering

Keep trenching dry during pipe laying. Divert surface water from the trench area to the greatest extent practicable without causing damage to the adjacent property. Before pipe laying is started remove all water that may have entered the trench and continue to dewater trench by the most expedient method.

3.07 Backfilling

After the bedding has been prepared and the pipe installed, selected material from excavation or borrow, at a moisture content which will facilitate compaction, shall be placed alongside the pipe in layers not exceeding 6 inches in depth. Care shall be taken to insure thorough compaction of the fill under the haunches of the pipe. Each layer shall be thoroughly compacted by rolling, tamping and mechanical rammers, or by hand tamping with heavy iron tampers, the tamping face area of which shall not exceed 25 square inches. The method of filling and compacting shall be continued until the fill has reached an elevation 12 inches above the top of the pipe. The remainder of the trench shall be backfilled and thoroughly compacted in layers not exceeding 12 inches.

Care shall be taken during backfill and compaction operations to maintain alignment and prevent damage to the joints. The backfill shall be kept free from stone, frozen lumps, chunks of highly plastic clay, or other objectionable material.

All local backfill materials shall be compacted at a moisture content satisfactory to the Engineer, which shall be approximately that required to produce the maximum density. The contractor shall dry or add moisture to the local material when required to provide a uniformly compacted and stable embankment.

When other than local material is used for backfilling above the foundation, such material will be classified as select backfill material as specified in Section 15 05 01 of these specifications. Use of this select backfill material shall be only when directed by the Engineer or his representative.

Backfill over and around the pipe and backfill around and adjacent to all drainage structure shall be compacted to a minimum density of 80 percent as determined by the AASHTO Standard Method T-99, except the backfill under pavements and adjacent areas within 4 to 10 feet of the proposed pavement shall be compacted to a minimum density of

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100%.

Tests for density of compaction may be made at the option of the Engineer, and deficiencies shall be corrected by the Contractor without additional cost to the Owner. The operation of heavy equipment shall be conducted so that no damage to the pipe shall result.

Heavy equipment shall not be operated over any pipe until it has been properly backfilled and has a minimum cover of three (3) feet, unless approved otherwise by the Engineer.

3.08 Testing

Testing of new mains shall be in accordance with Section 15 13 00.01

3.09 Disinfection

Disinfection of new mains shall be in accordance with Section 15 13 00.02

3.10 Valves, Hydrants and Miscellaneous Appurtenances

Installation of Valves, Hydrants and Miscellaneous Appurtenances shall be in accordance with Section 15 12 16

3.11 Water Service Connections

Water Service Connections shall be in accordance with Section 15 12 13

3.12 Connections to Existing Mains

A. Connection to existing mains by tapping assembly or sleeve shall be in accordance with Section 15 12 16.

B. Connections that require shutdown of existing mains shall be done as follows:

1. Contractor shall notify the owner in writing within three (3) working days of a shutdown and (7) days if bypass services will be required and shall include the following information:
 - i. Work being performed
 - ii. Area/zones being shutoff and valves to be closed
 - iii. Length of time of shutoff
 - iv. Means of notifying all affected customers
 - v. Method/plan of bypass service (if necessary for prolonged shutdowns)
2. Contractor shall dewater, backfill and compact in accordance with specifications herein.
3. Contractor shall make the connection safely with the greatest possible speed and with the least amount of disruption to traffic and water service.
4. Prior to filling of lines, flushing, chlorinating, etc., approval shall be obtained from the Engineer in accordance with Sections 15 13 00.01 and 15 13 00.02

3.13 Temporary Bypass Water Service System

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Temporary Bypass Water Service System shall be in accordance with Section 33 11 13.01

3.14 Abandonment of Watermains and Services

- A. Cap ends of mains to remain in service as shown on plans and provide required concrete blocking to support cap.
- B. For abandonment of water mains install approved plug or cap at each location where pipe was cut or valve removed; or Contractor may fill severed abandoned pipe with flowable fill.
- C. Where mains are to be abandoned and removed to a fitting or valve, cut and plug main at the fitting or valve.
 - 1. When shown on the Drawings, remove and salvage abandoned valves and hydrants and deliver to the owner
 - 2. Pipe, fittings and other appurtenances that are removed but not required to be salvaged become property of the Contractor. Remove and dispose of off site.
- D. Abandon house connections 2 inches and smaller in diameter by:
 - 1. Closing the corporation stop and disconnecting the copper or plastic service tube.
 - 2. Capping the corporation stop with an approved cap.
 - 3. Removing of the meter box and meter. Return to owner if requested.
- E. Abandonment of house connections 3 inches and larger
 - 1. Removal of Existing Gate Valve.
 - i. For a mechanical joint gate valve and fittings, remove existing gate valve and install mechanical joint plug to existing tee.
 - ii. For tapping sleeve and valve connections, remove existing gate valve from existing tapping sleeve assembly. Install blind flange to existing flange end of tapping sleeve assembly.
 - iii. For lead joint valve and fittings, remove existing gate valve and tee.
 - a. Before removing existing tee and valve, clean existing pipe and check pipe diameter and roundness to verify that a solid sleeve will fit.
 - b. Do not cut existing pipe closer than eighteen inches (18") to joint bell unless joint bell will be removed.
 - c. Reconnect existing main with new pipe and solid sleeve.

PART 4.00 – MEASUREMENT AND PAYMENT

4.01 Public Water Mains

- A. Measurement: By linear foot of various sizes and types provided, measured horizontally along the centerline of the installed pipe as part of the completed and

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accepted work.

- B. Payment: At unit price for each size and type of pipe installed as listed in the Bid Schedule.
 - 1. Payment includes work for location of utilities, excavation, trenching, backfilling, removal and replacement of driveway pipes, guardrails and other obstructions, connecting to new and existing mains, abandonment of mains and services, installation of concrete blocking, installation and testing of tracer wire, pressure and leakage testing of mains, and disinfecting and testing of mains.

4.02 Fittings

- A. Measurement: By the each of various sizes and types provided to include accessories.
- B. Payment: At unit price for each size and type of fitting installed as listed in the Bid Schedule as part of the completed and accepted work.
 - 1. Payment includes work for location of utilities, excavation, trenching, backfilling, removal and replacement of driveway pipes, guardrails and other obstructions, connecting to new and existing mains, installation of concrete blocking, installation and testing of tracer wire, pressure and leakage testing of mains and fittings, and disinfecting and testing of mains and fittings.

END OF SECTION