

DC6 – DESIGN CRITERIA FOR WATER LINE CONSTRUCTION

DC6-001 **GENERAL.** Proposed extensions of the water distribution system shall, in general, follow the pattern of constructing 12-inch water lines along all section lines and 8-inch water lines along all half-section lines. Deviations from this general policy may be deemed necessary by the city engineer should the provision of adequate service to prospective customers or fire protection needs, existing or anticipated, in the area to be served warrant said deviations.

Hydraulic calculations shall be submitted for review with all commercial and industrial plans. Upon request by the City Engineer, hydraulic calculations shall be submitted for residential plans. Typically, these calculations shall be shown on a drawing sheet included in the plans.

All commercial and industrial water lines shall be designed with a minimum of two (2) feed lines (looped system). Dead end lines will not be allowed without approval from the City Engineer.

No public water line shall be constructed less than six (6) inches in diameter. Where water lines less than six (6) inches exist, it shall be upgraded to a minimum diameter of six (6) inches, unless otherwise approved by the City Engineer.

DC6-002 **LOCATION OF WATER MAINS AND APPURTENANCES.** Proposed water mains shall be located in a dedicated ten (10) foot water line easement adjacent to the right of way, in a fifteen (15) foot stand-alone water line easement or, with the City Engineer's approval, within the street right-of-way. Street grades and elevations of proposed main shall be taken into consideration so relocation of the water line will not be required.

Combination air release valves are required at high points of water transmission mains where no services exist or are planned. The profile of the water main shall be designed to limit high points in the line where practical, particularly where mains are installed within the right-of-way.

DC6-003 **DEPTH.** All water mains shall have a minimum cover of forty-two (42) inches.

DC6-004 **MATERIALS OF CONSTRUCTION.** Polyvinyl chloride (PVC) or High-density Polyethylene (HDPE) shall be used for all mains constructed in the City of Gardner, unless approved otherwise by the City Engineer.

HDPE water mains shall conform to AWWA C906. The HDPE pipe shall be Ductile Iron Pipe Size (DIPS) with a minimum Dimension Ratio (DR) of 11. HDPE pipe shall be NSF 61 product certified.

The PVC pipe shall conform to ASTM D1784, ANSI/AWWA C900. Pipe wall thickness shall be DR-18 for pressure class 150 or DR-14 for pressure class 200.

DC6-005 **FIRE HYDRANTS.** Fire hydrants shall conform to AWWA C502.

Hydrants shall be traffic models with breakaway flanges and shall have one 4-1/2 inch pumper nozzle and two 2-1/2 inch nozzles. All hydrants shall be furnished with a six (6) inch auxiliary gate valves.

Hydrants shall be placed at or near street intersections, at the end of dead-end lines and at intermediate points when block lengths exceed 500 feet. Under no circumstances shall the spacing of fire hydrants exceed 500 feet in residential areas or 300 feet in commercial areas. Fire hydrant spacing in industrial areas shall be determined by the Fire Marshal.

Tapping of extended fire hydrant lines for water service lines, irrigation lines and private fire lines in commercial and industrial areas will require the approval of the City Engineer. An additional gate valve will be required at the fire hydrant when tapping has been approved.

Fire hydrant installations shall conform to all applicable Standard Details.

DC6-006 **LINE VALVES.** Gate valves shall be of the resilient-seated configuration and shall conform to the applicable requirements of AWWA C509 and C515.

Gate valves shall be used in all water mains less than sixteen (16) inches in diameter. Butterfly valves shall conform to AWWA C504 and shall be used in all mains sixteen (16) inches and larger in diameter.

Valves shall be placed in all straight runs of pipe at intervals not to exceed 500 feet. Where two lines intersect, a valve should be placed in each pipe on each side of the intersection. Valves should be so placed that any pipe two (2) blocks long can be cut out of the general circulation without interrupting service in the rest of the system.

DC6-007 **CONNECTIONS TO EXISTING WATER MAINS.** Connections to existing water mains shall be made in such a manner as to provide the least amount of interruption to water service. In the event closing of valves to make a connection will affect a customer who requires continuous service, temporary tap(s) shall be scheduled and made for temporary service. Temporary water service shall not be permitted from a fire hydrant. Where possible, connections to existing mains shall be made using tapping sleeves and valves as approved in the City of Gardner *Technical Specifications for Public Improvement Projects*.

All existing ductile iron dead end line assemblies shall be removed prior to the continuation/extensions of waterlines.

When connections are made to an existing system under normal conditions, the exposed pipe and fitting interiors shall be wetted with a 500 mg/L chlorine solution before closure. In emergency situations the exposed interiors of the pipe and fittings are to be swabbed with a 1% chlorine solution.

Wetting and or swabbing are not considered effective methods of disinfection when there is a potential for significant contamination of the main, i.e., sewage is detected in the trench during repairs.

DC6-008 **PROVISIONS FOR FUTURE EXTENSIONS OF WATER MAINS.** At the termination of all water mains or at locations as specified by the City Engineer, a fire hydrant in accordance with Standard Details shall be provided.

DC6-009 **THRUST BLOCKING.** All fittings shall be restrained joint unless approved by the City

Engineer. All piping within the designed distance of fittings shall be restrained joint in accordance with Table 1. The engineer shall determine, and the plans reflect the locations and distances required for the installation of restrained joint piping.

**TABLE 1
THRUST RESTRAINT FOR PVC MAINS AND
FITTINGS FAST GRIP GASKETS**

THE THRUST RESTRAINT TABLES ARE BASED UPON THE FOLLOWING CRITERIA:

1. HORIZONTAL FITTINGS ONLY
2. TYPE NO. 2 LAYING CONDITIONS
FLAT BOTTOM TRENCH, BACKFILL LIGHTLY CONSOLIDATED TO CENTERLINE OF PIPE.
3. CLAY NO. 1 SOIL CONDITIONS
CLAY OF MEDIUM TO LOW PLASTICITY
4. DEPTH OF COVER 3.5 FEET
5. DESIGN PRESSURE 180 PSI
6. SAFETY FACTOR OF 1.5 TIMES PLEASE

NOTE:

ANY TRENCH, SOIL DEPTH OR PRESSURE CONDITIONS WHICH DEVIATE FROM THE ABOVE LISTED CRITERIA SHOULD BE REVIEWED BY THE CITY ENGINEER FOR AN ALTERNATIVE SOLUTION.

TABLE OF PIPE FOOTAGES REQUIRED TO RESTRAIN FITTINGS BY SIZE					
RESTRAINT FOOTAGE IS FOR EACH SIDE OF FITTING					
FITTING	4"	6"	8"	12"	16"
11 1/4 BEND	5'	7'	9'	13'	17'
22 1/2 BEND	9'	13'	18'	26'	33'
45 BEND	20'	28'	37'	53'	70'
90 BEND	47'	68'	89'	129'	168'
DEAD END	37'	53'	70'	102'	134'

TABLE OF THRUST RESTRAINT FOR TEES					
(RESTRAINT IS ON THE BRANCH ONLY)					
BRANCH SIZE	4"	6"	8"	12"	16"
RESTRAINT LENGTH	37'	53'	70'	102'	134'

TABLE OF THRUST RESTRAINT FOR REDUCERS BY SIZE				
REDUCER-SMALL END	12"	8"	6"	4"
LARGE END				
16"	57'/75'	98'/188'	113'/285'	124'/450'
12"	-	54'/79'	74'/142'	88'/245'
8"	-	-	29'/38'	50'/95'
6"	-	-	-	27'/39'

Example: 16" x 12" reducer requires the following: 57'75'
Length of restrained joint piping for the large side of reducer 57 feet

NOTE: If the straight run of pipe on the small side of reducer exceeds 75 feet then no restrained joints are necessary.

DC6-010 **SEPARATION OF WATERLINES AND SANITARY SEWERS.** There shall be no physical connection between a public or private potable water supply system and a sewer, or appurtenance thereto, which would permit the passage of any wastewater or polluted water into the potable water supply.

When potable water pipes and sanitary sewer systems, including gravity mains, force mains and manholes, are installed parallel to each other, the minimum horizontal separation shall be ten (10) feet. Waterlines and sanitary sewer pipes shall not be installed in the same trench, regardless of the width of the trench. In cases where it is not practical to maintain a ten (10) foot separation, alternate designs which provide equivalent protection shall be submitted to the City Engineer and KDHE for approval.

The minimum vertical clearance between waterlines and gravity sanitary sewer pipes shall be two (2) feet. Crossings with less than two (2) feet of vertical separation shall be in accordance the material and jointing requirements of B.1 of Chapter VIII of KDHE's *Policies, General Considerations And Design Requirements for Public Water Supply Systems In Kansas* and pressure tested to assure water tightness pursuant to the most recent revision of KDHE's *Minimum Standards of Design of Water Pollution Control Facilities*. If concrete encasement is the selected alternative when two (2) feet of vertical separation between the gravity sanitary sewer and the waterline, the encasement for the sanitary sewer shall have a minimum thickness of six (6) inches and extend a minimum of 10 feet on each side of the crossing.

The vertical clearance between waterlines and sanitary sewer force mains shall be a minimum of two (2) feet and the waterline shall always cross above the sanitary sewer force main.

Joints in the sewer pipe shall be located as far as practical from the intersected water main.

DC6-011 **SEPARATION OF WATER MAINS AND OTHER POLLUTION SOURCES.** It is of the utmost importance that potable water lines be protected from any source of pollution. The following shall pertain to instances where septic tanks, absorption fields, waste stabilization ponds, feedlots, or other sources of pollution are encountered.

- a. A minimum distance of 25 ft. (7.6 m) shall be maintained between all potable water lines and all pollution sources, e.g., septic tanks, septic tank absorption fields, waste stabilization ponds, sewage contamination, wastewater, landfill leachate, and all CAFO facilities.
- b. Under no circumstances shall a water line be extended through an area that is a real or potential source of contamination to the water line or water supply.

Under no conditions shall the encasement of a water line be considered as adequate protection of a water line or a water supply for the purpose of extending the water line through a real or potential source of contamination.

DC6-012 **HIGHWAY AND RAILROAD CROSSINGS.** All crossings of highways or railroads shall be made by boring or tunneling. Casing pipe shall be greater than or equal to the strength and integrity of the carrier pipe (casing pipe shall conform to the City of Gardner

Technical Specifications for Public Improvement Projects. The installation shall comply with all federal, state and local regulations. The work shall be in conformance with all requirements and regulations of the entity having jurisdiction of the right-of-way.

- DC6-013** **STREET CROSSINGS.** Open cutting of streets shall be allowed only where permitted by the City Engineer. At locations where open cutting is not permitted, the crossing shall be made by boring or tunneling. All work and materials shall be in accordance with the requirements of the City of Gardner *Technical Specifications for Public Improvement Projects.*
- DC6-014** **STREAM CROSSINGS.** Waterlines crossing navigable streams, as determined by the US Army Corps of Engineers, are to be buried at a minimum depth of seven (7) feet beneath the streambed. Waterlines crossing non-navigable streams are to be buried at a minimum depth of five (5) feet beneath the streambed.
- DC6-015** **FIRE FLOW REQUIREMENTS.** Public improvement plans for water line projects serving development sites other than single family or duplex sub-divisions shall be reviewed for fire protection sufficiency by the Fire Marshal. The Fire Marshal shall determine the required rate of flow for fire protection based on I.S.O. guidelines. The Design Engineer shall obtain the flow requirements and then determine if the existing and proposed water lines can provide the minimum flow rate. Calculations verifying the flows shall accompany the drawings when submitted for approval.
- DC6-016** **END OF CUL-DE-SAC.** All waterlines terminating within cul-de-sacs shall be designed in conformance with the applicable Standard Details. The waterline shall be extended to a point where water service lines will not be located under the cul-de-sac bulb.
- DC6-017** **EASEMENTS.** Permanent easements must be provided for all water mains. Permanent easements shall be centered on the main. The minimum easement width shall be 10 feet; however, easement widths may be increased depending upon the size of the water main.
- DC6-018** **MINIMUM SEPARATION FROM OTHER UTILITIES.** Water mains in proximity to sanitary sewer mains must meet the minimum horizontal and vertical separation requirements stated in the City of Gardner's Design Criteria for Sanitary Sewer and Appurtenances. A minimum horizontal separation of 5 feet shall be provided between the outer wall of water mains and all other utilities. The separation between the outside walls of water mains and all other utilities that are within 10 feet of each other must be labeled on the plans. The utilities shall not be placed in a common trench. In addition, the utilities shall be separated by a minimum of 3' of unfinished soil.
- DC6-019** **PRIVATE FIRE LINES.** A private fire line shall be defined as a fire protection main which only has connections to private on-site fire hydrants and/or building fire sprinkler systems. All water lines and hydrants within a development which are classified as a "private fire line" shall conform to the design and specifications of water mains, as stipulated in the *Technical Specifications and Design Criteria for Public Improvement Projects* for the City of Gardner.

Construction of all private water lines requires installation of an isolation valve and a double check detector assembly (DCDA). The DCDA shall be located at the point of connection to the main. Variances from this policy shall be approved by the City Engineer. Maintenance of the backflow prevention device and private water line shall be responsibility of the property owner.

Public water service lines shall not be connected to private water lines. Private fire lines are for fire protection only and are considered non-potable.

Cross connections between a private water line used for fire protection and a public water main shall be prohibited.

DC6-020 **TRACER WIRE.** Underground tracer wire shall be installed to enable detection of all watermains and sanitary sewer forcemains.

Tracer wire used in open cut excavation and horizontal directional drilling applications shall be 12 AWG extra-high-strength copper-clad steel conductor (EHS-CCS). EHS-CCS conductor must be a 21% conductivity for locating purposes and shall have a minimum break load of 1,150 lbs.

Tracer wire used in horizontal drilling and pipe busting applications shall be 3/16” stainless steel, stranded, annealed (HDD). HDD conductor must be a 21% conductivity for locating purposes and shall have a minimum break load of 3,700 lbs.

Tracer wire shall be insulated with a 45 mil, high-density, high-molecular weight polyethylene (HDPE) insulation, rated for direct burial use at 30 volts. HDPE insulation color shall meet the APWA color code standard for identification of buried utilities.

The tracer wire system must be installed as a continuous single wire. Looping of the tracer wire is not allowed. The tracer wire shall be attached to the side of the main with tape or tie-wraps.

All mainline tracer wires must be interconnected where tees and crosses are installed along the main. Connectors in the approved materials list shall be used at these locations and where any other splicing is allowed. Splicing is not allowed on the main line for directional drilling and pipe bursting applications.

The tracer wire shall be brought to the ground surface at access point test stations, water meter pits for service connections, and air release structures. Enough tracer wire is required in each test station or meter pit to extend the wire a minimum of two feet above finished grade. Test stations will be required along the main at a maximum spacing of 800 feet, at intersections (tees and crosses), and at dead-ends. A single tracer wire will extend from the intersection to the test station at the fire hydrant.

All main dead-ends shall be grounded with an approved drive-in magnesium anode rod buried at the same depth as the tracer wire. Extended fire hydrant lines greater than 5 feet from tee, fire hydrants at cul-de-sacs, and forcemain discharge locations are considered dead-ends. Test stations will be installed at locations where grounding is required.

The Contractor will perform a post-construction locate to verify the tracer wire is working as intended. This will be done prior acceptance and the issuance of the Project Completion Certificate.

In addition, electronic locate markers shall be attached to all meter service line connections

to the main and meet the APWA standard color for buried utilities with a minimum frequency of 145.7 KHZ.