SECTION 3900 - WATER MAINS

CITY OF LEE'S SUMMIT, MISSOURI
STANDARD SPECIFICATIONS

3901 MATERIALS

A. General: All materials shall comply with the latest revision of the reference standard applying to that particular material. All pipes, fittings and appurtenances containing more than 0.25 percent lead calculated by weighted average shall not be used except materials in brass service saddles and fire hydrants.

B. Pipe and Fittings for Water Mains

1. Allowable Materials: Pipe and fitting materials used in the construction of water mains shall be:

   a. Ductile Iron (DI), special thickness Class 50
   b. Polyvinyl chloride (PVC), AWWA C900 and AWWA C905.
   c. Fusible Polyvinyl chloride (PVC), Fusible AWWA C900 and AWWA C905

2. Requirements: The pipe manufacturer shall furnish pipe of materials, joint types, sizes, and strength classes indicated and specified. The Contractor shall furnish maximum pipe lengths normally produced by the manufacturer except for fittings, closures, and specials.

3. Manufacturer's Experience: The Manufacturer shall be experienced in the design, manufacture, and commercial supplying of the specified material.

4. Inspection and Testing: Inspection and testing shall be performed by the Manufacturer's quality control personnel in a manner complying with applicable standards.

5. Markings: Each pipe or fitting shall have the following information plainly and permanently marked by indenting in the outside surface of the pipe or painted thereon with waterproof paint:

   a. Pipe size and class or designation.
   b. Date manufactured and lot number.
   c. Manufacturer's name or trademark.
   d. For ductile iron pipe, in lieu of the above listed markings, the information may be provided on an adhesive bar code labeling system that complies with AWWA Standards. The adhesive label shall be provided on the outside surface near the bell.

6. Handling: The Manufacturer and Contractor/Developer shall use equipment and methods adequate to protect the pipe and joint elements and to prevent shock contact of adjacent units during moving or storage. Damaged sections that cause reasonable doubt as to their structural strength or water-tightness will be rejected.

7. On-Site Inspection: All pipe and appurtenances will be inspected by the Inspector prior to installation, and all damaged pieces as well as any pieces not complying with the City of Lee's Summit Standard Specifications shall be immediately removed and replaced by pipe and appurtenances as may be acceptable to the Inspector at the expense of the Contractor/Developer.

8. Certification: Suppliers shall submit certifications with their material delivery. These certifications shall be given to the Inspector.

C. Ductile Iron Pipe and Fittings

1. Design: All DI pipe (DIP) shall comply with ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51. The minimum thickness shall be Special Thickness Class 50.

2. Fittings:

   a. All DI fittings shall comply with ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53 and shall have a pressure rating of 350 psi.

   b. All DI fittings shall have the pressure rating and the letters "DI" or "DUCTILE" distinctly cast into the outside surface.

3. Joints: Mechanical and push-on joints for pipe and fittings shall comply with ANSI/AWWA C111/A21.11. Natural rubber gaskets shall not be accepted.

4. Restrained Joint Pipe and Fittings:

   a. Restrained joint pipe and fittings shall be per the pipe manufacturer's recommendation. American Flex-Ring, US Pipe TR Flex, Griffen Snap-Lok, Griffen Bolt-Lok and McWane TR Flex are considered restrained joints.

   b. Retainer glands (e.g., Megalug, Uni-Flange, etc.), and gripper gaskets (e.g., Field-Lok, Fast-Grip, etc.) are not considered a permanent restraint and must be used in conjunction with straddle or thrust blocks.

5. Coatings:

   a. Pipe shall be furnished with a standard thickness exterior bituminous coating complying with ANSI/AWWA C151/A21.51.

   b. The interior and exterior of fittings shall be furnished with a fusion-bonded epoxy coating complying with ANSI/AWWA C116/A21.16.

6. Linings: Pipe shall have a standard thickness cement mortar interior lining complying with ANSI/AWWA C104/A21.4. A seal coat shall be provided over the cement mortar lining.

a. The seal coat may be subjected to an adherence test using 3M Tartan Duct Tape 3939. Pipe will be rejected if the seal coat is removed down to the cement mortar lining by the duct tape.

7. Polyethylene Encasement: All DIP and DI fittings shall be installed with a polyethylene tube encasement having a thickness of 0.012 inches (12 mils) and complying with Section 4.1.1. of ANSI/AWWA C105/A21.5. The polyethylene encasement shall be clear in color.

   a. The ends of the polyethylene encasement and joints shall be thoroughly sealed with adhesive tape. Where polyethylene wrapped pipe or fittings being installed connect to a pipe that is not wrapped (including existing pipe), extend the wrap a minimum of 3 feet onto the previously uncovered pipe. This includes service lines which may be wrapped in polyethylene or dielectric tape.

   b. Adhesive tape shall be a general purpose adhesive tape 2-inches wide, plastic backed, and capable of bonding securely to metal surfaces and/or polyethylene material. Tape shall be Polyken No. 900, Scotch Tape No. 50, Tapecoat CT or approved equal. Duct tape will not be allowed.

8. Bolts: Bolts shall comply with ANSI/AWWA C111/A21.11. All bolts shall be coated with FluoroKote #1 or approved equal. After field installation, all bolts shall be coated with an aerosol applied rubberized coating. The material shall be rapid dry and specifically designed for corrosion protection. 3M Rubberized Underseal Undercoating 08883 or any equivalent rubberized-bitumen based spray-on undercoating may be used.

D. Polyvinyl Chloride Pipe and Fittings

1. Design: All PVC pipe shall comply with either ANSI/AWWA C900 or ANSI/AWWA C905. The minimum pressure class shall be Pressure Class 235.

2. Fittings: Where fittings are required, they shall be ductile iron and comply with Paragraph 3901.C.2.

3. Joints: Joints for pipe and fittings shall comply with either ANSI/AWWA C900 or ANSI/AWWA C905.

4. Restrained Joint Pipe and Fittings:

   a. Restrained joint pipe and fittings shall be per the pipe manufacturer's recommendation. Fused and Certa-Lok are considered restrained joints.

   b. Retainer glands (e.g., Megalug, Uni-Flange, etc.), and gripper gaskets (e.g., Field-Lok, Fast-Grip, etc.) are not considered a permanent restraint and must be used in conjunction with straddle or thrust blocks.

5. Polyethylene Encasement: See Section 3901.C.7 for polyethylene encasement of DI fittings.

E. Concrete: Concrete shall be a MCIB mix with a design strength of 4500 psi, unless otherwise shown on plans. Mix shall meet MCIB Specifications November 2007 as listed on the Concrete Promotional Group Website www.concretepromotion.com.

F. Granular Bedding Aggregate Material: See Section 2100.

G. Backfill: See Section 2100.

H. Flowable Backfill: Flowable backfill shall consist of Controlled Low Strength Material (CLSM) complying with the requirements in Section 2100, Mix Design Type A.

I. Trench Checks: Trench checks shall consist of flowable backfill as specified in Paragraph 3901.H.

J. Utility Markers:

1. Utility marker tape shall be minimum 2 inches wide, 4-mil thick blue plastic tape with the word "WATER" lettered in permanent black graphics.

2. In addition to utility marker tape, a PVC water main shall have a tracer wire installed along the top of the pipe. The wire shall be insulated, no smaller than 12 gauge, and for underground applications. It shall be detectable using either the inductive or conductive modes using a pipe and cable locator.

3. Splices in wiring shall be made with epoxy/silicon splice connector.

K. Thrust and Straddle Blocks: Concrete used for thrust and straddle blocks shall be a 4500 psi MCIB mix.

L. Pipe Encasement: Concrete used for pipe encasement shall be a 4500 psi MCIB mix.

M. Valves

1. General:

a. All valves shall be certified as suitable for contact with drinking water by an accredited certification organization complying with ANSI/NSF Standard 61, Drinking Water Systems Components–Health Effects.

b. All valves shall have a 2-inch square nut operator.

c. Direction to open shall be counterclockwise and be marked as such.

d. Valves on the existing water system or valves that separate newly constructed mains from the existing water system shall be operated by City staff. The Water Utilities Supervisor shall be notified prior to operating any valves.

2. Butterfly Valves

   a. Design: All butterfly valves shall comply with ANSI/AWWA C504 for Class 150B service, as modified herein.

   b. Body: Valve bodies shall be constructed of cast iron ASTM A 126, Class B and comply with AWWA C504 in terms of laying lengths and minimum body shell thickness. Valve ends shall be mechanical joint or flanged as shown on the Drawings and shall comply with AWWA C504.

   c. Disc: Valve discs shall be made from cast iron ASTM A 126, Class B or ASTM A 48, Class 40 for 24-inch and smaller valves. For valves larger than 30 inches, the valve discs shall be built from DI complying with ASTM A 536. Disc shall be furnished with Type 316 stainless steel seating edge to mate with the rubber seat on the body. Discs for valves 20 inches and smaller shall be of an on-center design.

   d. Seat: The valve seat shall be Buna-N rubber located on the valve body. Resilient seats on the valve disc are not acceptable. For 20-inch and smaller valves, the valves shall have bonded seats that meet test procedures outlined in ASTM D 429, Method B. For valves 24 inches and larger, the seat shall be retained in the valve body by mechanical means without use of metal retainers or other devices located in the flow stream.

   e. Shaft: Valve shaft shall be 18-8 Type 304 stainless steel complying with ASTM A 276. Shaft seals shall be standard self-adjusting split V packing. Shaft seals shall be of a design allowing replacement without removing the valve shaft.

   f. Bearings: Valve bearings shall be sleeve-type that are corrosion resistant and self-lubricating.

   g. Actuator: Valve actuators shall be fully grease-packed and have stops in the open/close position. The actuator housing shall be cast or ductile iron. Valve actuator shall be attached to the body with a minimum of three bolts. The actuator shall have a mechanical stop that will withstand an input torque of 450 foot pounds against the stops without damage. The traveling nut shall engage alignment grooves in the housing. The actuator shall have a built-in packing leak bypass to eliminate possible packing leakage into the actuator housing. Actuators for valves 16 inches and larger shall be the link lever type to provide characterized closure and prevent line shock when closing.

   h. Coatings: All internal and external surfaces shall be covered with a polyamide cured epoxy coating applied over a sand blasted “new white metal surface” per SSPC-SP10 to a minimum of 6 mils in compliance with AWWA C550.

   i. Testing: Each valve shall be factory tested per AWWA C504. If the Drawings call for valves that have been subjected to and passed a one-time pressure test of 192.5 psi prior to delivery (for those areas of the City where the line pressure exceeds 100 psi), those valves shall be clearly marked to that effect. The manufacturer shall provide for

testing certification, which shall be given to the Inspector upon delivery of the valves to the site.

j. Bolts: Bolts shall comply with ANSI/AWWA C111/A21.11. All bolts shall be coated with FluoroKote #1 or approved equal. After field installation, all bolts shall be coated with an aerosol applied rubberized coating. The material shall be rapid dry and specifically designed for corrosion protection. 3M Rubberized Underseal Undercoating 08883 or any equivalent rubberized-bitumen based spray-on undercoating may be used.

k. Refer to the Water Utilities List of Acceptable Manufacturers and Models.

3. Gate Valves

a. Design: All gate valves shall comply with ANSI/AWWA C509 or AWWA C515 for resilient-seated gate valves, as modified herein. Gate valves shall be designed for underground direct burial service. The minimum design working water pressure shall be 200 psig. All internal parts shall be accessible without removing the body from the water main.

b. Body: Valve bodies shall be constructed of cast iron (ASTM A 126, Class B) or DI (ASTM A 536) complying with AWWA C509 or AWWA C515 in terms of minimum body shell thickness. Valve ends shall be mechanical joint or flanged as shown on the Drawings and shall comply with AWWA C509 or AWWA C515.

c. Gate/Wedge: The valve gate or wedge shall be fully encapsulated with rubber to create a resilient seat.

d. Stem: Valve stem shall be non-rising and made of bronze complying with ASTM B 138 or manganese bronze complying with ASTM B 584. Stem seals shall be the O-ring type, not flat gaskets.

e. Coatings: Coating shall be non-toxic and impart no taste to water. All internal and external surfaces shall be covered with a fusion bonded epoxy coating complying with AWWA C550. Although the AWWA standard only refers to interior coatings, the external epoxy coating shall be applied in a manner similar to that used for application of the interior coating. Coating shall be applied prior to assembly such that all exposed external areas—including end connection bolt holes, body-to-bonnet bolt holes, etc.—shall be coated with epoxy.

f. Bolts: Bolts shall comply with ANSI/AWWA C111/A21.11. All bolts shall be coated with FluoroKote #1 or approved equal. After field installation, all bolts shall be coated with an aerosol applied rubberized coating. The material shall be rapid dry and specifically designed for corrosion protection. 3M Rubberized Underseal Undercoating 08883 or any equivalent rubberized-bitumen based spray-on undercoating may be used.

g. Testing: Each valve shall be factory tested per AWWA C509 or AWWA C515.

h. Refer to the Water Utilities List of Acceptable Manufacturers and Models.

4. Air Release Valves

a. Design: These valves shall be combination air valves, performing the functions of both an air release and an air/vacuum valve. All air release valves shall comply with ANSI/AWWA C512.

b. Body: Valve bodies shall be constructed of cast iron complying with ASTM A 126, Class B and shall have a working pressure rating of at least 150 psi.

c. Connections: Inlets and outlets shall be full size, national standard pipe tapered (NPT) equal to the nominal valve size. The valve shall have two additional NPT connections for the connection of gauges, testing, and draining.

d. Seat: Resilient seat shall be Buna-N.

e. Orifice Button: The valve shall have an adjustable threaded orifice button.

f. Internal Parts: Floats, guide shafts, and bushings shall be constructed of Type 304 stainless steel. Non-metallic floats, linkage, or bushings are not acceptable. Floats shall be unconditionally guaranteed against failure, including pressure surges.

g. Coating: The exterior of the valve shall be coated with a universal alkyd primer.

h. Refer to the Water Utilities List of Acceptable Manufacturers and Models.

5. Tapping Valves:

a. Tapping valves shall have the same characteristics as gate valves specified in Paragraph 3901.M.3. of the City of Lee's Summit Standard Specifications. Tapping valve ends shall comply with Section 4.4.1.4.4 of ANSI/AWWA C509.

b. A flange x mechanical joint (MJ) gate valve with all characteristics specified in Paragraph 3901.M.3. of the City of Lee's Summit Standard Specifications may be used in lieu of a standard tapping valve if the tapping machine to be used does not have a full-size cutter.

N. Tapping Sleeves

1. Iron body tapping sleeves shall have the following characteristics:

a. Design: Tapping sleeves shall comply with MSS SP-111, as modified herein. The minimum working pressure rating shall be 150 psig.

b. Tapping sleeves shall be cast iron complying with ASTM A 126, Class B or DI complying with ASTM A 536 and shall be compatible with the tapping valve.

c. Coating shall comply with AWWA C550.

d. Cast iron tapping sleeves shall have MJ connection x flange end. The flange end shall include a recess to provide positive alignment of the tapping valve. Recess dimensions are per MSS SP-60.

e. Bolts: Bolts shall comply with ANSI/AWWA C111/A21.11.

f. Refer to the Water Utilities List of Acceptable Manufacturers and Models.

2. Stainless steel tapping sleeves shall have the following characteristics:

a. Design: The minimum working pressure rating shall be 150 psig. The height from the flange surface to the pipe centerline shall comply with MSS SP-111. Recess dimensions are per MSS SP-60.

b. Top Shell: The top shell shall be 18-8 Type 304 stainless steel, minimum 12 gauge thickness.

c. Bottom Shell: The bottom shell shall be 18-8 Type 304 stainless steel, minimum 14 gauge thickness.

d. Flange: The flange shall be 18-8 Type 304 stainless steel and shall have a ¾-inch NPT test port.

e. Gasket: The tapping sleeve shall have a full circumferential gasket made of synthetic rubber.

f. Refer to the Water Utilities List of Acceptable Manufacturers and Models.

O. Valve Boxes

1. Valve Box Covers: All valve box covers, whether in pavement or grassed areas, shall meet the following requirements:

a. Cast iron castings shall conform to the requirements of "Gray Iron Castings," ASTM A48/AASHTO M105, Class 30B.

b. Dimension Tolerances:

i. The dimensions of all castings shall be ± 1/8 inch of the dimensions shown in the Standard Drawings.

ii. No casting shall weigh less than 95 percent of the specified weight shown in the Standard Drawings.

c. Workmanship and Finish:

i. Castings shall be free of casting defects such as porosity, rough surfaces and shrinkage.

ii. Surfaces shall be free of fused on sand and shall be smooth.

iii. Runners, risers, fins and other cast-on pieces shall be removed.

d. Interchangeability: Castings shall be interchangeable with the City's existing valve box lids. These are assumed to be Clay & Bailey Model 2195.

e. Markings:

i. Imported castings shall meet the country-of-origin markings as required in accordance with Title 19, Code of Federal Regulations, Part 134 (19 CFR 134).

ii. The word "WATER" shall appear on the cover as shown on the standard details.

2. Valve Boxes:

a. In Pavement: Valve boxes to be located in pavement (roadways, driveways, sidewalks or shoulders) shall have a screw-type ferrous metal body. Refer to the Water Utilities List of Acceptable Manufacturers and Models.

b. In Non-paved Areas: Valve boxes to be located in non-paved areas may be made of ferrous metal, schedule 40 PVC, or of C900 PVC pipe. Valve box shall be cut to finish grade after final site grading is complete. Buried valve boxes shall be uncovered and extended by the Contractor/Developer prior to final acceptance of the Work by the City.

3. All valves with the operating nut greater than 3 feet below finished grade or road surface shall be provided with extension stems to bring the operating nut to within 3 feet of the finished grade. Stem guides shall be provided to keep the valve stem extensions concentric with the valve box.

4. All ferrous metal parts shall be painted with an asphalt varnish.

P. Backflow Prevention Devices

1. The current MDNR Approved Backflow Prevention Assemblies list shall be used to select the BFPD.

2. Vaults:

a. Vaults shall be made of at least MCIB/KCMMB 4000 psi concrete mix. Other materials may be used if approved by the City Engineer.

b. Steps meeting the requirements for manhole steps (see Paragraph 3500.P.8. of the City of Lee's Summit Standard Specifications) shall be cast into the vault wall in-line with the top opening.

c. Minimum clearance dimensions shall be as shown in the Standard Drawings.

3. Irrigation Box: Backflow prevention devices shall be installed horizontally.

Q. Fire Hydrants

1. All fire hydrants shall be the traffic model, break-away type, and comply with the current AWWA C502.

2. Hydrants shall have a minimum design working pressure of 150 psig and test pressure of 300 psig.

3. Hydrants shall have two 2½-inch nozzles and one 4½-inch pumper nozzle with national standard fire hose coupling screw thread. Nozzle caps shall be the "nut type" having the same dimensions as the operating nut. Such caps shall be securely chained to the base of the hydrant.

4. The size of the hydrant main opening shall be 5¼ inches.

5. Operating nut shall be 5-sided measuring 1½" from point to flat and include the weather shield.

6. Hydrant shall be furnished with a 6-inch isolation gate valve in accordance with Paragraph 3901.M.3 of the City of Lee's Summit Standard Specifications.

7. Direction to open shall be counterclockwise and be marked as such.

8. Hydrants shall come with an oil reservoir or grease zerk.

9. Hydrants shall be factory painted (baked on enamel) according to the following schedule:

Ownership	Color
City	Optic yellow
Private	Optic yellow with silver bonnet
Private–Yard fire hydrant (i.e., attached to the fire suppression system)	Red

10. Extension Kits

    a. Extension kits shall be supplied by the hydrant manufacturer.

    b. All extensions shall be factory painted (baked on enamel) and shall match the color of the barrel section as called for in Paragraph 3901.Q.9. above.

11. Hydrants shall be furnished with temporary black plastic caps or shall be covered with black plastic bags until the hydrants are available for service.

12. Refer to the Water Utilities List of Acceptable Manufacturers and Models.

R. Service Lines from the Water Main to the Water Meter: Service lines 2 inches in diameter and smaller shall be made of Type K soft copper, complying with ASTM B 88. Service lines greater than 2 inches in diameter shall be DIP or PVC pipe and shall comply with Paragraphs 3901.C. or 3901.D, respectively, of the City of Lee's Summit Standard Specifications, subject to restrictions based on the City's currently-adopted Fire Code.

S. Casing Pipe

1. Pipe

a. The casing pipe shall be made of steel complying with ASTM A 139, grade B, with a minimum yield strength of 35,000 psi.

b. The minimum wall thicknesses required are shown in the following table:

Casing Diameter (inch)	Minimum Wall Thickness
10, 12, 14, 16	0.188" (3/16")
18, 20, 22	0.250" (1/4")
24, 26	0.281" (9/32")
28, 30, 32, 34	0.312" (5/16")
36, 38, 40, 48	0.344" (11/32")

2. Spacers: Casing spacer shall be a two-piece shell or band made from T-304 stainless steel of a minimum 14 gauge thickness. The shell/band shall have risers made of 10 gauge T-304 stainless steel and have a PVC liner. The bearing surface (skid or runner) shall be made of an ultra high molecular weight polymer, glass reinforced polyester, or fiberglass reinforced nylon. The shell/band shall be bolted together with T-304 stainless steel bolts. The configuration of the carrier pipe in the casing pipe shall be centered. End seals shall be made by the same manufacturer as the casing spacers and shall use stainless steel bands to hold end seals to pipes.

3. Ends of the Casing Pipe: The ends of the casing pipe shall be closed with one of the following (see the Standard Drawings):

a. Manufactured end seal.
b. Concrete plug with allowances for water flow.

3902 CONSTRUCTION AND INSTALLATION

A. General

1. Notification

a. Disruption of Water Service:

i. When a disruption of water service will occur, the Contractor shall notify Water Utilities Operations at least 48 hours in advance to make the necessary arrangements.

ii. It shall be the Contractor's responsibility to place door hangers on the affected premises at least 24 hours in advance of the disruption. The door hanger shall indicate the date and time of the disruption and its anticipated length.

iii. Once the work begins, the work shall be continuous (24 hours per day) until completed.

b. The Contractor's work shall be scheduled in a manner to accommodate the schedules of the City and the affected customers.

i. In the event closing of valves to make a connection will affect a customer who cannot be without service, as approved by the City Engineer, the Contractor shall make provisions to provide temporary service to that customer.

ii. In the event closing of valves to make a connection will affect a customer who can temporarily be without service, the maximum amount of time the customer may be without service, without Contractor furnished provisions for temporary service, shall be 8 hours.

2. Protection of Existing Water Mains, Sewers, Structures, or Utilities

a. Where new lines approach, cross, connect to, or run parallel to existing water or sewer mains, the Contractor shall be held completely responsible for protecting, preserving, and otherwise maintaining existing line during construction of new line. Any damage inflicted to water and sanitary sewer mains or structures must be promptly reported to Water Utilities Operations and arrangement made for the repair. Any damage inflicted to storm sewer lines or structures must be reported promptly to the Public Works Operations Division and arrangement made for repair. Any damage inflicted to any other utility must be reported promptly to the respective utility and arrangement made for the repair.

b. The Contractor shall protect all existing structures, utilities, and work of any kind against damage or interruption of service that may result from the operations of the Contractor. Damage or interruption of service resulting from failure to do so shall be repaired or restored promptly at the expense of the Contractor.

c. The Contractor shall give reasonable notice to utility companies and to other owners of property when such property is liable to damage or injury could result from the execution of the Work, so that the owners of such utility or property may take precautionary measures.

d. The Contractor shall be responsible to adjust to finish grade any existing utility/appurtenances (i.e. valves, meter wells, sanitary sewer manhole, storm junction box etc.) that is affected by construction.

3. Handling and Storage

a. Handle pipe materials and fittings in a manner to assure installation in sound and undamaged condition. Use slings, lifting bags, hooks, and other devices designed to protect pipe, joint elements, and coatings. In handling plastic pipe of 10 feet or more long, a double sling will be required.

b. Ship, move, and store with provisions to prevent movement or shock contact with adjacent units.

c. Pipe shall be handled in a manner that minimizes the damage to the coating. Damaged coating shall be repaired in a manner complying with the pipe manufacturer's recommendations.

4. Inspection of Materials: All pipe, fittings, and accessories shall be examined by the Inspector prior to installation for soundness and specification compliance. Rejected materials shall be marked and removed from the project site, and replaced with approved materials.

5. Alignment: Pipe shall be laid to the lines and grades as shown on the approved Engineering Plans.

6. Cleaning: All pipe, fittings, and accessories shall be kept clean of foreign matter while being handled or stored. During installation, foreign matter shall not enter the pipe or appurtenances. At the end of each working day, a temporary plug shall be installed at the termination of the pipeline.

B. Water Main Installation

1. Installation Standards: All pipes shall be installed in a manner complying with the following standards:

   a. DIP - ANSI/AWWA C600.
   b. PVC Pipe - ANSI/AWWA C605.

2. Installation

   a. Governmental Requirements: Water main installation shall comply with applicable local, State, and Federal requirements.

   b. Trench Dewatering: See Section 2100.

   c. Drainage Course Crossings: See Section 2100.

   d. Trench Widths

      i. Minimum Widths: Trench widths pipe clearances shall be not less than those shown in the following table.

TRENCH WIDTHS AND PIPE CLEARANCES (in)			
		Minimum	Minimum

Nominal Pipe Diameter	Suggested Trench Width[1]	Pipe Side Clearance[2] (Soil/Rock)	Pipe Bottom Clearance (Soil/Rock)
6	30	6/6	6/6
8	32	6/6	6/6
10	34	6/6	6/6
12	36	6/6	6/6
16	40	6/6	6/6
18	42	6/6	6/6
20	44	7/9	6/9
24	48	7/9	6/9
30	54	8/9	6/9

[1] Measured at the top of the pipeline.

[2] Measured from the outside face of pipe barrel to inside face of trench.

ii. Maximum Widths: Maximum trench widths shall be governed by existing soils, trench type, bedding, and laying conditions. Maximum widths shall not exceed the manufacturer's recommendations.

iii. Trench Slope: See Section 2100.

iv. Trench Shields: See Section 2100.

e. Compacted Fill: See Section 2100.

f. Pipe Embedment: DIP and PVC pipe shall be bedded in bedding material with a minimum thickness beneath the pipe as specified in Paragraph 3902.B.2.d. Also see Section 2100.

g. Bedding Installation: See Section 2100.

3. Backfill: See Section 2100.

4. Utility Marker Tape and Tracer Wire: Install utility marker tape above the centerline of each water main. Bury marker tape 18 to 24 inches below finished grade, along the full length of the water main. When tracer wire is required, tracer wire shall be installed along the top of the pipe so that the wire is in relatively continuous contact with the pipe. The wire shall be accessible at every valve box. Marker tape and tracer wire shall be inspected by the public works inspector prior to backfill. All tracer wires shall be tested before acceptance. Any tracer wire broken during installation shall be repaired by the Contractor.

5. Domestic Service Connections

a. The City will install a corporation connection at the main for individual, commercial, industrial, and residential service lines that are 2 inches in diameter and less. The Contractor/Developer shall notify Water Utilities Operations 48 hours in advance of requiring a service connection.

b. Taps: Refer to the Water Utilities List of Acceptable Manufacturers and Models.

   i. A saddle shall be required when PVC pipe is tapped

   ii. A direct tap with a tapping machine is required for DIP.

c. For service lines larger than 2 inches in diameter, a tee shall be cut in with appropriate valving or a tapping sleeve and valve shall be installed. The Contractor/Developer shall notify Water Utilities Operations and the Inspector 48 hours prior to starting this work.

d. Excavation for service connections shall be provided by the Contractor/Developer as illustrated in the Standard Drawings. The excavation shall be prepared prior to the time scheduled with Water Utilities Operations for the tap.

e. Installation of meters greater than 2-inch diameter will be specifically approved by the City Engineer.

f. Excavation shall be adequately protected in accordance with Section 2103 of Lee's Summit Special Provisions. Backfilling shall take place as soon as practicable.

6. Thrust Restraint

   a. All plugs, caps, dead ends, tees, bends and hydrants shall be provided with thrust blocks as shown in the Standard Drawings.

   b. Concrete construction shall comply with ACI 301, Specifications for Structural Concrete.

   c. Concrete shall extend from fitting to undisturbed soil and shall be installed so that all joints are accessible.

   d. Concrete shall be placed and cured for 24 hours prior to energizing the water main.

   e. If adequate soil support cannot be obtained, a mechanical restraining assembly shall be installed as approved by the City Engineer.

7. Pipe Encasement, Straddle Blocks, and Trench Checks

   a. Total or partial encasement of pipe in concrete shall be used where the required safe supporting strength of the pipe cannot be obtained by other bedding methods. Concrete encasement shall also be provided at locations where there exists the possibility that standard bedding may be eroded by currents of water under and

around the pipe. Concrete construction shall comply with ACI 301, Specifications for Structural Concrete.

b. Concrete encasement shall be constructed at locations indicated and complying with details as shown on the Engineering Plans and in the Standard Drawings. Start and terminate encasement at a pipe joint. Adequately support and block the pipe to maintain position and prevent flotation. Form to dimensions indicated or construct full width of the trench.

   i. Longitudinal reinforcement shall be continuous.

   ii. Concrete encasement shall be protected and cured so as to prevent excessive evaporation of moisture or freezing. Backfilling will not be considered as a suitable method of curing the encasement.

   iii. Backfill trench only after concrete encasement has obtained a minimum of 2000 psi. All backfilling shall be done in accordance with Section 2100.

c. Straddle blocks shall be constructed at locations indicated on and comply with details shown on the Engineering Plans and in the Standard Drawings.

d. Trench Checks: Trench checks shall be located as shown on the plans. They shall consist of flowable backfill and extend 12 inches below the bottom of the pipe. Length shall be a minimum of 12 inches and width shall be the width of the trench. The height of the trench check shall extend to 12 inches above the top of the pipe.

8. Pipe Laying: All pipe installation shall comply with the pipe manufacturer's recommendations, except as modified herein.

   a. Pipe laying shall not proceed if the trench width as measured at the top of pipe exceeds the maximum allowable trench width. If this occurs, the Contractor shall submit to the Design Engineer and the City Engineer, for approval, a better bedding design for the pipe or pipe of sufficient strength to provide safe supporting strength.

   b. All pipe and fittings shall be stored and handled with care to prevent damage thereto. Do not use hooks to transport or handle pipe or fittings. Do not drop pipe or fittings.

   c. Pipe and fittings rejected by the Inspector shall be marked and removed from the project site. All pipe and fittings shall be examined for soundness and specification compliance prior to placement in the trench and rejected pipe or fittings shall not be incorporated into the pipeline. Check the class or pipe strength to be sure proper pipe is installed.

   d. Clean joint contact surfaces prior to jointing. Use lubricants, primers, or adhesives as recommended by the pipe or joint manufacturer. Keep lubricants and applicators clean.

e. Excavate bell holes for each pipe joint. When jointed, the pipe shall form a true and smooth pipeline.

f. The alignment of all pipelines shall be true to line and grade. The pipe shall be truly centered into the abutting pipe.

g. On transmission mains, the pipes and appurtenances shall be truly laid to line and grade throughout, all junctions and other pieces required shall be properly excavated for and laid as shown on the Drawings, and the following tolerances from true horizontal alignment and vertical grade shall be maintained:

Horizontal Alignment:	±12 inches
Vertical Grade:	± 0.1 feet

Pipe installed but not meeting these tolerances shall be ordered removed and replaced at the Contractor's expense.

h. The trench shall be excavated to sufficient depth to allow embedment to be placed in the bottom of all trenches. At the pipe joints, the trench shall be excavated to an additional depth so that the bell will not rest on the bottom of the trench, and all the weight of the pipe shall be evenly distributed along the entire length of the barrel of the pipe.

i. The water main must be made watertight at all points; any leaks or other defects discovered at any time before the final acceptance of the Work shall be immediately repaired or that portion of the water main shall be rebuilt if necessary.

j. In all cases, full length sticks of pipe shall be used, except in making closures.

k. Clean interior of all pipe, fittings, and joints prior to installation. To exclude entrance of foreign matter during discontinuance of installation, close open ends of pipe with snug fitting closures. Take reasonable precautions to not let water fill the open trench, and include provisions to prevent pipe flotation. Remove water, sand, mud, and other undesirable backfill materials from trench before removal of end cap.

l. In forming joints, each length of pipe shall be carefully aligned in such manner as to form an accurate concentric joint, thus providing a uniform circular pipe opening. Each length of pipe shall thrust into the bell and shall be securely held in position until the next length of pipe has been placed.

m. The pipeline trench excavation shall be dewatered sufficiently to allow pipe joints to be made under dry conditions. No joints shall be made under water.

n. Joints:

   i. Joints shall in general be made complying with the manufacturer's recommendations and as specified herein.

ii. Clean and lubricate all joint and gasket surfaces with lubricant recommended by pipe manufacturer.

iii. Care shall be exercised by the Contractor to insure against damage to joint material in storage, handling, or placing operations.

iv. No damaged joint material shall be permitted to be used and the same shall be removed from the job site.

v. All pipe joints shall be completed by insuring that the ends of the pipe to be joined are in contact and completely shoved into "home" position.

o. Pipe shall be cut in a neat workmanlike manner without damage to pipe. Cutting of pipe with a torch is not permitted. Smooth cut by power grinding to remove burrs and sharp edges. Repair the lining as required and approved by the Inspector.

p. All pipelines shall be plugged at the end of each day's progress. Plugs or other positive methods of sealing shall be utilized at all times to protect any existing system from entrance of stormwater or other foreign matter.

q. When a water main crosses an existing pipeline (sanitary sewer, storm sewer, service laterals or force mains) and the clearance is less than 18 inches, concrete encasement shall be required in a manner approved by the City's on-site representative.

9. Valves, Fittings, and Hydrants:

a. Valves, fittings, and hydrants shall be set and jointed to a new pipe in the manner specified for cleaning, laying, and jointing pipe.

b. Valves, fittings, hydrants, and pipe shall be supported in such a manner that there is no deflection in the valve or fitting-to-pipe joint. Larger valves and fittings may require additional support so that the pipe does not have to support the weight of the valve or fitting. In no case shall hollow pipe be used as a support mechanism.

c. Valve boxes and lids shall be installed over each valve. The valve box shall be supported in a manner to remain centered and plumb over the operating nut of the valve. The valve box shaft shall not transmit shock or stress to the valve. Valve box covers shall be installed flush with the finish grade, or as directed by the Inspector.

d. Hydrants:

i. Hydrants shall be installed as shown in the Standard Drawings.

ii. Hydrants shall be installed so that the steamer nozzle is 18 inches above final grade, and the bottom of the break-away coupling is 2 to 6 inches above final grade, as recommended by the hydrant's manufacturer.

iii. Hydrants shall stand plumb.

iv. The weep holes of the hydrant shall be kept clear and free to drain.

v. Refer to AWWA Manual M17 for additional installation guidelines.

10. Removal of Water: The Contractor shall provide dewatering as specified in Section 2103. Damaged pipe or structures of any kind resulting from insufficient dewatering facilities or similar lack of proper conduct of the work shall be replaced by the Contractor at their own expense. No structure or pipes shall be laid in water, and no water shall be allowed to run into or over any concrete work or pipe, or into or through any pipe.

11. Water Main Connections to Existing Main

    a. The Contractor/Developer shall furnish and install all of the fittings necessary for connections between new water mains and existing water mains. The use of tapping sleeves and valves is to be minimized and shall only be allowed where required on approved engineering drawings. The installation of tapping sleeves and valves shall be done while an Inspector is present.

        i. All tapping sleeves will be required to meet the following air test:

            - < 12-inch, hold 45 psi for 1 minute
            - ≥ 12-inch, hold 60 psi for 1 minute

        ii. Tapping into existing mains shall be done with no interruption of existing services unless otherwise approved by the City Engineer 48 hours prior to disruption of service.

    b. Valves on the existing water system or valves that separate newly constructed mains from the existing water system shall be operated by City staff. The Water Utilities Supervisor shall be notified prior to operating any valves.

    c. Special care should be taken when making a connection to an existing main. No foreign material or contaminants will be permitted to enter the water system.

    d. Thrust blocks shall be provided at the new connection to provide thrust restraint as shown in the Standard Drawings

12. Abandonment of Water Mains

    a. No existing water mains shall be abandoned prior to contacting Water Utilities Operations at least 48 hours in advance.

    b. Prior to abandonment of a water main, the Contractor shall verify that no existing services will be affected.

c. If a water main is indicated for abandonment, it shall be abandoned by removal and backfill if required or by plugging each end of the line segment. To plug each end of the line segment, a section of pipe at least 10 feet long shall be cut out of the existing line. The water shall be drained out to the fullest extent practicable, and the ends shall be sealed with a 1-foot thick plug of non-shrink grout sealed with a Portland cement grout.

d. Location of cut line and plugs shall be shown on the record drawings.

e. Hydrants (complete) shall be removed and returned to Water Utilities Operations.

13. Abandonment of Service Lines

a. Water Service Lines shall be abandoned when buildings are demolished and there are no re-development plans to reuse the existing tap.

b. For 2-inch and smaller water service lines that are connected to a water main with a service saddle (that is to remain in service), the water service line shall be abandoned by removing the corporation valve and replacing it with a plug.

c. For 2-inch and smaller water service lines that are connected to a water main without a service saddle (that is to remain in service), the water service line shall be abandoned by removing the corporation valve plugging the main using a stainless steel repair clamp.

d. For greater than 2-inch water service lines that are connected to a water main (that is to remain in service), the water service line shall be abandoned by removing the valve and installing a blind flange, severing the water service line within 2 feet of the valve, plugging the service line with concrete, removing the valve box, backfilling the hole left after removing the valve box, and repairing the surface. The valve box shall be returned to the Water Utilities Operations.

14. Protection of Water Supplies

a. There shall be no physical connection between a public or private potable water supply system and a sewer, or an appurtenance thereto, that would permit the passage of any wastewater or polluted water into the potable water supply.

b. For water mains paralleling or crossing sewer mains, see Paragraph 6901.D.1.c.

c. Water and sewer mains shall not be placed in the same trench or excavation.

15. Connection of Pipes of Dissimilar Materials: The connection of pipes of different materials shall be made using approved transition couplings, and shall provide a permanent and watertight connection that will withstand the hydrostatic test pressure.

C. Disinfection

1. General

    a. Precautions, methods, procedures and materials for disinfection shall comply with the current AWWA C651.

    b. Precaution shall be taken to protect the interior of pipes, fittings, and valves against contamination. Pipe shall be handled in such a manner to prevent the entrance of foreign material or water.

    c. All water mains shall be disinfected and tested. Not more than 4,000 feet of water main shall be installed without disinfecting and testing.

    d. The Contractor/Developer shall notify the Inspector at least 48 hours prior to commencing disinfection.

    e. Existing water distribution system valves shall be operated by City staff.

    f. Samples shall be taken at locations selected by the Inspector but not less than 1 sample shall be collected for every 1,200 feet of pipe, plus 1 sample from each dead end line, and at least 1 set from each branch. If trench water has entered the main, samples shall be collected every 200 feet.

    g. If the continuous feed method of chlorination is selected, bacteriological samples shall not be taken until the water mains have passed hydrostatic and leakage tests.

2. Filling: After installation, the entire main shall be completely filled with water to eliminate air and be flushed to remove any material that may have entered the main. Flushing velocities shall not be less than 3.0 feet per second.

    a. If the continuous feed method of chlorination is selected, the filling and flushing shall be done prior to chlorination.

    b. If the tablet method of chlorination is selected, the filling shall be done very slowly (i.e., less than 1 ft/s) and in the presence of the Inspector. The water main shall be flushed after it has been chlorinated.

3. Chlorination: Chlorination shall comply with the procedures given in AWWA C651, as modified below.

    a. The tablet method may only be used under the following conditions:

        i. The water main to be chlorinated is 12 inches in diameter or less,
        ii. Calcium hypochlorite granules are used (i.e., not tablets), and
        iii. The pipes and appurtenances are kept clean and dry during construction.

    b. The tablet method shall not be used if nonpotable water or foreign materials have entered the mains or if the water temperature is below 5°C (41°F).

    c. The slug method may only be used with prior permission from the City Engineer.

d. Cutting into or Repairing Existing Water Mains:

i. Disinfection procedures when cutting into or repairing existing water mains shall comply with AWWA C651.

ii. This procedure shall only be used if the length of pipe to be disinfected is less than 150 feet, unless otherwise approved by the City Engineer.

e. A basic flow chart for the chlorination process is given in Figure 3901-1 and is further described below.

i. Chlorinate water main and measure chlorine at the ends of the water main and ends of all branches. A minimum of 25 milligrams per liter (mg/l) free chlorine should be detected at each location, or additional chlorination is required until that level is reached.

ii. When acceptable chlorine levels are detected at all points, the Contractor/Developer shall operate all valves and hydrants within the newly-constructed section (except for the valve tying the new construction to the City's distribution system) in order to disinfect appurtenances.

iii. The chlorinated water shall be retained in the water main for at least 24 hours.

iv. If the required minimum residual of 10 mg/l chlorine is not present in all portions of the water main after 24 hours, rechlorinate the water main.

v. If the required minimum residual of 10 mg/l chlorine is present in all portions of the water main, flush the water main until chlorine measurements show the water leaving the test main are no higher than that prevailing in the system.

vi. Disposal of Heavily-Chlorinated Water: The heavily-chlorinated flush water shall be discharged to a sanitary sewer, or the flush water shall be dechlorinated in a manner complying with AWWA C651, Appendix C. If the flush water is to be discharged to the sanitary sewer, the Contractor/Developer will be charged for the disposal of the quantity of water disposed.

vii. Samples shall be taken of water that has stood in the main for at least 16 hours after final flushing has been completed and shall be tested by a state-certified laboratory, as approved by the City, for bacteriological quality complying with "Standard Methods for the Examination of Water and Wastewater." The samples shall meet the MDNR standard.

viii. Samples for bacteriological testing shall be taken through a corporation stop and copper tubing.

ix. The first set of bacteriological samples will be taken under the direction of the Inspector, who will take this and all subsequent samples to the laboratory.

x. The laboratory shall be one certified by MDNR for microbiological analyses.

xi. If the results are acceptable from the first samples (taken on Day 3), a second set of samples will be taken under the direction of the Inspector.

xii. If the results for the second set of samples (taken on Day 4) are acceptable, the laboratory shall provide a hard copy of the lab results to the Inspector.

xiii. If the results are not acceptable from the first set of samples, (taken on Day 3) the Contractor shall follow the procedure shown in the flow chart in Figure 3901-1 to flush and/or rechlorinate the water main until acceptable test results are achieved.

xiv. If the results are not acceptable from the second set of samples, the Contractor shall follow the procedure shown in the flow chart in Figure 3901-1 to re-chlorinate the water main (beginning at Day 1) until acceptable results are achieved.

D. Hydrostatic and Leakage Testing

1. Hydrostatic pressure and leakage testing shall be performed by the Contractor/Developer in the presence of the Inspector and shall comply with current AWWA C600 and C605 procedures for DI and PVC pipe, respectively. The Contractor/Developer shall supply all pipe, tools, and equipment necessary to operate the test.

2. The hydrostatic pressure during testing shall be:

   a. At least 125 percent of normal operating pressure at the highest elevation of the test section.

   b. At least 150 percent of normal operating pressure at the lowest elevation of the test section.

   c. At least 150 psi throughout the test section.

3. The leakage test shall be conducted concurrently with the pressure test. A DIP pipeline is acceptable if the leakage does not exceed the allowable limits as determined by the following formula:

$$L = SD\,(P)^{1/2}/148{,}000$$

where

L = testing allowance (makeup water), gallons per hour
S = length of pipe tested, feet
D = nominal diameter of pipe, inches
P = average test pressure during hydrostatic test, psig

4. A PVC pipeline is acceptable if the leakage does not exceed the allowable limits as determined by the following formula:

   $$L = ND\,(P)^{1/2}/7{,}400$$

   where

   L = allowable leakage, gallons per hour
   N = number of joints in the length of pipe tested
   D = nominal diameter of pipe, inches
   P = average test pressure during leakage test, psi

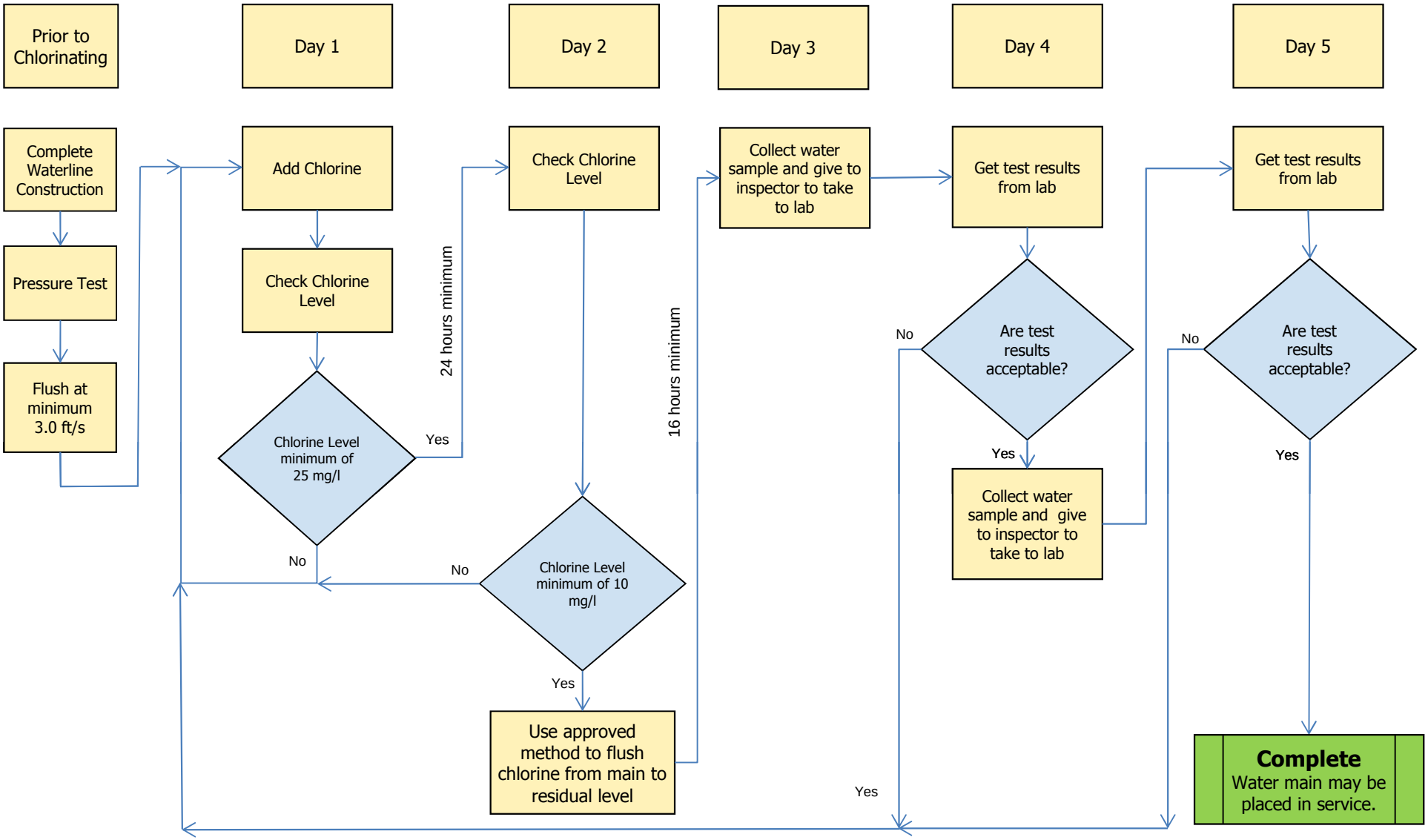
5. Water mains that fail to meet the test standards shall be repaired and retested, at the expense of the Contractor/Developer, as necessary, until the test requirements are met. Not more than 4,000 feet of main shall be installed without testing.

6. Fire lines shall be hydrostatically tested at not less than 200 psi for 2 hours.

3903 ACCEPTABLE MANUFACTURERS AND MODELS

A. General: A list of acceptable manufacturers and models for various materials will be maintained by the City Engineer and updated on a regular basis. An approved list of materials can be found on the City's web site www.cityofls.net. Go to Development, then Development Regulations, then Design and Construction Manual.

Figure 3901-1. Chlorination Flow Chart



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