



# **WATER SYSTEM PLANNING & DESIGN**

**PRINCIPLE**

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**Updated February 2006**

**Revised July 2, 2007**

# PRINCIPLE

The District's water system planning and design Principle is based on EMWD's Mission, Values and Beliefs:

- A. "The Mission of Eastern Municipal Water District is to provide safe and reliable water service to our community in an economical, efficient, and responsible manner, now and in the future."
- B. "We believe in providing superior services to the community in a safe, reliable and cost effective manner."

The goal for achieving this Principle will require a level of planning and design that accomplish the following:

- C. 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, etc.
- D. Anticipate and plan for predictable operating conditions and foreseeable circumstances to include, but not limited to, fire flow, pipeline failure, hydrant damage, power outage, pump failure and other facility outage.
- E. Accommodate normal operating and maintenance procedures for controlled staging of pumps for seasonal operations, MWD shutdowns, maintenance and replacement of pipelines and other facilities, etc.
- F. 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.
- G. Enhance operating efficiency through proper energy management, system automation, remote monitoring, etc.
- H. Provide safe work place 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.

# 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, by the District's Water Enterprise Team and/or Development Review Committee.

- I. Facilities for new development shall be planned and designed according to the attached planning and design criteria.**
- II. All facilities shall be planned, designed, and constructed in stages based on customer needs, District obligations and financial capabilities.**
- III. An existing water Pressure Zone should not have any part of its service area subjected to a pressure of less than 20 psi unless the service agreement otherwise specifically allows for a low pressure condition. When a low pressure condition occurs, the Water Facilities Master Plan (WFMP) shall be updated to identify the basic facilities for that PZ to provide the standard (desired) service condition of 60 psi, without fire flow, as well as a minimum of 20 psi w/500 gpm or greater fire flow as required by the local fire agency.**

This policy is based on the approved Water System Planning and Design Criteria Sections I through III. 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.

- IV. Each water pressure zone or combination of water pressure zones shall have the capacity to provide for operational flow, and 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.**

## **Source Capacity**

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.

## **POLICY, Cont.**

Source capacity for emergency and/or fire flow from another pressure zone may be considered borrowed.

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).

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 to utilize power cost savings' schedules.

### **Storage Capacity**

Ideally, each water pressure zone or combination of water pressure zones' storage capacity will be sufficiently sized to provide for operational flow, and 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.

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.

- V. This policy and related criteria will be reviewed and updated, as 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.**

# CRITERIA

The following criteria and 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.

## I. FLOW DEMAND CALCULATION(S):

### A. Average Day Demand (ADD)

The recommended rates for determining ADD are:

<b>1. RESIDENTIAL</b>	<b>DU/Ac</b>	<b>C/DU</b>	<b>GPD/C</b>	<b>GPD/Ac</b>
Low Density (0-3)	2.5	4	200*	2,000
Medium Density (4-8)	4.5	3.5	180	2,835
High Density (9-20)	12	2.5	120	3,600
Mobile Home	6	2	100	1,200

### 2. **NON-RESIDENTIAL**

Institutional	3,000* GPD/Gross Acre
Commercial	2,000* GPD/Gross Acre
Industrial	2,000* GPD/Gross Acre
Agricultural	1 to 5* AF/Ac/Yr
Golf Courses & Ponds	4.5 AF/Ac/Yr

\* Note: If site specific data is available and has a higher or lower use rate than the recommended value, it should be used. If no site specific data is available for Agricultural use, a default value of 4 AF/Ac/Yr shall be used.

# RECOMMENDATIONS, Cont.

## 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 Factor <sup>‡</sup>	
	Maximum Day	Peak Hour
1. Low and Medium Density Residential		
a. Small Pressure Zones Under 500 gpm ADD	3.0	7.0
b. Medium Pressure Zones 500-2,000 gpm ADD	2.5	5.0
c. Large Pressure Zones Above 2,000 gpm ADD	2.0	3.5
2. High Density Residential and Mobile Homes	1.5	2.5
3. Commercial and Industrial	1.5	2.0
4. Schools and Other Public Institutions (Institutional)	1.5	2.0
5. Parks and Golf Courses	2.5	2.5
6. Agricultural (see WFMP p. 3-23)	2.0	2.0
‡ Reference WFMP Table 3-5		

### Notes:

- Maximum Day Demand is equal to Average Day Demand times the Maximum Day Peaking Factor.
- Peak Hour Demand is equal to the Average Day Demand times the Peak Hour Peaking Factor.
- If a Peaking Factor is known to be higher or lower within an existing pressure zone (based upon record data), then it may used.

## RECOMMENDATIONS, Cont.

### C. Fire Flow Requirements

These Recommended Fire Flows will be used for District planning and design purposes unless the local (approving) fire department stipulates or requires a different fire flow. It is understood that the minimum Fire Flow in several less developed areas of the District is still 500 gpm.

<b>STRUCTURE</b>	<b>Flow GPM</b>	<b>Duration Hours</b>	<b>Number of Fire Hydrants</b>
Single Family (Residential)	1500	2	2
Multi-Family* (Residential)	3000	2	3
Light Commercial/Industrial (Including Schools)	3000	3	3
Heavy Commercial/Industrial	5000	4	4

\*Five or more units per acre

# RECOMMENDATIONS, Cont.

## II. WATER PRESSURE ZONE AND SERVICE CONDITIONS:

In general, a pressure zone may be required for approximately every 100 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:

CONDITION	WATER PRESSURE
Service Pressure Min/Max- Static	60 to 125 psi <sup>(a)</sup>
Service Pressure Min/Max- Dynamic @ Max Day Demand	60 to 125 psi <sup>(b)</sup>
Service Pressure Min/Max- Dynamic @ Peak Hour	50 to 125 psi <sup>(b)</sup>
Special Service Pressure Conditions	<40 & >80 psi <sup>(c)</sup>
Minimum Service Pressure- Dynamic @ Max Day Demand + FF	20 psi <sup>(d)</sup>

- (a) Minimum desired static water service pressure is 60 psi (139 ft. of head), calculated from an elevation level equivalent to 0% of the tank volume. Maximum desired water service pressure is 125 psi (289 ft. of head), calculated from an elevation equivalent to the high water level (HWL) of the tank. Special case-specific water service pressure conditions may be allowed (higher or lower); however, such cases must be reviewed and approved by Water Enterprise Team and/or Development Review Committee.
- (b) Refer to "Hydraulic Analysis" Table on p. 9.
- (c) Service pressures greater than 80 psi (185 ft. of head), calculated from an elevation equivalent to the high water level (HWL) of the tank, require individual regulators provided by the customer and a "Notice of High Pressure Condition" signed by the customer and recorded with property title (see EMWD Resolution 229.69, Section 3.05). Service pressures less than 40 psi (92 ft. of head), calculated from the base elevation of a tank, require a "Notice of Low Pressure Condition" signed by the customer and recorded with property title (see EMWD Resolution 229.69, Section 3.05).
- (d) Minimum dynamic pressure under Maximum Day Demand plus Fire Flow is 20 psi, except in historical low-pressure areas where low-pressure agreements may or may not exist.

**Note:** The 'Standard' System Operating Condition is 60 to 125 psi, without fire flow. A 'Marginal System Operating Condition is considered to be between 40 and 60 psi, without fire flow. A 'Sub-Standard' System Operating Condition is considered to be less than 40 psi without fire flow.



# RECOMMENDATIONS, Cont.

## III. PLANNING AND DESIGN CRITERIA:

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

### A. Distribution and Transmission Pipelines:

1. 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.
2. Pipeline flows should not exceed 10 fps, except during fire flow conditions.
3. 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 is likely to occur by other development activity within a reasonable time frame.
4. 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.
5. No more than one fire hydrant is permitted on a dead-end pipeline. The pipeline must be 8-inch diameter up to the fire hydrant tee; but can be a 6-inch diameter after the hydrant tee.
6. A Double Check Detector Assembly (DCDA) is required for all private fire hydrants and fire sprinkler systems.
7. 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.

### B. Storage:

1. 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.

## RECOMMENDATIONS, Cont.

- During maximum day demand plus fire flow, service pressure should not be less than 20 psi 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.

Pressure Zone Condition	Tank Level	Service Pressure		
		Pump	Minimum	Maximum
Static	100%	Off		125
Static	0%	Off	60	
MDD	50%	Off	60	125
Peak Hour	50%	On	50	125
MDD + FF*	50%	Off *	20	125

\*Note: Some Pressure Zones may require the pumps be “on” during MDD plus FF hydraulic analysis in order to meet Fire Flow requirements. This exception shall be approved by the Water Enterprise Team.

### C. 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:

- 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).
- Pumping stations serving relatively small pressure zones will have a minimum of two pumping units, each sized to provide total (firm) capacity.
- 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.