5/18/2005

CITY OF WEST SACRAMENTO

WATER MASTER PLAN UPDATE

MASTER PLAN REPORT

FINAL
May 2005

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This executive summary presents a brief background of the City of West Sacramento (City) water system, the need for this water system master plan, proposed improvements to mitigate existing capacity deficiencies, and proposed expansion improvements. A summary of the capital improvement program costs and Financial Analysis, through the buildout conditions of the General Plan (General Plan) as adopted in 2000 are presented at the end of this chapter.

ES.1 STUDY OBJECTIVE

Recognizing the importance of planning, developing, and financing water system facilities to provide reliable and enhanced service for the existing customers and to serve anticipated growth, the City initiated the preparation of this water system master planning study.

The objective of the study included the following tasks:

- Establish water system design and planning criteria
- Evaluate the existing water distribution system using computer hydraulic modeling
- Perform a demand analysis and review supply capacity
- Perform a system-wide storage analysis
- Review existing system and propose improvements to enhance system reliability
- Recommend improvements needed to service anticipated growth
- Develop a Metering Implementation Plan
- Develop a Capital Improvement Program (CIP) for the buildout conditions of the General Plan
- Develop a Financial Plan to fund the CIP

ES.2 STUDY AREA

The City is located in eastern Yolo County and borders the Sacramento River. The City is part of a four county metropolitan area that includes Yolo County, Sacramento County, and portions of Placer County and El Dorado County. The City limits extend from the Sacramento River and Tule Lake Road on the north, the Sacramento River on the east, Shangri-La Slough on the south, and the Yolo Bypass on the west. The City covers approximately 19 square miles with an estimated Year 2005 population of 38,000. For the

purpose of this Master Plan Report, the City's service areas are divided into North area and Southport area. All the areas north of Barge Canal are in the North area and the areas south of Barge Canal are in the Southport area.

ES.3 WATER SYSTEM OVERVIEW

The City operates its own surface water treatment plant (Bryte Bend Water Treatment Plant), obtaining raw surface water from the Sacramento River. The surface water is treated to drinking water standards then distributed to the City customers through the water distribution system. During the course of this Master Plan, the efficiency of the water distribution system to convey water from Bryte Bend Water Treatment Plant (Bryte Bend WTP) to the customers throughout the City was evaluated. These evaluations were performed for the existing distribution system and the future distribution system when vacant land within the City is developed in accordance with the City's General Plan.

ES.4 WATER DEMANDS

Water demands for the distribution system were developed for existing and ultimate buildout conditions. Water demands are a factor of land use type (i.e., residential, commercial, industrial). Ultimate buildout is when the City is developed in accordance with the General Plan. Water Demands for the existing system were based on historic water production data from the Bryte Bend WTP. The average day demand for Year 2004 is 13.1 mgd. The historic water production data for the Bryte Bend WTP from Year 1989 through Year 2004 is presented in Table ES.1.

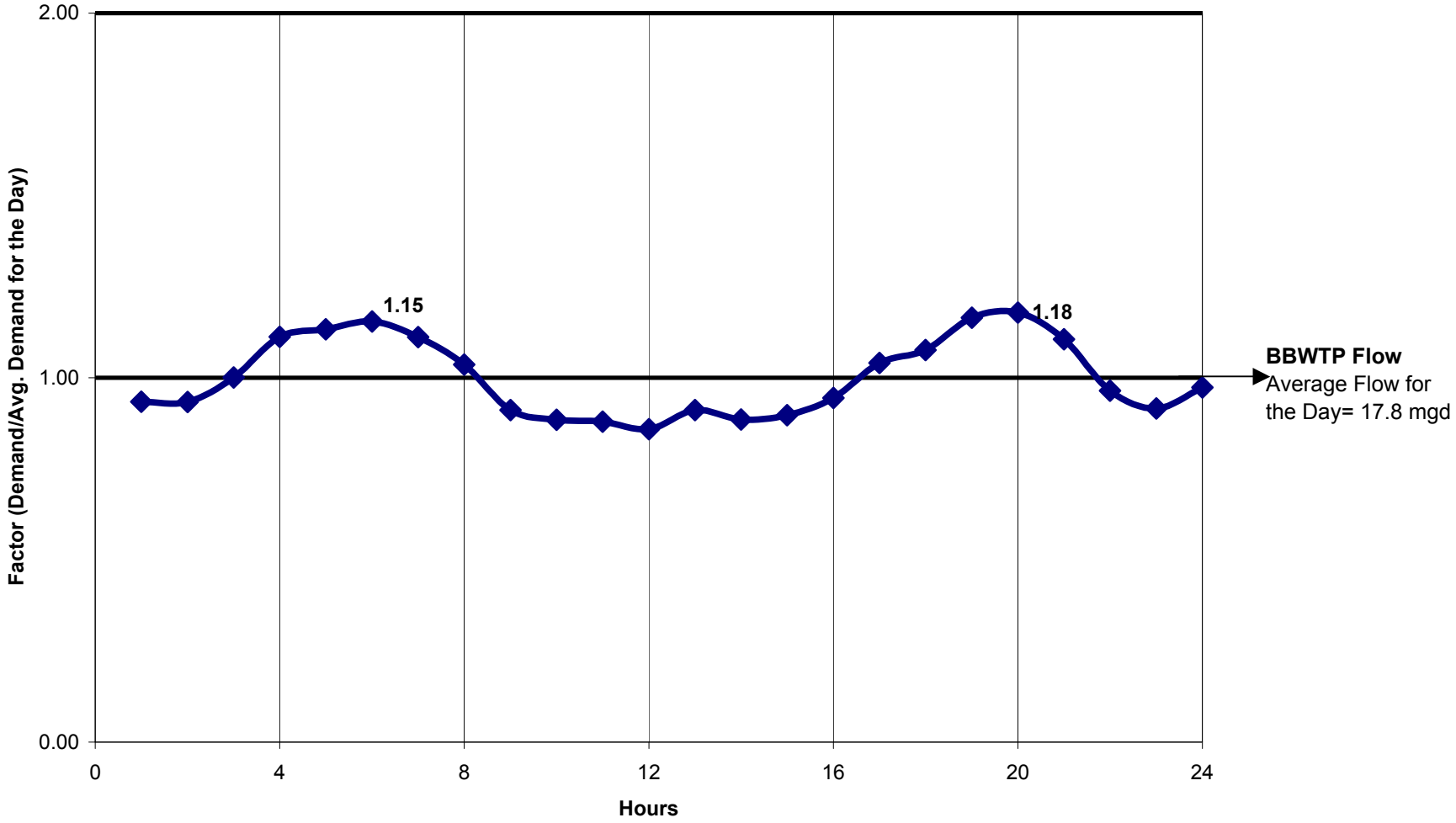
The ultimate buildout demands were based on the land use category and the average water usage by the customer type. Land use data was obtained from the City's General Plan. The average water usage by each customer was established in the City's previous water master plan. Land use types contained within the City include: residential, commercial, agricultural, industrial, and other.

In order to perform a time-based hydraulic analysis, the City conducted a 24-Hour Demand Test. The results from this test were used to determine the water usage diurnal patterns for the time-based hydraulic analysis. The water usage pattern obtained during this test is indicated on Figure ES.1.

ES.5 LAND USE AND PROJECTIONS

The General Plan was used to determine land use categories within the City boundaries. The demands for ultimate buildout were established based on the land use category and corresponding demands of each land use category. The demand factors for each customer type were established in the previous water distribution system study reports and are

Figure ES.1 Demand Pattern during 24-Hour Demand Test
Water Master Plan Update
City of West Sacramento



Note: Temperatures varied between 55 and 78 degrees during the test period. (June 8, 2004)

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Table ES.1 Demand Factors from Year 1989 through Year 2004 Water Master Plan Update City of West Sacramento			
Year	**Average Day Demand (ADD) (mgd)**	**Maximum Day Demand (MDD) (mgd)**	**MDD Peaking Factor(1)**
1989	7.58	13.10	1.73
1990	7.06	15.15	2.03
1991	7.64	17.12	**2.24**
1992	8.73	15.32	1.75
1993	8.15	15.91	1.95
1994	8.84	15.32	1.73
1995	8.64	16.22	1.88
1996	9.20	16.33	1.78
1997	9.38	16.91	1.80
1998	8.26	16.18	1.96
1999	9.28	18.53	2.00
2000	9.69	18.69	1.93
2001	10.59	19.83	1.87
2002	10.73	21.50	2.00
2003	10.97	20.40	1.86
2004	13.1	23.89	1.82

Note:
(1) Ratio of Maximum Day Demand to Average Day Demand = MDD/ADD

presented in Table ES.2. These demand factors were used to determine the buildout demands within the City.

Table ES.2 Demand Factors for Various Land Use Categories Water Master Plan Update City of West Sacramento	
Land Use Type	**Unit Demand Factor**
Single Family Residential	560 gpd/du
Multi-Family Residential	290 gpd/du
Commercial	2,950 gpd/acre
Industrial	2,950 gpd/acre
Schools	25 gpd/student
Parks/Others	1,800 gpd/acre

Note:
(1) gpd = gallons per day; du = dwelling unit
(2) Data is obtained from “December 1999 - Water Master Plan”.

Based on the land use and the demand factors, the average day demand within the City for the ultimate buildout year is estimated at 26.0 mgd.

ES.6 WATER DISTRIBUTION SYSTEM EVALUATION

The City's water supply, storage, and distribution facilities were evaluated based on the analysis and design criteria defined in this study. The developed criteria address the water supply capacity, storage capacity, acceptable service pressures, distribution system performance, average annual water demands, and daily and hourly peaking factors.

H2ONet hydraulic modeling software was used in evaluating the capacity adequacy of the City's water distribution system. Water distribution system hydraulic analysis is a powerful tool used in all aspects of water distribution planning, design, operation, management, emergency response, system reliability analysis, fire flow capacity analysis, as well as water quality simulations.

ES.7 STORAGE REQUIREMENTS

The principle function of storage is to provide a reserve supply of water for operational equalization, emergency needs, and fire events. Each storage type is described below:

- *Operational Storage*: This storage is required to aid in the operation of the distribution system. Storing excess water produced during low demand periods and pumping this water back to the distribution system during high demand periods will result in an efficient operational procedure. Operational storage helps the City save on operational costs.

- *Emergency Storage*: This storage is required to fulfill additional water needs in the event of an emergency. Emergencies cover a wide range of rare, but possible events, including: surface water contamination; treatment failure at the Bryte Bend WTP; High Service Pump Station failure; power outage; transmission pipeline rupture; earthquake; firestorm; etc.

- *Fire Storage*: This storage is required to fulfill additional water needs in the event of a fire. If there is fire within the City, the storage from the reservoir closest to the fire will be used to extinguish the fire.

Storage requirements increase with an increase in demands and with the growth within the distribution system. The storage requirements for the existing conditions and the ultimate buildout conditions are presented in Table ES.3 and Table ES.4.

Table ES.3 Existing Storage Requirements and Deficits
Water Master Plan Update
City of West Sacramento

Area	ADD (mgd)	MDD (mgd)	Required Operational Storage (MG)	Required Emergency Storage (MG)	Required Fire Storage (MG)	Total Required Storage (MG)	Existing Storage (MG)	Storage Deficit (MG)
			(0.25xMDD)	(0.5xMDD)				
North	8.7	17.4	4.3	8.7	2.4	15.4	15.4	**0.0**
Southport	4.4	8.8	2.2	4.4	1.5	8.1	3.9	**4.2**
Total	**13.1**	**26.2**	**6.5**	**13.1**	**3.9**	**23.5**	**19.3**	**4.2**

Notes:
(1) ADD = Average Daily Demand
(2) MDD = Maximum Day Demand
(3) MG = Million Gallons
(4) mgd = Million Gallons Per Day
(5) Fire Suppression in North = 8,000 gpm for 5 hours = 2.4 MG
(6) Fire Suppression in South = 5,000 gpm for 5 hours = 1.5 MG

Table ES.4 Storage Requirements and Deficits at Buildout Conditions
Water Master Plan Update
City of West Sacramento

Area	ADD (mgd)	MDD (mgd)	Required Operational Storage (MG)	Required Emergency Storage (MG)	Required Fire Storage (MG)	Total Required Storage (MG)	Existing Storage (MG)	Storage Deficit (MG)
			(0.25xMDD)	(0.5xMDD)				
North	14.2	28.4	7.1	14.2	2.4	23.7	15.4	**8.3**
Southport	11.8	23.6	5.9	11.8	1.5	19.2	3.9	**15.3**
Total	**26.0**	**52.0**	**13.0**	**26.0**	**3.9**	**42.9**	**19.3**	**23.6**

ES.8 HYDRAULIC ANALYSIS

Hydraulic analysis of the water distribution system was performed to determine the deficiencies within the distribution system. Deficiencies are defined as the distribution system facilities that are not sufficient to carry the required flows to the customers in the City. The deficiencies in the system are:

- *Pipeline Deficiencies*: These deficiencies are existing pipes in the system that are not large enough to carry the required flows from the source to the customer within established velocity and pressure criteria.

- *Pumping Deficiencies*: Pump stations are deficient when there are pressure problems and the pipeline leading to the deficient have sufficient capacity to deliver the flows.

The analyses of the existing distribution system and buildout distribution system were performed using the H2ONet hydraulic model. The following distribution system analyses were performed for the City's distribution system:

ES.8.1 Existing Maximum Day Demand (EMDD) Hydraulic Analysis

Existing maximum day demand (EMDD) is the condition when the system has the maximum day demands during the current year. The following analyses were performed for this scenario:

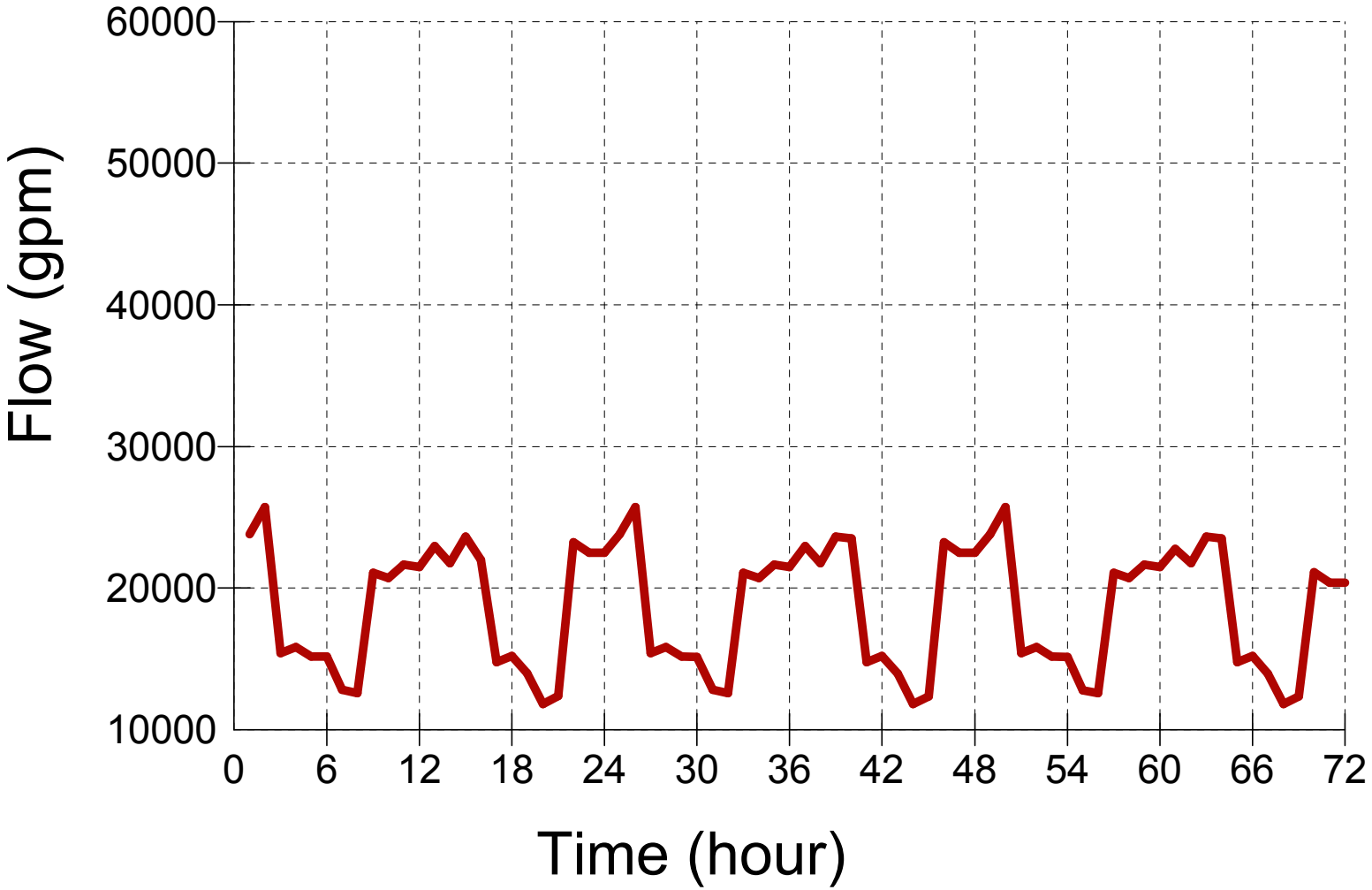
- *Existing Maximum Day Demand*: This is the analysis of the distribution system during the maximum day of the current year (i.e., Year 2004)

- *Existing Maximum Day Demand with Commercial Fire Demand*: This is the analysis of the distribution system during the maximum day of the current year with commercial fire flow demand in the North and Southport areas of the distribution system. Commercial fire demand is the amount of water required to extinguish the commercial fire as established in "March 2004 - Treated Water Storage Analysis".

- *Existing Maximum Day Demand with Residential Fire Demand*: This is the analysis of the distribution system during the maximum day of the current year with residential fire flow demand in the North and Southport areas of the distribution system. Residential fire demand is the amount of water required to extinguish the residential fire as established in "March 2004 - Treated Water Storage Analysis".

The flow from the Bryte Bend WTP High Service Pump Station (HSPS) during a 72-hour time-based analysis is indicated on Figure ES.2. The improvements required to eliminate the deficiencies in the existing distribution system based on the hydraulic analysis criteria are:

Figure ES.2 Existing Maximum Day Demand- Flow from High Service Pump Station



- 5,850 feet of 12-inch parallel pipeline towards the PSIP reservoir, this pipeline runs on West Capitol Avenue between the intersections of Harbor Boulevard and West Capitol Avenue to the intersection of West Capitol Avenue and Enterprise Boulevard and extends all the way to PSIP Reservoir on Enterprise Boulevard from the intersection of West Capitol Avenue and Enterprise Boulevard.

- Replacing the existing pumps at the PSIP reservoir

The existing system is performing efficiently with current demands except for the above improvements in the PSIP area.

ES.8.2 Buildout Maximum Day Demand (BOMDD) Hydraulic Analysis

The buildout maximum day demand (BOMDD) is the condition when the system has maximum day demands during the buildout year i.e., when the City is developed in accordance with the General Plan. The following analyses were performed for this scenario:

- *Buildout Maximum Day Demand*: This is the analysis of the distribution system during the maximum day of the ultimate buildout year (i.e., Year 2020 as per Year 2000-General Plan)

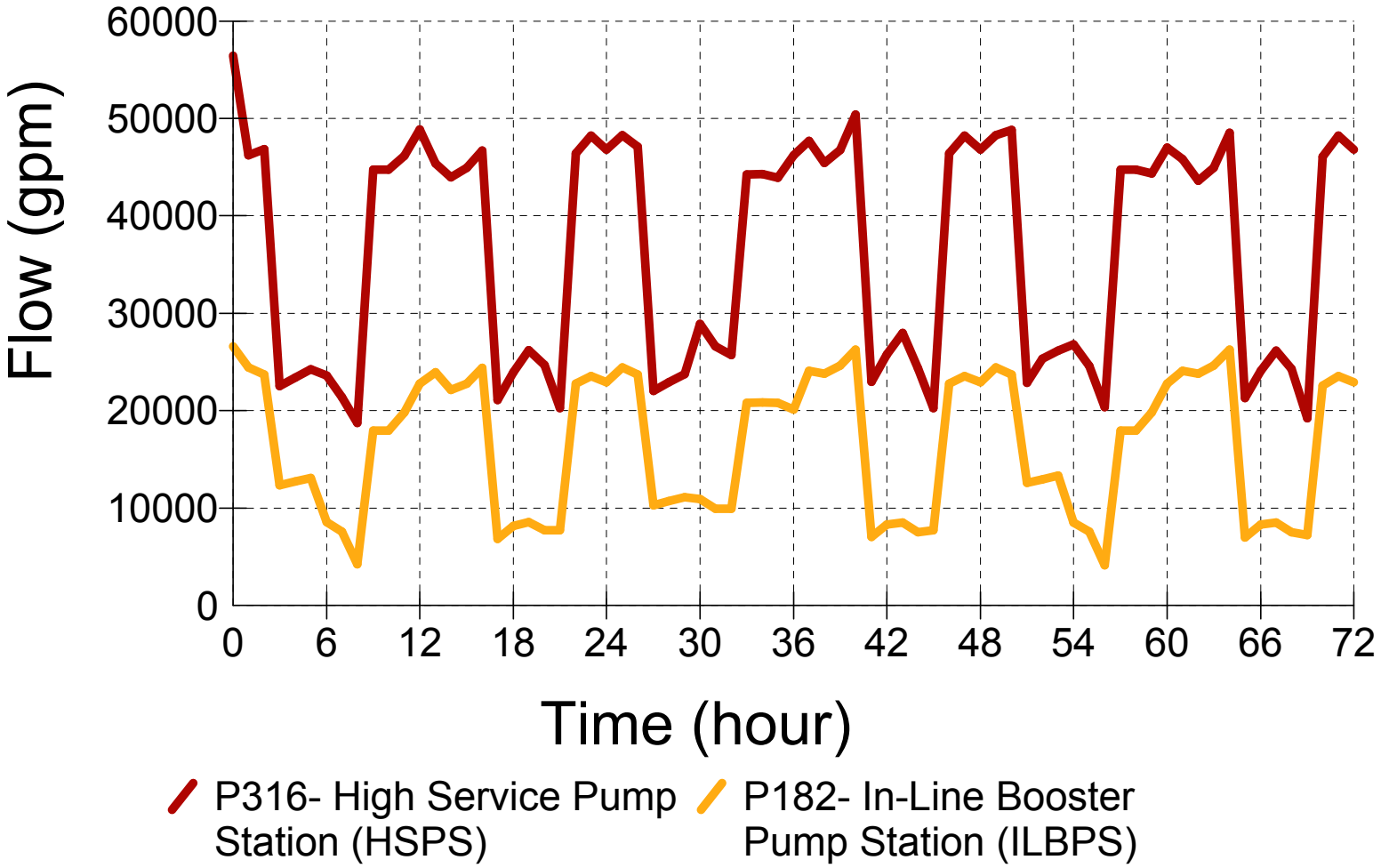
- *Buildout Maximum Day Demand with North Area Transmission Main Improvements*: This is the analysis of the distribution system with maximum day demands during the ultimate buildout year with transmission main improvements in the North area and booster pumping improvements towards the Southport area.

- *Buildout Maximum day Demand with Industrial Fire Demands in the North Area*: This is the analysis of the distribution system with maximum day demands during the ultimate buildout year with transmission main improvements in the North area and booster pumping improvements towards the Southport area. An industrial fire demand is allocated to the PSIP area.

The flow from the Bryte Bend WTP-High Service Pump Station (HSPS) during 72-hour time-based analysis is indicated on Figure ES.3. The improvements required to eliminate the deficiencies in the existing distribution system based on the hydraulic analysis criteria are:

- 6,200 feet of parallel 16-inch pipeline towards the PSIP reservoir. This pipeline runs through the following intersections:
  - ➢ From the intersection of West Capitol Avenue and Harbor Boulevard to the intersection of West Capitol Avenue and Enterprise Boulevard on West Capitol Avenue.

Figure ES.3 Buildout Maximum Day Demand- Flow from HSPS and ILBPS



➢ From the intersection of West Capitol Avenue and Enterprise Boulevard to the intersection of Seaport Boulevard and Enterprise Boulevard on Enterprise Boulevard.

This improvement supercedes the improvement recommended in EMDD conditions.

- An In-line Booster Pump Station (ILBPS) at the Barge Canal. This is the most cost-effective and constructible option to boost water from the North area to the Southport area. The ILBPS option will eliminate the need for transmission main improvements that run for miles and costs much more than the ILBPS. In addition, the ILBPS option will eliminate the new pipeline crossing the Barge Canal. Since construction across the Barge Canal will be difficult and the future pipe maintenance will be highly complicated, the ILBPS option eliminates those issues and will create a separate pressure zone in Southport area. This provides the operations staff with greater flexibility, i.e., the operations staff can turn-on and turn-off the pumps based on the demand and pressure requirements in the Southport area.
- New storage reservoirs required per water storage criteria.
- 5,500 feet of 24-inch parallel pipeline on Maryland Avenue or Virginia Avenue.
- Other improvements related to the new developments.

The ultimate buildout system needs numerous improvements for efficient performance of the distribution system. The transmission main improvements and storage reservoir improvements are indicated on Figures ES.4 and ES.5 respectively.

ES.9 METER IMPLEMENTATION PLAN

Assembly Bill No. 514 (AB 514) became law in 2003 and promulgated that all Central Valley Project (CVP) municipal contractors are required to install water meters on all residential and commercial services constructed prior to 1992. Note that all homes constructed after 1992 already have meters or meter boxes based on prior legislation.

The City is required to:

- Install water meters on all service connections to residential and commercial buildings constructed prior to January 1992, no later than January 1, 2013.
- Begin charging all customers for water based on actual volume used, commencing no later than March 1, 2013.

The City currently has partial metering infrastructure in-place. Most of the metering infrastructure was performed in the Southport area of the City. There are 10,277-meter

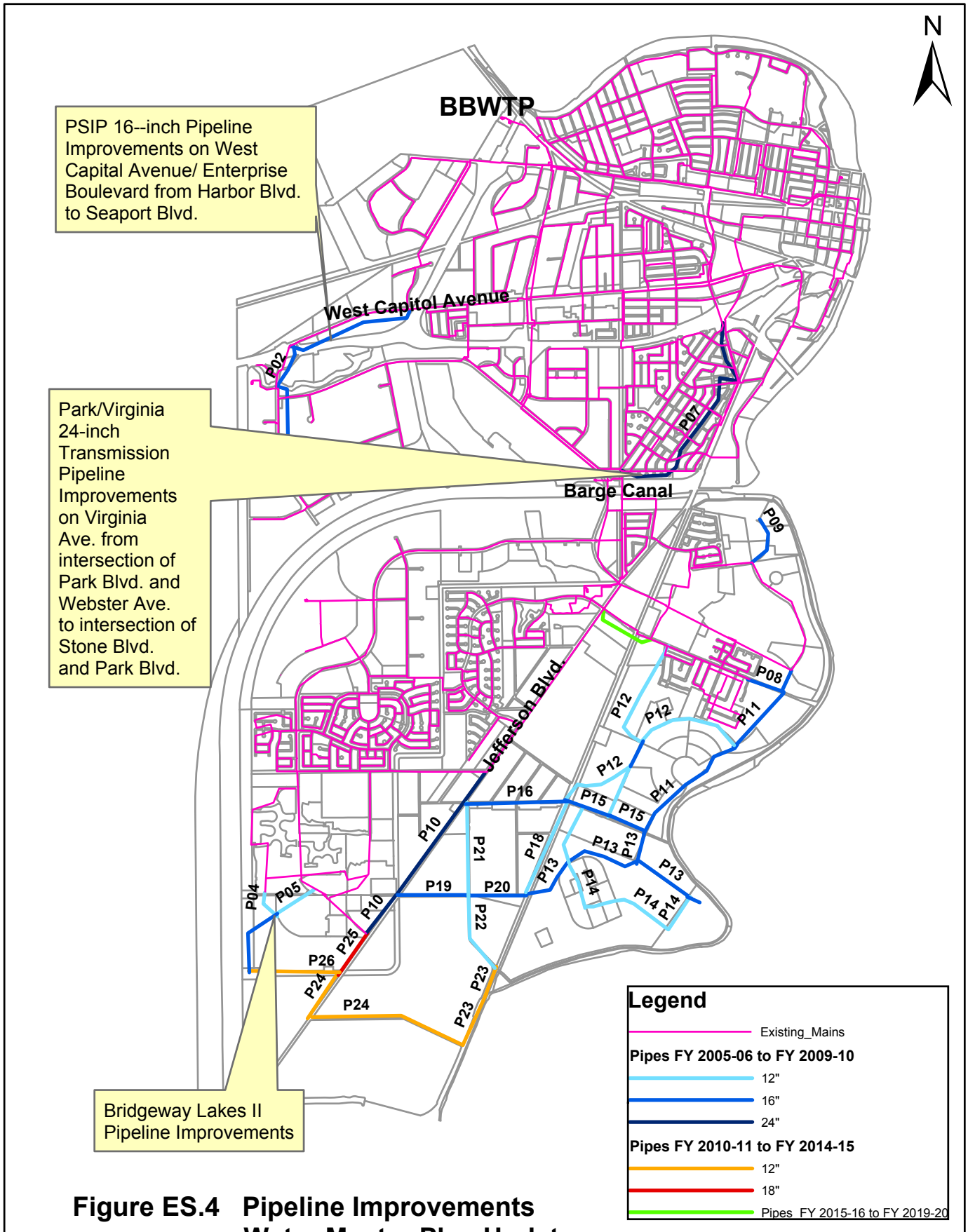


Figure ES.4 Pipeline Improvements
Water Master Plan Update
City of West Sacramento

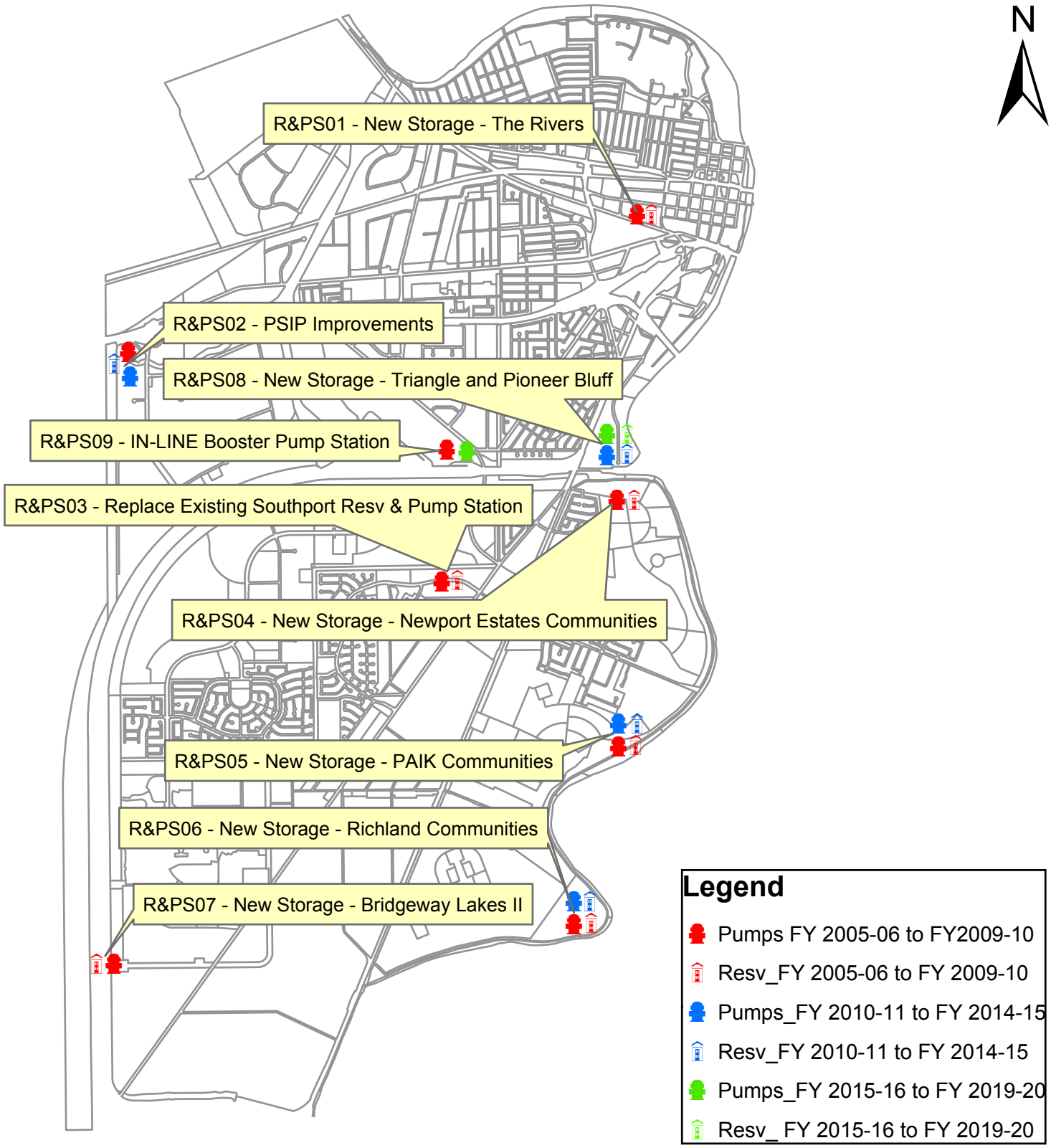


Figure ES.5 Reservoir and Pump Station Improvements
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installations that need to be completed as part of the meter implementation plan. The following metering infrastructure needs to completed by January 1, 2013:

- Installation of a transmitter only (3,524 services)
- Installation of a meter and transmitter at locations where mains have been replaced (1,564 services)
- Replacement of pre-1997 meters with radio-read meter and transmitter, (883 services)

The remaining 4,306 services (10,277 minus services listed above), will require either:

- Installation of a meter box, meter, and transmitter, or
- Installation of a meter and transmitter after installation of the services and meter box with main replacement projects

For a smooth completion of the meter implementation plan, a public outreach plan should be prepared. The public outreach plan will help in implementing this plan without interruption by providing a first-hand description of the benefits of the meter implementation plan to water usage customers within the City.

The meter implementation plan is targeted to conserve water and save the energy associated with treating and distributing that water. Water conservation will also help preserve the natural water resources during drought periods.

ES.10 CAPITAL IMPROVEMENT PROGRAM (CIP)

The Capital Improvements Program (CIP) describes all the improvements required within the City's distribution system between now (Year 2005) and ultimate buildout year (Year 2020). The planning period for this Master Plan Update and Capital Improvement Program are from Fiscal Year (FY) 2005-06 through FY 2019-20, and is divided into three time periods. These time periods are:

- FY 2005-06 to FY 2009-10
- FY 2010-11 to FY 2014-15
- FY 2015-16 to FY 2019-20

The various type of improvements required during the above-described time-periods are:

ES.10.1 Transmission Main (T-main) Improvements

These are the improvements required to transmit water from treatment source to customers. The T-mains are the larger pipelines in the system, generally 12-inches and larger. There are several T-main improvements recommended within the distribution system during the planning period. Some of the T-main improvements are to resolve deficiencies within the existing distribution system. The majority of the T-main improvements are to accommodate the growth within the distribution system.

The costs for T-main improvements associated with various time-periods and the total costs for the planning period are indicated on Figure ES.6.

ES.10.2 Reservoir and Pump Station Improvements

Reservoir and pump station improvements enhance the distribution system operation and increase the flexibility of the system operation. Reservoirs store water during the low demand periods and deliver water during the high demand periods. Pumps are required to boost the water into the system to desired pressures as all reservoirs within the City are surface reservoirs (located below the hydraulic grade line). The reservoirs also supplement the distribution system in case of emergency and fire situations. Every reservoir must be accompanied with a properly sized pump station in order to boost water into the distribution system.

The costs for reservoir and pump station improvements associated with various time-periods and the total costs for the planning period are indicated on Figure ES.6.

ES.10.3 Water Main Replacement Projects

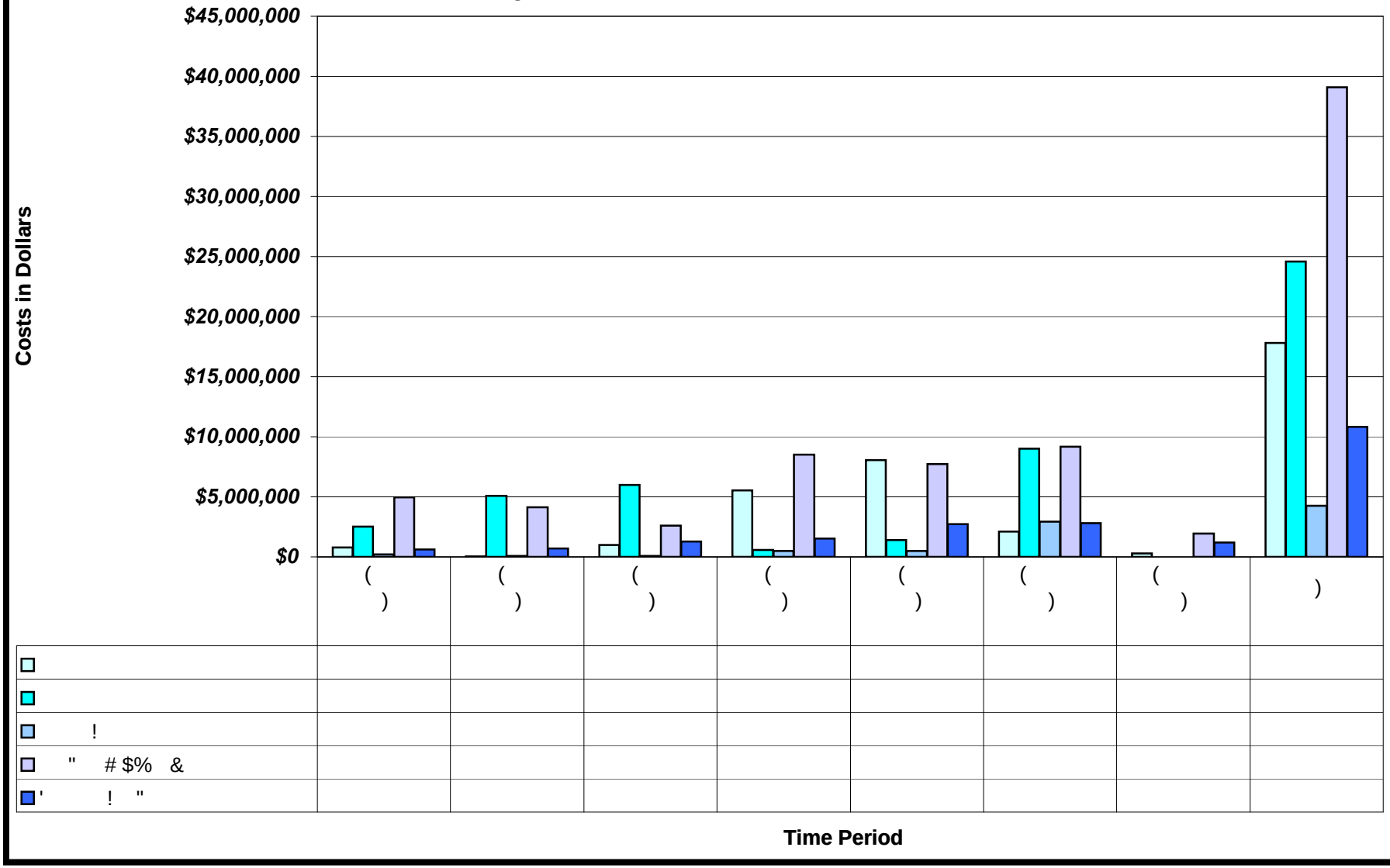
Previous City Master Plans have identified a program of replacing older pipelines that have a history of leaks or are constructed of uncoated or unlined steel pipe. The 1994 Water Master Plan identified approximately 120,000 feet of pipe for replacement under this program. At present, the program is driven by the City's aggressive road rehabilitation program, which includes numerous streets throughout the older portions of the City. In order to avoid trenching in newly paved streets, which can adversely affect the service life, the City needs to complete pipeline replacements on these streets prior to pavement rehabilitation. In order to accomplish this, the proposed water main replacement Capital Improvement Program is directly aligned with the City road rehabilitation program. Replacement of old, inadequate pipes is funded through water rate revenues.

The costs for water main replacement projects associated with various time-periods and the total costs for the planning period are indicated on Figure ES.6.

ES.10.4 Metering Implementation Plan

The meter implementation plan should be implemented by the beginning of Year 2013. Section ES.8 briefly describes the meter implementation plan. Since all the improvements

Figure ES.6 Cost Comparison During Various Time Periods
Water Master Plan Update
City of West Sacramento



Note: (1) Out of $2,534,500 for FY 2005-06, $331,500 is already spent during FY 2004-05.

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Cost CompA

under this plan are for existing customers, existing rate payers should pay all the costs.

The costs for the meter implementation plan associated with various time-periods and the total costs for the planning period are shown on Figure ES.6.

ES.10.5 Operational Improvements

Operational improvements have been identified by the City Staff and Carollo that will improve the operations of the distribution system and thus help the City in saving energy and operational costs. These improvements also include the improvements recommended by the Vulnerability Assessment of the City's water system.

The costs for operational improvements associated with various time-periods and the total costs for the planning period are indicated on Figure ES.6.

ES.11 FINANCIAL ANALYSIS

The water master plan update also involved financial analysis, which includes development of a 15-year financial plan, water rate recommendations for a 5-year period, and an update to the City's water system impact fees. The financial analysis is presented in Chapter 9 of this report.

The 15-year financial plan is intended to serve as a planning and management tool to assist the City in evaluating the current, near-term, and potential long-term implications of decisions and actions affecting the water utility. The water utility was found to be in generally sound financial condition at present. However, water rates currently do not adequately support ongoing capital rehabilitation and upgrade costs as reflected in the CIP. Near-term capital improvement costs that are appropriately borne by rate payers primarily include water main replacements (associated with Measure K street improvements) and the meter retrofit program.

Proposed water rates include annual increases of 5 percent or less for the next five years, and do not include significant rate structure changes. Metered rates appropriate for single family residential customers should be addressed as the City further develops its meter retrofit strategy. Water system impact fees have been updated with a recommended 3.2 percent increase to the current fees.

Details of the financial analyses, water rate recommendations, and water system impact fee recommendations can be found in Chapter 9 of this report.

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