WATER DISTRIBUTION SYSTEM DESIGN CRITERIA TECHNICAL MANUAL

CITY OF SAN MARCOS, TEXAS

2/11/2019

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1.1 General

This technical manual presents criteria, standards and regulations related to the design of the water distribution system facilities for general development within the City of San Marcos water service area. The material is directed to the competent design professional and establishes minimum design criteria. Additional requirements for individual water facilities may be imposed by the City of San Marcos as conditions warrant.

Designs for water distribution system construction and improvements shall conform to the most recent edition of 30 TAC Chapter 290 of the Texas Commission on Environmental Quality (TCEQ). Any unintended conflicts between the City of San Marcos and the TCEQ criteria will be resolved by the Engineering & Capital Improvements Director.

Developments proposed within the San Marcos ETJ, but outside the water service area of the City of San Marcos, shall comply with the design and construction standards of the utility certificated to provide service or the City of San Marcos standards, whichever are more stringent.

NOTE: If construction has not begun on the facility within two (2) years of the approval date, design documents must be resubmitted for approval and must include all criteria in effect at the time resubmitted.

The following words and terms, when used in this manual, have the following meanings.

COSM – City of San Marcos representative as deemed appropriate by the Engineering & Capital Improvements Director

Engineering Webpage – http://www.sanmarcostx.gov/323/Engineering-Capital-Improvements

Private Water Facilities – Privately owned and maintained water infrastructure including piping and on site pumps, wells, or storage tanks and associated equipment which conveys water from a water meter to private property. The break in jurisdiction between public and private facilities is at the outlet of the water meter.

Public Water Facilities – Publicly owned and maintained water infrastructure which serves more than one parcel, residence, business or facility and is located in a public easement, right-of-way, or publicly owned property.

Service Unit Equivalents (SUE) - The City established that one SUE is equal to the anticipated impact from one new single-family residential connection. The term Living Unit Equivalent "LUE" is used in some Ordinances and shall be used interchangeably with "SUE".

1.2 Submittal Requirements

1.2.1 Engineering Report

The Design Engineer shall submit an engineering report for all new or modified water connections to the City water distribution system. The following requirements must be shown in the report based off the type of project which is being designed:

1) Site & ROW Permit

a) Hydrant flow/pressure test results which were performed by City Fire Marshall
b) Water Model – of proposed improvements using hydrant flow test as starting conditions.
   i) Total Water Demand; which includes summation of peak hour domestic, irrigation and fire flow
      (1) Fire flow requirements can be found in Chapter 38.053, Appendix B Fire Flow Calculations.
   ii) Model must show residual pressure on the City main, when applying proposed Total Water Demand, does not drop below 35 psi.
   iii) If this minimum pressure is not met, the development must submit a PICP permit to keep pressure adequate.
c) Certification that plans meet all requirements and documentation of any proposed variances or alterations.

2) Public Improvement Construction Project (PICP)

a) All information required by Site & ROW Permit
b) Required mains per the City's current approved Water Master Plan
   i) If the Water Master Plan shows any proposed improvement within the same limits as the PICP, the Developer must upsize the main to the proposed size shown in the Water Master Plan.
   ii) The City may cost participate for the size increase based off the cost difference between what is required for the Development and what is required by the Water Master Plan.
c) Water Model
   i) Full model layout of the Development
   ii) Nodes placed at critical points, such as line connections and pressure plane differences. Nodes must show:
      (1) Available Flow
      (2) Total Water Demand = Fire Flow + Irrigation + Peak Hour Domestic
      (3) Static & Residual Pressure after Fire Flow
      (4) Minimum pressure must be 35 psi
      (5) Maximum pressure must 110 psi; which will require a new pressure plan.
      (6) Indicate all nodes where static pressure exceeds 80 psi; which will require pressure reducing valves after meters.
d) Certification that plans meet all requirements and documentation of any proposed variances or alterations.

3) Capital Improvements Project (CIP)

a) Required mains per the City's current approved Water Master Plan
b) If the main is not shown on the Water Master Plan, replace with minimum of 8" water main or match existing; whichever is greater.
c) Replace all water services to the existing meter using current details.
d) Certification that plans meet all requirements and documentation of any proposed variances or alterations
e) Engineer's Opinion of Probable Construction Cost

1.2.2 Construction Plans

Construction plans shall be submitted in PDF format as well as two (2) hard copies. The following information should be provided on the construction plans:

1) Site & ROW Permit

a) See Design Checklist – minimum plan requirements are shown on this checklist which can be found on the Engineering webpage

b) Additional Plan Requirements, required to be ***shown to scale***:

i) All meter locations with size and type callouts
ii) All tap locations
iii) All valve locations
iv) All fire hydrant locations
v) All backflow preventer locations with size and type callouts
vi) Grading and proposed condition

2) Public Improvement Construction Project (PICP)

a) See Design Checklist – minimum plan requirements are shown on this checklist which can be found on the Engineering webpage

b) See Standards For Electronic Submittals Checklist – additional requirements for electronic file submittal

c) If there are no standards or specifications available on the City webpage, then the design engineer must prepare all required documents and submit to the City for review and approval

3) Capital Improvements Project (CIP)

a) See Plan Review Checklist – minimum plan requirements are shown on this checklist which can be found on the Engineering webpage

1.2.3 Special Designs

The City's Engineer may, upon written request, approve an alternate design or construction methodology that differs from the requirements in this manual if the City's Engineer determines that:

1) The alternative design or construction methodology is equivalent to, or superior to, the methodology required in this manual, and
2) The alternative design or construction methodology is sufficient to ensure public health and safety.

1.3 Water Line Designations

Water system line designations are as follows:

(a) Transmission water lines are generally lines conveying water from pumping facilities to reservoirs or lines conveying water directly between pumping facilities or directly between reservoirs. Such lines may not be tapped for any purpose without special approval.
(b) Distribution water lines are generally lines providing local distribution of water and from which individual user service taps are made. Distribution lines stem from transmission lines or from other local distribution lines.
(c) Service water lines are lines providing service from the distribution line directly to the individual's meter.
(d) Private services are service lines on private property on the customer side of the meter and are the responsibility of the customer.
(e) Fire Hydrant leads are pipes connecting a fire hydrant to distribution or transmission water line.

1.4 Water Design Demands

The developer's engineer is responsible for sizing all new waterlines within the development and submitting these sizing calculations to the City for acceptance. The developer's engineer will recommend one of the following 3 methods to City Staff for sizing. The final decision will be made by City Staff on which method shall be used.

a) Sizing of off-site waterlines shall conform to the Water Distribution System Master Plan, where applicable.
b) In other instances, computer modeling is the required method for sizing water lines.
c) The minimum requirement is for the design engineer to submit hand calculations justifying the size of the proposed waterlines.

The following criteria are to be used in sizing new waterlines.

Table 1: Design Parameters

Hazen Williams Coefficient (PVC)	150
Hazen Williams Coefficient (DI)	130
Service Unit Equivalent (SUE)[1]	
Single-family residential	1.0 SUE per unit
Multi-family residential	0.66 SUE per unit
Average Day Demand	0.24 gal/min/SUE
Maximum Day Demand	0.70 gal/min/SUE
Peak Hour Demand	0.4 gal/min/SUE
Maximum Pressure	110 psi
Minimum Pressure[2]	35 psi
Note 1 *Refer to General Code of Ordinance Chapter 86 Article 5: DIVISION 4. - IMPACT FEE ORDINANCE OF THE SAN MARCOS CITY CODE for required SUE parameters.*	
Note 2 *Lines shall be sized to provide for either the peak hour demand plus a fire flow demand. Fire flows shall conform to Insurance Standards Office (ISO) standards. The fire marshal has identified minimum fire flow requirements based on type of construction for use in determining line sizing. In all instances, a minimum fire flow of 1000 gpm will be required for design purposes. When the City determines that a waterline needs to be larger than required to facilitate future services in the area, the City may require that a waterline may be oversized.*	

1.5 Determination of Pipe Size and Material

The following nominal pipe sizes will be the only sizes allowed for use in the distribution system:

Table 2: Pipe Size & Material

Use	Pipe Material	[1]Pipe Sizes	[2]SPL
Service lines	Copper Tubing	1”	WW-613
Service lines	PVC	2”	WW-587
Service lines	PVC	4”, 6”, 8”, 12”	WW-308
Fire Hydrant Lead	DI	6”	WW-27
[3]Distribution lines	PVC	8” or 12”	WW-308 or WW-308A
[3]Distribution lines	DI	8” or 12”	WW-27 or WW-27F
Transmission lines	PVC	16” or 24”	WW-308C
Transmission lines	DI	16” or 24”	WW-27 or WW-27F

Note 1
If the required pipe size is not listed; then install the next larger size listed and reduce to the needed size at the meter per the COSM details. See COSM details for more information.

Note 2
The COSM Standard Products List (SPL) can be found on the engineering webpage.

Note 3
The minimum distribution system line size is eight (8) inches, with the exception of short Cul-de-Sacs as indicated in Section 1.8.6 Cul de Sacs

1.6 Main Alignment and Location

All Public Water Facilities shall be located in dedicated public right-of-way or in a water easement dedicated to the City or on public property. The typical assignment for new waterlines in new streets shall be under the pavement, seven (7) feet from the back of curb, or five (5) feet from the edge of pavement for streets without curbs. These assignments shall be based on the north or east curb line or edge of pavement. Where feasible, these assignments should be maintained for new waterlines installed in existing streets. Assignments for major streets should be discussed with the City. Alternative assignments must maintain appropriate separation distances per TCEQ regulations and must be approved by the City. In all cases, the separation distance between wastewater and water facilities shall comply with TCEQ §290.44. Water mains shall be installed with a minimum clearance of 48 inches horizontally and 24inches vertically from other utility or drainage lines. Variances will be considered on a case by case basis.

Easements shall be a minimum of 20 feet in width for a 12” or smaller line, with minimum cover defined in *Section 1.8.3 Embedment and Depth of Cover*. The City will require greater easement width depending on pipe size, depth, and location and future accessibility of the easement based on characteristics such as slope or other factors. Easements that are intended to accommodate multiple pipelines will require wider easements. Installation of water mains shall be 8’ from one side of the easement. Utility or easement lots may be appropriate in some cases. New water lines should not be installed underneath or along the side slope of a waterway or drainage system detention facility.

The City may require the location of a proposed water main within a site to be revised based upon proximity to any existing or proposed buildings. Where possible, water lines should be located at least 20 feet away from structures, however size and depth of proposed water line may increase distance.

1.7 Service Alignment and Location

All residential connections and service leads shall be installed according to the City's Standard Details on both sides to edge of right-of-way or easement at the time of main line installation.

1.7.1 Service Taps

Service connections shall only be tied into distribution mains. Service connections shall be shown on the plans per COSM detail 520S-WMT-SM.

Taps that are 2 inches or greater shall require a gate valve. Corporation stops are only acceptable on 1 inch taps.

Service connections will not be allowed on transmission mains, without approval from the City. Lines that are 16 inches in diameter or larger, are designed to deliver water from a large supply to a large demand area. Parallel distribution mains must be constructed to provide for the service tap. The parallel main shall be extended across the width of the property frontage in accordance with the City's main extension policy. These parallel lines shall be connected to the transmission main or other distribution mains at intervals not to exceed 500 feet. The minimum size of the parallel line shall be six (8) inches. Variances for a four (4) inch parallel main will be considered on a case by case basis.

1.7.2 Service Lines

House services, single and dual, shall be 1-inch diameter, copper tubing. The developer's engineer shall determine service line sizes for multi-family, commercial, or fire lines. The pipe material for these services shall be in accordance with Table *2*: Pipe Size & Material

1.7.3 Pressure Reducing Valves

Individual pressure reducing valves (PRVs) shall be installed on services where the static pressure in the main is greater than 80 psi. The PRV shall be located on the property owner's side of the water meter.

1.7.4 Backflow Prevention

All service lines shall be provided with a testable, double check back flow prevention device per section 86.592 of the City Code.. Service lines for customers that have been identified as having a high backflow hazard will be required to install a reduced pressure zone (RPZ) backflow prevention assembly. The back flow prevention device should be located on private property, as close as possible to the public right-of-way or easement.

All fire lines are to be tested at 200 psi for two hours. A State licensed/certified back flow prevention assembly tester must inspect all backflow prevention devices and the results shall be submitted to the City.

1.7.5 Meter Boxes & Vaults

Meter boxes shall not be installed in the sidewalk or driveway, without approval from the City. Typically, this is only allowed when the street cross section does not have a green space. Proposed sidewalk and ROW/easement line shall be shown to confirm meter boxes are not being installed within the sidewalk or on private property. The engineer shall confirm the meter box placement is shown on the plans per COSM 520S-series details.

Concrete meter vaults are required for services that are 1.5" and larger. The engineer shall account for the required space of the vault in the design. Refer to COSM 520S-series details for more information.

Meter boxes & vaults shall be shown on the plans, to scale, using dimensions of items listed on the COSM SPL to verify there are no conflicts.

1.7.6 Meter Sizing

The meter shall be sized using the Peak Flow/LUE calculator, which can be found on the Design & Construction Guide of the Engineering webpage under the "Complete Site Preparation Plans" tab. The engineer may upsize the line, ***on the other side of the backflow prevention device***, if needed to reduce the velocities in the line prior to entering the building. The Peak Flow/LUE calculator does not apply to irrigation meters.

1.8 Pipeline Design

Water mains shall be designed with minimal bends and avoid creating high points. The design of the water distribution mains should provide safe, full and economical access for maintenance and repair, reliability of location and minimum disruption to surrounding facilities during repair operations. In all cases, water facilities shall comply with TCEQ requirements and the Fire Code.

Design plans shall be prepared using the COSM standard specifications, details and standard products list located on the Engineering webpage. ***City of Austin standard specifications, details and standard products are not acceptable***, unless the City does not have the required documentation and written approval must be requested from the City.

Please refer to the "Design & Construction Guide" on the engineering webpage for other useful guides and checklists.

1.8.1 Highway and Railroad Crossings:

Water distribution mains that cross state highways must conform to the City's Technical Specifications and the requirements of the Texas Department of Transportation (TxDOT). Water distribution mains that cross railroads must conform to the City's Technical Specifications and the requirements of the railroad company whose right-of-way is being crossed. All crossings of existing streets must use dry bores, unless otherwise approved by COSM. The City requires copies of approved permits from the Owner before the City can approve a plan for construction in ROW not owned by the City.

Above-grade crossing for water distribution mains at creeks or drainage channels will not be allowed. Below grade crossings of creeks and drainage channels shall have a minimum cover as indicted by detail 510S-TD-SM. All below grade crossings will require encasement with steel encasement pipe and all ends shall be capped and sealed. The casing shall be carried into the bank a distance that should consider changes in the creek channel. This distance would usually be beyond the high bank such that if you measured a 1:1 slope from the high bank away from the channel, the casing would terminate at that location. Directional drilling will be considered under special circumstances only. City staff may require these crossing to be bored if there is concern about scour or returning the creek crossing back to pre-construction condition.

1.8.2 Encasements:

Steel cylinder pipe shall be used for all encasement pipe unless approved by COSM. Encasement pipe thickness and diameter shall be shown on the design plans per the table show in COSM Detail 501S-1-SM. The casing shall be steel pipe conforming to ASTM 134 per COSM standard specification 505S. Coating of encasement pipe may be required in special soil conditions.

1.8.3 Embedment and Depth of Cover

Embedment material for water system construction shall conform to the City's standard details and the pipe manufacturer's recommendations, whichever is more conservative. The profile shall be prepared using the table shown in COSM Standard Detail 510S-TD-SM.

- For water installation that include new road construction, the depth of cover shall be measured from the **bottom of the paving base**
- For water installation that does not include new road construction, the depth of cover shall be measured from **the top of existing paving**
- Depth of cover for a 16" is more stringent than a 12" water main
- In no case will a minimum depth of cover of less than two (2) feet be allowed

1.8.4 Thrust Restraint

All thrust restraint shall be accomplished with mechanically restrained joints. Concrete thrust blocking is NOT acceptable. The restrained joint design shall conform to the following:

a) Water line tees, bends, valves and fittings must be restrained against thrust forces to prevent movement or failure of the water line.
b) The designer is responsible for providing, on the construction drawings, an adequate restraining system design for the waterline, including minimum length of restrained pipe required in each direction. Computer programs to calculate restrained joint requirements, as distributed by EBAA Iron, Inc and CertainTEED are acceptable.
c) Restraint distance shall be shown on the plans
    - All input information used to calculate the restraint length must be shown on the plans.
    - This must include identification of calculation program used and all variables inputted as required per calculator.

1.8.5 Looping And Dead End Mains

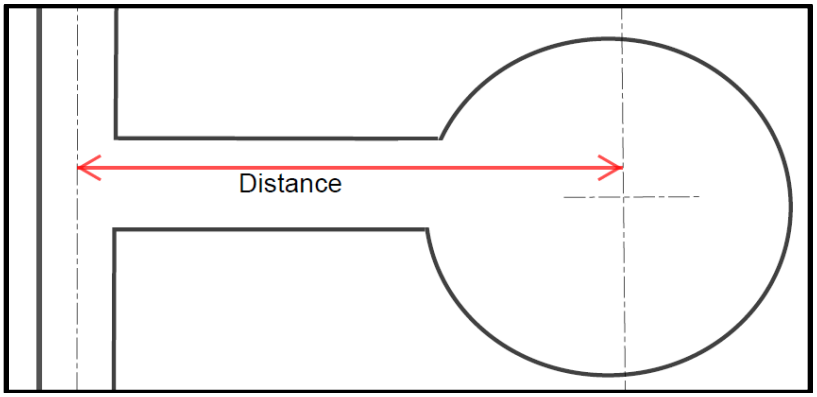
Where feasible, all pipelines other than those in cul de sacs, should be connected to other distribution system pipelines so that all services may receive feed from two directions for system redundancy.

Dead end mains shall not exceed 1,320 feet. If a dead end main is proposed under a temporary condition, it may be allowed under the following conditions:

(1) The extension is shown on the overall development plans
(2) An automatic flush valve is installed
(3) Fire protection and demand can be met with the dead end main.

1.8.6 Cul de Sacs

The distance of a cul de sac shall be measured from the centerline of the connecting street to the centerline of the cul de sac circle.



All cul de sacs **longer** than 300' shall meet the following requirements:

(1) Fire hydrant installed at the intersection of the cul de sac and the connecting street
(2) Fire hydrant install at the end of the cul de sac circle
(3) Additional fire hydrants as required to satisfy the spacing indicated in section *1.10 Fire Hydrants.*
(4) Install 8" water main

All cul de sacs **equal to or shorter** than 300' shall meet the following requirements:

(1) Fire hydrant installed at the intersection of the cul de sac and the connecting street
(2) If **no additional** fire hydrants are required to satisfy the spacing indicated in section *1.10 Fire Hydrants*; then:
    (i) Install a 2-inch blow off valve behind the curb at the end of the line
    (ii) Install 6" water main
(2) If additional fire hydrants **are required** to satisfy section *1.10 Fire Hydrants*, then follow the criteria for cul de sacs longer than 300'.

1.9 Valves

Refer to the COSM SPL for approved valves.

1.9.1 Isolation Valves Types

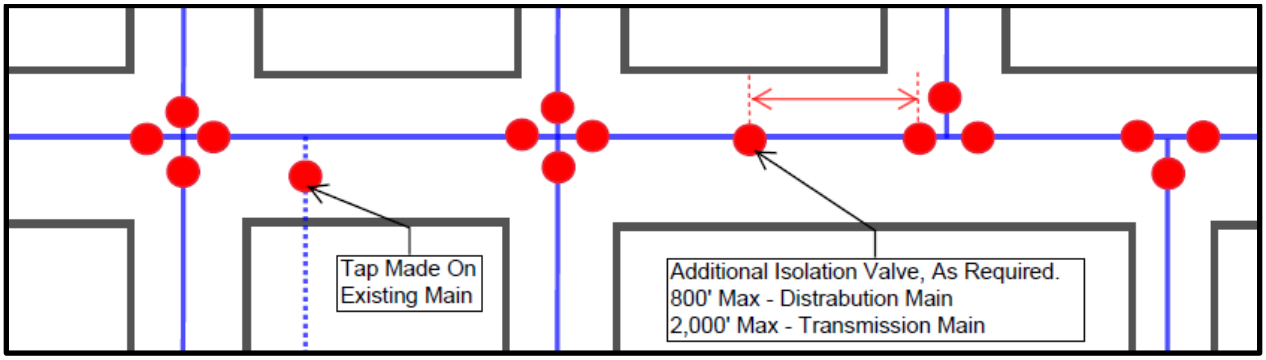
Isolation valves shall be gate valves (2" – 24") and conform to COSM Standard Detail 511S-7SSM and SPL WW-700B. Butterfly valves are not acceptable.

1.9.2 Isolation Valves Locations

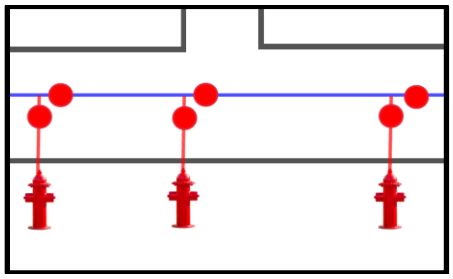
Isolation valves should be located on all branches of new mainline tees or crosses, including those cut into an existing main. If an existing main is tapped to make a service connection, only one valve at the tap is required.

Additional isolation valves shall be installed on the main at intervals of:
1) No greater than 800 feet on distribution mains
2) No greater than 2000 feet on transmission mains.
3) No more than water service to 50 lots

The Water Department may require more frequent spacing of valves.



Isolation valves shall be placed on all fire hydrant leads. All fire hydrants shall have a mainline valve adjacent to the fire hydrant lead or positioned such that the closing of three valves shuts down the main and only puts one fire hydrant out of service.



Isolation valves provided on both sides of the bore under State highways, railroads or large creeks/rivers.

1.9.3 Air Release Valves

On mains 16 inches and larger, air release valves shall be located at all significant high points. A significant high point is defined where the crown of the pipe is greater than 1.5 times the diameter of the pipe above the flowline of the pipe in the adjacent low points. Air valves are not required in smaller water distribution mains of 12" or smaller in diameter where fire hydrants and service connections provide a means for venting trapped air.

Air valves can be sized as per "Manual of Water Supply Practice, M51: Air-Release, Air/Vacuum & Combination Air Valve by AWWA, latest edition" or other methods as applicable.

1.10 Fire Hydrants

1.10.1 Spacing

Table 3: Fire Hydrant Spacing

Dwelling Type	Spacing (Feet)	Remarks
Single Family Residential Development or Single Family Duplex	500	Additional fire hydrants shall be installed as necessary, so that every portion of every building in the EJT will be within 500 feet of a standard city fire hydrant, measured along accessible approved roadways.
All Others	300	

1.10.2 Locations

The location of all public fire hydrants shall meet the following criteria:

- Fire hydrants shall be located as near to the street intersections as possible but out of the radius of curb turnouts, within 1.5' to 12' behind curb or projected future curb.
- Fire hydrant locations between street intersections shall be at the projection of a property line between owners.
- New fire hydrants shall be placed as close to the location of the existing fire hydrant to be replaced as possible.
- Rail lines, controlled access highways, divided roadways, fences and walls will inhibit laying the fire hose in the most direct route and must be considered as barriers when determining whether a structure is within 500 feet of a hydrant.
- Fire hydrants shall be located at all low points on transmission lines per detail 511-BH-SM.
- Fire hydrants shall not be installed within nine feet vertically or horizontally of any wastewater main, wastewater lateral, or wastewater service line regardless of construction.

1.11 Abandonment of Facilities

If a new project will abandon existing facilities, the plans shall provide for the appropriate abandonment of these facilities. The plans shall include, at a minimum, the location, sequence, details, and methodology for abandoning the facility. Abandonment shall be considered permanent. Area shall be restored to a condition acceptable to COSM.

(a) Water Mains - *see Modifications 510.3(31)*
All existing water mains to be abandoned upon completion of the project shall be cut and plugged at the general location shown on the plans. An approved plug shall be used and the exact locations shall be marked and field verified with the Owner.

(b) Water Services - *see Modifications 510.3(31)*

- **Services on abandoned mains**
  - Water meters to be abandoned shall be removed at the locations indicated on the plans and the meters and meter boxes delivered by the Contractor to a yard located at 630 E. Hopkins, San Marcos, Texas.
  - Service lines shall be cut 12" below ground
- **Services on active mains**
  - Water meters to be abandoned shall be removed at the locations indicated on the plans and the meters and meter boxes delivered by the Contractor to a yard located at 630 E. Hopkins, San Marcos, Texas.
  - Service shall be removed per COSM detail 510S-AT-SM

(c) Water Valves – *see Modifications 511S.4.K*
All gate valves connected to an abandoned water main shall be abandoned by removing the top 6" of the valve box and filling the valve box with concrete (packaged concrete is acceptable). The surface shall be restored to match existing conditions, this includes but is not limited to asphalt, concrete or sod.

(d) Fire Hydrants – *see Modifications 511S.4.K*
All fire hydrants connected to an abandoned water main shall be abandoned by cutting the fire hydrant 6" below the ground and filling with concrete. The surface shall be restore to match existing conditions, this includes but is not limited to asphalt, concrete or sod.

All abandoned fire hydrants shall be delivered by the Contractor to a yard located at 630 E. Hopkins, San Marcos, Texas; unless otherwise indicated by the Inspector.

END OF SECTION