

## SECTION 2

### POTABLE WATER SYSTEMS

#### 2.1 GENERAL

This section sets forth the general requirements for design, installation and testing of water distribution systems for potable service and fire protection.

#### 2.2 SYSTEM DESIGN

Potable water and fire protection shall be independent systems designed by a Florida Registered Professional Engineer (Engineer of Record) and constructed in accordance with the design and installation requirements as specified by Lee County Utilities (LCU), the Florida Department of Environmental Protection (FDEP), the Lee County Department of Health (LCDOH), the Lee County Department of Transportation (LCDOT), the Florida Department of Transportation (FDOT) and any other relevant state and local regulatory agencies as well as with the requirements established by the Lee County Land Development Code (LDC) as amended from time to time.

##### A. Flow Demands

1. LCU does not guarantee flow, fire flows, or pressure.
2. Flow demands for design shall be calculated on the basis of full development as known or projected. The average daily flow for domestic use shall be calculated at the minimum rate as follows:
  - a) Single-Family (SF) Residence = 100 gpd per capita, 2.5 persons per residence for a flow of 250 gpd per SF residence.
  - b) Multi-Family (MF) Residence = 100 gpd per capita, 2.0 persons per residence for a flow of 200 gpd per MF residence.
  - c) Mobile Home Park (MHP) Unit = 100 gpd per capita, 2.0 persons per unit for a flow of 200 gpd per MHP unit.
  - d) Recreational Vehicle Park (RVP) Unit = 50 gpd per capita, 2 persons per unit; for a flow of 100) gpd per RVP unit.

A. Flow Demands - continued

- e) Commercial, Industrial and special-type developments shall be established based on Chapter 64E-6 of the Florida Administrative Code guidelines &/or historical flow data for similar establishments.
  - (1) In order to use historical flow data; a minimum of the most recent 12 months of billing histories for at least six (6) similar establishments must be provided.
  - (2) Similarities must be demonstrated including but not limited to; size, hours of operation, number of employees, etc.
- f) Irrigation Flows shall be calculated using the Blaney-Criddle Formula.
  - a) LCU has a threshold of 2,000 gallons per day when irrigating with potable water is requested.
  - b) A separate water meter must be utilized for this purpose.
- 3. A minimum peak day factor shall be 2.5 times the average daily value.
- 4. An Equivalent Residential Unit (ERU) is defined as 250 gpd.

B. System Size Computation

- 1. All design data and computer printouts or data disks shall be signed and sealed by a Professional Engineer and submitted to LCU showing what adverse effect the design may have on the existing LCU facilities and is subject to review and approval by LCU.
- 2. The minimum design for water distribution systems shall provide for at least 100% of the combined average day demand rate times the peak factor at 2.5 plus the required fire flow.
- 3. The allowable minimum service pressure under such design conditions shall be 20 psi.
- 4. Design computations shall be by the MWH InfoWater 7.0 software, the most current software LCU is using or other LCU approved model, if done by computer.
- 5. H2O NET Version 2.5 shall be the preferred method in all cases with Hardy-Cross only being accepted for small system analysis.

C. Minimum Water Main Size

1. Single family and duplex dwelling unit developments shall be no less than 8" in diameter.
2. Multifamily developments with three to six dwelling units per building and not exceeding more than two stories in height shall be no less than 8" in diameter.
3. Multifamily developments composed of buildings with more than six dwelling units per building and exceeding two stories in height shall be no less than 10" in diameter.
4. All commercial developments shall be no less than 10" in diameter.
5. All industrial developments and all hazardous storage areas shall be no less than 12" in diameter.

D. Water Main Installation, Location and Depth

1. All piping shall be installed in accordance with the pipe manufacturer's recommendations and approved shop drawings.
2. Where pipe deflections are necessary, they are not to exceed 80 percent of the maximum deflections limits shown in AWWA C600.
3. Water main extensions are to conform to the existing water main design layout.
  - a) Water mains are to be installed on the same side of the road as the existing main unless otherwise approved by LCU.
4. The standard minimum cover for water mains shall be:
  - a) 30" from the top of pipe to finished grade, and
  - b) 36" from the top of pipe to finished grade for all road crossings.
  - c) Should this design not be possible, alternate methods must be submitted to and approved by LCU.
5. The maximum cover for water mains shall not exceed 48" unless otherwise approved by LCU.

E. Horizontal and Vertical Separation for Mains

1. Water mains and related appurtenance shall be installed at least 10 feet horizontally from any existing or proposed sewer main.
  - a) The distance shall be measured from outside pipe wall of the water pipe to outside pipe wall of the sewer pipe.
  - b) In cases where it is not practical to maintain a 10 foot separation, LCU may allow deviation on a case-by-case basis. Such deviations may be approved if:
    - (1) Supported by data provided by the Engineer of Record,
    - (2) Approved by FDEP, and
    - (3) The water main is at an elevation so the bottom of the water main is at least 18 inches above the top of the sewer main.
2. Water mains shall cross over sewer mains unless otherwise approved by LCU.
3. Water mains crossing sewer mains shall be installed to provide a minimum vertical separation of 18 inches.
  - a) The distance shall be measured from the outside pipe wall of the water main to the outside pipe wall of the sewer main.
    - (1) This shall be the case regardless of whether the water main is above or below the sewer main.
  - b) Crossings shall be arranged so that the water main joints will be equidistant and as far as possible from the sewer main joints.
4. When it is impossible to obtain proper horizontal and vertical separation as indicated above, the following shall apply:
  - a) The water pipe shall be designed and constructed equal to the requirements of the sewer pipe design, and shall be pressure tested at 150 psi to assure water tightness prior to backfilling.
  - b) The sewer line shall be encased in a watertight casing pipe, which extends 10 feet on both sides of the crossing, measured perpendicular to the water main
    - (1) This alternate must be approved by LCU and the LCDOH.
5. Additional horizontal separation for water mains and related appurtenances shall be as follows unless otherwise approved by LCU:
  - a) A minimum of ten (10) feet horizontal separation is also required between other public and/or private utilities, structure(s), building(s), wall(s), fountain(s), fence(s) and LCU infrastructure unless specifically approved by LCU.

E. Horizontal and Vertical Separation for Mains - continued

- b) Drainage inlets shall be located no closer than (5) feet from proposed or existing water mains.
  - (1) When the 5' separation cannot be achieved for new mains, LCU requires one joint of pressure class 350 ductile iron pipe to be centered on said inlet with 3' of separation.
- c) All new light pole foundations shall be a minimum of five (5) feet from any existing or proposed LCU owned and maintained pipeline or facility unless approved by LCU.
- d) The root ball of palm trees shall be a minimum of five (5) feet and the root ball of shade trees shall be a minimum of ten (10) feet from any existing or proposed LCU owned and maintained pipe or facility.
- e) TV cable, telephone, gas, electric power, and irrigation lines may cross under LCU facilities with a minimum of eighteen (18) inches of vertical clearance.

F. Water Meter Box Location

- 1. Water meter boxes shall be installed within the road R-O-W or within LCU Easements unless otherwise approved by LCU.
- 2. Meter boxes are to be installed on the 'parcel' side of the main unless otherwise approved by LCU.
- 3. 2' of separation is required between the supply side of the box(s) and the edge of all sidewalks.

G. Connection to Existing System

- 1. The cost of all work associated with making connections to the existing system shall be paid for by the Contractor.
- 2. All connections to existing mains shall be made as authorized by LCU.
- 3. A representative of LCU must be present at all tie-ins and wet taps.
  - a) Forty eight hours advance notification is required.
- 4. Valves separating the mains being installed from existing mains shall be operated by or under the direction of LCU.
- 5. In the event any existing customers will be without water while a connection is being made; the Contractor shall notify them 72 hours in advance of when the water will be turned off and when he estimates service will be resumed.

G. Connection to Existing System - continued

- a) These connections shall be made at night unless an alternate tie-in time is approved by LCU.
- b) No customer shall be without water service for more than 4 hours unless specifically approved by LCU.

H. Tapping Sleeves

1. Tapping sleeves used to make "wet" taps into existing mains shall be rated for 150 psi working pressure.
2. They shall be constructed entirely of stainless steel and shall be installed with stainless steel bolts.
3. The Contractor shall determine the outside diameter and type of the existing main before ordering the sleeve.
4. Size on size taps will only be allowed when connecting to C900 DR 18, C900 DR 14, and all ductile iron pipes unless otherwise approved by LCU.
  - a) When other types of pipelines are encountered, the proposed tap shall be at least 2 diameter inches smaller than the diameter of the existing pipeline unless otherwise approved by LCU.

I. Gate Valves Locations

1. Gate valves shall be provided at all locations necessary to provide an operable, easily maintained and repaired water distribution system including but not limited to:
  - a) pipe terminations,
  - b) all intersecting water mains,
  - c) fire hydrants,
  - d) on both sides of all subaqueous crossings.
2. The maximum length of water main between valves which can be used for shutting down the line for repair work shall not exceed:
  - a) 1,000 feet for all transmission mains,
    - (1) All mains 16" and above are considered to be transmission mains.
  - b) 500 feet in commercial and industrial areas,
  - c) 1,000 feet in residential areas.

I. Gate Valves Locations - continued

3. Valves may only be operated by LCU staff or someone under the direct supervision of LCU staff.

J. Gate Valve Boxes

1. Cast iron valve boxes shall be provided for all valves installed underground.
2. Valve boxes shall have an interior diameter of not less than 5".
3. They shall be adjustable to fit the designated depth of each cover over the valve.
4. Valve boxes are to be designed to prevent the transmission of surface loads directly to the valve or piping.
5. All valve boxes shall be provided with covers marked with the word "WATER".
  - a) The covers are to be constructed to prevent tipping or rattling.

Please refer to the LCU Approved Material List and Standard Detail sections located in this manual for additional information.

K. Fire Hydrants

1. All fire hydrants shall be designed for a working pressure of 150 psi.
2. They shall conform to AWWA Standard C502, "Fire Hydrants for Ordinary Water Works Service".
3. In all cases, fire hydrants shall be installed so that the center of the pumper connection is no less than 18" and no more than 24" above finished grade.
4. Fire hydrants shall be installed with a valve at the point of connection to the main line.
  - a) If the distance from the point of connection to the fire hydrant exceeds 100', a second fully restrained valve shall be required within 5' of the hydrant base.
5. A 7.5' clear zone in the front and the two sides with a 5' clear zone in the back of the hydrant is required.
6. Fire hydrants shall be installed on the 'parcel' side of the water main unless otherwise approved by LCU.
7. 2' of horizontal separation is required between the operating nut of the pumper nozzle and the edge of all sidewalks.
8. Hydrant barrels shall be painted AWWA Safety Yellow.

K. Fire Hydrants – continued

9. Fire hydrants shall be spaced as follows:
  - a) Hydrants for single-family and duplex dwelling unit developments shall be 800 feet apart as measured along the centerline of the street.
  - b) Hydrants for multi-family developments with three to six dwelling units per building and not exceeding two stories in height shall be 600 feet apart measured along the centerline of the street.
  - c) Hydrants for multi-family developments with more than six dwelling units per building or more than two stories in height shall be 400 feet apart as measured along the centerline of the street.
  - d) Hydrants for commercial developments shall be 400 feet apart as measured along the centerline of the street.
  - e) Hydrants for all industrial and hazardous storage areas, as defined in the Standard Building Code, shall be 300 feet apart as measured along the centerline of the street.
10. For water quality purposes, fire hydrants shall be installed at the terminal end of all dead-end water mains 6” in diameter or greater.
11. LCU requires the installation of an LCU approved backflow prevention device for all fire hydrants serving one or more buildings located on private property where applicable easements cannot be granted and or behind a fence or other barrier in which 24 hour access is not provided.
  - a) The LCU approved backflow prevention device is to be located out of the right of way, beyond the 10’ wide PUE (if applicable) on private property.
    - (1) An LCU easement must be provided up to and including the first O.S. & Y. valve of the backflow prevention device.
  - b) Hydrants located behind an LCU approved backflow prevention device such as a double detector check valve assembly or master meter assembly are to be painted red.
  - c) The fire hydrant(s), water main and all related appurtenances located behind the first O.S. & Y. valve of the backflow prevention device will be considered private.
  - d) It shall be the responsibility of the property owner to adequately maintain all private facilities.

L. Fire Hydrant Guard Posts/Bollards

1. Guard posts/bollards will be required for all hydrants located in areas subject to traffic flow and maneuvering issues.
2. Guard posts/bollards shall be constructed of 6" diameter, Class 50, Ductile Iron Pipe, 6' long, buried 3' below finished grade, filled with 2,500 PSI concrete and painted AWWA safety yellow.
3. Guard post/bollard locations must be approved by the Engineer of Record and LCU prior to installation.

Please refer to the LCU Approved Standard Detail located in this manual for additional information.

M. Air Venting

1. Automatic air release assemblies shall be installed at all critical points on major mains.
2. Where the water main profile is such that air pockets or entrapment occur which could result in flow blockage, automatic air release valves shall be provided.
3. Air venting capabilities shall be provided for distribution mains by appropriately placing fire hydrants or utilizing the LCU Standard Blow-off Assembly.
  - a) All dead-end water mains less than 6" in diameter, whether temporary or permanent, shall be equipped with a manually operated blow-off assembly at the terminal end.
  - b) All dead-end water mains 6" in diameter or greater shall be equipped with a fire hydrant at the terminal end.

Please refer to the LCU Approved Standard Detail located in this manual for additional information.

N. Joint Restraining

1. Pressure pipe fittings and other appurtenances requiring restraint shall include joint restraint devices, manufactured restrained joint pipe and fittings.
2. Joint restraining systems shall be designed for the maximum pressure condition and the safe bearing load for horizontal and vertical thrust.
3. If approved by the Engineer of Record and LCU, thrust blocks may be utilized.
4. Thrust restraining systems shall have a working pressure equal to or greater than the pipe material maximum pressure rating.
5. All restrained fittings and joints shall be shown on the plan and profile and must be included on the record drawings.

Please refer to the LCU Approved Standard Detail located in this manual for additional information.

O. Electrolysis Prevention

1. All systems shall be designed to best avoid electrolytic action through the contact of dissimilar metals.
2. Preventative action, if required, may consist of installing insulating or dielectric couplings between the two materials.

P. Dead End Lines

1. Unless justified by the Engineer of Record and specifically approved by LCU, dead-end lines will not be allowed.

## 2.3 MATERIALS

### A. Inspection of Materials

1. The contactor shall obtain a Certificate of Inspection from the pipe manufacturer indicating that the pipe and fittings supplied have been inspected at the plant and that they meet LCU requirements and specifications.
2. Any and all materials received from a given plant may be rejected if:
  - a) the methods of manufacturing fail to produce uniform results and/or
  - b) the materials used are such that produce inferior pipe and/or fittings.
3. All materials shall be subjected to visual inspection at time of delivery as well as just before they are to be lowered into the trench.
  - a) Any materials; pipe, fittings or other appurtenances that do not conform to LCU requirements and specifications will be rejected.
    - (1) The contractor must remove any rejected materials immediately.

### B. Pipe

It shall be the responsibility of the Engineer of Record to prepare and complete design loading calculations for water mains to determine if the proper material requirements are greater than those minimums specified herein.

1. Ductile Iron
  - a) Ductile Iron Pipe shall be used for all vertical deflections, ditch crossings, subaqueous crossings, and under all pavement unless otherwise approved by LCU.
  - b) Water mains larger than 12" shall be constructed of Ductile Iron Pipe.
  - c) Ductile Iron Pipe shall be a minimum pressure Class 250 and will be accepted in any diameter for use within the distribution system.
  - d) The pipe wall thickness shall not be less than that required by a working pressure of 250 psi in laying condition Type 4 "B" with 5-foot cover in conformance with ANSI Standard A21.50.
  - e) All aboveground piping shall be painted blue.
2. Polyvinyl Chloride Pipe (PVC)
  - a) All 4" through 12" diameter PVC pipe shall be rated per AWWA, C900, DR18, minimum Class 150.

B. Pipe - continued

- b) PVC pipe 4" in diameter or larger shall have provisions for expansion and contraction provided in the joints.
  - c) All PVC pipe less than 4" in diameter shall be Schedule 80 with a pressure rating of 200 psi solvent welded.
3. High Density Polyethylene (HDPE)
- a) HDPE may be used for water main crossings of roadways, ditches, environmentally sensitive lands and subaqueous crossings.
  - b) HDPE water mains shall have the same equivalent internal diameter as the corresponding PVC and DIP pipe, unless otherwise approved by LCU.
  - c) HDPE shall be PE3408, shall be rated per AWWA C-906, SDR11 minimum
  - d) Must have at least three equally spaced horizontal blue marking stripes.

C. Service Connections

- 1. Service connections shall not be installed on pipeline 24" and larger unless extenuating conditions exist and said connection is approved by LCU.
- 2. When practical, in new residential, commercial, or/and industrial subdivisions, the corporation stop shall be located at the intersecting property line or in the center of the lot.
- 3. All potable service taps shall be located in open/green areas unless specifically approved by LCU.
  - a) Any service taps that are approved within an impervious area shall require the use of a 2" cast iron body gate valve versus a corporation stop.
- 4. Schedule 40 PVC shall be an acceptable casing material for service lines.

Please see 'Conditions Requiring Casing' Section for additional information regarding roadway crossings.

Please see the 'LCU Approved Materials List' for additional information on the following:

1. Pipe
2. Casing
3. Fittings/Joints
4. Gaskets
5. Gate Valves
6. Valve Boxes
7. Restraining Devices
8. Concrete
9. Fire Hydrants
10. Check Valves
11. Service Connections
12. Meter Boxes & Covers
13. Backflow Devices
14. Air Release Valves
15. Sand

## 2.4 CASING INSTALLATION

The provisions of this section shall represent the minimum standards for the installation of casing pipe for water mains as well as conditions requiring casing.

### A. General

1. For water mains to be placed under all Lee County Department of Transportation (LCDOT) roadways, the casing and procedures shall conform to the requirements of LCDOT as outlined in Administrative Code "AC-11-12" and any supplements thereto.
2. All work and materials shall be subject to inspection by LCDOT.
3. Specific crossing requirements of the authority having jurisdiction shall be obtained in advance and complied with for all underground water mains crossing Lee County roadways, Florida State Highways, and railroads.
4. Casing requirements for private roadways within LCU service areas shall be the same as those for LCDOT roadways.
5. It shall be the responsibility of the engineer to prepare and complete design loading calculations for the water main casing to determine if the proper material requirements are greater than those minimums specified here.
6. Casings shall be installed in accordance with permit conditions of the authority having jurisdiction.

### B. Conditions Requiring Casing

1. When new roadways, turn lanes, acceleration lanes, deceleration lanes, or driveways are proposed; split steel casing pipe with bell restraints and casing spacers shall be installed on any existing PVC main.
  - a) Relocation or replacement of existing PVC pipe lines is an option to installation of split steel casing, if approved by LCU.
2. LCU reserves the right to require split steel casing on existing LCU mains under any other conditions deemed necessary.

B. Conditions Requiring Casing – continued

3. New carrier pipe conditions which will require a casing are as follows:

Location	Carrier Pipe Material		
	PVC DR 18	DIP C 250	HDPE DR 11
All Rights-of-Way, not under traveled way	none	none	none
Local Roadways and Collectors no more than 2 lanes			
Under Primary Travel Lane <sup>1</sup>	steel casing <sup>3</sup>	steel casing <sup>3</sup>	none
Under Secondary Travel Lane <sup>2</sup>	steel casing <sup>3</sup>	steel casing <sup>3</sup>	none
Collector More than 2 lanes or Arterial Roadway			
Under Primary Travel Lane <sup>1</sup>	steel casing <sup>3</sup>	steel casing <sup>3</sup>	HDPE casing <sup>4</sup>
Under Secondary Travel Lane <sup>2</sup>	steel casing <sup>3</sup>	steel casing <sup>3</sup>	none
Controlled Access, Expressway, and Freeway			
Under Primary Travel Lane <sup>1</sup>	steel casing <sup>3</sup>	steel casing <sup>3</sup>	HDPE casing <sup>4</sup>
Under Secondary Travel Lane <sup>2</sup>	steel casing <sup>3</sup>	steel casing <sup>3</sup>	HDPE casing <sup>4</sup>
Railroads	steel casing <sup>3</sup>	steel casing <sup>3</sup>	HDPE casing <sup>4</sup>
Driveway or Access Drive			
For Institutional sites (schools, hospital, etc)	steel casing <sup>3</sup>	steel casing <sup>3</sup>	none
For all others	none	none	none

Notes:

1. Includes condition where the carrier pipe crosses under both Primary and Secondary Travel Lanes together.
2. Condition where the carrier pipe is only under a Secondary Travel Lane.
3. Steel casing shall conform to the requirements of the Steel Casing Section of this Chapter.
4. HDPE casing shall conform to the requirements of the HDPE Casing Section of this Chapter.

4. In addition to the above; LCU reserves the right to require casings for new mains if conditions warrant &/or if deemed necessary.

C. Casing Pipe Installation

1. Casing pipes crossing under roadways shall be located at suitable approved alignments in order to eliminate possible conflict with existing or future utilities and structures.
2. A minimum 36” depth of cover shall be required between the top of the casing pipe and the surface of the roadway.
3. Casing requirements for private roadways within LCU service areas shall be the same as those for LCDOT roadways.
4. For casing pipe crossings under roadways, railroads, or other installations not within the jurisdiction of Lee County, the Contractor shall comply with the regulations of said authority in regard to design, specifications and construction.
5. State Highway casing installations shall be as specified in the FDOT, "Utility Accommodation Guide".

C. Casing Pipe Installation - continued

6. For railroad crossings, the American Railway Engineering Association, Part 5, Section 5.2, "Specifications for Pipelines Conveying Nonflammable Substances", shall be applicable.
7. In no case shall the minimum casing pipe diameter and wall thickness, for a specific carrier pipe size, be less than that specified herein.

D. Casing Pipe Material

1. Steel Casing

- a) Steel casings shall be prime steel pipe conforming to the requirements of ASTM Designation A-139.
- b) Unless otherwise approved by LCU, the minimum casing pipe size and wall thickness shall be as shown in the following table, for the carrier pipe size indicated.

Carrier Pipe Normal Size Inches	Casing Pipe Nominal Diameter Inches	Casing Pipe Wall Thickness Inches
4	10	0.250
6	12	0.250
8	16	0.250
10	20	0.250
12	24	0.312
14	28	0.312
16	30	0.312
20	36	0.375
24	42	0.500

- c) For sizes not included in the above or for special design considerations, approval shall be obtained from LCU.

2. HDPE Casing

- a) HDPE casings shall be a minimum DR 11 for carrier pipes less than 16" diameter.
- b) HDPE casings for carrier pipes 16" diameter and larger shall be DR 17.
- c) There shall be a minimum of 4" annular clearance between the interior of the casing pipe and the outside of the carrier pipe, unless otherwise approved by the LCU.
- d) HDPE casing pipe shall be manufactured from PE 3408 polyethylene meeting AWWA C906 standards.

D. Casing Pipe Material - continued

- e) Unless otherwise approved by LCU, the minimum casing pipe size and wall thickness shall be as shown in the following table, for the carrier pipe size indicated.

Carrier Pipe Normal Size Inches	Carrier Pipe Wall Thickness Dimension Ratio	Casing Pipe Nominal Diameter Inches	Casing Pipe Wall Thickness Dimension Ratio
4 <sup>2.</sup>	11	10	11
6 <sup>3.</sup>	11	14	11
8	11	16	11
10 <sup>4.</sup>	11	18	11
12 <sup>5.</sup>	11	20	11
14 <sup>6.</sup>	11	24	11
16 <sup>6.</sup>	11	24	17
18 <sup>7.</sup>	11	30	17
20	11	30	17
24	11	30	17

3. Schedule 40 PVC

- a) Acceptable casing material for direct bury of service lines only.

E. Carrier Pipe

1. PVC and DI water main carrier pipes to be installed within steel casings shall be Restrained Joint with casing spacers in accordance with this section and the requirements of the LCU Approved Standard Details.
  - a) Pipe and fittings shall comply with the applicable provisions of these Standard Details.
  - b) Casing spacers shall be Stainless Steel with Teflon skids.
  - c) Spacers shall be installed 7 feet, or less on center.
2. HDPE water main carrier pipes are to be installed within HDPE casings.
  - a) Casing spacers and bell restraints are not required with HDPE carrier and casing.
3. After the carrier pipe has been tested for leakage, both ends of the casing shall be blocked with an 8" wall of brick masonry with a weep hole installed near the bottom of each wall.

Please see the 'LCU Approved Materials List' for additional information.

## 2.5 TESTING AND DISINFECTION

### A. Flushing

1. All water mains shall be flushed to remove all sand and other foreign matter.
2. Flushing shall be terminated at the direction of LCU Inspection Staff.
3. The Contractor shall dispose of the flushing water without causing a nuisance or property damage, and meet all regulatory requirements for the protection of the environment.

### B. Hydrostatic Testing

1. The Contractor shall furnish the necessary labor, water, pumps, and required number of gauges at specified locations and all other items required to conduct the required water distribution system testing and perform necessary repairs.
2. The Contractor shall perform hydrostatic testing of the water distribution system as set forth in the following:
  - a) It is the underground contractor's responsibility to pre-pressure test prior to scheduling the official test with LCU and the Engineer of Record.
  - b) 48 Hours advance notice must be provided to LCU before all testing.
  - c) Testing is to be conducted in the presence of representatives from LCU and Engineer of Record.
  - d) Piping and appurtenances to be tested shall be within sections between valves unless otherwise approved by LCU.
  - e) Testing shall not proceed until all restraining devices are installed.
  - f) All piping shall be thoroughly cleaned and flushed prior to testing to clear the lines of all foreign matter.
  - g) While the piping is being filled with water, care shall be exercised to permit the escape of air from extremities to be tested.
  - h) Hydrostatic testing shall be performed with a sustained pressure for a minimum of two (2) hours at 150 psi.
  - i) Testing shall be in accordance with the applicable provisions as set forth in the most recent edition of AWWA Standard C600.

B. Hydrostatic Testing - continued

- j) The allowable rate of leakage shall be less than the number of gallons per hour determined by the following formula:

$$L = \frac{SD(P)^{0.5}}{133,200}$$

L = Allowable leakage in gallons per hour;

S = Length of pipe tested in feet;

D = Nominal diameter of the pipe in inches;

P = Average test pressure maintained during the leakage test in pounds per square inch

For 150 psi,  $L = (9.195 \text{ EE-}5)SD$

3. The testing procedure shall include the continued application of the specified pressure to the test system, for the two (2) hour period, by way of a pump taking supply from a container suitable for measuring water loss.
  - a) The amount of loss shall be determined by measuring the volume displaced from said container.
4. Should the test fail, necessary repairs shall be accomplished by the Contractor and the pressure test shall be rescheduled.

C. Disinfection

1. Following acceptable pressure testing, the Contractor shall disinfect all sections of the water distribution system.
2. The disinfection procedure shall be accomplished in accordance with the applicable provisions of AWWA Standard C601, "Disinfecting Water Main" and all appropriate approval agencies.
3. 48 hour advance notice must be provided to LCU before disinfecting procedures begin.
4. The disinfection procedure shall be repeated until two series of satisfactory samples are obtained. The period between such series of samples shall be a minimum of 24 hours.
5. Prior to placing the system into service, the contractor must obtain the approval of LCU and all appropriate agencies.

Please see 'Technical Specifications' Section for additional information on flushing, hydrostatic testing and disinfection requirements.

Please see the 'LCU Technical Specifications' for additional information on the following:

1. Sheeting and Bracing
2. Concrete
3. Workmanship
4. Trench Dimensions
5. Trench Grade
6. Unsuitable Material Below Trench Grade
7. Extra Utility Bedding Material
8. Excavated Material
9. Material Disposal
10. Rock Excavation
11. Excavation Site Safety
12. Dewatering
13. Obstructions
14. Backfill
15. Protective Concrete Slab
16. Restoration
17. Protection and Restoration of Property
18. Cleanup
19. Inspection of Material
20. Pipe Cleanliness
21. Pipe Gradient
22. Pipeline Identification
23. Pipe Joints
24. Pipe Joint Deflection
25. Rejects