CASTLEROCK PROJECT
CITY OF SAN DIEGO
WATER SERVICE STUDY

March 7, 2012

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Job No. 648-010

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March 7, 2012

648-010

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Attention: Allen Kashani, P.E., Land Development Manager

Subject: Water Service Alternatives for the Castlerock Project in the City of San Diego

Introduction

The Castlerock development is located within the Elliott Community Planning area in the City of San Diego. The planning area originally encompassed approximately 10,120 acres from Murphy Canyon on the west; Friar's Road, San Diego River and Sycamore Canyon on the south and east; and the former Camp Elliott military reserve on the north. Over the years, some of this area was removed from the Elliott Community Plan and incorporated into the new Tierrasanta Community, Mission Trails Regional Park Plans, landfill expansion, and designated open space under the Multiple Species Conservation Program. The remaining portion of the Elliott Community, known as East Elliott (Castlerock), is largely undeveloped.

The Castlerock development is located at the City of San Diego's eastern boundary adjacent to the City of Santee and is planned for residential development. The area encompasses 117 acres, with 422 dwelling units currently planned based on the No Annexation scenario. The project consists of 282 single family detached units and 140 multi-family dwelling units. There is a 4 acre public park as well as several pocket parks totaling 0.64 acre.

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This study provides an overview of alternative means of providing potable water service to the proposed Castlerock development project from the City of San Diego. Potable water service includes domestic water service and fire protection. A description of the proposed alternatives for water service to the development and a discussion of technical issues associated with these facilities are provided.

Project Background - Padre Dam Municipal Water District Service Alternative

The Castlerock project is processing its land development plan which includes de-annexing from the City of San Diego and annexing to the City of Santee. Under this scenario, water service to the project would be provided by Padre Dam Municipal Water District. The Castlerock project proposed tentative tract map incorporates an Alternative A scenario which reflects annexation to the City of Santee and water service from Padre Dam Municipal Water District. The tentative map also addresses an Alternative B scenario which considers the project to remain within the City of San Diego; under this alternative, water service to the project would be provided by the City of San Diego.

Under the Alternative A scenario, Padre Dam Municipal Water District would provide water and recycled water service to the project. Padre Dam Municipal Water District facilities for both water and recycled water service are in the streets adjacent to the Castlerock development.

For service from the City of San Diego, only potable water service can be provided since at this time the City of San Diego does not have recycled water facilities in the near vicinity of the Castlerock project. If water service will be provided by the City of San Diego, it is possible that the City of San Diego would negotiate an arrangement with Padre Dam Municipal Water District by which recycled water would be provided to the Castlerock project. At this time, the City of San Diego water service alternatives are based on all Castlerock project water demands being satisfied by potable water service.

City of San Diego Water Service Alternatives

The proposed Castlerock development project is within the city limits of the City of San Diego. The City currently does not operate water facilities in the near vicinity of the project. The closest City of San Diego water supply facilities are located in the Tierrasanta area to the west of Mission Trails Regional Park and south of State Route 52, or in the Navajo area south of Mission Trails Regional Park along Mission Gorge Road.

The City of San Diego also owns some capacity in the El Capitan Pipeline which is owned and operated by the Padre Dam Municipal Water District. The El Capitan Pipeline is 36-inches diameter and is located in Mission Gorge Road. It currently provides service to the Padre Dam MWD from a San Diego County Water Authority aqueduct connection in the vicinity of Mission Gorge Road and Jackson Drive. The El Capitan Pipeline generally follows the San Diego River to the north and east until it enters Mission Gorge Road.

Water service to the Castlerock development project by the City of San Diego would entail constructing a connection to the El Capitan Pipeline, installing a meter on the pipeline outlet, and constructing City of San Diego water pipelines from the Mission Gorge Road location to the project site. In addition, it is expected that coordination between the City of San Diego and Padre Dam MWD will be necessary prior to commencing water service to confirm there is available capacity in the San Diego County Water Authority aqueduct connection and flow control facility for the City of San Diego demand, to confirm the hydraulics of the El Capitan Pipeline to ensure that water service to the City of San Diego will not negatively impact the available flow and pressure to Padre Dam MWD's system, and to work out such details as the allowable peak flows to the City through the El Capitan Pipeline, outlet connection and meter facilities ownership, and operation and maintenance responsibilities.

Two alternative scenarios are identified to provide City of San Diego water service to the Castlerock development. Both alternatives address the City of San Diego Design Guide requirement to provide redundant water service to all City of San Diego customers. The alternatives include extending existing City of San Diego water facilities to the site. A description of each of the water alternatives is provided below and illustrated in Figures 1 and 2.

Castlerock Project Water Demands

The water demands and corresponding onsite and offsite water facilities proposed for each water service alternative were developed in accordance with the City of San Diego Design Guidelines and Standards. Single family residential water demand is estimated based on 3.5 persons per dwelling unit and a unit water demand of 150 gpd/person which results in a water demand rate of 525 gpd per single family dwelling unit. For multi-family residential, the water demand estimate is based on 3.0 persons per dwelling unit which results in a water demand rate of 450 gpd/dwelling unit. Water demand for developed parks is estimated at 4,000 gpd/acre.

The City of San Diego average day demand for the Castlerock project is:

525 gpd/SF DU x 282 SF DUs =	148,050 gpd
450 gpd/ MF DU x 140 MF DUs =	63,000 gpd
4,000 gpd/acre x 4.64 acres parks =	18,560 gpd
Total Average Water Demand =	229,610 gpd

From the City of San Diego Guidelines and Standards, Figure 2-2, the maximum day demand to average annual demand ratio is 2.5 based on the Inland Central peaking curve, resulting in an estimated maximum day demand of 574,025 gpd (399 gpm; 0.57 mgd).

From the City of San Diego Guidelines and Standards, Figure 2-1, the peak hour demand to average annual demand ratio is 5.9 based on the Inland Central peaking curve, resulting in an estimated peak hour demand of 1,354,699 gpd (941 gpm; 1.35 mgd). Appendix A of this report presents the backup data for determining these peaking factors.

The fire flow demand is estimated at 2,000 gpm for single family residential and 3,000 gpm for multi-family residential for 5 hours with a minimum operating pressure of 20 psi.

Water Supply Source

The source of water for the City of San Diego water service alternatives is proposed to be the City of San Diego's capacity rights in the El Capitan Pipeline. As discussed earlier, this is the City of San Diego water supply source in closest proximity to the proposed Castlerock development project.

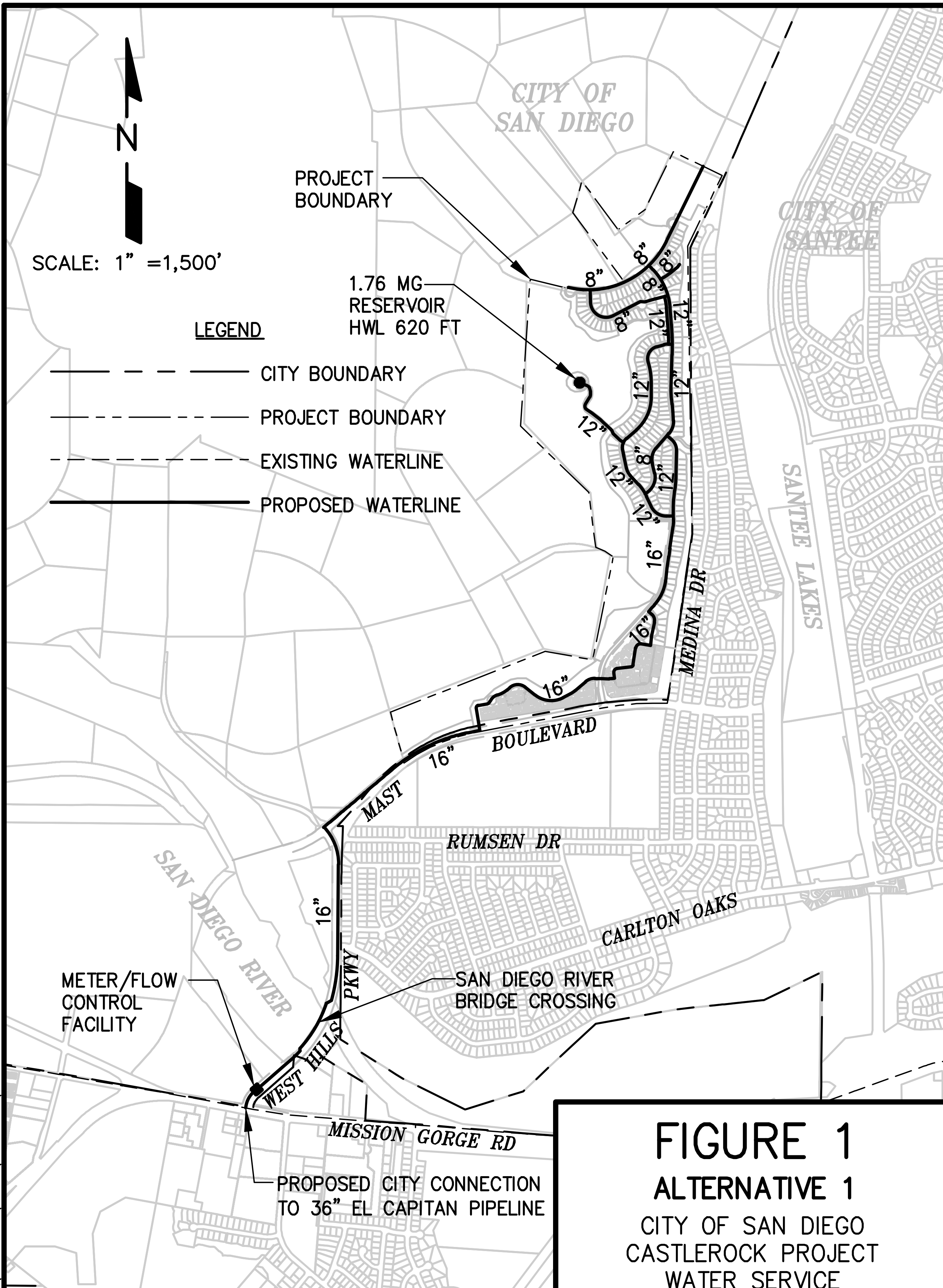
For the Castlerock development, water service would entail construction of a side outlet on the 36-inch El Capitan Pipeline and a flow metering and flow regulating facility for the water flowing to the City of San Diego service area. From the El Capitan Pipeline, water service to the Castlerock development would include water system piping extending north and east from Mission Gorge Road to West Hills Parkway, north to Mast Boulevard, and then east to the project site. The total estimated length of offsite water line piping is approximately 7,600 linear feet.

Alternative 1 – City of San Diego Water Supply with Onsite Reservoir

This alternative uses the onsite reservoir storage component to provide water system redundancy to the Castlerock development. A single water supply pipeline is proposed from the El Capitan Pipeline connection up to the onsite reservoir site. In the event of a pipeline break, the onsite reservoir storage would provide water service until the pipeline break is repaired.

As shown in Figure 1, the primary water supply system for the Castlerock development includes a single pipeline from Mission Gorge Road in West Hills Parkway and Mast Boulevard that would convey water from the existing El Capitan Pipeline to the project site. A new City of San Diego onsite reservoir would provide a back-up water supply.

Offsite facilities for this alternative include approximately 7,600 feet of 16-inch diameter water line piping as well as the pipeline outlet and flow metering facility on the El Capitan Pipeline. The new City of San Diego water supply pipeline would be installed in existing roadways. The size of the offsite water line is based on providing maximum day plus fire flow to the multi-family residential portion of the project from the offsite connection in the event of a pipe break between the multi-family area and the onsite reservoir.



PACIFIC\DWG\648010\WATER_FIGURE_1.DWG 03-07-12 10:44:44 LAYOUT: LAYOUT1

FIGURE 1

ALTERNATIVE 1

CITY OF SAN DIEGO
CASTLEROCK PROJECT
WATER SERVICE

Onsite facilities include a 1.76 million gallon reservoir (96.8 feet diameter, 32 feet water depth) at an approximate high water level of 620 feet mean sea level to provide operational, emergency, and fire storage in accordance with the City of San Diego Guidelines and Standards. Appendix B presents the calculations of the estimated reservoir storage volume appropriate for the Castlerock development project. The storage volume includes three days of average demand as emergency storage. In summary, the storage volume components include:

Operational Storage, 30% of Maximum Day Demand	0.17 MG
Fire Protection Capacity, 5 hrs @ 3,000 gpm	0.90 MG
Emergency Storage, 3 Average Days	0.69 MG
Total Storage	1.76 MG

The onsite reservoir is proposed to be constructed with two equal chambers the sum of which will be 1.76 million gallons. This feature will provide reservoir storage redundancy to facilitate the maintenance of the reservoir over the course of its operational life. Each chamber will have 0.88 million gallons capacity. This volume will provide:

0.17 MG	Operational Storage, 30% of Maximum Day Demand
0.71 MG	Fire Protection Storage, equaling 3.9 hrs @ 3,000 gpm
0 MG	Emergency Storage
0.88 MG	Total

No emergency storage is considered under the reservoir redundancy case as it is expected that half the reservoir would be taken out of service during a low demand period and when all the rest of the water system was functioning.

Under the redundancy scenario, fire storage is reduced below the City guidelines; however, the California Fire Code Table B105.1 (copy in Appendix B) indicates a fire flow duration of 3 hours for a fire flow of 3,000 gpm. In the reservoir redundancy scenario, 3.9 hours of the maximum required fire flow are provided.

Piping and valving on the reservoir site will be configured to allow for shutdown of one chamber of the reservoir while maintaining full use of the other chamber. The inlet and outlet piping will be designed to provide maximum water circulation in the reservoir.

Onsite piping required for this alternative includes approximately 4,500 feet of 8-inch, 6,700 feet of 12-inch, and 4,000 feet of 16-inch waterlines. All offsite and onsite water facilities in this alternative are owned and maintained by the City of San Diego.

Alternative 2 – City of San Diego Water Supply with Dual Water Mains

This alternative method of providing water supply to the Castlerock project in accordance with City of San Diego Design Guidelines and Standards considers the dual piping approach. This approach includes two parallel pipes extending from the water supply source all the way to the development project site. In the event one pipe breaks, the second pipeline can continue to provide service to the project.

As shown in Figure 2, the primary and secondary water supplies include two 16-inch pipelines from the El Capitan Pipeline in Mission Gorge Road to West Hills Parkway and Mast Boulevard. The pipelines convey water from the existing El Capitan Pipeline to the project site similar to Alternative 1. The offsite piping for Alternative 2 is 16-inch diameter because of the need to deliver to the development project site the maximum expected demand for the project. This is equivalent to the maximum day demand plus the largest required fire flow which totals 3,399 gpm.

Offsite facilities for Alternative 2 include approximately 12,000 feet of 16-inch diameter water line piping as well as the pipeline outlet and flow metering facility on the El Capitan Pipeline. The proposed parallel 16-inch water lines would be installed in existing roadways.

Onsite facilities would include 4,500 feet of 8-inch waterline, 11,700 feet of 12-inch waterline, and 1,700 feet of 16-inch waterline. All offsite and onsite water facilities in this alternative are owned and maintained by the City of San Diego.

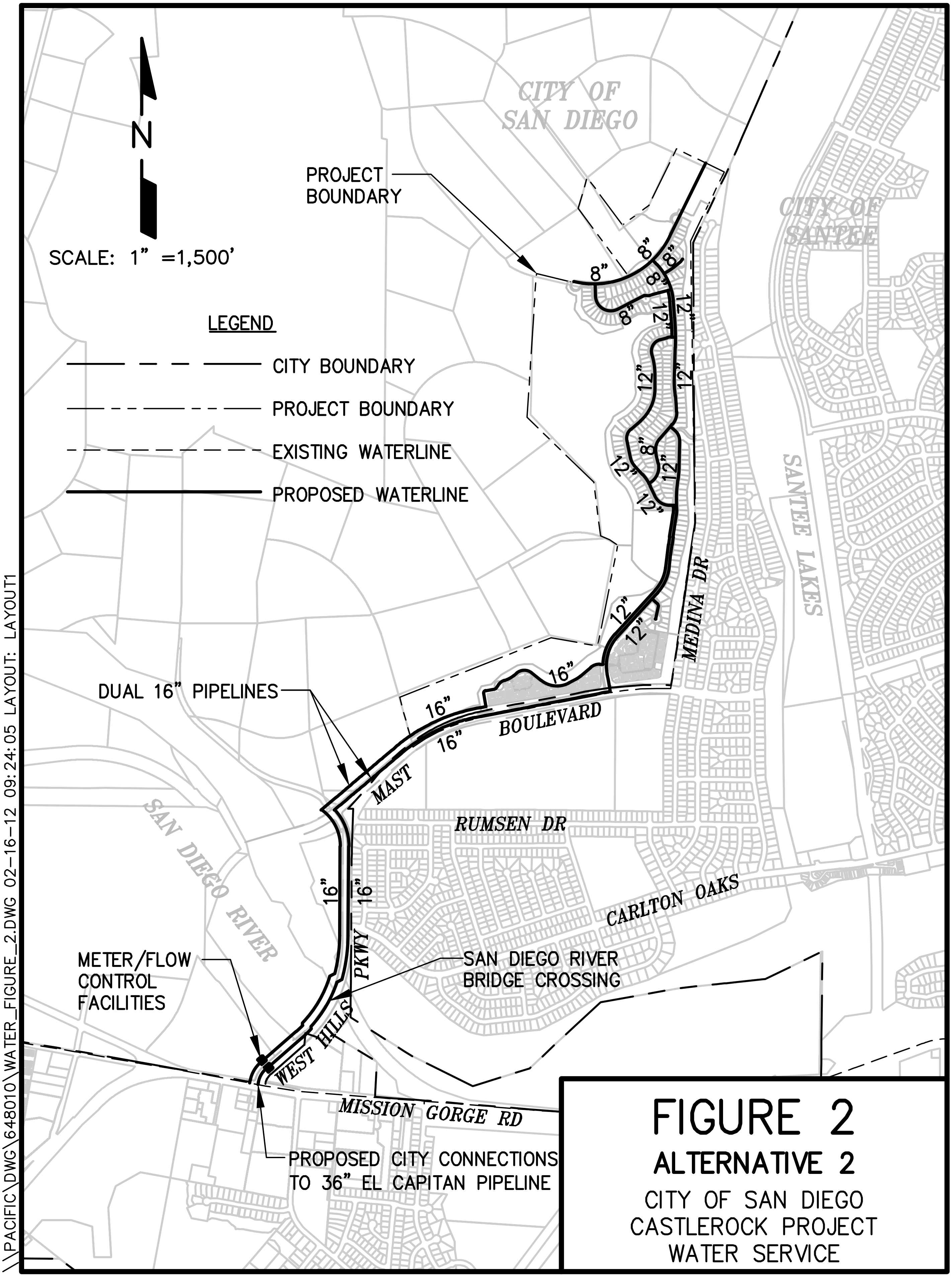


FIGURE 2

ALTERNATIVE 2

CITY OF SAN DIEGO
CASTLEROCK PROJECT
WATER SERVICE

Water Service Alternatives Challenges

The primary challenge relative to providing water supply to the Castlerock project is the construction of the proposed offsite water line(s) across the San Diego River. The proposed alignment of the offsite water lines includes pipeline(s) in West Hills Parkway. A portion of this road segment is a bridge across the river.

The offsite water supply pipelines area proposed to be installed inside the bridge cells. Because of limited space in the cells, it may be necessary to reduce the pipeline sizes through the bridge for the Alternative 2 scenario. In this event, hydraulic calculations will incorporate a section of smaller diameter pipe through the bridge to ensure that the required flow and pressure can be delivered to the Castlerock project site. If necessary, onsite piping can be increased in size to ensure proper water service to the project.

Constructing water lines through an existing bridge is costly. However, this approach will provide a means to cross the San Diego River without the environmental mitigation issues associated with open trench construction or a directional drill river crossing.

Conclusion

Thank you for the opportunity to provide you and the Castlerock development project with our engineering services in the preparation of this report. Please contact us if you have any questions or need additional information.

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APPENDIX A

WATER DEMAND PEAKING FACTOR CALCULATIONS

FIGURE 2-1
PEAK HOUR DEMAND FACTOR

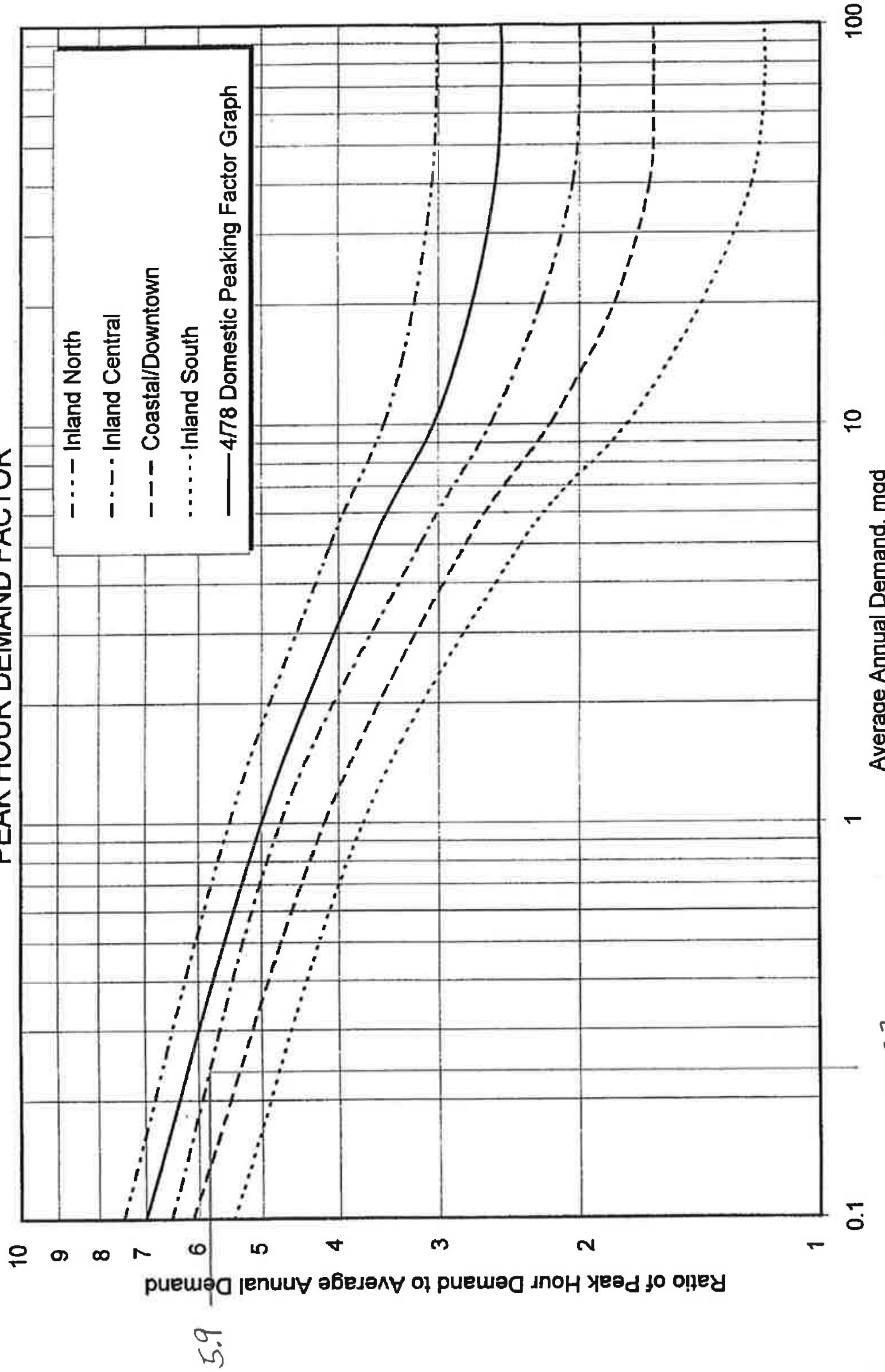
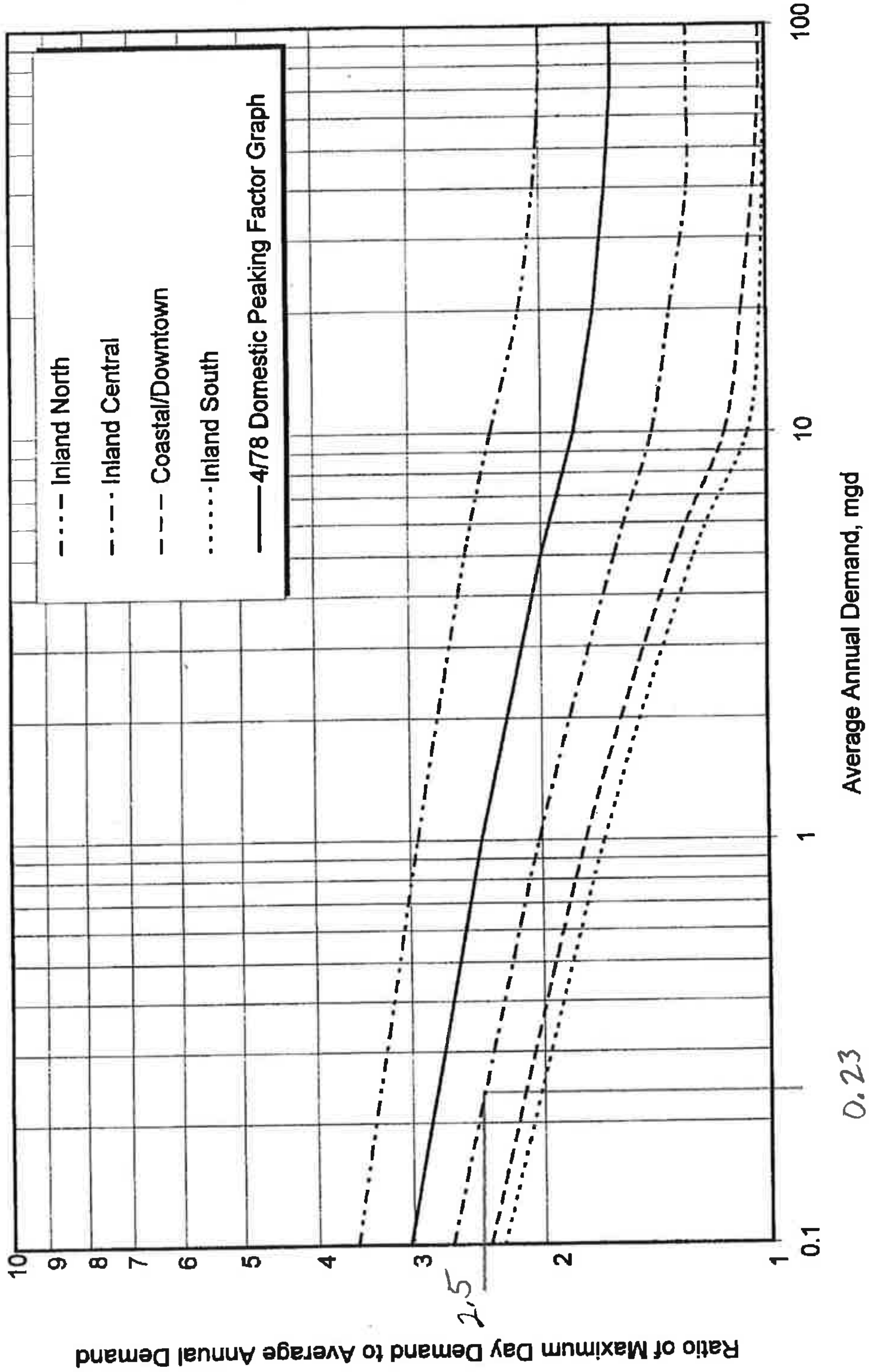
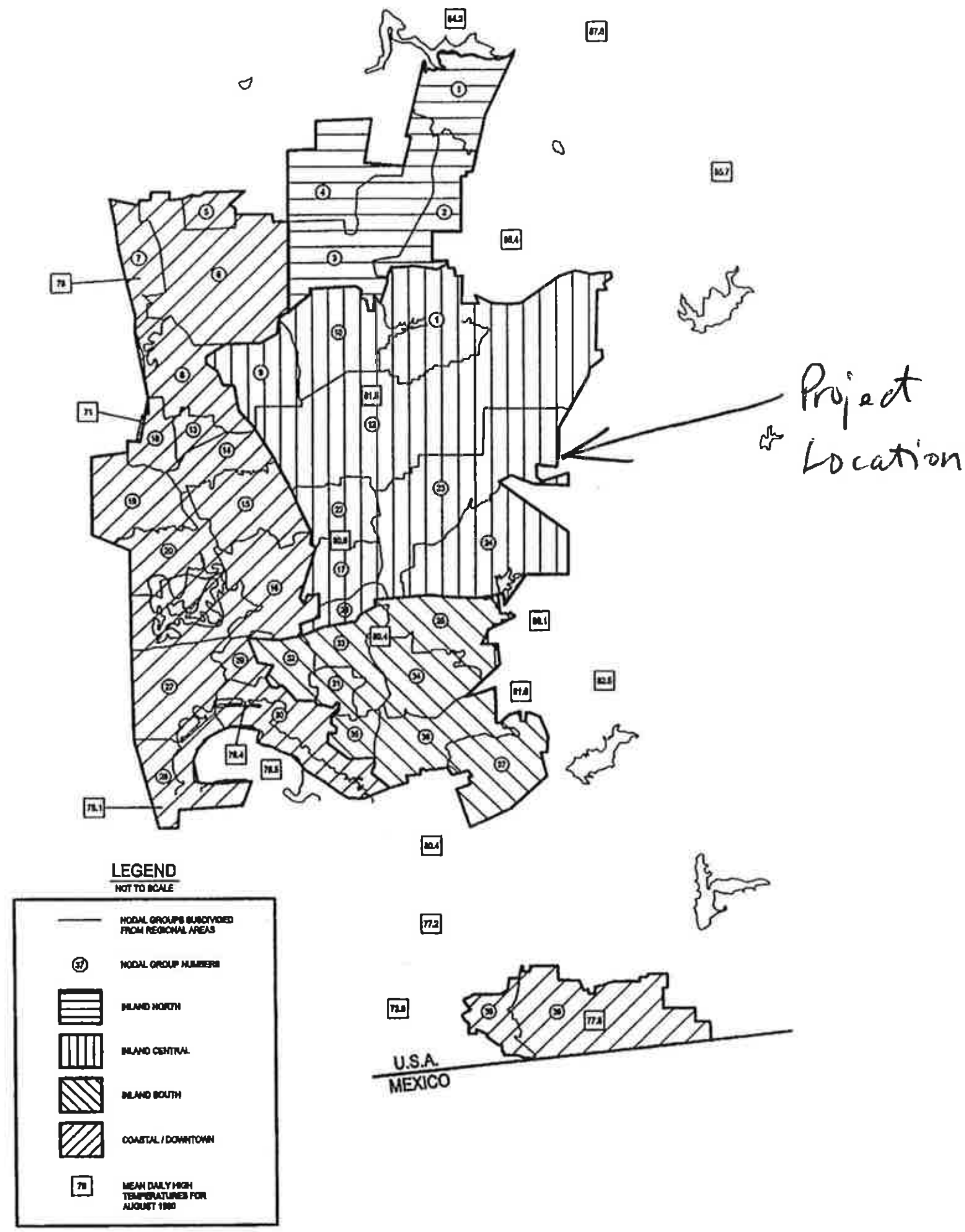


FIGURE 2-2
MAXIMUM DAY DEMAND FACTOR



PEAKING FACTOR ZONES
(BOUNDARIES BASED ON LAND USE GROUPINGS)

FIGURE 2-3



July 1999

Peak water demands are estimated as follows:

Peak Hour Demand = Average Annual Water Demand * Peak Hour Demand Ratio

Maximum Day Demand = Average Annual Water Demand * Maximum Day Demand Ratio

2.6 Fire Demands

The DESIGN CONSULTANT estimates fire demands flows by using the *Fire Suppression Rating Schedule*, Edition 6-80, Section 1 (Public Fire Suppression), published by the Insurance Services Office.

The fire flow duration for planning purposes is at least five hours. In general, minimum required fire demands for design are shown in Table 2-3.

Table 2-3
Fire Demands for Design Purposes

Development Type	Fire Demand (gpm)
Single family residential	2,000
Duplexes	2,500
Condominiums and apartments	3,000
Commercial	4,000
Industrial	6,000

Should application of the ISO methodology result in figures lower than those shown in Table 2-3, the CIP Project Manager may approve the ISO figures on a case-by-case basis following submittal of supporting calculations.

The required fire demand must be supplied from at least two fire hydrants within a maximum radius of 750 feet from the fire.

2.7 Pressure Criteria

2.7.1 Design Pressures

Water systems must be designed to provide the minimum residual pressures given:

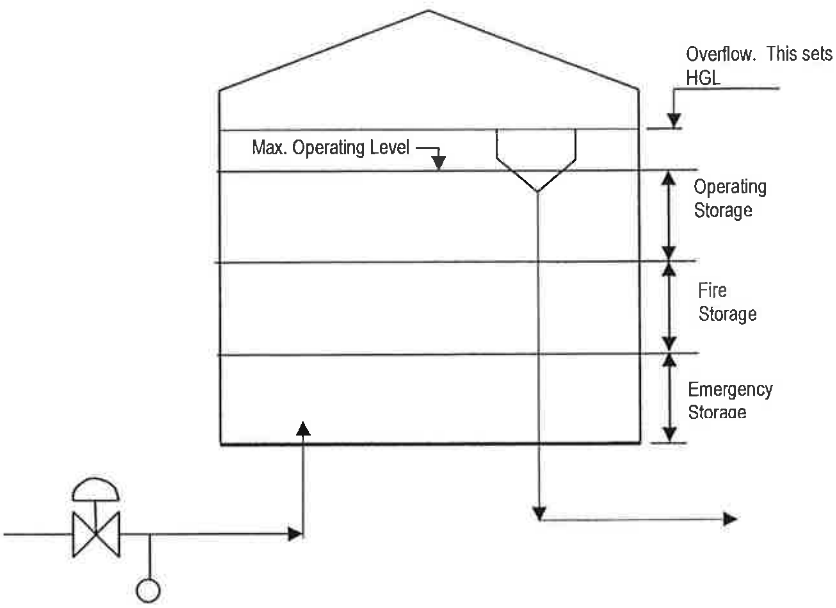
(1) maximum day demands plus fire demand conditions, or
(2) peak hour demand conditions.

In analyzing the supply to a pressure zone, the minimum hydraulic grade line elevation available from the water source is used, a level that typically occurs during dry weather conditions. The maximum static pressure in gravity systems is determined from reservoir overflow elevations and/or the discharge control setting on pressure reducing valves, whichever is greater. The

APPENDIX B

WATER STORAGE VOLUME CALCULATIONS

A. Operating Storage



1) Definition. Operating storage is defined as the volume of storage necessary to allow a reservoir's sources of supply to operate at a uniform rate throughout the day while meeting variable water demand. In some cases, operating storage is used to permit reducing or stopping of supply during peak hour water demand conditions or stopping of pumping operations during hours of peak energy demand. Operating storage may also be defined as the amount of storage necessary to supply Peak Hour Demand with a water supply having a uniform Maximum Day Demand Flow Rate. Operating storage must fluctuate daily in all water storage facilities, like standpipes and elevated tanks supplied by pumps and in ground level reservoirs supplied by gravity pipelines.

In order to optimize the use of transmission facilities and to improve water pressure during peak water demand conditions, pump or gravity inflow must be controlled to achieve top operating levels at 5:00 AM each morning.

2) Calculation Procedure. Operating storage is calculated as 30 % of the ultimate maximum day demand in the service area (one or more pressure zones). The source(s) of supply must provide for maximum day demand.

To allow the reduction or stopping of supply during peak hour water demand conditions or stopping of pumping operations during hours of peak power demand, requires additional operating storage volume. Assuming that the amount of operating storage was already determined to balance a uniform daily supply with continuously variable demand, the additional operating storage for reducing or stopping of supply due to peak hour water demand or peak power demand management equals the rate of supply reduction times the duration of supply reduction.

If more than one reservoir is planned for the service area, operational storage can be divided between reservoirs, but only when water system modeling shows that minimum pressure requirements are met during peak hour demand.

For existing and substantially developed service areas, the amount of operational storage may be determined by flow measurement. This flow measurement, based on supply and demand curves, must be adjusted for future growth and reasonably anticipated climatic extremes.

The amount of operating storage may be reduced by water supply capacity available in excess of maximum day demand flow rate.

3) Example. Assume the expected ultimate maximum day demand in a pressure zone is 6,000 gal/min, then the required operating storage is:

229,610 gpd avg x 2.5 pk factor x 0.3 = 172,208 gal = 0.17 MG

Operating storage = ~~((6,000 gal/min x 1440)/1,000,000) x 0.3 = 2.6 mg~~

Continuing with the example above, let us assume now that the pumps are shut off for two hours for peak power demand management, the supply is thus reduced by 6,000 gal/min for 2 hours. The additional operating storage required is then:

Power management storage = ((6,000 gal/min x 60) x 2)/1,000,000 = .72 mg
Use 0.8 mg for power management storage.

Total operating storage: 2.6 mg + 0.8 mg = 3.4 mg

B. Fire Storage

1) Definition. Fire storage is the minimum amount of water required to be stored for firefighting purposes. Minimum fire flow flows and their duration are established by the City Fire Marshall based on Insurance Services Offices (ISO) guidelines.

2) Calculation Procedure. Fire storage is calculated by multiplying the maximum fire demand expected in the service area by its duration, as stated in Section 2.6. If more than one tank is planned for a service area, fire storage can be divided between tanks, but only when water system modeling shows that minimum fire flow and pressure requirements are met.

The amount of fire storage may be reduced by water supply capacity available in excess of maximum day demand flow rate with operating storage, or in excess of peak demand flow rate without operating storage.

3) Example. Continuing with the example above, let us assume now that the pressure zone is classified as commercial with minimum fire flow of 4,000 gal/min for 5 hours. (For service areas with UMDD of 100 MGD and more, consider that 2 fires are burning concurrently.) The minimum fire storage is:

Fire storage = ((~~4,000~~ 3,000 gal/min x 60) x 5)/1,000,000 = ~~1.20 mg~~ 0.90 MG

C. Emergency Storage

1) Definition. Emergency storage is the amount of water that needs to be stored to satisfy demand when any single component of the system (power, pump, supply pipe, etc.) is out of service.

2) Calculation Procedure. Maximum emergency storage is calculated as 12 hours times the ultimate maximum day demand, in gallons per minute. If anticipated total service outage exceeds 12 hours, then a cost/benefit analysis is required to determine the most cost effective solution to meet reliability and water quality objectives.

The amount of emergency storage may be reduced by water supply capacity available after a single system component is out of service, or by the reduced time it takes to return to full service based on reasonable estimate of time for restoration of system capacity, as determined by Water Operations Division.

If more than one reservoir is planned, emergency storage can be divided between the reservoirs, but only when water system modeling shows that minimum flow and pressure requirements are met during peak hour and fire demand conditions.

3) Example. The minimum amount of emergency storage based on the examples above is:

229,610 gpd avg × 2.5 pk factor × 12 hrs / 24 hrs = 287,013 gal = 0.29 MG

Emergency storage = (~~(6,000 gal/min x 60) x 12)/1,000,000 = 4.4 mg~~

If, for instance, there are two pump stations with a 3,000 gal/min capacity each supplying the same pressure zone and one pump station is out of service, the emergency storage is reduced to:

((3,000 x60) x 12)/1,000,000 = 2.2 mg

D. Total Storage. For the examples listed above, the total storage would be the sum of operating, fire and emergency storages, or 3.4+1.20+4.4 = **9.0 million gallons**.

Note: Water storage volume located in pumped zones of a service area may not be used to reduce the calculated "Total Storage" for the gravity fed portions of a service area.

2.9.2Forebays

Forebays are usually small tanks located on the suction side of a booster pump station. They balance available supply with pumping demand and provide a stable suction head to the pump station. If a pump station is adjacent to a regulating reservoir; the reservoir acts as a forebay also. Due to the nature of its function, forebays have only one element – operating storage.

The required volume can be calculated as shown in section 2.9.1A.2 above.

2.9.3Clearwells

A clearwell is a regulating reservoir to store filtered water near a water treatment plant.

However, considering the reservoir is the sole means of supplying water in the event of a pipe break, estimate that emergency storage = 3 days of average demand = 229,610 ×3 = 688,830 = 0.69 MG

* Then total storage required = 0.17 + 0.90 + 0.69 = 1.76 MG

TABLE B105.1
MINIMUM REQUIRED FIRE-FLOW AND FLOW DURATION FOR BUILDINGS[a]

FIRE-FLOW CALCULATION AREA (square feet)					FIRE-FLOW (gallons per minute)[c]	FLOW DURATION (hours)
Type IA and IB[b]	Type IIA and IIIA[b]	Type IV and V-A[b]	Type IIB and IIIB[b]	Type V-B[b]		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	2
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	3
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	4
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250	
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	26,301-29,300	4,500	
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	
—	—	115,801-125,500	83,701-90,600	51,501-55,700	6,250	
—	—	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
—	—	135,501-145,800	97,901-106,800	60,201-64,800	6,750	
—	—	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
—	—	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
—	—	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
—	—	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
—	—	191,401-Greater	138,301-Greater	85,101-Greater	8,000	

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

a. The minimum required fire flow shall be allowed to be reduced by 25 percent for Group R.

b. Types of construction are based on the *California Building Code*.

c. Measured at 20 psi.