



SECTION 2

Design Manual

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SECTION 2

DESIGN MANUAL

STANDARD REQUIREMENTS FOR DESIGN OF DOMESTIC WATER AND SANITARY SEWER FACILITIES

2.01 GENERAL WATER AND SEWER REQUIREMENTS

All proposed work shown on plans submitted for approval shall be designed according to these standards. In all matters the District Engineer's decision shall be final.

These guidelines have been developed to assist consulting engineers and developers of any type of development or improvement which requires connection to Fallbrook Public Utility District's existing water or sewer systems. The guidelines presented herein are acceptable to the District and following them will require the least amount of review time.

Every effort was made to provide criteria for any situation that may come up in the design process, however, the private engineer's ultimate aim should be directed toward providing a water system for both domestic and fire fighting purposes and a sewer system to accommodate the design waste flows as indicated in this document. However, all plans showing water or sewer systems shall be subject to review and final approval by the District Engineer.

The District Engineer, at his discretion, may grant exceptions to these Standards, providing such exceptions will substantially conform to the intent of these Standards. No exceptions will be granted without the express written consent of the District Engineer.

2.02 WATER REQUIREMENTS

A. SYSTEM CAPACITY

The capacity of the water distribution system shall deliver the maximum daily demand *simultaneously* with the required fire flow at a minimum residual pressure of 20 psi at all fire hydrants. Fire flow requirements are as required by the North County Fire Protection District.

B. PIPELINE SIZING

Pipelines shall be sized to provide the required capacity as indicated in Paragraph 2.02A of this section. The design shall accommodate requirements for maximum hour or maximum daily demand plus fire flow, whichever is greater.

Design calculations shall be done by a registered engineer and submitted to the District for approval. The minimum main size shall be 6-inch for all zones, except Commercial and Industrial zones which shall have a minimum 12-inch mainline size. Acceptable main line sizes are 6-inch, 8-inch, 10-inch, 12-inch, 16-inch and 24-inch only. Variations from this standard must be approved by the District Engineer, but in no case will variations be

allowed that are in conflict with Section 64628 or Title 22 of the California Administrative Code.

Oversizing of a mainline can be required by the District Engineer for future development. If oversizing is required by the District, the District's Board of Directors may authorize payment to compensate the developer for the oversize. Only mainlines greater than 12-inches in diameter may be eligible for reimbursement and only if the oversize is required by the District Engineer.

All pipes must be sized in accordance with the current version of the Water Master Plan for FPUD unless approved by the District Engineer. All pipes must be sized so that the velocity shall not exceed 5 fps during peak hourly flow and 10 fps at maximum day plus fire flow.

C. HORIZONTAL ALIGNMENT

When possible, all water mains shall be located in the paved street, 7-feet north or west from the face of the curb unless otherwise required to clear obstructions. The location for any mainline within easements shall be approved by the District Engineer. When a roadway has not been completely developed, the District may elect to locate the main in the unpaved portion of the right of way in order to align the pipe with the future paved roadway.

On side hill streets, the main shall be located on the cut side of the center line of the street or on the high side of super-elevated curves. Where the water main is to parallel a sewer or storm drain, there shall be a minimum horizontal clearance of 10-feet from the sewer or storm drain or other wet utilities unless otherwise approved by the District Engineer. The separation of water and sewer lines must comply with the California Department of Health requirements. No gas or sewage main, electric, telephone, or cable television, or other utility line shall be installed in the same trench with any water mains or water lateral.

In Subdivisions the water main or sewer main shall be extended across the end of the last parcel or lot split or to a point beyond the permanent street paving. Water mains must be looped as required by the District Engineer and the Water Master Plan. Water and sewer improvements for Parcel Maps shall be extended 20 feet into the last parcel to be served.

D. VERTICAL ALIGNMENT

Invert grades of water mains shall provide minimum and maximum cover requirements as specified below and also ensure proper clearance between top of valves and valve box covers. Minimum cover from grade to the top of pipe for all water mains shall be as follows: 30 inch minimum cover and 36 inch maximum cover

No mains or service laterals shall be surface installed except in temporary situations as necessary to maintain service during construction or maintenance. Each case must be approved by the District Engineer prior to construction.

E. PIPE MATERIALS

All water mains shall be CML&C Steel Pipe. Joints shall be welded joint unless otherwise approved. In all cases, the District Engineer reserves the right to specify the type of pipe, joint, or class of pipe to be used.

The class of water mains shall be determined by the maximum pressure to be expected in the line including pressures resulting from surges. . The class of pipe and test pressure shall be shown on the plans.

F. VALVES

Valves shall be located at all branches or intersections of mainlines. The valves shall be flanged and be bolted onto a cross or tee.

All water system designs shall include valves so that the spacing between valves shall be less than the following:

- 1,000-feet for transmission mains 16 inches or larger
- 750-feet in residential areas.
- 500-feet in all other areas.

Where a new main is connected to an existing main, valves on both the new and the existing mains shall be installed as required above (where the District Engineer determines that it is impractical to shut off an active main for connection, a tapping sleeve with tapping valve may be allowed). Valves may be required near the end of a main line that will be extended in the future to minimize the number of times live mains are shut down.

No valve shall be installed where the invert slope of the mainline exceeds 6%. Valves shall be located so that there will be minimum clearance of 6-inches between the top of the valve and the bottom of the valve box cover.

All valves shall be a rated for the working pressure of the mainline. The class of valve shall be shown on the plans. FPUD has areas where pressures exceed 250 psi and the District Engineer must specify the use of appropriately classed valves.

Specific types of valves shall be as follows except when approved by the District Engineer:

- Resilient wedge gate valves will be used for all lines where static pressure is less than 150 psi.
- High pressure resilient wedge gate valves will be used where static pressure is between 150 psi and 250 psi.
- Plug valves shall be used where static pressure is 250 psi or above.

G. BLOW OFF ASSEMBLY

Blow-off assemblies shall be installed at all system and local low points. Blow-off assemblies shall be as shown on the FPUD Standard Drawings. Blow-off assemblies shall be installed at the end of dead end lines. Fire hydrants shall be used whenever indicated by the District Engineer.

Blow-off Sizes

Blowoff assemblies shall be sized and located as shown on the FPUD approved plans. Generally, blow-offs will be located at the end of a pipeline or at a low point on a given pipeline.

Pipe size	Blow-off Size	Valve size
6" & 8"	2"	2" BV
> 8" to 16"	4"	6" GV
> 16"	6"	6" GV

H. AIR RELEASE AND VACUUM RELIEF VALVES

Air release and vacuum relief valve assemblies shall be installed at all system and local high points and just downstream of shut-off valves. Whenever possible, air release and vacuum relief valve assemblies shall be installed at the BC or EC on curb returns. Air release and vacuum relief valve assemblies shall be as shown on FPUD Standard Drawing and sized in accordance with the manufacturer's requirements. Calculations for sizing of air release and vacuum relief valves shall be submitted for approval. All Air Vac assemblies shall be capped. (FPUD Standard Drawings W-11 and W-12).

Pipe Size	6" to 14"	16" to 20"	> 20"
AR/VR Valve	2"	4"	6"

I. FIRE HYDRANTS

Fire hydrants shall be installed in locations and spaced as directed by the North County Fire Protection District and conform to the FPUD Standard Details. The fire flow requirements are as required by the North County Fire Protection District. Under special conditions, the District Engineer may require higher fire flows. Unless otherwise directed by the District Engineer or the North County Fire Protection District, the location of hydrants shall conform to the following requirements: (See FPUD Standard Drawings W-9, W-10)

1. Hydrants shall be located in front of a boundary line between lots.
2. Hydrants shall be located on the cut side of side hills
3. Whenever possible fire hydrant assemblies shall be installed at the BC or EC on curb returns
4. All fire hydrant shut-off valves will be securely fastened directly to the distribution main by a tapping sleeve and valve or by flanging the valve onto a flanged tee.

5. As-built plans must show actual fire flow and pressure with date and time of test for each hydrant. Pressure data is to include static and residual pressure during the test per AWWA testing procedure.
6. Direction of the 4-inch outlet shall be a 90° angle to the road. Any deviation shall be subject to the approval of the Fire Marshal. (FPUD Standard Drawings W-9 and W-10).

J. DEAD END MAINS

All dead end water mains shall have provisions for flushing. Extending a fire hydrant or blowoff directly off the end of the mainline is acceptable.

K. WATERLINE CROSSINGS

Where proposed water mains cross or are constructed parallel to any proposed sewer, storm drain or recycled water facility the water mains shall have their invert elevation a minimum of 1-foot higher elevation than the top of the other utility. Any deviation to this design parameter must be approved by the District Engineer. The requirements of the California Department of Public Health for water crossings shall be enforced in all situations.

L. CORROSIVE SOILS

A soils report is required with the first plan check for all improvement projects and shall specify potentially corrosive soils based on soil boring samples and laboratory analysis. Based on the soils report, the District Engineer may require corrosion protection methods be implemented as part of the project. This implementation may include, but is not limited to, design drawings and Specifications created by a licensed Corrosion Protection Engineer.

In all cases, the details of the materials and methods to be used shall be as approved by the District Engineer. If cathodic protection is required, it shall be designed by a licensed Corrosion Protection Engineer and approved by the District Engineer.

M. WATER SERVICE CONNECTIONS.

Services and connections on water mains shall be installed for each property in accordance with the Standard Details. Where practical, services shall not be located adjacent to electric, telephone, and sewer lines leading into the property to be served. Only one (1) meter shall be connected to a single service lateral. All services shall be located at right angles to the distribution main except to serve rear lots per FPUD Standard Drawing W-17. The property to be serviced must abut a water main.

Services shall not be connected to 16-inch or larger mains unless specifically permitted by the District Engineer. Service connections of appropriate size shall be provided to connect such lateral with each meter site. Services shall have a minimum cover of 30-inches within the street pavement area. No services shall be high-lined.

The size, location, and type of material of each service shall be indicated on the Construction Plans. Each residential unit requires a minimum 1-inch service line . Design

calculations used to size the services shall be submitted to the District Engineer for approval.

Services and connections shall be of type K copper with appropriate valves, stops, and fittings, as shown in the Standard Details. Services shall be connected to the main in accordance with the Standard Details. Meter boxes shall be furnished by and installed by the Contractor as shown on the Standard Details. Meter boxes shall not be installed in driveways or sidewalks.

N. BACKFLOW PREVENTION

All irrigation meters and meters for commercial and industrial users require a reduced pressure principal backflow prevention device.. Unless otherwise directed by the District Engineer the location of the approved assemblies shall conform to the following requirements: (FPUD Standard Drawings W-1A and W-2A).

1. Backflow preventers shall be located downstream of the water meter and prior to any branch connections on the customer side.

O. HOT TAPS

Hot taps to an existing water line are allowed for water services, fire hydrants, air release and vacuum relief assemblies, and blow off assemblies. All hot taps shall be done only with the approval of the District Engineer. All hot taps shall be made with the District Engineer or designee present.

All Hot Taps done on Asbestos Concrete Pipe shall utilize a ROMAC JCM 432 SST tapping sleeve or approved equal. The ¾-inch test plug shall be removed and a pressurized water hose shall be attached and turned on while drilling is being conducted in order to flush out excess debris. The test plug shall be replaced after drilling and tightened in accordance with the manufacturer's recommendations.

P. TIE-INS

Prior to construction, the Contractor shall pothole the existing pipe at the location of the proposed connection. To facilitate the proposed connection and allow for slight adjustments in alignment, the Contractor shall leave a minimum 10-foot gap between the new pipe installation and the proposed connection point at the existing water main or as directed by the District Engineer. The new pipeline shall have successfully passed pressure testing in accordance with Section 15044 and disinfection and bacteriological testing in accordance with Section 15041 prior to proceeding with the connection to the existing pipeline. All tie-ins shall be made with the District Engineer or designee present.

All tapping valves, saddles, and fittings must be disinfected prior to use. The District Engineer may postpone or reschedule any shutdown operation if, for any reason, the District Engineer believes that the Contractor is improperly prepared with competent personnel, equipment, or materials to proceed with the connection.

2.03 SEWER REQUIREMENTS

A. MAINLINE SIZE

No public collection sewer shall be less than 8-inches in diameter. The following criteria shall be used in determining the size of pipes:

1. Flow estimates shall be determined as the product of the number of equivalent dwelling units (EDUs) and a unit flow factor. Flow factors for average and peak flows are presented in the following paragraphs.
2. Average Flow - A flow factor of 255 gpd/EDU shall be used to calculate average sewage flows. Table 1-2-1 presents EDU Factors adopted by FPU D Ordinance that shall be used to determine the number of EDU's for a given land use.

SCHEDULE OF EQUIVALENT DWELLING UNITS AND CLASS OF SERVICE

TABLE 1-2-1

Class 1	Single-family residence or mobile home in individual parcel	1.00
	Detached cottage with bathroom and kitchen on a parcel with a single-family residence	0.80
Class 2	Apartment or condominium complex (per/unit)	0.80
Class 3	Mobile home park (per/unit)	0.80
Class 4	Motel or hotel each unit with kitchen	0.80
	Motel or hotel each unit without kitchen	0.50
Class 5	Business- per each separate business	
	First 3,500 square feet (exterior building area)	1.33
	Each additional 1,000 square feet (exterior building area)	.38
Class 6	Automobile service station	
	If not more than four (4) Gasoline pumps	2.00
	If more than four (4) Gasoline pumps	3.00
	For each RV holding tank disposal station	1.00
Class 7	Church, fraternal lodge, or similar auditorium	
	For each two hundred (200) persons of seating capacity	1.00
Class 8	Bakery- for each 3,500 square feet (exterior building area)	1.00
Class 9	Theater- for each one hundred fifty (150) persons seating capacity	1.33
Class 10	Hospital – per bed	0.65
Class 11	Convalescent or boarding home – per bed	0.30
Class 12	Labor camp – per bed	0.10
Class 13	School (public or private)	
	Elementary school- per each sixty (60) students or part thereof	1.00
	Junior high school- per each forty (40) students or part thereof	1.00
	High school- per each thirty (30) students or part thereof	1.00
Class 14	Mortuary	1.00
Class 15	Special class	1.00
Class 21	Car wash	5.00
Class 22-5	Grocery store under 2,500 square feet	3.00
	Grocery store under 2,501 to 7,000 square feet	4.00
	Grocery store over 7,000 square feet	5.00
Class 23	Self-service laundry	5.00
Class 24	Restaurants	
	under 2,500 square feet	3.00
	under 2,501 to 7,000 square feet	4.00
	over 7,000 square feet	5.00
Class 88	Standby	0.24

Design Peak Flow shall be 3x Average Flow. Sewers greater than 12-inches in diameter shall be designed with a d/D of 2/3. Sewers 12-inches in diameter and less shall be designed for a d/D of 1/2.

A value of 0.013 shall be used as a coefficient of roughness equivalent to Manning's "n" or as approved by the District Engineer.

All sewers shall be designed and constructed with hydraulic slopes sufficient to give mean velocities at design day quantities of flow of not less than 2-feet per second. Maximum velocity shall not exceed 10-feet per second.

Following are minimum slopes that should be provided. These are guidelines that shall be verified by the design engineer with calculations showing a cleansing velocity of 2-feet per second, provided to the District Engineer.

<u>Sewer Size, Inches</u>	<u>Minimum Percent Grade</u>
8	0.4%
10	0.32%
12	0.24%
15	0.15%
18	0.12%

All sewer main pipe inverts shall be shown on profile on the improvement plans and shall include stations, slope and distance.

B. SEWER FORCE MAINS

1. Force mains may not be constructed in the same trench as sewers. Minimum separations from waterlines shall be those specified for sewers. Insofar as practicable, force mains shall be laid at continuously ascending grades without intermediate high points or low points.
2. Minimum cover for force mains shall be 4-feet from finish grade to top of pipe, plus additional vertical clearance to locate sewage-type (long-body) combination air release and air and vacuum release valves and appurtenances below ground. Top of pipe profile shall be shown on the profile.
3. Size of force mains must be considered in conjunction with characteristics of the pumping equipment to be provided. In general, the design rates of flow shall be not less than 3-feet per second nor higher than 8 feet per second. Every attempt should be made to limit the maximum retention time in force mains to six (6) hours.
4. Unless otherwise approved or specified, force mains shall be minimum Class 200, PVC C-900 or C-905. Other materials shall only be used if approved by the District Engineer.
5. Low points in force mains shall be fitted with approved blow-offs (drains). High points shall have approved appurtenances for air release and air and vacuum release.

6. Thrust restraint calculation shall be submitted to the District Engineer for review and approval. Restraint may be provided either by restrained joint pipe or by thrust blocks.
7. Show all minimum clearances of other underground utilities in both plan and profile per State Department of Public Health Services "Criteria For The Separation Of Water Mains And Sanitary Sewers."

C. LIFT STATION DESIGN

Public and private wastewater lift stations shall only be allowed if the District Engineer determined that connection to existing gravity sewer is not feasible . *Specific written agreement from the District Engineer for the use of a lift station is required prior to approval of grading or improvement plans.* If a lift station is approved, the design engineer shall submit a lift station basis of design report to the District Engineer for review and approval. After approval of the basis of design report, subsequent plan and specification packages shall be submitted to the District Engineer for review and approval.

D. MANHOLES

Manholes shall be installed on sewers at all changes in slope, size of pipe, or alignment, at ends of all mains, and at all intersections of main line sewers. The maximum spacing allowable between manholes is 350-feet for pipelines 18-inches and smaller. The maximum spacing allowable between manholes is 300-feet for pipeline greater than 18 inches. Clean outs are not allowed in lieu of a manhole. Drop manholes are only allowed with prior written approval of the District Engineer. (FPUD Standard Drawings, S-5 & S-6) Pre-cast manhole bases are not allowed, all bases shall be poured in place with pipe or shaped smooth channels.

A minimum drop 0.10-foot and a maximum of 0.60-foot shall be used on a straight-through line. For a 90 degree bend through the structure, a minimum of 0.20-foot and a maximum of 1.00-foot shall be used. Minimum does not apply to sewers greater than 18-inches.

Where a proposed sewer connects to an existing manhole, the elevation of the inlets and outlets shall be shown in profile as determined by actual survey. If an existing sewer is straddled by a new manhole, the elevations of the proposed manhole shall be determined by actual survey. The applicant's private engineer shall submit the field notes.

All standard manholes shall be 60-inches minimum diameter with a minimum 36-inches entrance, with no steps. Manholes shall be installed at all changes in vertical and horizontal alignment.

E. RECYCLED WATER

All developments within 1000 feet of any existing recycled pipelines, or those that are in areas that are identified for expansion of the recycled pipeline system, shall include a recycled water system for all suitable landscaped common areas. The recycled system piping system shall be in accordance with the District and County requirements and the contractor shall obtain necessary approval from the County for the design of the recycled system.

F. HORIZONTAL ALIGNMENT

In general, sewers should be located in public streets parallel to and along the street centerline. The standard minimum distance between the sewer and other utilities is 5-feet outside of pipe to outside of pipe, except for water lines, which shall be 10-feet outside of pipe to outside of pipe.

Scaled detail plans shall be provided for all manholes with multiple angled inlets and outlet. Plans shall show adequate clearance provided between manhole base penetrations to assure clearance and water tightness.

In all streets, the pipe is to be along the street centerline where possible. Pipe shall not be located in median strips or parking lanes. On curved streets, pipe shall parallel as nearly as possible the street centerline.

G. SEWER DEPTH

The minimum depth to the invert of sewers is 3.5-feet with a maximum depth of 20-feet. Shallow sewers are subject to approval and may require additional protection such as special pipe, casing and/or a concrete cap. Sewer over 15 feet in deep shall be Concrete Mortar Lined DIP. The District Engineer may require greater depths where it is required to extend sewers to serve other areas.

The separation of water and sewer lines must comply with the California Department of Public Health requirements.

H. SERVICE LATERALS

Each property occupied by a single-family dwelling shall have a 4-inch sewer service lateral installed at a minimum 2% grade from the main line sewer to the property line, maintained at a minimum of 5 ½-feet depth below the surface at the property line. Alternately, 6-inch service laterals may be laid on a 1% grade, maintained at a minimum of 5 ½-feet depth below the surface at the property line. For multiple-family dwellings, commercial lots, schools, etc., special consideration shall be given when determining the correct size. Lateral sizing for all special considerations shall be approved by the District Engineer.

A service lateral shall be installed for each property along a main line extension. A cleanout one foot inside of the property must be installed as shown on the Standard Details. Sewer lateral connections to the main can not be made within 3-feet of any other sewer connection, including laterals serving the other side of the street. Deep cut lateral shall not be used.

All service laterals shall be constructed perpendicular to the sewer main unless special considerations are approved by the District Engineer.

Back-water (Backflow preventer) valves shall be required for dwellings in which the lowest drain is at or below the nearest upstream sewer Manhole rim elevation. Installation and maintenance of the valve shall be the responsibility of the property owner. The Valve shall be installed between the dwelling/ building and the property boundary cleanout with appropriate accessibility for annual maintenance and repair. Installations deeper than 4 feet may require a manhole for access.

I. TV INSPECTION

As part of the final inspection, the District will videotape the sewer lines. The District Engineer shall review said videotape for potential construction defects prior to acceptance of the project.

Any areas showing evidence of reverse slope as indicated by ponding water or dips in vertical pipe alignment, as well as any other defects shall be repaired to the satisfaction of the District Engineer at the Contractor's expense.

J. PLAN AND PROFILE

Show all underground Public utilities in both plan and profile, and provide minimum clearance per California Department of Public Health, Water Works Standards, latest revision.

K. SEWER NOTES

FPUD Sewer Notes shall be included in all sewer improvement plans. The notes are included in the FPUD Standard Drawings and are subject to revision by the District Engineer.

L. VERTICAL CLEARANCE

The minimum vertical distance between sewers and other utilities shall be 1-foot. Special design is required for sewer laterals or gravity mains over water lines. Force mains are not permitted over water lines.

M. CUT-OFF WALLS

In steep unpaved areas, pipe (and trench) shall be protected by cut-off walls per FPUD Standard Drawing S-10. Pipe anchors are required on all slopes 15% or greater.

N. CONNECTION OF COLLECTION LINES WITH DIFFERENT DIAMETERS

The crown elevations of connecting pipes shall be matched at manhole junctions.

O. MANHOLE LINING

Manholes with the following conditions shall be provided with polyurethane protective lining system:

1. All new manholes on sewers 15-inches or greater diameter.
2. All new manholes where entering pipe slope is 5% or greater.
3. All existing manholes with new connections.
4. All manholes within 1,000-feet of receiving a force main discharge.
5. All channels, shelves and lines shall be lined.
6. All new Drop Manholes

END OF SECTION

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