Design Conditions

A. Systems Planning and Design Principle

The District's Systems Planning and Design Principles are based on EMWD's Vision, Mission, and Guiding Principles:

Mission: To deliver value to our diverse customers and the communities we serve by providing safe, reliable, economical and environmentally sustainable water, wastewater and recycled water services.

Vision: To provide an exceptional level of customer and community service, exceeding the performance of any other public or private entity

Guiding Principles: EMWD embraces excellence in all facets of our business:

Community: We will be actively engaged in promoting prosperity, environmental values and public health in the communities we serve.

Innovation: We will creatively seek to improve the services we provide.

Integrity: We will be honest and ethical in all of our interactions.

Leadership: We will take a proactive role in leading industry policies, practices and initiatives on behalf of our customers, employees and community.

Respect: We will be considerate, aware and caring.

Responsibility: We will be accountable for our conduct in serving our customers, employees and community.

Safety: We will ensure the safety of our employees and the public, without compromise.

Transparency: We will ensure the decisions and investments we make are clearly communicated and easily understood.

Achieving these Principles will require sound systems planning and design to accomplish the following:

1. Provide a "High" level of customer service, system reliability and safety with considerations for multiple sources of supply, back up source capacity and power

capability, pipeline looping, proper service elevations, proper valving, and attention to water quality.

2. Anticipate and plan for predictable operating conditions and foreseeable circumstances to include, but not limited to, fire flow, , power outages, and facilities and systems outages.

3. Accommodate normal operating and maintenance procedures for controlled staging of pumps for seasonal operations, MWD shutdowns, and maintenance and replacement of pipelines and other facilities, etc.

4. Perform planning and design for expansion of source capacity (i.e., pump stations, regulator stations, pipelines, valves, etc.) to anticipate annual growth and large developments.

5. Enhance operating efficiency through proper energy management, system automation, remote monitoring, etc.

6. Provide safe workplace for: chlorine handling, confined spaces, and access to facilities with traffic considerations, etc.

It is the District's intent to achieve and maintain the above. Improvements required for existing water systems will be phased with attention to existing pressure conditions, economic feasibility, and activity related to land development.

B. Water System Planning and Design Guidelines

The following defines planning & design guidelines for new development and water system replacement, betterment, and expansion. To improve the level of service, the District will consider alternative water system designs, on a case by case basis

1. Facilities for new development shall be planned and designed according to the attached planning and design criteria.

2. All facilities shall be planned, designed, and constructed in stages based on customer needs, District obligations and financial capabilities.

3. An existing water Pressure Zone should not have any part of its service area subjected to a pressure of less than 50 psi at the Water Service connection point, unless a Low Pressure Service Agreement allows for a low pressure condition. Where a low pressure condition occurs, the Water Facilities Master Plan (WFMP) shall consider this location in its next update to identify the basic facilities for that PZ to provide the desired service condition of 50 psi, without fire flow, as well as a minimum of 20 psi w/1,500 GPM or greater fire flow as required by the local fire agency.
   a. It is understood that the WFMP provides the recommended facilities required to meet the ultimate land use or build-out for a PZ. However, these facilities will be installed in stages based on need, District's obligation, and financial capability. There may be (historical) existing services that are unable to be raised to the minimum standard service condition.

4. Each water pressure zone or combination of water pressure zones shall have the capacity to provide for operational flow, emergency, and fire flows. In the case where source and/or storage capacity is temporarily borrowed from (an)other pressure zone(s), phased improvements shall be performed to ensure continued service and reliability when the borrowed capacity is no longer available.
   a. Source Capacity
      i. Source capacity is considered to be any source of water supply into a pressure zone via direct connection(s), pump station(s), regulator(s), well(s), etc.
      ii. Source capacity for emergency and/or fire flow from another pressure zone may be considered borrowed.
      iii. Source capacity used for emergency and/or fire flow in lieu of sufficient pressure zone storage requires redundancy such that no single-source facility failure renders the pressure zone(s) unable to provide emergency and fire flow services. Redundancy will be accomplished with back up source capacity and/or standby power capability (i.e., pumps on).
      iv. Source capacity will be sized to provide for the maximum day demand rate in addition to the flow through demands for adjacent pressure zone(s). Additional

capacity may be required to supplement fire flow/emergency storage deficiencies, and/or use power cost savings' schedules.

b. Storage Capacity

i. Ideally, each water pressure zone or combination of water pressure zones' storage capacity will be sufficiently sized to provide for operational flow, emergency, and fire flows. Each pressure zone, however, shall have at minimum the required operational storage. The operational storage is typically defined as a volume equivalent to one-half the maximum day demand. This provides for peak-hour flow rates over and above the maximum day demand capacity of the pressure zone's source(s). The emergency storage is also a volume equivalent to one-half the maximum day demand. This volume provides a minimum of 12 hours of storage. The fire flow storage capacity will provide for the required fire flow per the Water System Planning and Design Criteria Section III.

ii. Existing pressure zones having a storage volume less than identified above will be reviewed for either increasing the storage volume for that pressure zone or increasing the source capacity to that pressure zone. This review will be based on economic and reliability evaluations compatible with phased system upgrades pursuant to the District's Water Facilities Master Plan. In the case of increasing the source capacity to a pressure zone in lieu of increasing the storage volume, adequate storage must be available in an adjacent pressure zone(s) along with back up source capacity and/or standby power capability (i.e., pumps on) to ensure the supply reliability.

5. This document and related criteria will be reviewed and updated by EMWD staff when necessary on a periodic basis to reflect changes in District water system planning and design, principle(s), legal requirements, and technological changes that affect system performance and operational methods, etc.

C. **Water System Criteria**

The following criteria are to be used in the planning and design of facilities for the District's domestic water system. They apply to existing and future conditions.

1. FLOW DEMAND CALCULATION(S):

   a. Average Day Demand (ADD)
   The recommended rates for determining ADD are:

Unit Potable Water Demand Factors to Compute Average Daily Demand			
Land Use	DU/ac	EDU/DU or EDU/ac	gpd/DU or gpd/ac[a]
Residential - DOPP			
Single-Family Residentia[b]	440 gpd/EDU		
Residential - Ultimate Land Use (EDU/DU and gpd/DU)[c]			
Open Space Rural (<0.1)	0.05	3	1320
Rural Mountains (0.05 to 0.1)	0.1	3	1320
Residential Rural (0.1 to 0.5)	0.2	3	1320
Estate Density (0.5 to 1)	0.5	1.5	660
Very Low Density (1 to 2)	1	1.5	660
Low Density (2-3)	2.0	1.3	570
Medium Density (3-6)	4.5	1.0	440
Medium/High Density (6 to 11)	6	0.9	400
HighDensity(11-17)	12	0.7	310
Very High Density (17 to 20)	17	0.65	290
Nonresidential - DOPP and Ultimate Land Use (EDU/ac and gpd/ac)[d]			
Public Facilities/Schools/Mixed Use Policy Area		5	2,200
Commercial/Business Park/Hospital		5	2,200
Business Park/Light Industrial/Warehouse		1.25	550
Industrial		7.5	3,300
Open Space/Ag/Recreation (EDU/ac and gpd/ac)[d]			
Agricultural, Open Space (Conservation, Landscape, Water)		0	0
Open Space Recreational		5	2200

(a) Values shown may not agree with calculated values due to rounding.
(b) DOPP projection factor specified by District staff . Incorporates permanent conservation savings for compliance with SB x7-7 . Residential water use factors developed using SFR water use factor in gpd/EDU multiplied by the DU/EDU for the land use type to get gpd/DU .
(c) Non-residential land use factors developed using SFR water use factor , in gpd/EDU, multiplied by the EDU/acre, to get use in gpd/acre .
gpd = gallons per day
ac = acre

b. Maximum Day Demand (MDD):
Based on the results of studies conducted to develop the Water Facilities Master Plan, recommended Peaking Factors (PF) are as follows for use in system analysis:

Land Use	Peaking Factors	
	MDD	PHD
Facilities Sizing*		
a. Small Pressure Zones Under 500 gpm ADD	3.0 x ADD	2.0 x MDD
b. Medium Pressure Zones 500-2,000 gpm ADD	2.5 x ADD	2.0 x MDD
c. Large Pressure Zones Above 2,000 gpm ADD	2.0 x ADD	2.0 x MDD
MDD = Maximum Day Demand ADD = Average Day Demand PHD = Peak Hour Demand MDD = ADD x PF PHD = MDD x PF		

Notes:

i. Maximum Day Demand is equal to Average Day Demand times the Maximum Day Peaking Factor.

ii. Peak Hour Demand is equal to the Average Day Demand times the Peak Hour Peaking Factor.

iii. If a Peaking Factor is known to be higher or lower within an existing pressure zone (based upon record data), then it may be used.

c. Fire Flow Requirements

These Recommended Fire Flow Demands will be used by EMWD for planning and design purposes related to developer-projects, unless the local (approving) fire department stipulates or requires a different fire flow.

STRUCTURE	**Flow (GPM)**	**Duration (Hours)**	**Number of Fire Hydrants**
Single Family (Residential)	1,500	2	2
Multi-Family* (Residential)	4,000	4	3
Light Commercial/Industrial (Including Schools)	4,000	4	3
Heavy Commercial/Industrial	5,000	4	4

*Five or more units per acre

Notes:

i. For planning purposes, the applicant shall use the appropriate fire flow demand/requirements corresponding to the proposed land use.

ii. For design purposes, the applicant shall use fire-flow demand/requirements approved by fire marshal or listed in the land agency's Conditions of Approval.

iii. The above recommended fire flows are assumed based on typical reduction in conjunction with fire sprinkler systems.

iv. While fire flows are to be supplied with a minimum required residual pressure of 20 psi (within the same pressure zone, and under normal operating conditions), District requires a minimum residual pressure of 30 psi under computer-model fire flow conditions. This allows for potential variances between the model and actual field conditions. Accordingly, this provides a 10 psi buffer between the predicted pressures in the computer model, as compared to real-world conditions.

2. WATER PRESSURE ZONE AND SERVICE CONDITIONS:
In general, a pressure zone may be required for approximately every 100-150 feet change in elevation. Use existing pressure zones if they are compatible. A small amount of overlap should be included at zone boundaries.

The following table provides the District's static and dynamic water pressure conditions:

CONDITIONS for: **Pressure Zones**	**WATER PRESSURE** **(At The Meter)**
Service Pressure Min/Max- Dynamic	50 to 110 psi (a) (d)
Service Pressure Min/Max- Dynamic @ Max Day Demand	50 to 110 psi (d)
Service Pressure Min/Max- Dynamic @ Peak Hour	50 to 110 psi (d)
Special Service Pressure Conditions	<50 & >80 psi (b) (d)
Minimum Service Pressure- Dynamic @ Max Day Demand + FF	20 psi (c) (30 psi in the computer-model)

a. Minimum and Maximum Pressures
   i. Minimum desired dynamic water service pressure is 50 psi (116 ft. of head), calculated from computer-model results (derived from project's hydraulic boundary conditions, as requested by applicant and provided by District).
   ii. Maximum desired water service pressure is 110 psi (254 ft. of head), calculated from computer-model results (derived from project's hydraulic boundary conditions, as requested by applicant and provided by District).
   iii. If the applicant desires to compare computer-model results to static pressure calculations, then minimum service pressure may be calculated from an elevation level equal to 10 feet above the bottom of the tank, during Peak Hour Demands, and an elevation equivalent to 50% of the tank volume during Maximum Day Demands. Maximum service pressure may be calculated from an elevation equivalent to the high-water level (HWL) of the tank.
   iv. Special case-specific water service pressure conditions may be allowed (higher or lower); however, such cases must be reviewed and approved by EMWD.

b. Service pressures greater than 80 psi (185 ft. of head), require “Notice of High Pressure Condition” signed by the applicant and recorded with property title (see EMWD Resolution 5111, Section 5.106). Service pressures less than 50 psi (116 ft. of head), require a “Notice of Low Pressure Condition” signed by the customer and recorded with property title (see EMWD Resolution 5111, Section 5.106).

c. Minimum dynamic pressure under Maximum Day Demand plus Fire Flow is 20 psi (30 psi in the model), except in historical low-pressure areas where low-pressure agreements may or may not exist.

d. All service connections shall be fitted with individual private pressure and operated and maintained by the customer.

D. Water System Planning & Design Criteria:

The following Planning and Design criteria will be used when performing hydraulic analysis, investigations, and/or designing layouts:

1. Distribution and Transmission Pipelines
   a. In general, head loss for transmission pipelines should not exceed 3.0 feet/1000 feet for flows up to 20 cfs, 2.0 feet/1000 feet for flows between 20 cfs and 50 cfs and 1.0 feet/1000 feet for flows over 50 cfs.
   b. Pipeline flows should not exceed 7 fps, except during fire flow conditions.
   c. At least two different supply sources should be available for each development (looped system). Two sources from the same water transmission pipeline may be considered if a source from a different location is unavailable but likely to occur by other development activity within a reasonable time frame.
   d. Dead-end water pipelines are to serve no more than 25 services. A looped water pipeline system is required for 26 or more services on a existing or proposed dead-end pipeline.
   e. A Double Check Detector Assembly (DCDA) is required for all private fire hydrants and fire sprinkler systems.
   f. Minimum widths for water pipeline easements are 30-feet for 8-inch diameter pipelines and 40-feet for 12-inch diameter (and larger) pipelines. Pipelines should be horizontally aligned within the center of the easement. Pipelines should not be constructed through a lot easement.

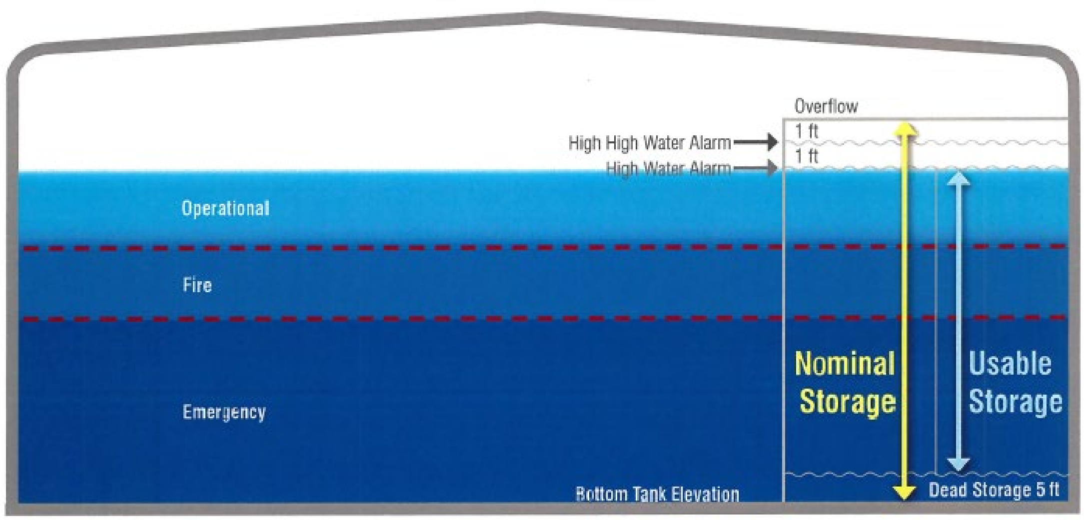
2. Storage:
   a. All proposed water storage capacities are to be determined based on one maximum day demand plus fire flow (MDD + FF) requirement. Fire Flows shall be stipulated by the local fire department or as recommended in Section I.C. above. Height of water storage tanks will be determined by District staff and will be either 32.0 feet or 40.0 feet tall, depending on case-specific criteria. During planning, a Usable tank volume will be identified with an expectation to add the Nominal/Operational volume which consists of 5 ft of dead storage and 2 ft of overflow per Figure 5-1.
   b. During maximum day demand plus fire flow, service pressure should not be less than 20 psi (30 psi in the model) for the period of the fire incident (assume tank to be half full). The following tabular summary is to be used when performing hydraulic analysis.
   c. Usable Storage Tank volume shall consist of:
      i. Fire Storage (use the highest fire flow for the pressure zone)
      ii. Operational Storage (include equalizations, time of use, and pump through)
      iii. Emergency Storage (determine number of pumps within the pressure zone to evaluate the peaking factors.)

3. Pumping Stations:

   Pump station design criteria shall be determined by District staff on a case-specific basis. The following general guidelines shall be used when planning or designing a pump station:

   a. The total flow to be pumped will normally be Maximum Day Demand for the area to be served (plus all pump-through demands for the next higher pressure zones).
   b. Pumping stations serving relatively small pressure zones will have a minimum of two pumping units, each sized to provide total (firm) capacity.
   c. Pumping stations serving moderate to large pressure zones shall have three or more pumping units, each with adequate capacity to meet total (firm) capacity with the largest unit out of service.
   d. Pumping capacity calculations will include time of use.

      Pumping capacity = MDD x (24/18) hours



Usable Storage: High Water Level to top of dead storage
Nominal Storage: Overflow to Bottom of Tank
40-foot high tank: Design Volume = Usable Storage x 1.2
32-foot high tank: Design Volume = Usable Storage x 1.25

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Figure 5-1

Definitions of Usable and Nominal Storage

Eastern Municipal Water District
Water Facilities Master Plan

E. Sewer System Planning and Design Criteria

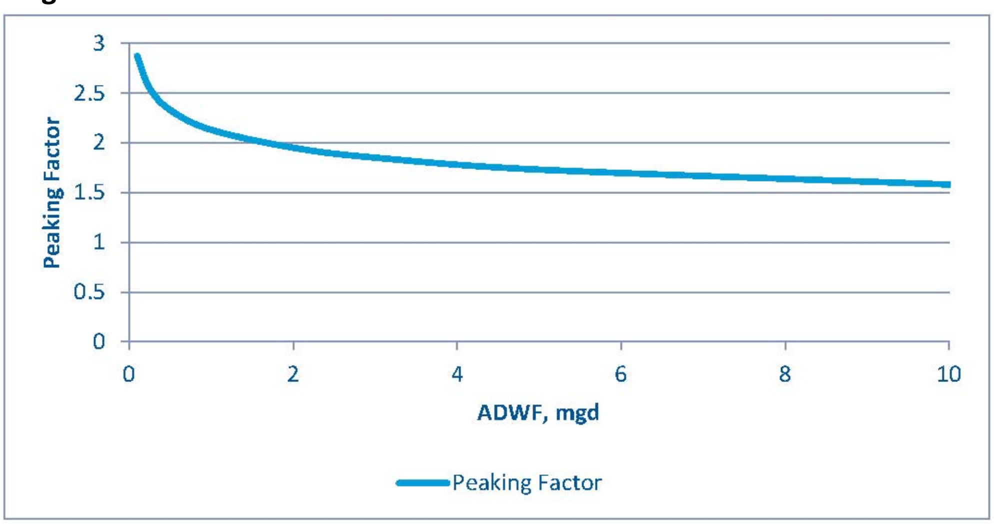
1. DESIGN FLOWS

In 2015, a survey of the District's sewer system was performed to determine flow generation rates from various land uses. This information is contained in the Wastewater Facilities Master Plan Supplement prepared by Black & Veatch dated 2015. The results of the survey showed variation in sewage generation not only by type of use but also by location. The survey also took into account the current conservation efforts of new development. However, for design purposes it is important that criteria be developed and used on a consistent basis.

To achieve this goal a meeting was held to agree on the current criteria for sewer design. The result of the meeting is a compromise of actual measurements vs design criteria. Table 1 attached shows the relationship of land use to the wastewater flow agreed to. The information in Table 1 shall be used by the District for future sewer design. This information has been adjusted to correspond to future conditions that are expected to uniformly occur as development takes place in all areas of the District.

The Wastewater Facility Master Plan also developed peak flow rates and obtained data which correlate peak flow rates with average flow rates. By a plot of this data, a curve has been established which is used in determining the peaking factor to be used in the design of the sewer. The peaking curve that is to be used in District design is shown in Figure 1 below. The peaking factors are determined an equation.

Figure 1
Peaking Factor Curve



Peaking Factor: PF=2.13 $Q^{-0.13}$, where Q=Average Dry Weather Flow and PF=Peaking Factor. (Max Peaking Factor is 2.87)

The procedure to be followed in determining design flows is to first determine the tributary drainage area for the sewer pipeline, determine the various average flows within the drainage area, add these average flows, and then convert these average flows to a peak flow for the design of the sewer (i.e., Q design = Qavg. x Peaking Factor).

Manning's Coefficient "n": use n = 0.015 (for sizing pipes)
Velocity: 2 ft/sec MINIMUM, 3 ft/sec recommended, & 10 ft/sec maximum

Flow per Equivalent Dwelling Unit: For all types of development, the land use categories were converted to EDU's based on Table 1. Wastewater flow (ADWF) was calculated by multiplying the number of EDU's per land parcel by a rate of **235 gpd/EDU**; the District's criteria use for regional planning.

2. PIPE SIZE SELECTION

Sewers 12-inches in diameter and smaller are designed to flow at a maximum depth of 0.50 D/d of the pipe diameter. Sewers 15-inches in diameter and larger are designed to flow at a maximum of 0.70 D/d of the pipe diameter.

It is important to maintain an air gap in the top of sewer pipes to convey sewer gases downstream along with the sewage flow. Maintaining the maximum depth of flow to pipe diameter ratio (D/d) conditions described above helps to ensure that sufficient space occurs to meet these conditions.

An 8-inch diameter pipeline has been established as the minimum sewer pipe size. This conclusion was established for two main reasons:

a. Maintenance problems can occur on smaller size pipes.
b. Sufficient space is necessary to convey sewage and debris downstream in the sewer pipe to avoid possible backflow up sewer laterals.

The only exceptions to the 8-inch minimum pipe size criteria are in the communities of Romoland, Homeland, and Green Acres, where 6-inch diameter sewer pipelines were installed due to formerly restricted Assessment District grant conditions applied to the financing of sewers in these communities. Not for new development.

MANNING's FLOW EQUATION

Pipe size is determined by using Manning's equation which is shown below:
Q=$(1.486/n)\, AR^{2/3}S^{1/2}$

Q= flows (cfs)
n= Manning's coefficient (Use EMWD's value for sizing pipelines, n=0.015)
A=cross sectional area of pipe (feet ^{2})
R= hydrologic radius of the wetted cross-section of the pipe (feet)

S=slope of energy gradient

Refer to the Handbook of Hydraulics by Brater and King or the Clay Pipe Engineering Manual for use of the equation.

3. PIPE SLOPES

The minimum slopes for sewer pipelines are based on obtaining a minimum velocity of 2 fps at design peak flow depth. This provides a means to resuspend solids deposited in the sewer during peak flows. Refer to Table 2 for minimum pipe slopes.

On small-size sewers, there is generally no particular concern with maximum slopes or velocities; however, they become a concern in the case that a dead-end sewer is insufficient in volume and velocity to move and cleanse solids. On large-size sewers, it is necessary to design sewers which would have a peak velocity not exceeding 10 fps to avoid damage to plastic liners on RCP joints and cause the release of hydrogen sulfide which can damage sewer manholes while creating local odor concerns (see **HYDRAULIC JUMPS** section below).

4. SEWER SIPHON

Sewer siphons are designed to convey sewage under obstructions. **All efforts should be made to design a sewer system to avoid sewer siphons,** because severe odor due to hydrogen sulfide gas and maintenance problems can result. The major concern is grease and other floating material cannot easily flow into and through the siphon and become trapped in the upstream manhole. These frequently require intensive maintenance to remain operational and avoid sanitary sewer overflows (SSOs).

5. LIFT STATIONS

All reasonable evaluations should be made to design a sewer system to avoid lift stations, to reduce the operation and maintenance costs to EMWD and its customers. The project applicant shall prepare all necessary reports identifying all possible alternatives to be reviewed and evaluated by EMWD during the Design Conditions phase. A lift station should be considered as the option of last resort. Temporary/Interim lift stations will be subject to developer deposits to guarantee the proper future abandonments of said facilities. Based on historical flow and maintenance data, the District has determined that a 20% allowance for wet weather flows and pump wear is adequate for lift station capacity planning. The District’s lift stations and force mains are evaluated based on the ability to service the Peak Lift Station Flow (Peak Wet Weather Flow x 1.2). Lift station capacity is evaluated in terms of total and firm capacity. The total capacity is the maximum capacity of the lift station with all pumps operating. The firm capacity is defined as the capacity of the lift station with all duty pumps running; excluding backup pumps. The capacity of the lift station is dependent upon the pumping capacity and the system head that is experienced in the downstream force main. The system head is determined by the static pumping requirements as well as the head loss experienced through the force main under the varying flow conditions. The system head is determined using the force main diameter, length, assumed C-factor, static pump requirements (wet well and discharge elevation). For each station, the pump curves are plotted against the system head curve expected to occur under the peak lift station flow for all planning years.

Further design details are available on our Small Sewage Lift Station Guidelines, Standard Drawings, and Specifications.

6. FORCE MAINS

The capacity of a sewer force main pipe is a function of the velocity in the pipe. The Hazen-Williams equation is used to calculate flows in force mains:
$V = 1.318CR^{0.63}S^{0.54}$

Where:

- V = Velocity in feet per second (fps)
- C = Hazen-Williams coefficient of roughness
- R = hydraulic radius (flow area divided by wetted perimeter) in feet (ft)
- S = Slope of energy grade line, ft/ft

The District assumes a Hazen-Williams coefficient value of 100 for all force mains. Velocity is the major criterion when sizing force mains. In general, force mains should be sized to convey Peak Lift Station Flow at build-out conditions with a velocity between 2-6 fps. Velocities less than 2 fps will result in wastewater spending additional time in the force main which can cause downstream operational problems. Force mains with a velocity greater than 6 fps tend to have excessive head loss and can affect the proper operation of the lift station.

Further design details are available on our Small Sewage Lift Station Guidelines, Standard Drawings, and Specifications.

7. HYDRAULIC JUMPS

Hydraulic jumps can occur when a steep slope suddenly turns flat. *Low jumps*, that is, when the change in depth is small, the water will not rise obviously and abruptly but will pass from the low to the high stage through a series of undulations gradually diminishing in size. When the jump is high, that is, when the change in depth is great, the jump is called a *direct jump*. The direct jump involves a relatively large amount of energy loss through dissipation in the turbulent body of water. High turbulence results in the release of hydrogen sulfide gases. Since hydrogen sulfide gases result in concrete corrosion it is necessary that all manholes are coated within 1000-feet downstream from the hydraulic jump location. **Hydraulic jumps should be avoided in sewer design.**

F. Sewer Calculation Tables

Table 1 - EMWD - System Design and Loading Criteria
Average Daily Flow:

Table 1: Development Densities

LAND USE CATEGORY	UNITS	AVERAGE RESIDENTIAL DENSITY (DU/ACRE)	RESIDENTIAL (EDU/DU)	DEVELOPMENT DENSITY (EDU/ACRE)
Residential Land Use				
Estate Density	DU	0.5	1.5	0.8
High Density	DU	12	0.7	8.4
Low Density	DU	2	1.3	2.6
Medium Density	DU	4.5	1	4.5
Medium High Density	DU	6	0.9	5.4
Mobile Home Park	DU	10	0.65	6.5
Rural Mountainous [(1)]	DU	0.1	3	0.3
Rural [(1)]	DU	0.2	3	0.6
Very High Density	DU	17	0.65	11.1
Very Low Density [(1)]	DU	1	1	1.5
Non-Residential Use				
Agriculture [(1)]	acre			0
Business Park/Light Industrial	acre			5
Business Park/Light Industrial/Warehouse	acre			1.25
Commercial Office	acre			5
Commercial Retail	acre			5
Heavy Industrial	acre			7.5
Hospital	acre			5
Mixed Use Policy Area	acre			5
Open Space (Conservation, Landscape, Recreation, Rural, or Water) [(1)]	acre			5
Public Facilities (Municipal or School)	acre			5

(1) The following uses were assumed to be served by septic systems and do not contribute flow to the wastewater collection system: Rural Mountainous, Rural, Very Low Density, and Agriculture, and Open Space.

TABLE 2
PIPE MINIMUM PIPE SLOPES IN GRAVITY SEWER MAINS

Pipe Diameter	Preferred Preferred Minimum	Ordinary Minimum	Maximum slope (not mandatory)
8-inch	.0065	.0040	.12
10-inch	.0050	.0032	.085
12-inch	.0040	.0024	.066
15-inch	.0032	.0016	.050
18-inch	.0024	.0014	.037
21-inch	.0020	.0012	.030
24-inch	.0017	.0010	.025
27-inch	.0015	.0008	.022
30-inch	.0013	.0007	.018

4 and 6-inch sewer laterals require a minimum slope of 0.020. 4-inch and 6-inch sewer laterals are private facilities and owned and maintained by the customer or maintenance association.

8-inch sewer laterals are owned and maintained by the District and require manholes and easements for access and maintenance. If manholes or proper access cannot be provided, the 8-inch sewer lateral shall be privately owned and maintained similar to the above, and a letter of concurrence by the land agency shall be provided to EMWD. Please, refer to EMWD easement requirements.

Table 3
Sewer Pipe Capacity

D/d = 0.5
K' Coeff. = 0.232 Manning Coeff. n = 0.015

Pipe Size (d) (in)	Minimum slope (S)	Q (cfs)	Max# of EDU's
8	0.004	0.332	318
10	0.0032	0.538	516
12	0.0024	0.758	726

D/d = 0.70
K' Coeff. = 0.388 Manning Coeff. n = 0.015

Pipe Size (d) (in)	Minimum slope (S)	Q (cfs)	Max# of EDU's
15	0.0016	1.89	1,811
18	0.0014	2.85	2,731
21	0.0012	4	3,833
24	0.0010	5.2	4,983
27	0.0008	6.35	6,085
30	0.0007	7.9	7,570
36	0.0007	12.8	12,266
42	0.0007	19.3	18,495
48	0.0007	27.6	26,449
54	0.0007	37.8	36,223

Notes:
1. Per Table 1 and Table 2.
2. Equivalent Dwelling Unit (EDU) = 235 gpd
3. Use D/d ratio of 0.50 for 8”, 10” and 12” sewer pipelines; Use D/d ratio of 0.70 for 15” and larger sewer pipelines.

Table 4
Table 7-13 in HANDBOOK OF HYDRAULICS pg. 7-64
Values of *K* for Circular Channels in the Formula

$$Q = \frac{K}{n} D^{8/3} s^{1/2} \qquad K' = \frac{Qn}{d^{8/3} s^{1/2}} \qquad Q = CFS \quad d = FT$$

D = depth of water *d* = diameter of channel

$\frac{D}{d}$	.00	.01	.02	.03	.04	.05	.06	.07	**.08**	.09
.0		15.02	10.56	8.57	**7.38**	6.55	5.95	5.47	5.08	4.76
.1	4.49	4.25	4.04	3.86	3.69	3.54	3.41	**3.28**	3.17	3.06
.2	2.96	**2.87**	2.79	2.71	2. 3	2.56	2.49	2.42	2.36	2.30
.3	2.25	2.20	2.14	2.09	2.05	2.00	1.96	1.92	1.87	1.84
.4	1.80	1.76	1.72	1.69	1.66	1.62	1.59	1.56	1.53	1.50
.5	1.470	1.442	1.415	**1.388**	1.362	1.336	1.311	1.286	1.262	**1.238**
.6	1.215	1.192	1.170	1.148	1.126	1.105	1.084	1.064	1.043	1.023
.7	1.004	.984	.965	.947	**.928**	.910	.891	.874	.856	**.83S**
.8	**.821**	**.804**	**.787**	.770	.753	.736	.720	.703	.687	.670
.9	.654	.637	- 21	.604	**.588**	.571	.553	.535	.516	.496
1.0	**.463**									

4. Table 5
Table 7-14.
Values of *K′* for Circular Channels in the Formula

$$Q = \frac{K'}{n} d^{8/3} s^{1/2}$$

D = depth of water *d* = diameter of channel

$\frac{D}{d}$	.00	.01	.02	.03	.04	.05	.06	.07	**.08**	.09
.0		.00007	.00031	.00074	.00138	.00222	.00328	.00455	.00604	.00775
.1	.00967	.0118	.0142	.0167	.0195	.0225	.0257	.0291	.0327	.0366
.2	.0406	.0448	.0492	.0537	.0585	.0634	.0686	.0738	.0793	.0849
.3	.0907	.0966	.1027	.1089	.1153	.1218	.1284	.1352	.1420	.1490
.4	.1561	.1633	.1705	.1779	.1854	.1929	.2005	**.2082**	.2160	**.2238**
.5	**.232**	.239	**.247**	.255	.263	.271	.279	**.287**	.295	.303
.6	.311	.319	.327	.335	.343	.350	.358	.366	.373	**.380**
.7	**.388**	.395	.402	.409	.416	.422	.429	.435	.441	.447
.8	.453	**.458**	.463	.468	.473	.477	.481	.485	**.488**	.491
.9	.494	.496	.497	.498	.498	.498	.496	.494	.489	**.483**
1.0	.463									

G. Frequently Asked Questions

1. What happens once the customer/developer submits Design Conditions (DC)?
   a. The administrative staff processes the DC documents and sends them to a DC Engineer for a completeness review. If the submittal is complete, then the documents are processed and a work order number is created. If the submittal is incomplete, the submittal is not processed and the DC Engineer will send an e-mail identifying the pending submittal items.

2. What is the typical turn-around time for my Design Conditions (DC) review?
   a. The typical turn-around time for District review is approximately 3-4 weeks per review.

3. How many Design Conditions (DC) reviews does it take to get an approval?
   a. It depends on the complexity of the project and if the consultant engineer is familiar with EMWD's process. On the average it takes about 3-4 reviews.

4. What will I receive when my project is approved in the Design Condition (DC) phase?
   a. An Approved Design Condition package will be provided via email. This shall include a Design Condition form (DSD-045) that is signed by the Principal Engineer and DC Engineer. It will also include other documents i.e.: Vicinity Map, Fire flow results, facility exhibits, if potable water (landscape spreadsheet), RWUE, etc.

5. If I am proposing private onsite water facilities, does the District have standard requirements for the connections?
   a. Yes, to minimize impacts and maintain the integrity of existing infrastructure, the District uses manifolds. Standard Manifold Details can be located and downloaded from EMWD's website. Link: https://www.emwd.org/forms-new-development-process

6. Can I order the Fire Flow hydraulic model test and hydraulic boundary conditions prior to submitting the Design conditions (DC)?
   a. Yes, it is recommended as the hydraulic results tend to take about 3-5 weeks to process. There is a fire flow application and fee amount on EMWD's website www.emwd.org. Specific directions and information requirements are located on the application. Please coordinate with the Development Services Administrative Staff.

7. Is there a sample DC from EMWD for formatting purposes?
   a. Yes, it is recommended you reference this sample. It is located in EMWD's website. Link: https://www.emwd.org/forms-new-development-process

8. If a sewer study is required what does it consist of?
   a. The study consists of using EMWD's latest sewer design criteria to analyze the effects of increased of sewer flows generated by the proposed tributary area on the

downstream existing system and to adequately size proposed sewer pipelines. The DC engineer shall help determine the outline of the tributary area and the extent of the study on downstream facilities. The sewer study may include different densities of residential, commercial, industrial and institutional developments with their associated peaking factors. The sewer study report includes an Objective, Analysis Criteria, Sewer Analysis, Conclusion, and other required attachments. The studies also include maps of areas to be studied, as well as tables and hand calculations. The study identifies locations of the existing sewer that cannot adequately handle the proposed sewer flows that are considered critical segments. A conclusion or recommendation shall be provided in the study report. An example for formatting purposes is located here on EMWD's website.

9. What happens after we receive approved plans/signed mylars?
   a. After you receive signed plans from EMWD, you must enter into a standard construction facilities agreement with EMWD to build public facilities. Prior to receiving EMWD service, you must pay all applicable project and financial participation connection fees. This is coordinated in the agreement and post-construction phases with the DS Coordination group.