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CITY OF WEST SACRAMENTO

WATER MASTER PLAN UPDATE

MASTER PLAN REPORT

FINAL
May 2005

carollo engineers

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MASTER PLAN REPORT

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WATER MASTER PLAN UPDATE

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.

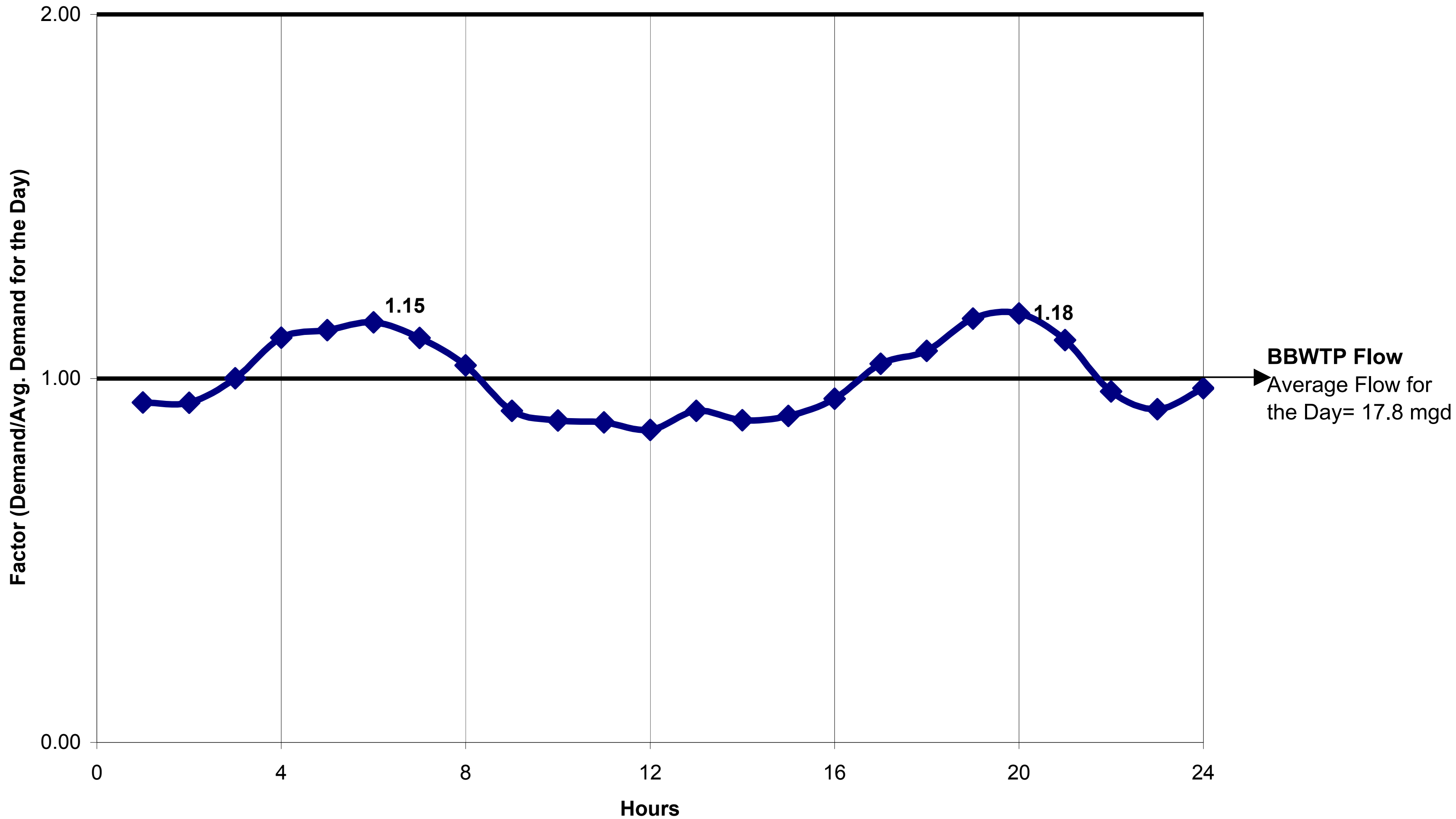
The ultimate buildout demands were based on the land use category and the average water usage by the customer type. Land use data was obtained from the City's General Plan. The average water usage by each customer was established in the City's previous water master plan. Land use types contained within 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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HrPtn Graph

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:

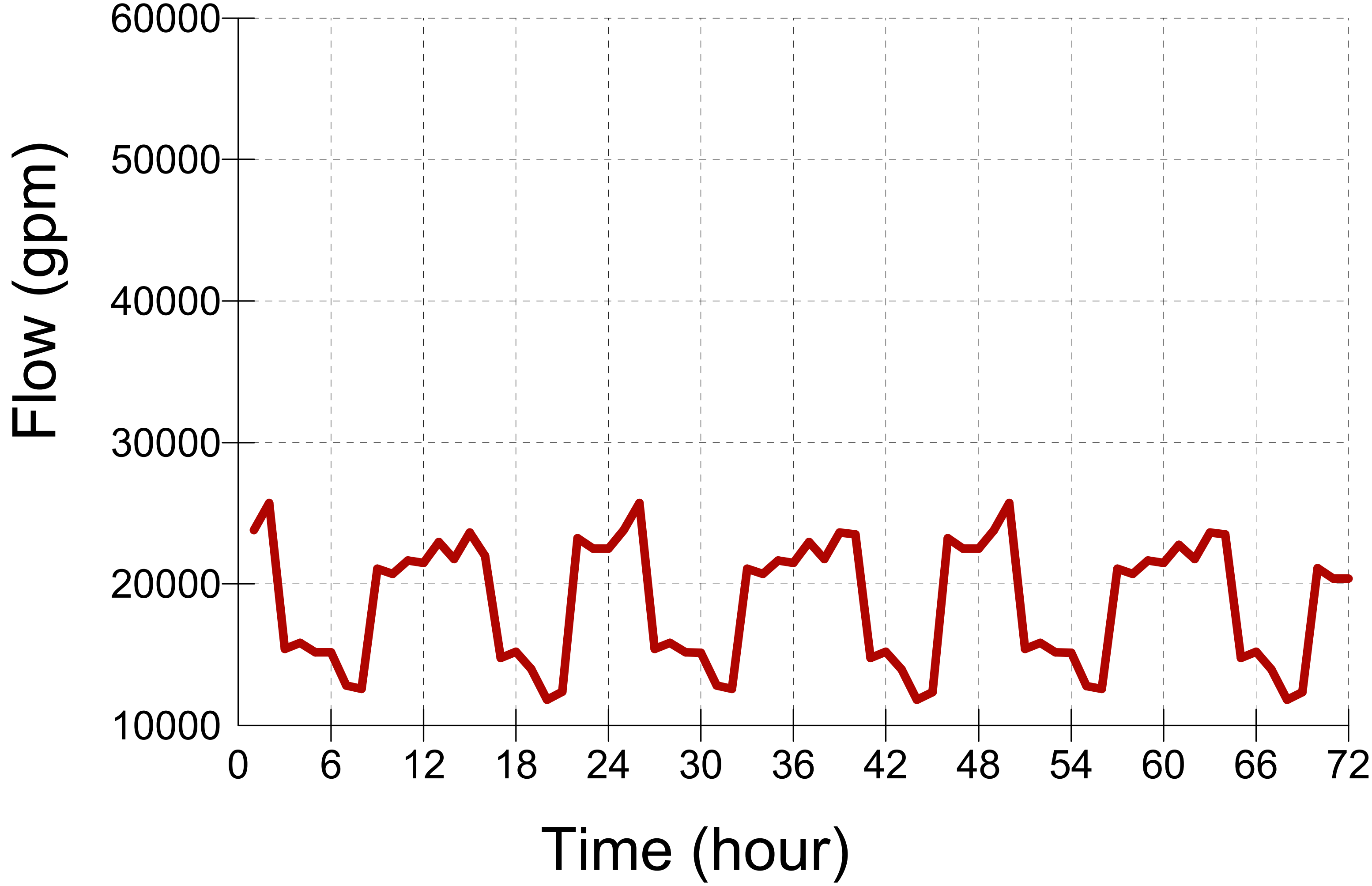
- *Existing Maximum Day Demand*: This is the analysis of the distribution system during the maximum day of the current year (i.e., Year 2004)

- *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.

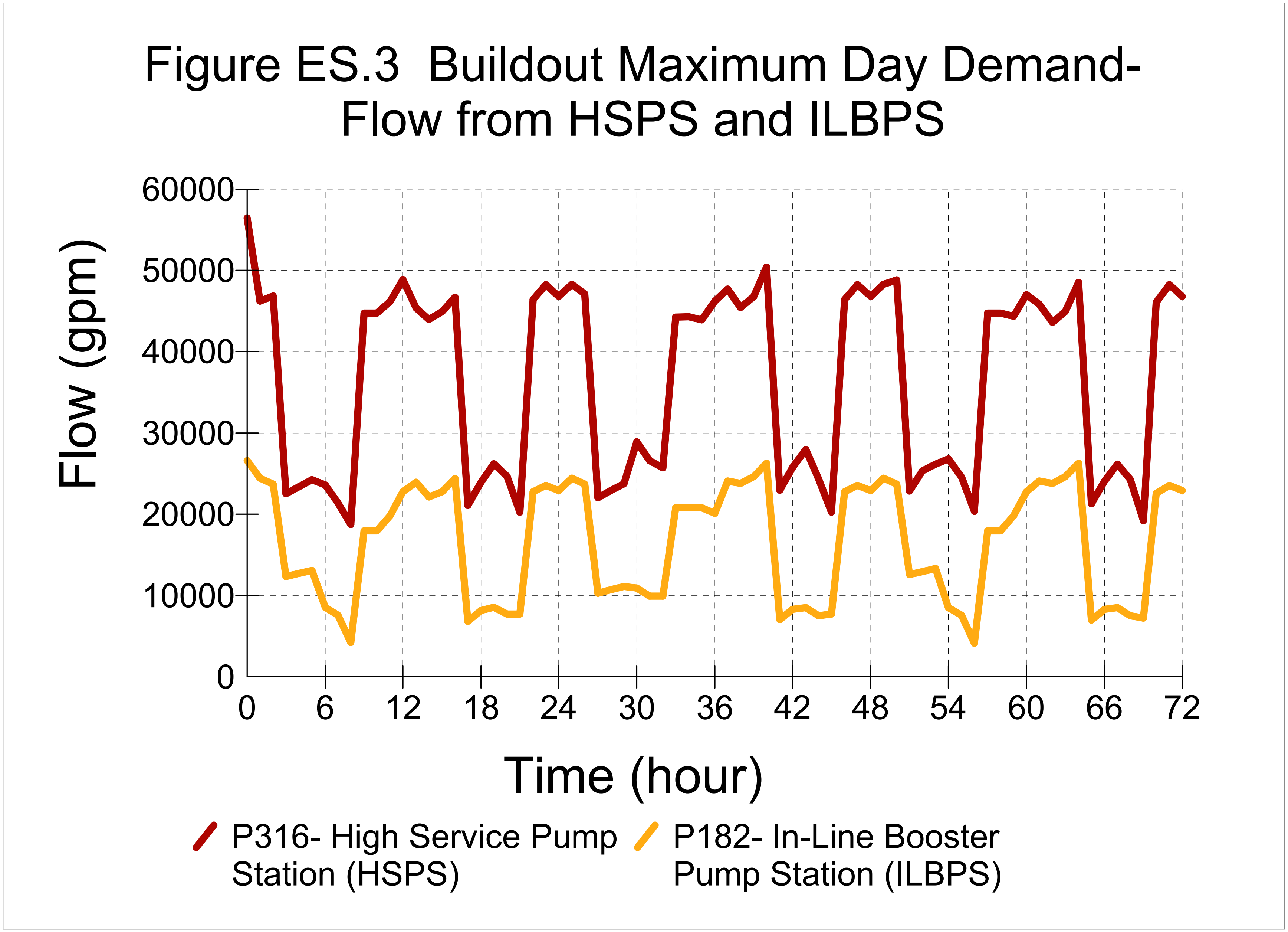


Figure ES.3 Buildout Maximum Day Demand-
Flow from HSPS and ILBPS
Flow (gpm)
60000
50000
40000
30000
20000
10000
0
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
P316- High Service Pump Station (HSPS)
P182- In-Line Booster Pump Station (ILBPS)

- ➢ 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

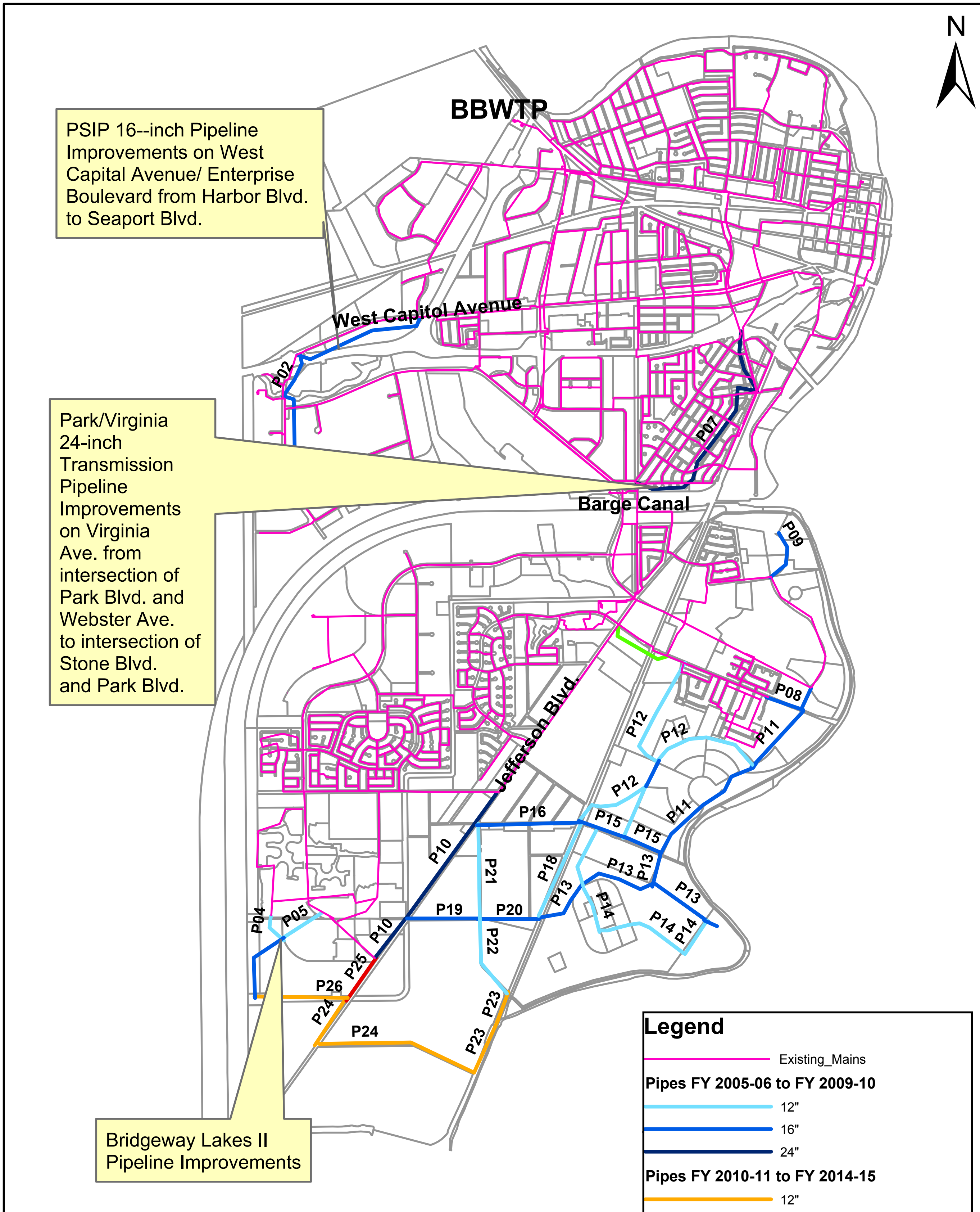


Figure ES.4 Pipeline Improvements
Water Master Plan Update
City of West Sacramento

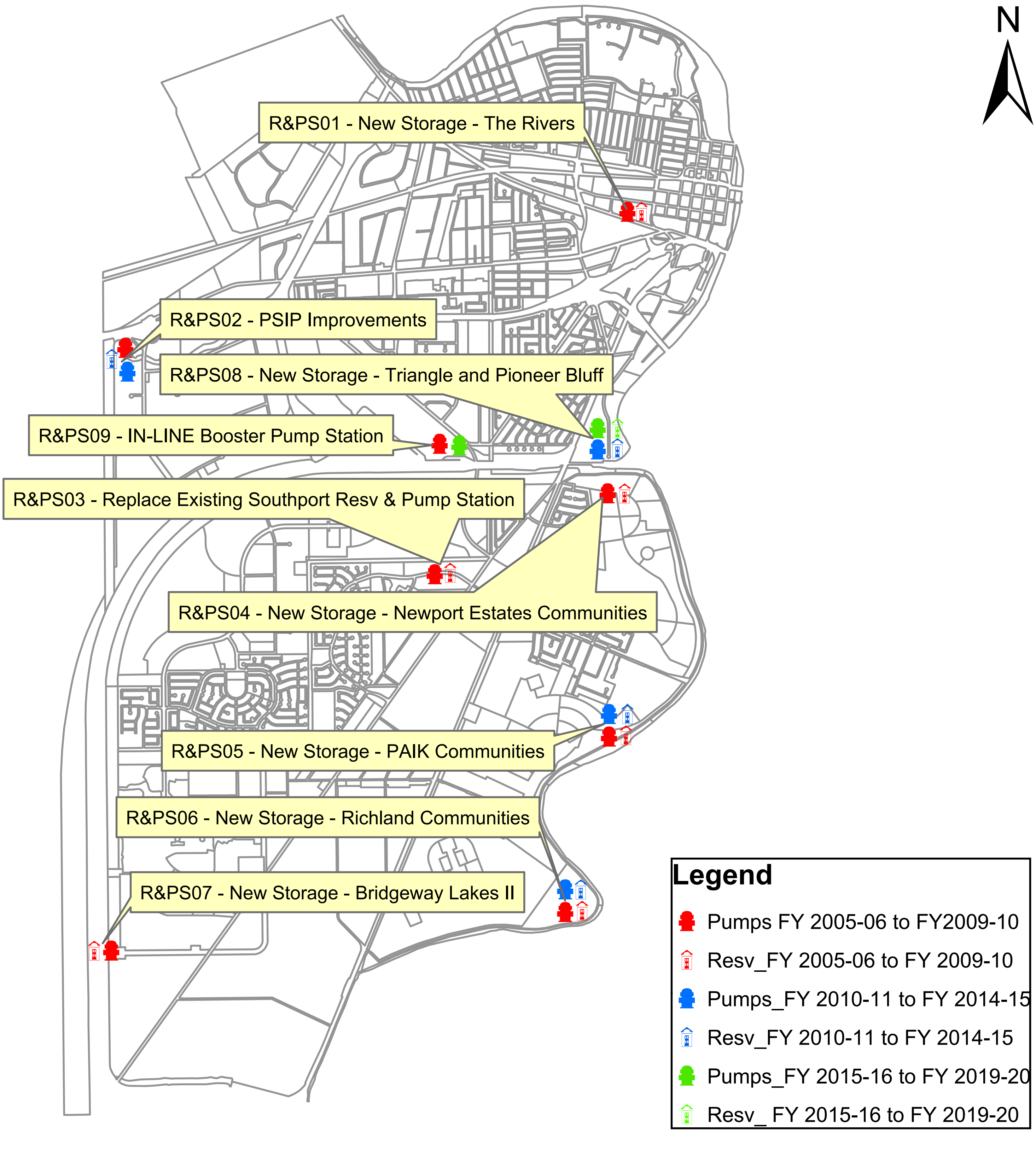


Figure ES.5 Reservoir and Pump Station Improvements
Water Master Plan Update
City of West Sacramento

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

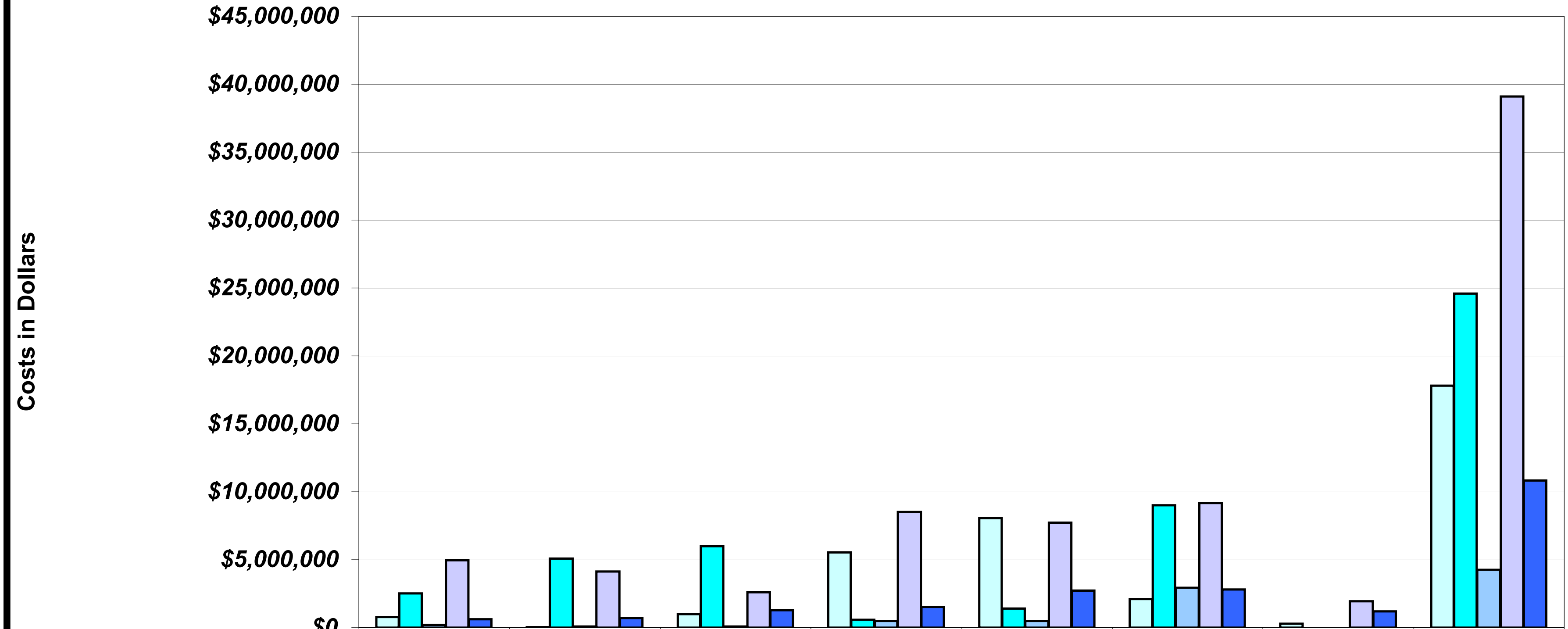
Previous City Master Plans have identified a program of replacing older pipelines that have a history of leaks or are constructed of uncoated or unlined steel pipe. The 1994 Water Master Plan identified approximately 120,000 feet of pipe for replacement under this program. At present, the program is 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



	2005-06, Total= $9,095,900	2006-07, Total= $10,041,500	2007-08, Total= $10,986,600	2008-09, Total= $16,640,000	2009-10, Total= $20,408,500	2011-2015, Total= $25,996,400	2016-2020, Total= $3,405,000	Total= $96,574,000
Transmission Mains	$802,800	$38,978	$1,004,725	$5,519,174	$8,073,724	$2,094,200	$273,400	$17,807,000
Water Main Replacement (1)	$2,534,500	$5,092,000	$5,994,500	$597,500	$1,387,500	$9,000,000	$0	$24,606,000
Metering Implementation	$200,000	$78,008	$78,008	$476,913	$500,807	$2,919,661	$0	$4,253,000
Reservoirs & Pump Stations	$4,957,574	$4,125,530	$2,620,378	$8,527,397	$7,737,447	$9,177,542	$1,926,600	$39,072,000
Operational Improvements	$601,000	$707,000	$1,289,000	$1,519,000	$2,709,000	$2,805,000	$1,205,000	$10,835,000

Time Period

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

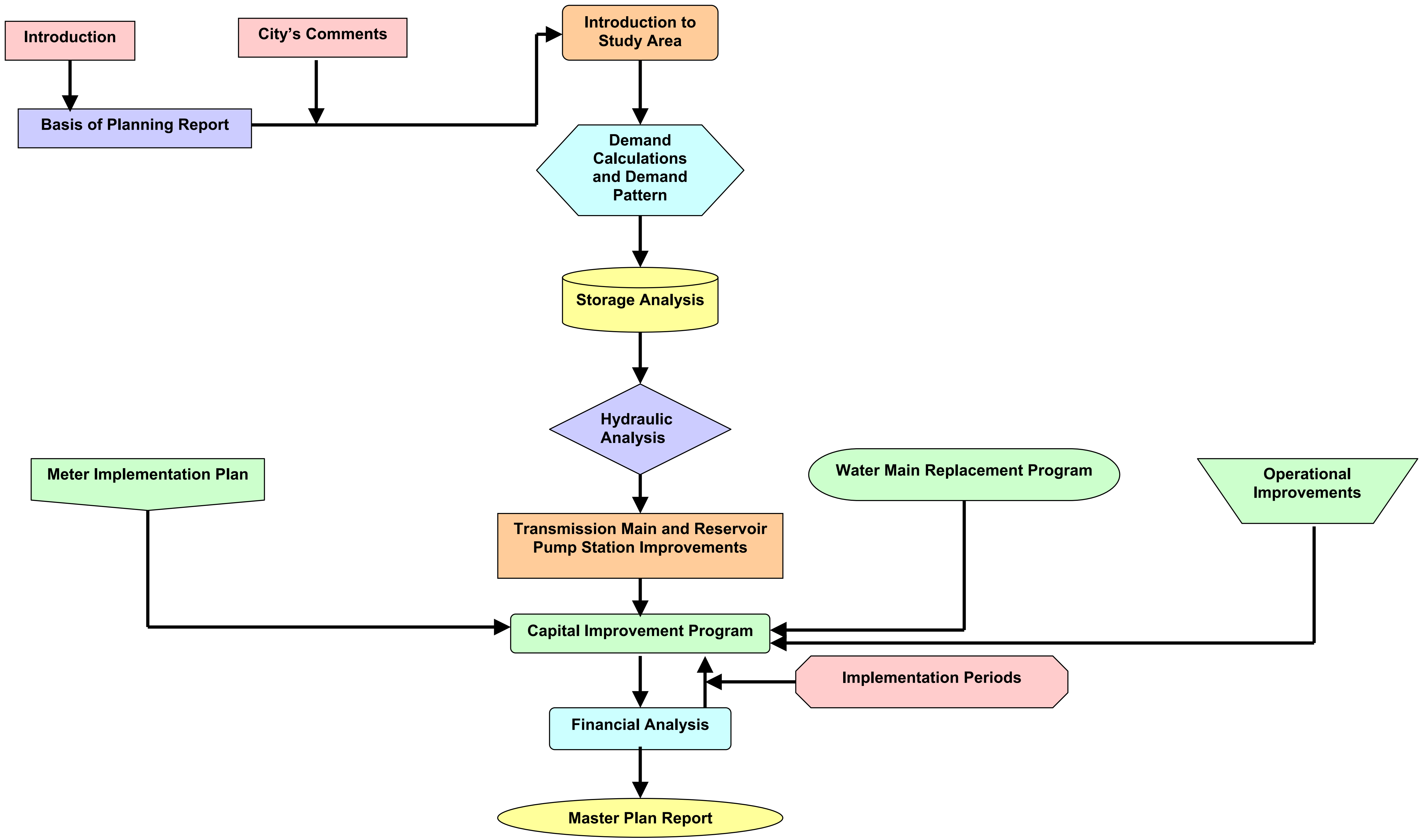
The water master plan update also involved financial analysis, which includes development of a 15-year financial plan, water rate recommendations for a 5-year period, and an update to the City's water system impact fees. The financial analysis is presented in Chapter 9 of this report.

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.

EXECUTIVE SUMMARY
WATER MASTER PLAN UPDATE
CITY OF WEST SACRAMENTO



INTRODUCTION

1.1 INTRODUCTION TO STUDY AREA

The City of West Sacramento (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 study area comprises all of the existing and future developments within the City boundaries. The City covers approximately 19 square miles with an estimated Year 2005 population of 38,000. Lands north of the Barge Canal are considered the North area, including Broderick and Bryte, which are older, well-established neighborhoods. Lands south of the Barge Canal are considered the Southport area.

The North area includes a mix of residential, commercial, and industrial development. There is a large industrial development located in the southwestern portion of the North area that has high fire protection demands. The current residential and commercial developments will grow with the addition of three new developments. The Rivers, a residential community planned for the northern tip of the City, will add housing and residents to the community. Commercial development and the addition of office space in the North Area will increase in the near future with the addition of the Triangle and Pioneer Bluff developments. These developments, as well as more industrial growth, will substantially raise the future water demands for the North area.

The Southport area is expanding rapidly with the addition of several new housing developments including: Bridgeway Lakes with 1,300 new homes, Newport Estates with 860 new homes, and the soon to be developed PAIK and Richland Communities adding several thousand new homes. The Southport Area is also growing in its industrial development with 14,544,00 square feet of industrial space, increasing the fire protection demands. With the abundant growth in the Southport Area, the water demands in this region will increase substantially.

The Study Area of this Master Plan is indicated on Figure 1.1.

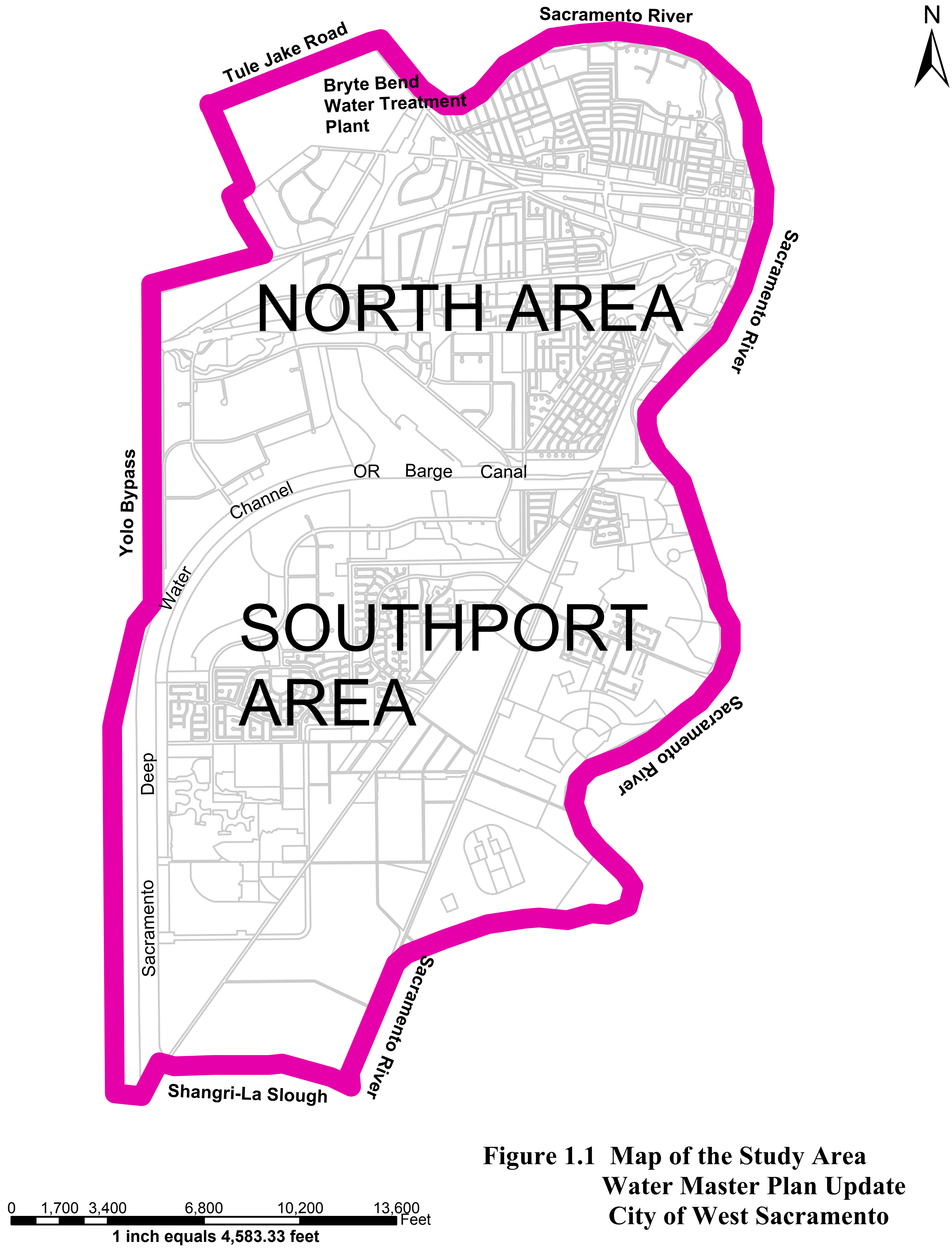


Figure 1.1 Map of the Study Area
Water Master Plan Update
City of West Sacramento

1.2 BACKGROUND INFORMATION

The City serves treated surface water to various customers within the City limits. The water is diverted from the Sacramento River through an intake structure to the Bryte Bend Water Treatment Plant (Bryte Bend WTP). At this location water is treated before it is pumped to customers and reservoirs via the distribution system.

The City supplies water to various land use categories such as residential, commercial, industrial, schools, parks, sports arena, etc. The primary source of water supply is diverted from the Sacramento River. Although there are old groundwater sources, the City intends to permanently abandon them for water quality reasons.

The purpose of this Master Plan Report is to evaluate the existing system, define required improvements, and propose new infrastructure to support the City's projected growth in the future. The City is currently growing at a rapid pace and the existing facilities need to be evaluated for their ability to supply water for the projected growth in the City's Year 2000-General Plan (General Plan). A summary of major growth areas within the City is indicated on Figure 1.2. This Master Plan Report also presents the results and findings from hydraulic modeling evaluations, field visits, and meetings with City staff. The following reports and sources are utilized to establish the criteria listed in the report:

- December 1994 - Water Master Plan
- December 13, 2000 (Revised July 31, 2002) - Urban Water Management Plan
- October 24, 2003 (updated March 8, 2004) - Treated Water Storage Analysis
- Year 2002 and Year 2003 - Production and Cost Analysis Data from the City
- Water production data from City (through email from the City on 05/03/2004)
- Field visits of City facilities
- Meetings with City staff

The criteria for the evaluation of the existing distribution system and the future scenarios are presented in the following sections. A schematic of the existing distribution system, including water reservoirs, is indicated on Figure 1.3. The study area consists of the entire area within the City boundaries.

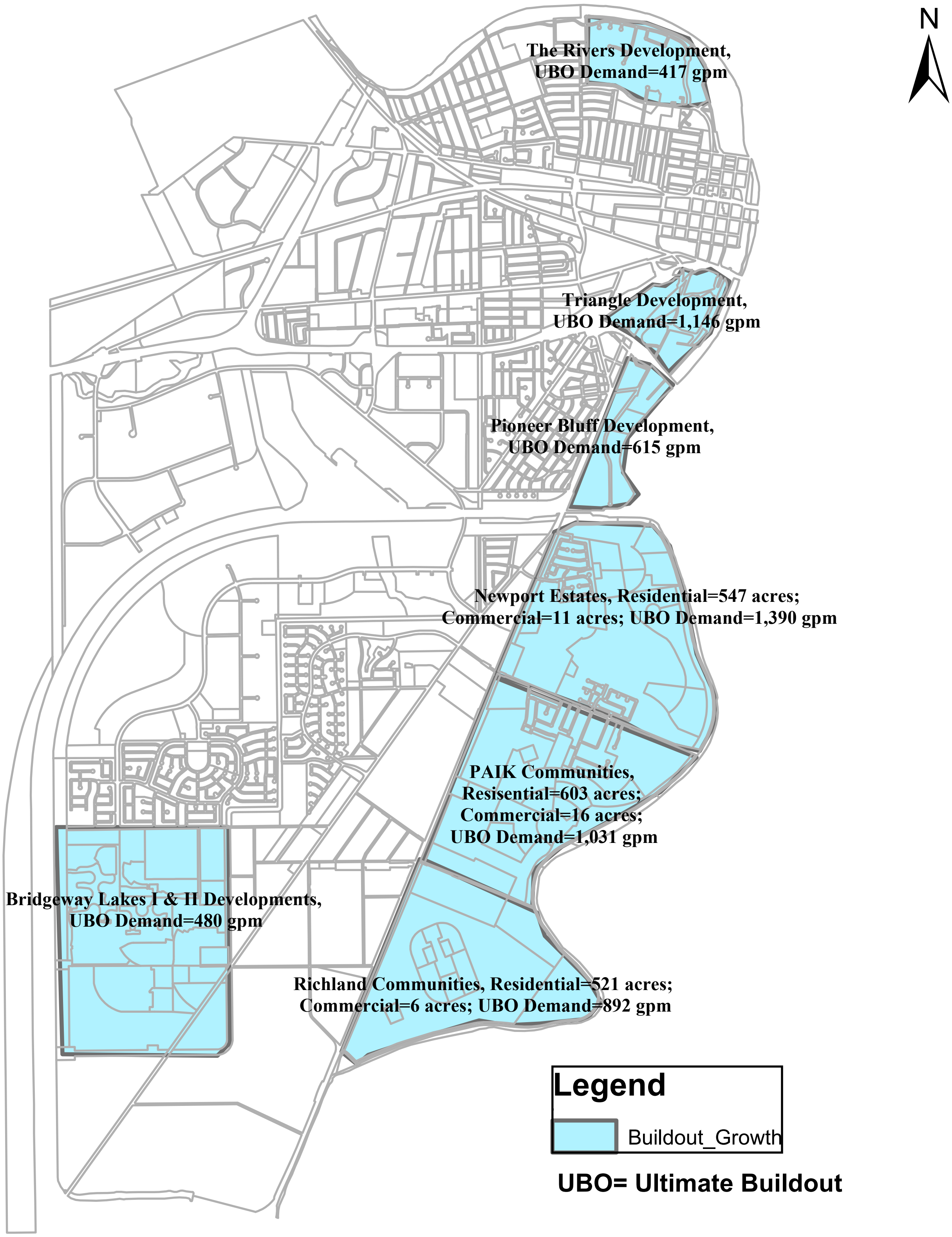


Figure 1.2 Major Growth Areas within the City
Water Master Plan Update
City of West Sacramento

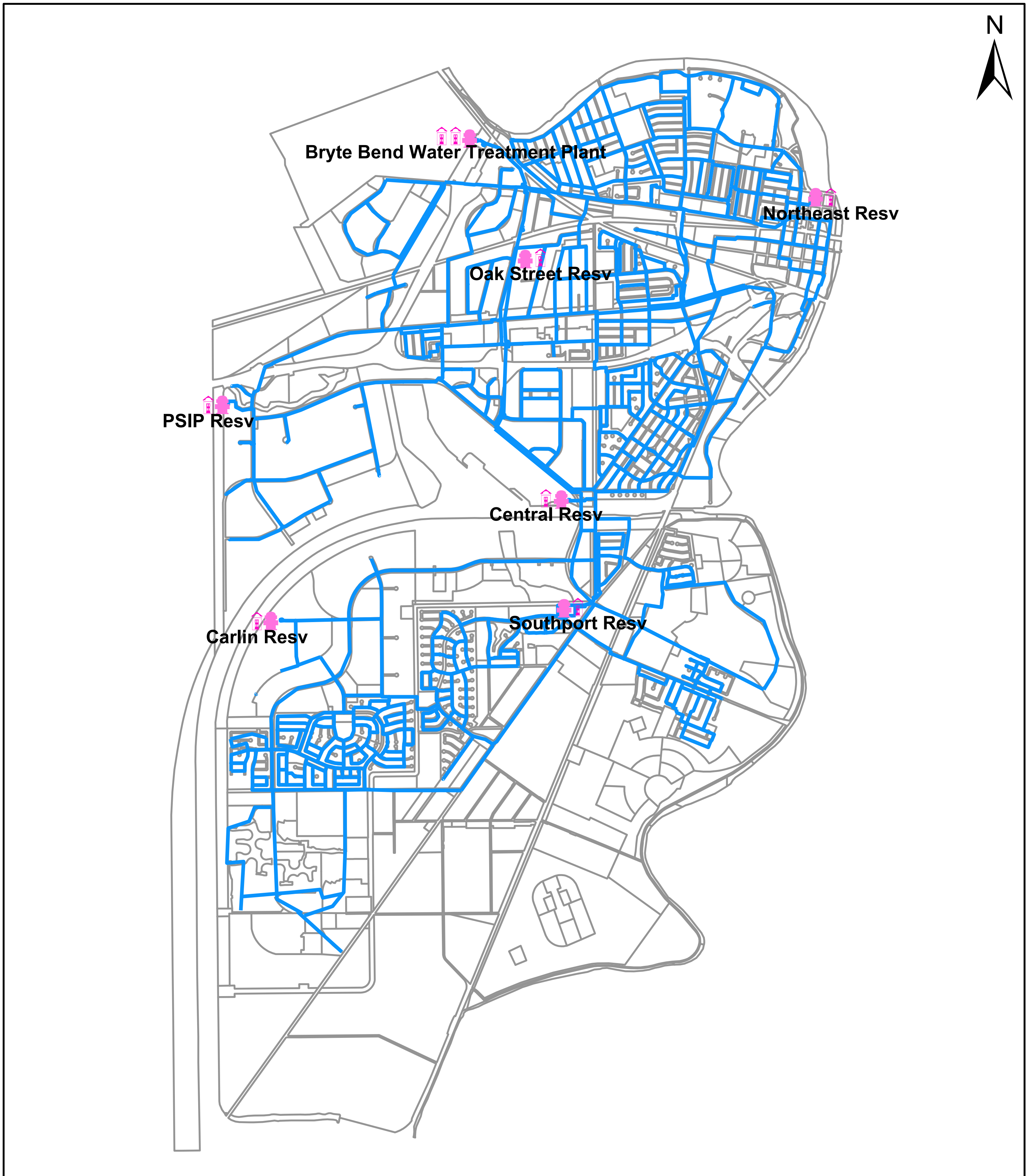


Figure 1.3 Existing Distribution System
Water Master Plan Update
City of West Sacramento

The tasks that were performed in order to evaluate the existing facilities and develop a comprehensive Capital Improvement Program (CIP) are presented below.

- Demands and Demand Patterns: Demands for existing and UBO systems were established from City data. The diurnal demand pattern was established from actual operational data from the distribution system.
- Storage: Storage criteria and requirements were established based on the demands in the system.
- Hydraulic Analysis: Hydraulic Analyses was performed based on the demands and storage requirements within the distribution system.
- Capital Improvement Program (CIP): CIP was performed to estimate the costs and schedule of the projects that are required to improve the performance of the City's distribution system.
- Metering Implementation Plan: A Metering Implementation Plan was developed as a part of this project.
- Financial Analysis: Based on the CIP, the financial analysis will determine the water rate and impact fee changes.

The above tasks and distribution system evaluation are described in detail in the following chapters.

WATER DEMANDS

Carollo Engineers (Carollo) reviewed historical demands from various reports and water production data from the City's Bryte Bend WTP. Water production data from the previous four years was compared to determine the average daily demand (ADD) and maximum daily demand (MDD) for existing conditions. Land use data was used to develop future demand projections. Carollo used Geographic Information System (GIS) software to determine the UBO demands using the City's General Plan land use data.

2.1 CRITERIA FOR DEVELOPING DEMANDS

The demands within a distribution system reflect the amount of water usage within the system plus distribution system losses. The demands within the distribution system vary from day to day, month to month, and year to year. The common practice is to design distribution system transmission and storage facilities for MDD conditions and check the validity of the design utilizing peak hour demand and fire demand conditions.

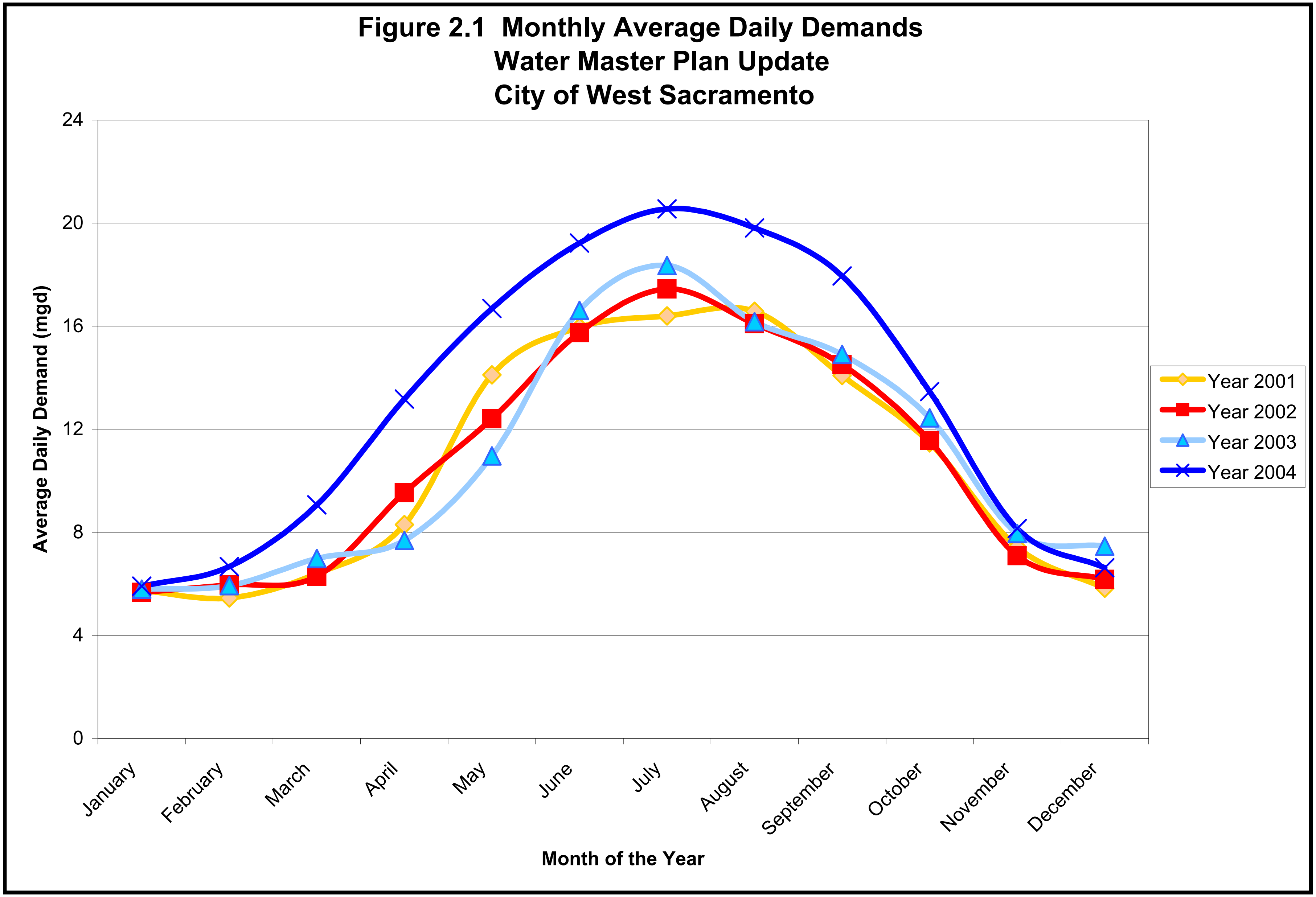
Since the distribution system is designed to handle MDD conditions, the performance of the system will be more efficient during these conditions than any other demand condition. Reservoirs provide storage for emergency conditions when demands are higher than the MDD conditions.

2.1.1 Existing Conditions

The existing ADD and MDD are obtained from the historical flow data at Bryte Bend WTP. The City provided the water production data from the Bryte Bend WTP for the past four years. The following are the criteria for establishing existing demands in the system is listed below:

- ADD is the average day production from Bryte Bend WTP for the Year 2004. Year 2004 is used as the Existing Year because it is the last year with complete production data. The ADD for each month from Year 2001 through Year 2004 is indicated on Figure 2.1. The ADD for Year 2004 is 13.2 million gallons per day (mgd), which is 20 percent higher than Year 2003 production. Reasons for this increase include: New developments in Southport, establishing new landscaping and lawns in Southport, higher pressures at the improved High Service Pump Station (HSPS), and a very dry and warm spring.

- MDD is the maximum daily production from Bryte Bend WTP. Ratios of MDD to ADD were reviewed for the previous twelve years to determine an appropriate peaking factor.



Note: Based on Water Production Data from Bryte Bend Water Treatment Plant, provided by the City.

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ADD Comparison

- Peak Hourly Demand (PHD) was previously determined by multiplying the ADD with a peaking factor. Carollo recommends that the results of the distribution system's 24-Hour Demand Test be used to determine an appropriate peak hour to daily average peaking factor.

2.1.2 Demand Pattern

The demand pattern for the City's distribution system has not been previously established. The City performed a 24-Hour Demand Test on June 8, 2004. The ratio of hourly demand to the average demand during the 24-hour period was used to establish the hourly demand pattern in the dynamic hydraulic analysis. Dynamic modeling of the system was evaluated over a 72-hour period (Extended Period Simulation feature of the H20Net software), which provided valuable information on storage reservoir and pump station operation.

A protocol for the 24-Hour Demand Test was submitted to the City and a copy of the protocol is presented in Appendix B of this report. The following criteria was used for the 24-Hour Demand Test:

- Only facilities with accurate reading instruments are used during the testing.
- Only the High Service Pump Station (HSPS) and Carlin Reservoir Pump Station are operating during the test period. These facilities have flow meters for measuring discharge flows.

Only Carlin Reservoir was operating during the testing, for all other reservoirs the inlet and outlet valves were closed during the test period.

The demand pattern during the 24-Hour Demand Test is indicated on Figure 2.2. The following observations were made from the test:

- On the test date, the average of demands during the peak hour is approximately 20.9 mgd, average of demands during the low demand hour is 15.3 mgd, and average demand during the 24-hour period is 17.8 mgd.
- The demand pattern for the City during the test day was relatively flat and does not indicate extreme high or low demand hours during a day. The high percentage of commercial and industrial land use with their higher mid-day demands balance with the higher night-time household lawn irrigation demands so that there are no high peaks or low troughs in the daily demand pattern.
- The ratio of PHD to the daily demand for the day did not exceed 1.20.
- This demand pattern indicates that if the HSPS continuously pump the average flow for the day, the reservoirs only need to be used minimally.

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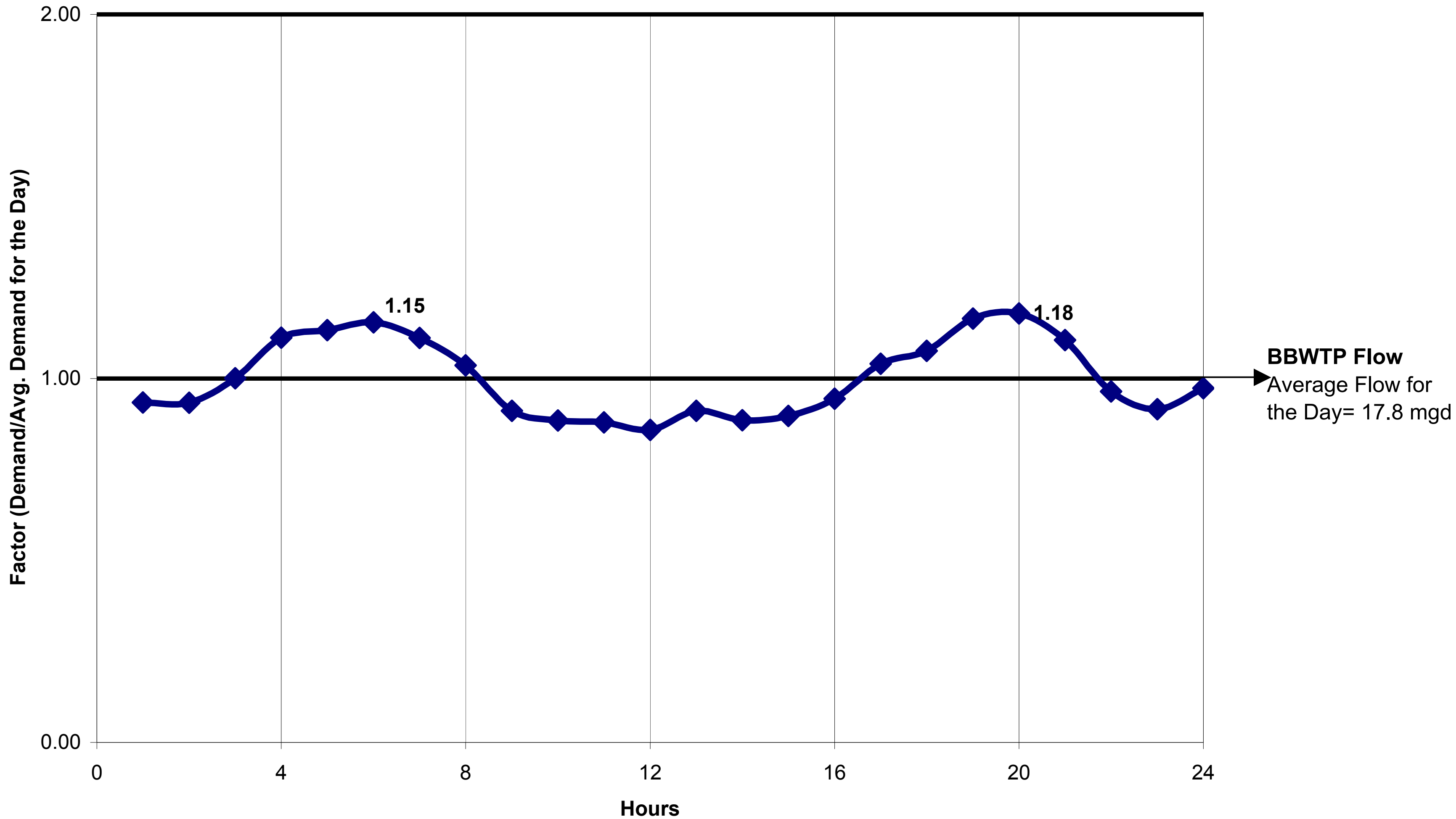
Figure 2.2 Demand Pattern during 24-Hour Demand Test
Water Master Plan Update
City of West Sacramento



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

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HrPtn Graph

The same demand pattern and peaking factors were used for the hydraulic analysis of the buildout demand conditions.

Carollo assumes that the City's demand pattern does not vary much from the demand pattern observed during the 24-Hour Demand Test. This test was performed on a weekday when offices and schools were functioning. The demand pattern during the weekends and on holidays varies from the pattern observed during this test.

The demand pattern obtained from this test was extended for 72-hours and used for the distribution system evaluation. All the results of the hydraulic analysis are based on this demand pattern and other storage requirements and are described in the following chapters.

2.2 FUTURE CONDITIONS

Future conditions are considered to be the conditions when the City's service area is 100 percent developed. Carollo determined the future demands based on the land use data provided in the General Plan. The following are the criteria for establishing the future demands within the distribution system:

- ADD is the demand associated with the number of developed dwelling units (du) multiplied by the demand factor of each du developed in the City's previous reports as listed in Chapter 1 of this report. The demands for the commercial, industrial, and agriculture will be established based on the area. The ADD based on the City's General Plan buildout land use data is 26.0 mgd.

- MDD is the demand that is obtained by multiplying the ADD by the maximum day peaking factor. The peaking factor that will be used to establish the MDD from ADD is 2.0. The MDD for the buildout is 52.0 mgd.

- PHD is obtained by multiplying the MDD with the highest hourly factor based on the 24-Hour demand testing of the distribution system. See page 2-8 for PHD factors.

Future demands are established based on the assumption that the City's current zoning land use information is a valid projection of buildout conditions. The City plans to update its General Plan in 2005. Any densification of residential land use or conversion of agricultural land use to residential land use will increase the buildout demands projected here.

The comparison of ADD and MDD between the existing distribution system and buildout distribution system is indicated on Figure 2.3.

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Figure 2.3 Comparison of Existing and Future Demands
Water Master Plan Update
City of West Sacramento

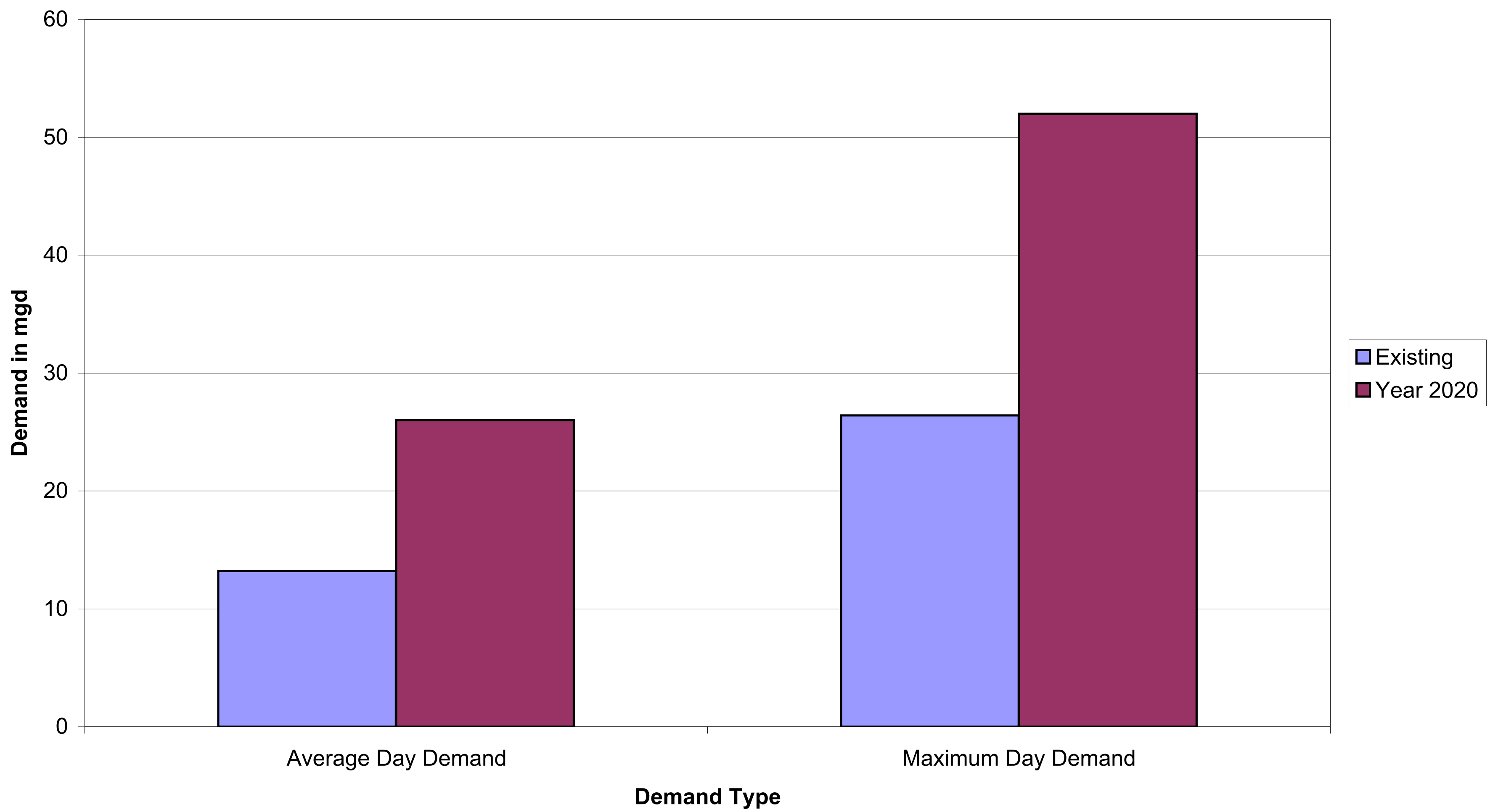

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Chart1

2.2.1 Fire Flows

Fire flows presented in the March 8, 2004 - Treated Water Storage Analysis Technical Memorandum were used for the current analysis. The fire demands were applied at certain locations during the hydraulic analysis. The fire was spread to two or three nodes in an area in order to match the actual conditions in the event of a fire, i.e., the water will be pulled from various fire hydrants instead of a single fire hydrant in the event of a fire.

2.3 CRITERIA FOR DEVELOPING PEAKING FACTORS

The demands in a distribution system vary from time to time. In order to establish demand factors for the system, Carollo verified the City's historical data from Year 1989 through Year 2004. The ADD, the MDD, and the ratio of MDD to ADD (MDD/ADD) are presented in Table 2.1.

Table 2.1 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)	Ratio of MDD to ADD
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: Ratio of Maximum Day Demand to Average Day Demand = MDD/ADD

Based on the data from the table, the City decided to use a value of 2.0 as a Ratio of MDD to ADD. From the historic data, Carollo believes that the previously used peaking factor of 2.2 is 10 percent more conservative than the historically observed values. Using a higher peaking factor will result in over designing storage reservoirs and transmission pipelines.

A graphical representation of the above data is presented in Figure 2.4. The figure illustrates that the variance between MDD and ADD during the month of July is only 25 percent during the past 11 Years.

In the previous master planning efforts, the City used a ratio of PHD to MDD of 1.82 (i.e., 4.0/2.2), where 4.0 is the ratio of PHD to ADD and 2.2 is the ratio of MDD to ADD. From the 24-Hour Demand Test (described in detail in Section 2.1.2) the ratio PHD to the MDD (during the test) is only 1.18. This ratio of 1.18 is much less than the 1.82 ratio. Carollo recommends using a factor between 1.25 to 1.35, which: is much lower than the previously assumed value of 1.82, and is higher than the observed value of 1.18

As a conservative approach, Carollo recommends a peaking factor of 2.0 MDD/ADD be used, and a 1.35 PHD to MDD peaking factor.

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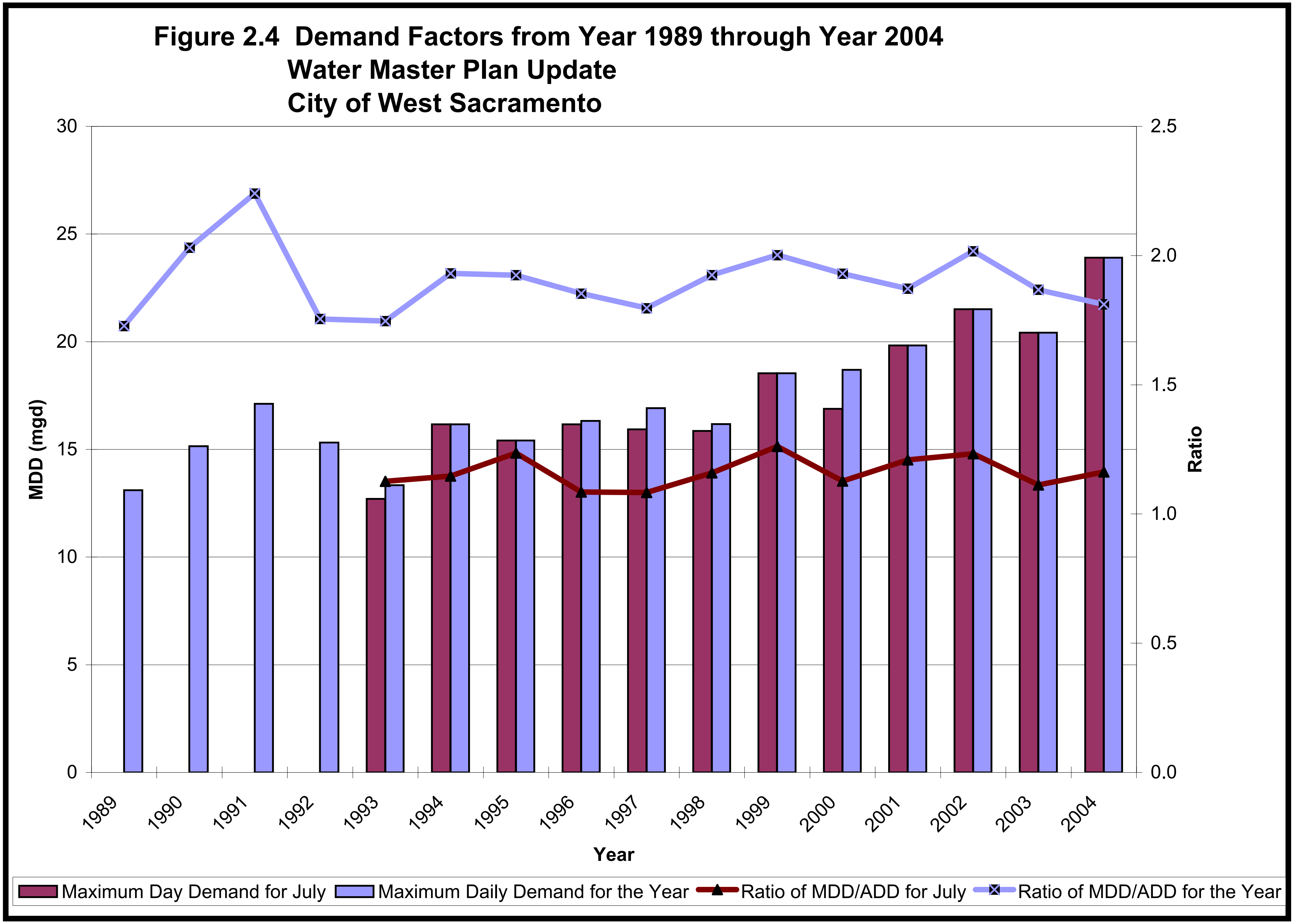

Note: MDD- Maximum Daily Demand; **ADD**- Average Daily Demand.

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Comparison Graph

LAND USE DATA AND PROJECTIONS

3.1 LAND USE DATA AND PROJECTIONS

The City provided Carollo with a zoning map and land use data. The zoning map is an update of the land uses described in the City's General Plan. Carollo used this land use data to develop buildout demands. Buildout is defined as the condition when all the land within the City's boundaries is fully developed to their currently zoned land use. Buildout, based on City planners' projections, is assumed to occur in the Year 2020. Buildout demands were used to size the transmission mains (T-mains) and overall storage facilities. Carollo also used land use density factors provided by the City's Planning Division to develop the buildout demands within the City.

In order to develop the future demands, the data and information from the following documents were utilized:

- Unit Demand Factors from December 1994 - Water Master Plan
- Land Use Density Factors from City's Year 2000 General Plan
- Triangle Area Specific Plan (1993)
- Pioneer Bluff Land Use Map
- Urban Water Management Plan (July 2002)

The City's zoning map was used to calculate the area of each land use. By applying the densities and the demand factors to these land use categories, the total demands for the buildout conditions were calculated. The land use densities for various land use categories and the relative unit demand factors are presented in Table 3.1 and Table 3.2 respectively. This information was provided by the City and unit demand factors are consistent with the City's current Urban Water Management Plan. The land use densities vary slightly between the existing and the buildout year since the City plans to densify existing and future developments.

Carollo considers these land use densities currently used by the City's planning staff to be accurate projections of buildout conditions. Demand factors are similar to those used by other local water agencies.

Carollo used GIS software to calculate the areas of each land use categories.

Table 3.1 Densities for various Land Use Categories
Water Master Plan Update
City of West Sacramento

Type of Land Use	Designation	Density Range		Estimated Average Density Current Units/Acre	Projected Average Density at Buildout Units/Acre
		Minimum Units/Acre	Maximum Units/Acre		
Agricultural Zones					
Agricultural General	A-1	0	0		
Residential					
Rural Estate	RE	0	0.4	0.32	0.32
Rural Residential	RRA	0.5	1	0.8	0.8
Residential Single Family	R-1-A	1.1	5	4.2	4.2
	R-1-B	1.1	5	4.2	4.5
Residential Single- Family or Multi-Family	R-2	5.1	12	6	9.6
Multiple- Family Residential	R-3	12.1	25	15	20
Apartment	R-4	25.1	50	-	40
Commercial					
Neighborhood Commercial	C-1	0	0.33	-	-
Community Commercial	C-2	5.1	12	11	9.6
Highway Service Commercial	C-H	0	0.5	0	0
Commercial-Water Related	C-W	------	------	------	------
General Commercial	C-3	------	------	------	------
Professional Office	P-O	------	------	------	------
Business Park	B-P	------	------	------	------
Industrial					
Limited Industrial	M-L	------	------	------	------
Light Industrial	M-1	------	------	------	------
Heavy Industrial	M-2	------	------	------	------
Waterfront Industrial	M-3	------	------	------	------
Other Zones					
Central Business District	CBD	------	------	------	------
Waterfront(1)	WF	25.1	50	------	------
Public Quasi-Public	PQP	------	------	------	------
Recreation and Parks	RP	------	------	------	------
Public Open Space	POS	------	------	------	------
Special Study Area	SS	------	------	------	------
Planned Development Overlay	PD	------	------	------	------
Mixed Use(1)	MU	5.1	25	------	------

Notes:
(1) The Floor Area Ratio (FAR) for offices shall not exceed 10 and for other users FAR shall not exceed 3.
(2) The "**------**" cells indicate the cells with indeterminate data.

Table 3.2	Demand Factors for Various Land Use Categories Water Master Plan Update City of West Sacramento
Land Use Type	**Unit Demand Factor[2]**
Single Family Residential	560 gpd/du[1]
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:

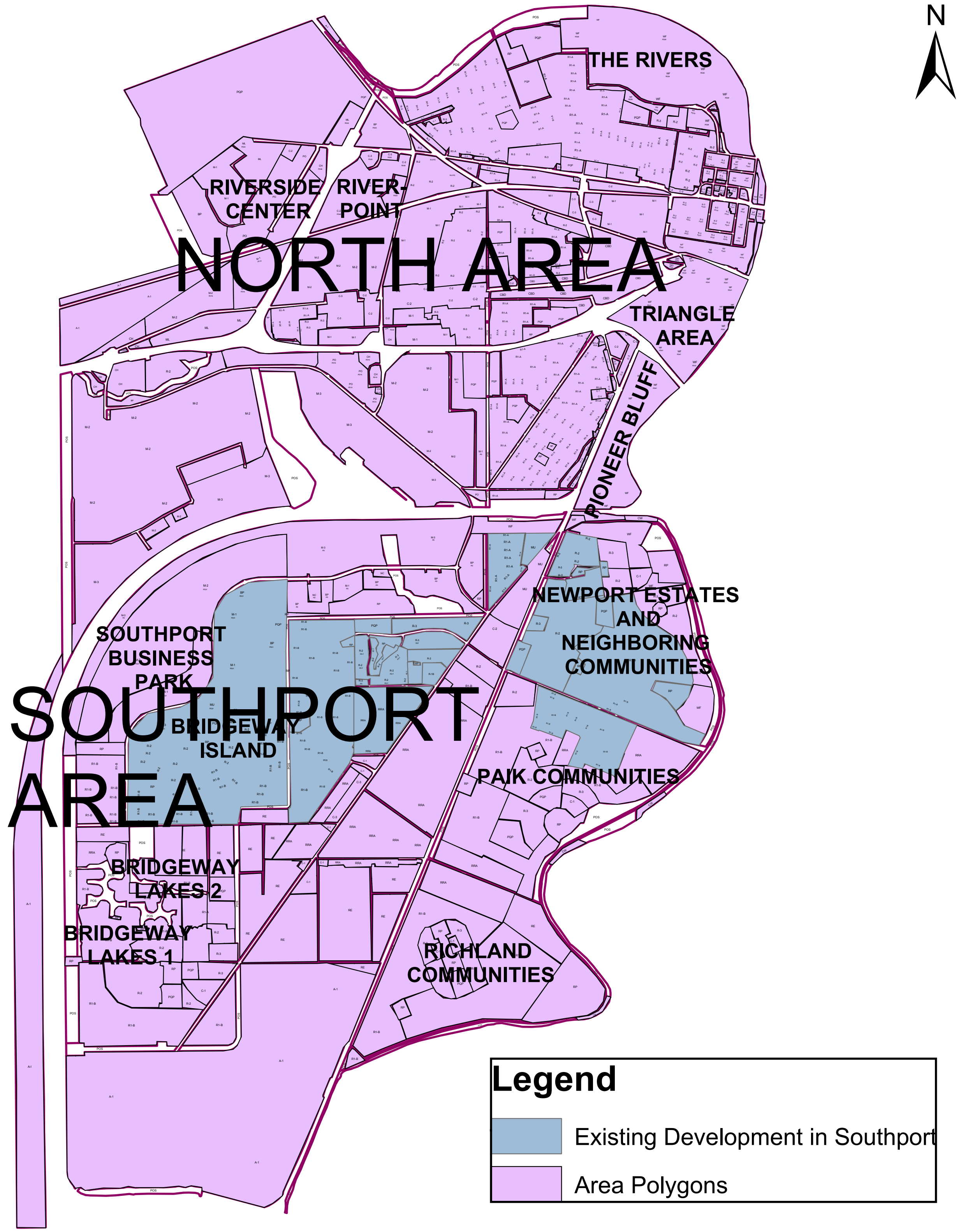
(1) gpd = gallons per day; du = dwelling unit

(2) Data was obtained from previous reports as listed in Chapter 1.

The following procedure was used to calculate the areas of various land use categories:

- Area polygons are drawn around each land use category using the GIS software. The software then calculates the respective area of each land use category. Figure 3.1 indicates area polygons covering various land use categories. Existing developments in the Southport area are also indicated on the figure.
- The demand distribution was completed after overlaying the land use layer over the hydraulic model in the GIS program.
- ArcMap Version 8.3 GIS software used the polygons to calculate the areas of various land use categories. The “Area and Demand Summary” Table indicating areas of various land use categories and corresponding demands is in Appendix C. The ADD for buildout is estimated at 26.0 mgd based on the land use area calculation. This is very close to 26.3 mgd (MDD/2.2) presented in the March 8, 2004 Treated Water Storage Analysis Technical Memorandum.

From the areas indicated on Figure 3.1, calculated existing ADD in the Southport area is 4.03 mgd, whereas it is reported as 2.0 mgd in the March 8, 2004 - Treated Water Storage Analysis Technical Memorandum. This difference may be attributed to high home occupancy rates in the past four years, whereas the technical memorandum refers to 1999 land use data. Also, as a substantial portion of the Bridgeway Lakes I development was occupied by the end of 2004, Southport’s ADD is estimated to increase to 4.4 mgd.



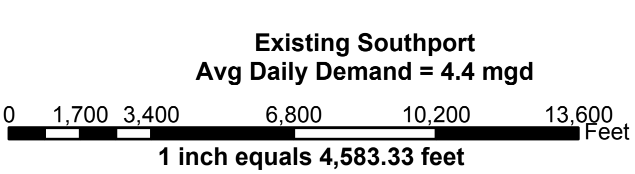


Figure 3.1 Land Use Area Polygons
Water Master Plan Update
City of West Sacramento

The land use category “Water Front” does not have any fixed land use density or demand factors. Therefore, the following assumptions were made in the Water Front land use areas in order to calculate the total demand within the City:

- The ADD within The Rivers is 0.60 mgd based on 430 detached and 900 single family attached residences plus 30 acres of irrigated park/open space.

- The ADD for Pioneer Bluff is 0.89 mgd from Sacramento Riverfront Master Plan land use map and the land use densities provided by the City. A detailed demand calculation for this area is presented in “Pioneer Bluff - Projected Land Use and Demands” Table in Appendix C.

- The ADD for the Triangle Area is 1.63 mgd based on the West Sacramento Triangle - A Specific Plan for the Development of Downtown West Sacramento (Adopted June 30, 1993).

From the above assumptions and from the land use demand calculations, the total ADD for the City during the buildout year was projected to be 26.0 mgd. A summary of demands within the City for the buildout year is presented in Table 3.3. A demand comparison between the buildout average day demands between the North Area and the Southport Area is indicated on Figure 3.2.

Table 3.3 Summary of Buildout Demands within the City
Water Master Plan Update
City of West Sacramento

Service Area	Type of Land Use	Total Demand (mgd)
Triangle Area	Water Front	1.63 (1)
The Rivers	Water Front	0.60 (2)
Pioneer Bluff	Water Front	0.89 (2)
Rest of the City	Various	22.9
Total Demand		**26.0**

Notes:

(1) From June 30, 1993 adopted Triangle Specific Plan.

(2) Based on the calculations from the City provided land use data. The calculation is presented in Appendix C of this report.

Conservation measures, including water metering with commodity pricing of all new and existing residential customers, will lower unit and overall demands.

ADD at buildout for areas of the City within the North Delta Water Agency (NDWA) is 23.1 mgd. The demand in areas north of the NDWA boundary is 2.9 mgd.

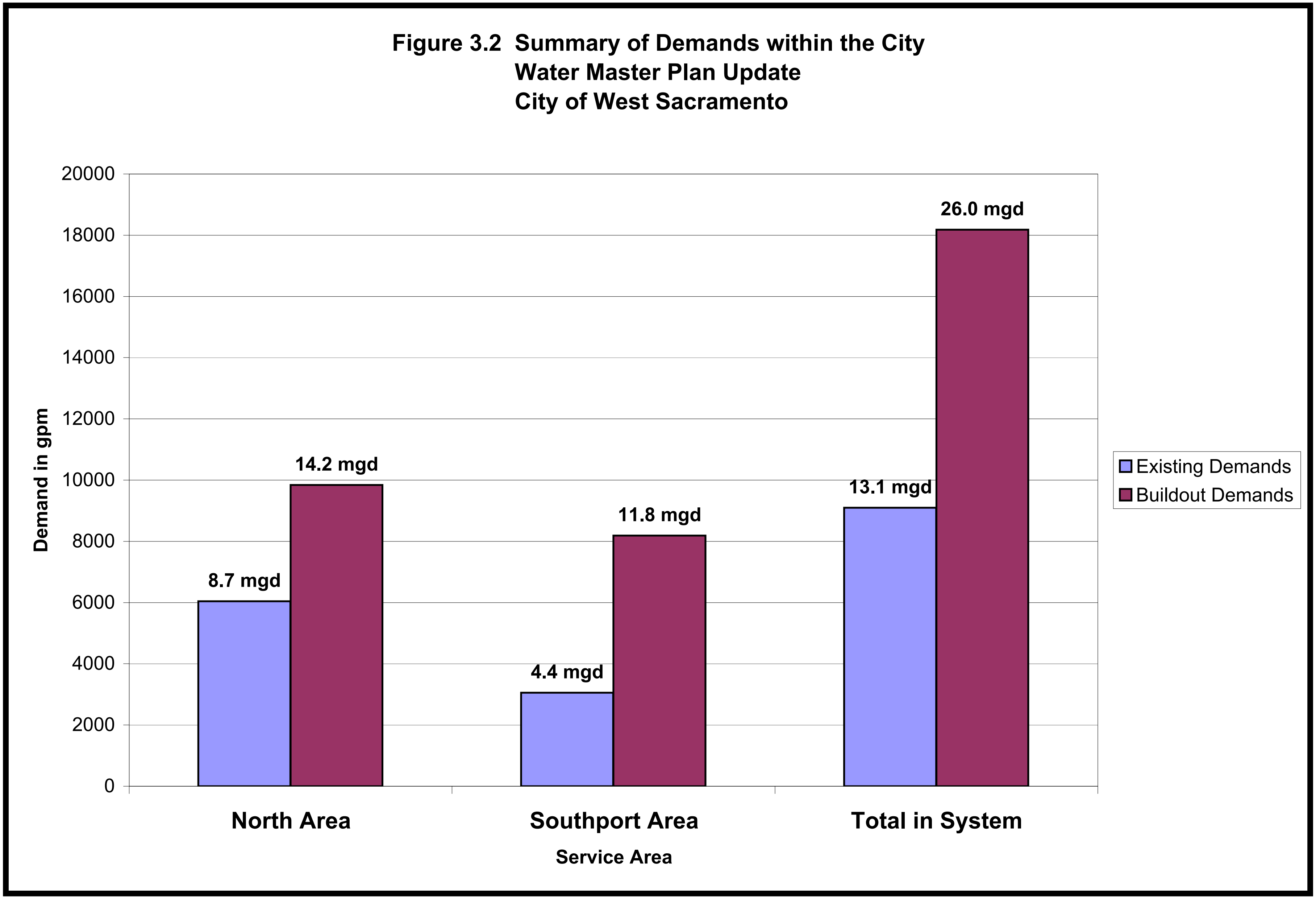


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Figure 3.2

DISTRIBUTION SYSTEM

Carollo performed the hydraulic analysis of the existing and buildout year (Year 2020) distribution system using H20Net hydraulic modeling software. The City provided the base map of the pipe network and previous distribution system hydraulic model. The previous hydraulic model is a steady state model, with demands distributed throughout the system.

The distribution system consists of all T-mains and large diameter distribution mains. Pipes 6-inches in diameter or smaller were not included in the model unless the pipe bridges between two large pipes. A hydraulic model distribution system consists of five basic elements in order to synchronize the model with the actual distribution system. These basic elements are:

- **Tanks (or) Reservoirs:** These elements supply water into the distribution system and includes the clearwells at the Bryte Bend WTP. Without these elements, there will be no water supply into the distribution system, and the model with water demands will not work. Therefore, it is important to model the tanks or reservoirs appropriately and consistently to reflect normal operations and to provide water into the distribution system.

- **Nodes:** These elements represent intersections of pipeline network and provide ground elevations of various locations within the distribution system. Nodes are essential elements in the creation of the distribution system network.

- **Pipes:** These elements connect all the other elements within the distribution system in order to transmit water from one location to the other. Only the larger pipelines are included in the model, the smaller pipes are generally not included unless these pipes have significant impacts on the results.

- **Pumps:** These elements supply water from tanks or reservoirs to boost pressure into the distribution system and include the HSPS at the Bryte Bend WTP. The pumps in the model reflect the actual pump characteristics, as actual pump curves were incorporated.

- **Valves:** These elements reflect the actual field valves. The valves that are used in the model reflect the actual field equipment including: Pressure Reducing Valves (PRV), check valve, altitude valve, *etc.* The valve settings inputs are adjusted to reflect the valve's actual field conditions.

The settings and the properties of all the above elements were reviewed in order to synchronize the model with the actual field conditions.

4.1 PREVIOUS MODEL VERSUS BASE MAP

Carollo reviewed the distribution system and identified the following differences between the actual base map and the model provided to us that affect the results of the hydraulic analysis:

- Suction and discharge pipelines near the pumps in the distribution system were set 99-inch in diameter and one foot in length, with no minor loss coefficient associated with these pipes. Carollo changed these pipe conditions in the model to the actual field conditions of the pipes, based on the information provided by the City.

- The pump configuration at the HSPS in the original model is different from the actual field conditions. The configuration in the model was changed based on the actual field conditions.

- Some of the more recent developments in the Southport Area, including, Bridgeway Lakes I, are not included in the original model. These new developments were added to the model.

- Carollo performed a thorough check of the model and the existing distribution system and identified some pipelines that are missing in the model. Carollo added these pipelines to the model.

- In order to perform dynamic or extended period analysis, a demand pattern must be assigned to all the demand nodes within the distribution system. The demand pattern obtained from the 24-Hour Demand Test was used in the model. This pattern is essential to convert the existing steady state model into a dynamic or an extended period model.

- All storage tanks were modeled as unlimited volume reservoirs in the original steady state model. These reservoirs were changed to limited volume storage tanks (reflecting actual field conditions) for the dynamic analysis. Storage volumes do not have any impact in steady state analysis, but do have a significant impact on the results in the dynamic analysis. The base elevation, high water elevation, reservoir diameter, and the reservoir volume of various reservoirs within the distribution system are summarized and presented in the "Storage in the Distribution System" table in Appendix D.

- The piping around the reservoirs was changed to reflect actual field conditions.

- Pumps and the pump curves were updated based on the actual distribution system conditions. A list of pumps within the distribution system and the associated pump curve information is presented in Table 4.1.

Table 4.1 Pump Curves Data and Comparison of Model and Actual Data
Water Master Plan Update
City of West Sacramento

Item No.	Pump Station Location	Number of Pumps		Pumps - HP			Provided Pump Curves to Carollo
		in Model	Actual	Small	Medium	Large	
1	HSPS-OLD [3]	5	5	0	0	Five - 200 4000 gpm	YES 148 ft
	HSPS-NEW [1][3]	8	6	0	0	Six - 200	YES
2	Northeast	4	4	Two - 30 550 gpm	Two - 75 1800 gpm	0	YES [4] 135 ft
3	Central	4	4	Two - 30	Two - 75	0	YES [4]
4	PSIP [5]	6	4	One - 25	Three - 100	0	NO
5	Oak Street	3	3	One - 30 700 gpm	Two - 75 1750 gpm	0	YES 127 ft
6	Southport [2]	4	4	One - 25 500 gpm	One - 75 1750 gpm	Two - 100 2400 gpm	YES 120 ft
7	Carlin	4	4	0	One - 75 1400 gpm	Three - 125 2800 gpm	YES

Notes:

(1) The model indicates 6-Big and 2-Small pumps at this facility.
(2) The model indicates 2-Big, 1-Medium and 1-Small pump at this facility.
(3) Clearwell elevation at Bryte Bend WTP HSPS is 17.5 feet in model, 7.5 feet from the bottom of the clearwell.
(4) Two operating points and shutoff head provided per specifications for Northeast and Central Reservoir Sites (May 1987- specifications).
(5) This pump needs a VFD at 80% before it can be run against the distribution system head. Currently runs off the curve.

The City has provided the base map and other information at the reservoirs and pumps. Carollo collected some information during field visits, 24-Hour Demand Test, and Hydraulic Stress Test. In the existing model, the following updates were performed:

- Skeleton of the distribution system
- Pump suction and discharge piping
- Number of pumps and the corresponding pump curves
- Storage reservoir/tank information
- Demand pattern
- Valve information

Carollo performed all of the above updates to synchronize the model with the existing distribution system and to convert the model from steady state to extended period simulations. All the model updates are based on the data received from the City and from the demand test. After performing the updates and calibrating the model, Carollo modified the system for buildout (Year 2020) analysis. The model revisions required for the buildout analyses are described in detail in the following sections.

4.2 BUILDOUT MODEL

The buildout model was created from the calibrated and updated original model. The network and demands were updated based on the City's General Plan.

- Demands were based on the demands calculated from the land use data. The demands were distributed by overlaying the existing model with the zoning map in the GIS software.
- The T-main skeleton is based on the future developments within the City. The alignment of the T-main skeleton for new developments is for hydraulic analysis purposes; though the alignments were adjusted to follow the anticipated pipe routes, the actual alignment may vary from the alignment indicated in the model.
- Storage reservoir volume is based on storage requirements for future demand conditions. All the new storage reservoirs are based on the storage criteria described in Chapter 5.
- Pumps in the model are based on the pumping requirements for future demand conditions.

4.3 CALIBRATION METHODOLOGY

The calibration of the existing distribution system is based on the Hydraulic Stress Test, performed on June 22, 2004. The protocol for this test is presented in Appendix B. The test is performed for various demand conditions within the City in order to stress the existing distribution system by creating a large hydraulic gradient within the distribution system. The protocol explains the procedure for creating a large gradient within each distribution system and is based on delivering high flows into the distribution system reservoirs. The purpose of the Hydraulic Stress Test is to obtain steady state hydraulic information to calibrate the hydraulic model. The calibration effort serves to improve the hydraulic accuracy of the results.

From the Hydraulic Stress Test results, a 5-minute interval steady state period is defined for each test location and the average value of this period will be considered for calibrating the model. The Hydraulic Stress Test results that were used in calibrating the model are presented in Table 4.2. The model was calibrated by applying the flows and operations criteria obtained from each test. The results for the Southport Reservoir were not used for the calibration, as the level indicator was malfunctioning. However, the results for PSIP, Carlin, Central, and Northeast Reservoirs were all used to calibrate the model.

The calibration process includes changing the Hazen-Williams' pipeline roughness coefficient C-factors in the model in order to obtain the desired results. For example, the following procedure was used in order to calibrate the model based on the Hydraulic Stress Test of the PSIP storage reservoir:

- A demand of 5.5 mgd was introduced at the PSIP Reservoir.
- The inlet and outlet of all other reservoirs within the distribution system are kept closed, i.e., all the reservoirs (except PSIP) are not operational during the PSIP test.
- A flow of 22.0 mgd was pumped into the system from the Bryte Bend WTP (HSPS).
- The C-factors of pipes in the model was changed in order to obtain desired pressures, as presented in Table 4.2, at various locations (HSPS, PSIP, Central, Southport, Carlin, Northeast, Oak Street, Half Moon Bay, and South River Road).

The above procedure was used for other reservoirs and the model will be more accurate after calibrating the model for the four (since Southport test will not be used for calibration) different tests. Oak Street Reservoir was not stressed, as this reservoir is located too close to the HSPS to provide for an accurate determination of hydraulic gradients.

Demands in the model were adjusted to match demands during a five-minute steady state period. Two-thirds of the total demand will be assumed in North Area and one-third of the

Table 4.2 Summary of the Hydraulic Stress Test
Water Master Plan Update
City of West Sacramento

Reservoir	**Test Date**	**Test Time**		**Steady State 5- Min Average**									
		From	**To**	**PSIP Test**		**Central Test**		**Southport Test**		**Carlin Test**		**Northeast Test**	
				Flow (mgd)	**Pressure (psi)**	**Flow (mgd)**	**Pressure (psi)**	**Flow (mgd)**	**Pressure (psi)**	**Flow (mgd)**	**Pressure (psi)**	**Flow (mgd)**	**Pressure (psi)**
HSPS(1)	22-Jun-04			22.0	62.2	24.8	61.5	23.4	62.1	23.0	62.2	24.6	61.1
Demands (1)				16.5		17.5		18.2		17.2		17.0	
PSIP	22-Jun-04	9:19:50 AM	9:48:22 AM	5.5	39.2	0.0	54.6	0.0	55.9	0.0	56.9	0.0	58.6
steady state		9:29	9:34										
Central	22-Jun-04	10:03:53 AM	10:55:56 AM	0.0	55.3	7.3	50.7	0.0	53.2	0.0	54.3	0.0	56.5
steady state		10:23	10:28										
Southport	22-Jun-04	11:02:57 AM	11:36:28 AM	0.0	54.4	0.0	50.8	5.2	46.3	0.0	48.0	0.0	49.4
steady state		11:09	11:14										
Carlin	22-Jun-04	12:50:03 PM	1:32:35 PM	0.0	55.1	0.0	52.0	0.0	53.3	5.8	40.2	0.0	56.9
steady state		12:58	1:03										
Northeast	22-Jun-04	1:35:05 PM	2:18:08 PM	0.0	58.1	0.0	56.3	0.0	57.2	0.0	57.6	7.6	46.2
steady state		1:45	1:50										
Oak Street	22-Jun-04			0.0	65.6	0.0	64.6	0.0	65.3	0.0	65.1	0.0	64.2
Half Moon Bay(4)	22-Jun-04				57.6		55.2		56.4		47.3		60.0
South River Road(4)	22-Jun-04				46.3		43.7		44.7		45.4		45.5

Notes:

(1) The HSPS Flows indicate the demands in the system including flows to reservoirs. Demand flows exclude flows into reservoirs and represent system demands (I.e., HSPS Flow **-** Flow into Reservoir **=** System Demands).

(2) 5-minute steady state interval is the period where there are no major pressure swings during the 5-minute interval at all the pressure reading locations.

(3) Demands calculated are the average demands during the above mentioned 5-minute interval.

(4) These are the fire hydrant locations where pressures are being recorded during the test.

H:\Client\WestSac_Sac\6954A.00\Tests\HdStrsTestResults.xls
Final Table

total demand will be assumed in the Southport Area. The model demand distribution will be adjusted differently for the buildout (Year 2020) analysis.

After the calibration process was completed, the hydraulic analysis of the existing and the buildout model will be performed. The details of the hydraulic analysis will be described in detail in the following chapters.

4.4 CALIBRATION RESULTS

Based on the calibration methodology described above, higher pipeline roughness coefficients were applied in the Southport Area in order to meet the pressures observed during testing. The C-factors south of Linden Road/Carlin Drive and west of Jefferson Boulevard are changed from 130 to 60. The C-factors in the rest of the City vary between 130 and 150. Carollo contacted the City regarding the low pressures in southern Southport. The City indicated that a valve was closed in that area, but was uncertain if it was closed during the test.

Chapter 5

WATER STORAGE

5.1 STORAGE CRITERIA

Distribution system storage requirements are currently defined by the City as follows:

- Storage is required to meet system demands during high demand hours. This is defined as operational storage volume and 25 percent of MDD volume is required.

- Storage is required to meet system demands during emergencies. Emergencies cover a wide range of possible events, including: surface water contamination; treatment failure at the Bryte Bend WTP; HSPS failure; power outage; transmission pipeline rupture; earthquake; firestorm; etc. The required emergency storage volume and is 50 percent of MDD volume. Prior to 2004, the emergency storage criteria was set much lower, at 0.25 of ADD Value. Groundwater facilities were assumed to provide the vast majority of emergency demands.

- Storage is required for suppressing fires, and is defined as fire storage volume. Based on the Treated Water Storage Analysis Technical Memorandum of March 8, 2004, the largest likely fire use and duration was assumed as the fire storage requirement for the entire city. This is a fire in a non-sprinkled industrial/business park, which equates to a fire demand flow requirement of 8,000 gpm for a five-hour duration (equivalent to 2.4 million gallons (MG)). Half (1.2 MG) of this fire storage was allocated to the North area and the other half (1.2 MG) was allocated to the Southport area.

The above mentioned operational, emergency, and fire storage criteria should be reviewed based on changes in demands and with changes in type of land use within the distribution system. Storage volume criteria for other water agencies have been compared to the criteria presented above. The operational and emergency storage criteria are within the range of comparative criteria. However, a single, albeit large, fire flow for a distribution system the size of the City's may be underestimating the fire storage needs. As the City continues to grow, and demands increase, there is more of a likelihood that major simultaneous fires could occur within the City. Also, if a separate pressure zone is created in the Southport area, then the largest possible fire demand should be separately allocated for the North and the Southport area. Based on these premises, Carollo recommends that the City consider increasing the fire storage volume capacity and assigning.

- A single fire to the North area, equivalent to a fire in a non-sprinkled industrial/business park of 8,000 gpm for a five-hour duration (equivalent to a volume of 2.4 MG).

- A single fire in the Southport area. As all industrial/business park facilities are sprinkled in the Southport Business, the non-sprinkled fire demand would be 5,000 gpm for a five-hour period (equivalent to a volume of 1.5 MG).

The fire flow requirements for various land use category is presented in Table 5.1. This table also provides the difference in fire flow requirements between the sprinkled and non-sprinkled land use categories. The criteria described above will be used to determine the storage requirements for the existing and buildout distribution systems.

Table 5.1 Fire Flow Requirements
Water Master Plan Update
City of West Sacramento

Land Use	Non-Sprinkled		Sprinkled[1]	
	Fire Flow (gpm)	Duration (hours)	Fire Flow (gpm)	Duration (hours)
Single-Family Residential	2,000	2	1,000	2
Multi-Family Residential	3,000	2	1,500	2
Commercial	4,000	2	2,000[2]	2
Institutional	4,000	4	2,000[2]	4
Industrial/Business Park	8,000	5	5,000[2]	5
School	8,000	4	4,000[2]	4

Notes:

(1) Most communities allow up to a 50% reduction in fire flow if a building is sprinkled. However, a fire flow less than 1,000 gpm is not permitted for single family residential.

(2) Commercial/industrial areas and schools should be reviewed on a case-by-case basis before reducing by 50%.

5.2 EXISTING STORAGE

The City currently has six distribution system storage reservoirs and two clearwells at the Bryte Bend WTP. Total storage volume was calculated based on the usable volumes in these reservoirs, which was calculated from high water levels maintained by operations in the respective reservoirs. Total existing storage volume at the Bryte Bend WTP, in the North area, and in the Southport area, is presented in Table 5.2.

5.3 STORAGE REQUIREMENTS

Based on the storage criteria presented above (including updated fire storage criteria), storage required for the North and Southport Areas are presented in Table 5.3 for Existing (2004) conditions of 13.1 mgd ADD. Appendix D presents “Storage in the Distribution System” table for more details.

Based on a MDD/ADD factor of 2.0, the City is currently 4.2 MG deficient in storage volume for existing conditions. This storage deficiency is completely allocated to the Southport area. Thus, additional storage should be constructed in the near future in the Southport area (the Capital Improvement Program chapter, Chapter 8, presents the storage

Table 5.2 Existing Storage Water Master Plan Update City of West Sacramento			
Reservoir	**Diameter (feet)**	**Usable Volume (MG)**	**Total Volume (MG)**
Clearwell - two basins	170	4.0 each	8.0 at Bryte Bend WTP
Oak Street	110	2.0	
Central	110	2.0	
Northeast	110	2.0	
PSIP	106	1.4	
North Area Total			7.4 in North Distribution
Southport	90	1.0	
Carlin	130	2.9	
Southport Area Total			3.9 in Southport Distribution
Grand Total			**19.3 Total System**

requirements and implementation periods in detail). New development shall not occur without a corresponding increase in storage volume (see Table 5.5 "Storage Required at New Developments").

Storage Requirements for buildout conditions are indicated in Table 5.4. These projections are based on the buildout ADD of 26.0 mgd, with a buildout MDD of 52.0 mgd (26.0x2.0). A significant amount of storage, 15.3 MG, needs to be constructed in the Southport area. Developers should construct a significant amount of this storage as new developments are added into the water distribution system.

The 8.0 MG existing clearwell storage volume is assigned to the North area. The above demands are based on projected demands in the Water Front land use area, which includes demands for The Rivers and Pioneer Bluff developments.

5.4 OPERATIONAL AFFECTS ON STORAGE VOLUME ALLOCATION

The distribution system operation affects where storage should be located. For example, more emergency storage should be located in the Southport area, as this area is further away from the Bryte Bend WTP. This could be justified based on the likelihood that a T-main rupture near the Barge Canal could greatly restrict flows from reaching Southport area. Overall, the allocation of operational, emergency, and fire storage will be determined for:

- The 8.0 MG clearwell volume at the Bryte Bend WTP
- Distribution system storage reservoirs
- The Oak Street Reservoir

Table 5.3 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 5.4 Storage Requirements and Deficits at Buildout Conditions
Water Mater 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**

Operational storage volume is required at the clearwell, as clearwell levels vary during the day due to the diurnal demand pattern and operation of the Bryte Bend WTP at a relatively constant daily flow. An amount of "buffer" volume is required in the clearwells to prevent the clearwells from overflowing during low demand hours of the day. Also, fire demands should be met from distribution system reservoirs, not from the HSPS, as a fire could occur during maximum day conditions (a condition which relates to the required capacity of the Bryte Bend WTP). Having fire storage originate from reservoir(s) near the fire demand can optimize the transmission pipeline system. If fire storage volume must be pumped from the clearwells by the HSPS, the transmission pipeline system would need to be upsized. Thus, fire storage volume should be allocated to system reservoirs, not the clearwells, to meet fire suppression demands. The majority of the clearwell volume is anticipated to be dedicated as emergency storage.

Based on conversations with operations staff, the operation of the Oak Street Reservoir causes the pumps at the HSPS to operate at higher head and lower flows due to the close proximity of this reservoir to the HSPS. This reservoir and pump may be dedicated to:

- Receive HSPS system flows during low demand hours only
- Receive surge flows
- Deliver flows into the distribution system east of the reservoir (not into the main transmission main) during high demand hours

5.5 EXISTING STORAGE DEFICIENCIES

The existing 4.2 MG storage volume deficiency (0.0 MG in the North and 4.2 MG in the Southport area) is primarily due to the City's recent change to its emergency storage volume criterion. Emergency storage volume required for recent (pre-2004) developments in the Southport area, including Bridgeway Island and Bridgeway Lakes I, were based on an emergency storage criterion that is less than 25 percent of the current emergency criterion 50 percent of MDD. This is due to the City's former policy of utilizing groundwater facilities to meet emergency demands. Now that these groundwater facilities are being retired, the City must use stored surface water to meet emergency demands.

As the Southport area is significantly deficient in storage today, the need to provide additional storage in the Southport area is paramount given:

- The distance of this area from the Bryte Bend WTP
- That there are only two T-main crossings of the Barge Canal

Two projects are planned to address this storage deficiency, including:

- Upgrading the Southport Reservoir from a 1.0 MG to a 3.0 MG facility. Additional pumps would be required at this site to convey flow from the larger reservoir.

- Installing additional storage at the site (the tail end of the Main Drain) planned for the Bridgeway Lakes II development's storage reservoir. As only 0.65 MG is required for this relatively small development, additional storage could be sited at this location. Coordination between the City and the developer of Bridgeway Lakes II and other future developments in Southport area are recommended to facilitate installation of this additional volume as soon as possible.

The capacity requirements for of all storage reservoirs required due to additional development (demands) is presented in Table 5.5. This table indicates all the new sites for new storage requirements reservoirs in the North and Southport areas. 4.2 MG of the total storage presented in this table is to fulfill existing deficiencies (2.2 MG at Bridgeway Lakes II and 2 MG at the existing Southport Reservoir). The location map and cost details for these improvements are presented in Chapter 8. Yarborough is agricultural land as per the General Plan. The volume required for Yarborough is not included in the storage requirements.

5.6 STORAGE SITE REQUIREMENTS

Several new storage facilities are required by buildout of the General Plan. Each site requires a pump station with standby power facilities. Two reservoirs maybe constructed at many of these sites, so that a single reservoir can be taken out of service during the low demand (winter) periods. In general, most of these new sites will require either a single 2.0 MG reservoir or two 2.0 MG reservoirs. Based on providing adequate access to the pump station, reservoir, and standby power engine generator, the following site acreage is required:

- 1.0 to 1.25 acres for a single 2.0 MG reservoir

- 1.5 to 1.75 acres for two 2.0 MG reservoirs (4.0 MG total)

If a taller reservoir(s) can be installed, e.g. 32-foot tall reservoir, and then site acreage requirements would be towards the lower end of the site acreage range. If a shorter-profile reservoir is required, e.g. 24-foot tall reservoir, then site acreage requirements would be towards the higher end of the site acreage range. Nearby housing developments often require a lower profile for a new reservoir to improve property values. Partial burial of a reservoir is also a viable alternative if yet lower visual perspective is desired. Cost estimates for storage reservoirs included in this Master Plan are for at-grade steel tanks.

Table 5.5 Storage Required at New Developments
Water Master Plan Update
City of West Sacramento

Specific Development	ADD (mgd)	MDD (mgd)	Operational Storage (MG)	Emergency Storage (MG)	Fire Demand (gpm)/ Fire Duration (hrs)	Fire Storage (MG)	Total Storage Required (MG)	Storage Proposed (MG)
North Area of the System								
The Rivers	0.60	1.21	0.30	0.60	4,000 gpm / 4 hours	0.96	**1.86**	1.9
Pioneer Bluff Redeveloplment [(1)]	0.89	1.78	0.45	0.89	4,000 gpm / 2 hours	0.48	**1.82**	2.4
Triangle Area [(1)]	1.65	3.30	0.83	1.65	4,000 gpm / 2 hours	0.48	**2.96**	2.4
						Total =	**6.63**	6.7
						Total Storage Deficit from Table 7.4 =	**8.30**	8.3
						Volume Required to fulfill the Deficit [(2)]=	**1.67**	**1.60**
Southport Area of the System								
Newport Estates Development [(3)]	2.00	4.00	1.00	2.00	4,000 gpm / 2 hours	0.48	**3.48**	2.2
PAIK Development [(3)]	1.48	2.97	0.74	1.48	4,000 gpm / 2 hours	0.48	**2.71**	4.2
Parlin Ranch (306 SF houses) [(3)]	0.17	0.34	0.09	0.17	2,000 gpm / 2 hours	0.24	**0.50**	0.0
Richland Communities [(3)]	1.28	2.57	0.64	1.28	4,000 gpm / 2 hours	0.48	**2.41**	4.0
Bridgeway Lakes II [(3)] (487 Single Family houses)	0.27	0.55	0.14	0.27	2,000 gpm / 2 hours	0.24	**0.65**	2.85
						Total =	**9.74**	**13.25**
						Total Storage Deficit from Table 7.4 =	**15.30**	**15.30**
						Volume Required to fulfill the Deficit [(4)]=	**5.56**	**2.05**
Yarbrough (SW Village)*	2.05	4.10	1.03	2.05	4,000 gpm / 4 hours	0.96	**4.04**	
Yarbrough - per General Plan**	0.00	0.00	0.00	0.00	4,000 gpm / 4 hours	0.00	**0.00**	

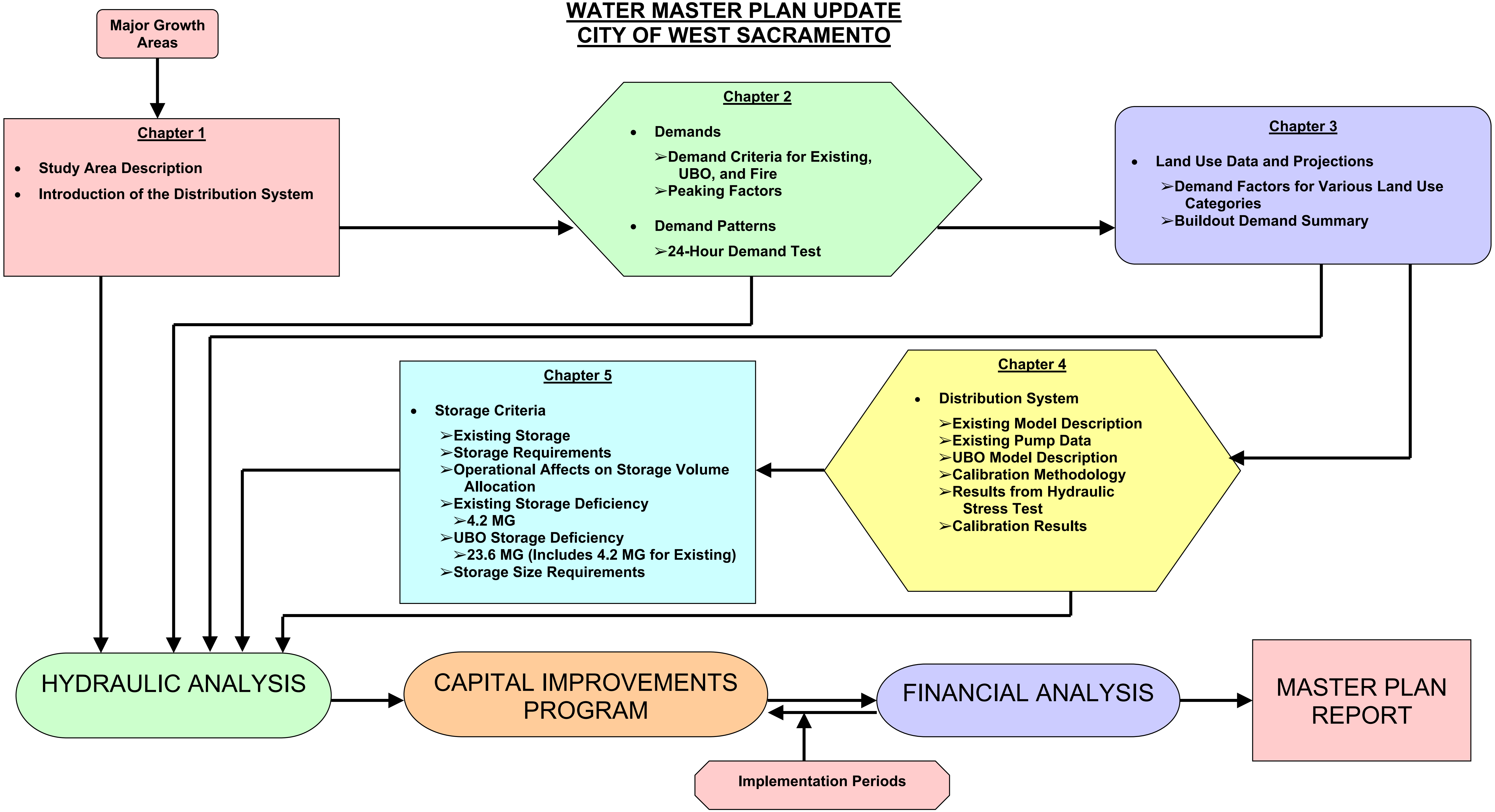
* - N.A.P. parcels (Not A Part parcels) are not included with Yarbrough (Southwest Village) land use.
** - City Zoning Map indicates Agricultural General (A-1) for all of the Yarbrough (Southwest Village).
Note: Average Daily Demand (ADD) x 2.0 = Maximum Day Demand (MDD)

Demand Criteria used to determine ADDs:
- o 560 gpd/du for Single Family Residential
- o 290 gpd/du for Multi-Family Residential
- o 1800 gpd/acre for irrigated park/open space
- o 2950 gpd/acre for commercial and village core
- o 25 gpd/student at school(s)
- o 0 gpm for Agricultural General (A-1) - no demand as well water assumed

Storage Criteria:
- o Opeational Storage = 0.25 Maximum Day Demand (MDD)
- o Emergency Storage = 0.50 Maximum Day Demand (MDD)
- o Fire Storage = Largest Fire Demand x Duration in Development
- o Fire at Sprinkled School = 4,000 gpm for 4 hours
- o Fire at Non-Sprinkled Commercial = 4,000 gpm for 2 hours
- o Fire at Non-Sprinkled Residential = 2,000 gpm for 2 hours

Notes:
(1) A common reservoir with a storage volume of 4.8 MG will be installed within these areas.
(2) This development related deficit will be fulfilled with a new storage reservoir at the existing PSIP reservoir.
(3) The development related storage deficit within the Southport area will be distributed to these reservoir sites.
(4) The remaining deficit will be fulfilled by replacing the existing 1.0 MG reservoir with 3.0 MG reservoir at the Southport Reservoir location.

CHAPTERS 1 - 5 SUMMARY FLOW CHART
WATER MASTER PLAN UPDATE
CITY OF WEST SACRAMENTO



HYDRAULIC ANALYSIS

6.1 INTRODUCTION

Hydraulic analysis of the distribution system was used to determine the deficiencies in the system and to determine the required facilities for the future developments within the distribution system. The City and Carollo agreed to perform the hydraulic analysis of the system using the H2ONET hydraulic modeling software. The hydraulic analysis of the system is based on the distribution system skeleton described in previous chapters. Carollo used the base model prepared by West Yost & Associates and has made the improvements in order to reflect the actual site conditions and to convert steady state model into extended period dynamic model.

6.2 FEATURES OF A DISTRIBUTION SYSTEM

The following are the features of the model used for hydraulic analysis of the distribution system:

- **Source of Water Supply**: The Sacramento River is the raw water source of water supply into the distribution system. The only supply of water in this distribution system is Bryte Bend WTP. The Bryte Bend WTP treats water and delivers it into two 4.0 MG clearwells. The treatment plant was recently expanded and can treat up to 60 mgd. The permitted plant capacity currently varies during a given year; it is 58 mgd from April through October and 40 mgd from November through March.

- **Water Demand Points (Nodes)**: These are the points in the water distribution system that consume the water supplied from the source. These locations generally include businesses, residential customers, fire, industries, irrigation, storage reservoirs, etc. In addition, distribution system pipe leaks contribute to an increase in demands. As the water demands increase in the system, the system is stressed. If the water demands in the system are more than the system capacity, the system is considered deficient and ineffective.

- **Pumping Stations**: Since there are no ground water sources within the distribution system, all the pump station facilities are booster pump station (BPS) facilities. These pump stations pump water from the source clearwells or storage reservoirs into the distribution in order to meet demands and at the same time maintain required pressures within the distribution system. Since the elevation difference within the City is minimal and all the reservoirs are located at ground elevation, BPS facilities are required within the distribution system. The High Service Pump Station (HSPS) at the treatment plant delivers water from the clearwells into the distribution system. The HSPS can deliver 55 mgd today and can be readily expanded to 65 mgd.

- **Storage Reservoirs**: Storage reservoirs are required in every distribution system in order to provide operational, emergency, and fire demands within the distribution system. The storage criteria were described in detail in Chapter 5 of this report. The storage reservoirs will be filled during low demand periods and will be drained using the BPS during the high demand periods. In the City's water distribution system, the elevation difference is minimal. Therefore, there is a BPS associated with each storage reservoir in order to boost water from each reservoir to the hydraulic grade line of the system.

- **Pipelines**: Pipelines connect all the above-described features within the distribution system. There are two types of pipelines, T-mains and distribution mains. The T-mains are pipes that connect all the major areas with the water supply sources, while the distribution mains distribute water from T-mains to the customers within the distribution system. The T-mains are generally the larger pipelines; in the City's distribution system, any pipe larger than 12-inches is considered to be a T-main. The distribution mains are generally the smaller size pipelines; in City's distribution system, any pipe 12-inches and smaller is considered to be a distribution main.

All the features in the model reflect the actual distribution system. Carollo verified all the major features in the model through input and data provided by City staff.

6.3 DESCRIPTION OF DEFICIENCIES

All the above-described elements are integrated in the model to reflect the actual distribution system. Once the model is verified for connectivity, the model is analyzed using the demand and supply conditions. The following are the criteria used to determine if there are deficiencies based on the hydraulic analysis:

- **Pipe Deficiencies**: The velocities during the ADD and MDD conditions shall not exceed 7.0 feet per second. During the fire and emergency conditions, velocities shall not exceed 10.0 feet per second. If a velocity in a pipe is greater than this criteria, it is considered a bottleneck, i.e., it is carrying greater flows than the acceptable criteria, creating high headloss necessitating an improvement to increase water transmission capacity. Pipe deficiencies decrease the hydraulic grade line from one end of the distribution system to the other. These deficiencies reduce the efficiency of the system by increasing the operational costs, thus, it is desirable to remove the pipe deficiencies in the distribution system.

- **Pressure Deficiencies**: These deficiencies are the result of deficiency in transmitting flow from the source to the customer at desired pressures. Pressure deficiencies can occur for any of the following reasons: pipe deficiency, pumping deficiency, capacity deficiency, etc. The pressure deficiency in the system indicates all the various deficiencies within the distribution system. The minimum pressure criteria used for the

City's system evaluation are: 40 psi during average and maximum day demand conditions and 20 psi near fire demands.

It is important to improve all the deficiencies in order to make the system efficient and to reduce the operational and energy costs of water supply within the distribution system. The City and Carollo agreed that the hydraulic analysis of the system would be performed for two different scenarios, they are:

- Existing System
- Buildout (Year 2020)

The following sections describe the various scenarios performed in order to identify the deficiencies within the distribution system.

6.4 CRITERIA FOR HYDRAULIC ANALYSIS

The following criteria for the hydraulic analysis were developed with City staff input and are used to identify the deficiencies in the distribution system:

- Maximum velocities in the pipes shall be less than 7.0 feet per second.
- Maximum velocities in the pipes near fire nodes shall be less than 10.0 feet per second.
- Minimum pressure in the system shall be greater than 40.0 psi.
- Maximum pressure in the system shall be less than 70.0 psi. Note: This pressure can reach up to 80.0 psi during emergencies but is not desirable during normal operations.
- Minimum pressure at and near fire nodes shall be greater than 20 psi.
- Daily reservoir turnover shall be 30 percent.

The distribution system shall satisfy the above criteria in order to determine if the system is efficient. If any part of the distribution system does not satisfy the above criteria, it is considered a deficiency in the system and will affect the system performance greatly. The deficiencies that violate the above criteria are identified in the following sections.

6.5 CRITERIA FOR PUMP OPERATIONS

There are several existing booster pump stations and future booster pump stations that are modeled using the following criteria during the hydraulic analysis:

6.5.1 Existing Conditions:

- All the pumps are operated based on a new operations pattern, new demand pattern, and storage criteria presented in this report.
- Pumps are operating in such a way that there is no double and triple pumping within the system.
- The criteria for individual pump stations will be based on flow and head requirements during various demand conditions. The results from the hydraulic analysis will provide the required flow and head conditions.
- The HSPS should be operating all the time, i.e., no breakdown in the water supply from HSPS.

6.5.2 Future Conditions:

- All conditions described in Section 6.5.1 apply for these conditions. The operations pattern will vary with demands.
- An In-Line Booster Pump Station between North and Southport Areas was used during the hydraulic analysis that will eliminate the necessity of a transmission main to accommodate increases in demand.

6.6 EXISTING SYSTEM HYDRAULIC ANALYSIS

The existing distribution system is mostly developed in the North area of the City with partial development in the Southport area. The elements of the existing distribution system are described in detail in Chapter 4 of this report. The distribution system demands are described in detail in Chapter 2 of this report. In order to perform the hydraulic analysis of the existing system, various operations patterns were created by Carollo based on the existing storage reservoir volume and daily volumetric turnover for water quality reasons. These operational patterns are necessary because the reservoirs altitude valves and booster pumps must be scheduled to operate during particular hours of the extended period simulations (EPS). The following are the operations patterns used for the analysis of the existing distribution system:

- Existing Maximum Day Demand (EMDD) Operations Pattern, with no double or triple pumping.
- EMDD with one storage reservoir filling (Carlin Tank) and other storage reservoirs are pumping.
- EMDD with double and triple pumping Operations Pattern.
- EMDD with special operations at PSIP Reservoir.

All the above described operation patterns are presented in Appendix E of this report. The following demand conditions are used for the analysis of the existing distribution system:

- EMDD
- EMDD with Commercial and/or Residential Fire

Each of these two demand conditions include three peak hours of demand during the 72-hour EPS. The diurnal demand pattern measured during the 24-hour demand test was applied for all hydraulic analyses.

The hydraulic analysis of the existing system was performed with a combination of above demand conditions and operations patterns. In order to determine the deficiencies in the system, a specific group of hydraulic analyses were performed that stressed the distribution system. Numerous hydraulic scenarios were performed to check the efficiency of the distribution system; the scenarios and the summary of findings of the corresponding scenarios are presented in Table 6.1. The highlighted values represent deficiencies in the system under the specific test conditions. The following are the hydraulic runs performed in order to determine the deficiencies in the distribution system.

6.6.1 Existing Maximum Day Demand Scenario

The EMDD scenario resembles the existing distribution system during a maximum day demand condition. The following are the conditions for this scenario:

The calibrated model is used for the hydraulic analysis; the model is calibrated based on the results obtained from the Hydraulic Stress Test. Calibration methodology is described in detail in Chapter 4 of this report.

- ADD for the Year 2004 is 13.5 mgd. Thus the MDD for the existing condition is 2.0 times the ADD, which is equivalent to 27.0 mgd. Note: The ADD for the Year 2004 was projected mid-year (during these evaluations) to be 13.5 mgd. After December 31, 2004, ADD was calculated to be 13.2 mgd. Use of slightly higher ADD and MDD values do not change conclusion of the hydraulic analyses.
- The pattern obtained from the 24-Hour Demand Test is used and is extended to 72-hours for this hydraulic modeling scenario. Demand patterns are described in detail in Chapter 2 of this report.
- EMDD Operations Pattern is used for this scenario. This pattern does not allow for double and triple pumping within the distribution system, i.e., no reservoirs fill when flow is pumped from another reservoir.

Table 6.1 Description of Model Runs - Existing Analysis
Water Master Plan Update
City of West Sacramento

Case	Description	Scenario Conditions	Difference from Current Operating Conditions	Pressures at Various Nodes at Reservoirs (PSI) (values rounded-off to the nearest integer)								Low Pressure at Fire Nodes (PSI)	Pressures Description	Description on Reservoir Levels	Description on Pipe Velocities	Improvements from Existing Conditions	Conclusion from the Scenario
				PSIP		Central		Southport		Carlin							
				High	Low	High	Low	High	Low	High	Low						
1	Existing Maximum Day Demand	EMDD Conditions without double pumping. Also in the File is Ex. Avg. Day Demand Scenario with 12.5 mgd dmd.	No double and triple pumping Pump Operations follow Demand Pattern.	65	48	65	59	68	63	74	58	N/A	Big Pressures Swings at PSIP and Carlin	Reservoir Levels are Varying during a day Nothing Unusual	Pipe Velocities in Normal Range	Base Run with Calibrated Model with New Operations Scheme.	System is Working Fine with high Pressure Swings near PSIP & Carlin. Transmission capacity to PSIP need to be improved.
2	Existing Maximum Day Demand **with PSIP 12" Parallel Line**	EMDD Conditions without double pumping. Parallel line of 12" Dia to PSIP. **For 5850'**	No double and triple pumping Pump Operations follow Demand Pattern.	66	56	65	59	68	63	74	58	N/A	Pressure Swing at PSIP reduced with Parallel Pipe	Reservoir Levels are Varying during a day Nothing Unusual	Pipe Velocities in Normal Range	Parllel 12-inch Pipeline for 5850 feet.	System needs the PSIP improvements to improve water transmission to the area.
3	Existing Maximum Day Demand **Commercial Fire-Southport Area** Carlin ON during Fire	Case 2 plus 5,000 gpm Fire Demand for five hours (Not File, Scenario in EMDDP)	No double and triple pumping Pump Operations follow Demand Pattern.	66	56	65	59	68	63	75	58	58	No Change in Pressures at Resv's from EMDDP	Special operations required to fill back the Res'v drained during Fire.	Pipe Velocities in Normal Range	Parllel 12-inch Pipeline for 5850 feet.	The operation of Carlin during fire will keep the system pressures and operations NORMAL.
4	Existing Maximum Day Demand **Residential Fire-Southport Area** Southport ON during Fire	Case 2 plus 4,000 gpm Fire Demand for four hours (Not File, Scenario in EMDDP)	No double and triple pumping Pump Operations follow Demand Pattern.	65	56	65	59	68	63	74	58	35	Pressures Near Fire Demand fell considerably. Res'v- ON for better pressures.	Special operations required to fill back the Res'v drained during Fire.	Vel. High near Fire Nodes but less than 10 fps.	Parllel 12-inch Pipeline for 5850 feet.	New Reservoir is required near fire since the existing reservoirs are insufficient to meet fire without affecting pressures.
5	Existing Maximum Day Demand **Commercial Fire - North Area** 1st Row PSIP OFF- 2nd PSIP ON	Case 2 plus 5,000 gpm Fire Demand for five hours (Not File, Scenario in EMDDP)	No double and triple pumping Pump Operations follow Demand Pattern.	65 65	29 40	65 65	59 59	68 68	63 63	74 74	58 58	19 28	Pressures Near Fire Demand fell considerably. Res'v- ON for better pressures.	Special operations required to fill back the Res'v drained during Fire.	Vel. High near Fire Nodes but less than 10 fps.	Parllel 12-inch Pipeline for 5850 feet.	PSIP Res'v needs to be Turned On to improve pressures. The pressures are still below 30 psi near fire nodes.
6	Existing Maximum Day Demand **Residential Fire- North Area** Northeast ON during Fire	Case 2 plus 4,000 gpm Fire Demand for four hours (Not File, Scenario in EMDDP)	No double and triple pumping Pump Operations follow Demand Pattern.	65	48	65	59	68	63	74	58	55	Pressures Near Fire Demand fell considerably. Res'v- ON for better pressures.	Special operations required to fill back the Res'v drained during Fire.	Vel. High near Fire Nodes but less than 10 fps.	Parllel 12-inch Pipeline for 5850 feet.	The operation of Northeast during fire will keep the system pressures and operations NORMAL.
7	Existing Maximum Day Demand **with PSIP 12" Parallel Line** with reciprocal demand	Case 2 with Reciprocal Demand Pattern (**PATN7** in the model) (Not File, Scenario in EMDDP)	No double and triple pumping Pump Operations follow Demand Pattern.	67	55	66	58	69	60	74	56	N/A	Greater Pressure Swings due to filling during High Demand Periods.	Reservoir Levels are Varying more than due to change in pattern.	Pipe Velocities in Normal Range	Parllel 12-inch Pipeline for 5850 feet. Change in Pattern.	Even if the Reservoirs are filled during high demand hours and drained during low demand hours, systen is OK.
8	Existing Maximum Day Demand **with shorter PSIP 12" Parallel Line**	EMDD Conditions without double pumping. Parallel line of 12" Dia to PSIP. **For 1635'**	No double and triple pumping Pump Operations follow Demand Pattern.	66	50	65	59	68	63	74	58	N/A	Intermediate pressures between EMDD and EMDDP	Reservoir Levels are Varying during a day Nothing Unusual	Pipe Velocities in Normal Range	Parllel 12-inch Pipeline for 1635 feet.	A parallel line is needed to improve transmission to PSIP area. Paralleling full length is better than partial length
9	Existing Maximum Day Demand **Commercial Fire - North Area** PSIP ON During Fire	Case 8 plus 5,000 gpm Fire Demand for five hours (Not File, Scenario in EMDDPA)	No double and triple pumping Pump Operations follow Demand Pattern.	66	36	65	59	68	63	74	58	18	Presurres at Fire Node fell below 20 psi even with PSIP ON	Special operations required to fill back the Res'v drained during Fire.	Vel. High near Fire Nodes but less than 10 fps.	Parllel 12-inch Pipeline for 1635 feet.	Paralleling full length to PSIP is better option in order to keep the pressures relatively high (over 20 psi) during fire.
10	Existing Maximum Day Demand **with double pumping**	Case 2 with Double & Triple pumping	Carlin Filling when other pumps are Pumping.	65	48	65	59	68	63	74	58	N/A	No Change in Pressures from EMDDP	Reservoir Levels are Varying during a day Nothing Unusual	Pipe Velocities in Normal Range	Parllel 12-inch Pipeline for 5850 feet.	The filling of Carlin when other Resv's are pumping did not affect the system drastically. No Ops concerns at all.
11	Existing Maximum Day Demand **w/Alternate Operations Analysis**	Case 1 with Three Resv's Pumping and Three filling at same time.	Double & Tripple pumping since Three Resv's in North draining and three Resv's in South filling.	64	53	65	58	68	60	72	56	N/A	No Change in Pressures from EMDDP	Reservoir Levels are Varying during a day Nothing Unusual	Pipe Velocities in Normal Range	Parllel 12-inch Pipeline for 5850 feet.	Three Resv's pumping and Three Resv's filling did not affect the system No Ops Concerns at all.
12	Existing Maximum Day Demand **w/ only Small Pump @ PSIP**	Case 1, but only Small Pump is Operating at PSIP. None of the BIG Pumps are Operating.	No double and triple pumping Low Flow from PSIP.	63	56	65	59	68	63	74	58	N/A	No Change in Pressures from EMDDP	Reservoir Levels are Varying during a day PSIP Minimal Turnover.	Pipe Velocities in Normal Range	Base Run with Calibrated Model with New Operations Scheme.	Only Small pump at PSIP is Operating The System is working fine, but only 9% turnover in PSIP during a day.
13	**EMDDPSIP w/Comm. Fire & Small PSIP** Small PSIP ON during Fire	Case 12, with Commercial Fire Demand in North Area and only Small Pump Operating at PSIP.	No double and triple pumping Low Flow from PSIP.	63	32	65	59	68	63	74	58	18	Presurres at Fire Node fell below 20 psi even with PSIP ON	Special operations required to fill back the Res'v drained during Fire.	Vel. High near Fire Nodes but less than 10 fps.	Base Run with Calibrated Model with New Operations Scheme.	Only Small Pump at PSIP operating. This pump is not sufficient to keep pressures over 20 psi.
14	**EMDDPSIP w/ Commercial Fire & Small & Big Pumps PSIP** BIG & Small PSIP ON during Fire	Case 13, with Big Pump turning ON during Fire Demand.	No double and triple pumping Low Flow from PSIP. Except during Fire Demand.	63	48	65	59	68	63	74	58	32	Pressure at Fire Node are over 20 psi when Big Pump is ON at PSIP.	Special operations required to fill back the Res'v drained during Fire.	Vel. High near Fire Nodes but less than 10 fps.	Base Run with Calibrated Model with New Operations Scheme.	The Big Pump at PSIP needs to Turn ON to improve pressures during Fire pressures over 20 psi.
15	**EMDDO+H Oak in conjunction with HSPS**	Case 2 with Oak complimenting HSPS to narrow flow range.	Oak is Pump when other Res'v filling and vice-versa.	67	59	66	61	68	64	74	59	N/A	Pressure Swing at PSIP reduced with Parallel Pipe	Reservoir Levels are Varying during a day Nothing Unusual	Pipe Velocities in Normal Range	Parllel 12-inch Pipeline for 5850 feet.	Oak will be operated in conjunction with HSPS in order to reduce the band of flow coming out of HSPS
16	**EMDD-Dan-WntR Winter Operation Conditions**	Case 1 with Winter Average Day Demands.	HSPS-Pumping & Resv's filling from 7 a.m. to 7 p.m., Resv's Pumping from 7 p.m. to 6 a.m.	70	65	68	65	71	68	75	65	N/A	Test run to verify the results for Winter Operations	Reservoir Levels are Varying during a day Nothing Unusual	Pipe Velocities in Normal Range	Base Run with Calibrated Model with Winter Operations Scheme.	System is working fine with the winter operations mode.

Notes:

(1) The Total Demand in the System is 27.1 mgd (18,818 gpm) for all the runs. Fire Demand values are 5,000 gpm for Five hour for Commercial Fire, applied from hours 34 through 38 and 4,000 gpm for Four hours for Residential Fire applied from hours 34 through 37. Commercial and Residential Fires are not applied simultaneously.

(2) The Daily pattern obtained from 24-Hour Demand Test is applied for all the runs for Three consecutive days, except for Case 7.

(3) Oak Street and Northeast Reservoir pressures were not reported since the pressures are OK during all the analyses.

(4) The values Highlighted in yellow indicate the deficiencies within the system during the corresponding hydraulic analysis.

- Six storage reservoirs are in operation within the distribution system.

- The storage reservoir operations are based on a volume turnover of about 30 percent in each of the reservoirs.

- No Fire Demand is applied to the distribution system.

- No improvements in the distribution system.

The results for this scenario are presented in Table 6.1; Case 1 indicates the results obtained for this scenario. The flow from the HSPS, the pressures at the nodes near reservoirs, and the levels in the reservoirs are indicated on the figures in Appendix E (all Figures indicated as EMDD in the title).

- The flow from HSPS graph indicated on Figure 6.1 and the flow from HSPS is synchronous with the demand pattern applied to the distribution system i.e., the reservoirs are filling during low demand periods and draining during the high demand periods.

  - The operations pattern is different from the current operations of the distribution system.

  - The ADD during a day for this scenario is 27.0 mgd but the EMDD graph indicates low flow values between 18.0 mgd and 21.0 mgd during hours 03:00 to 08:00 & 17:00 to 21:00 and high flow values between 30.2 and 36.7 during hours 01:00 to 2:00, 09:00 to 16:00, and 22:00 to 24:00. This pattern indicates two-cycles of filling and draining within the distribution system.

  - The low flow values from HSPS indicate that the reservoirs in the distribution system are draining during these hours and the high flows from HSPS indicate that the reservoirs in the distribution system are filling during these hours.

  - Flows from HSPS are based on the generic operations pattern that is relative to the demand pattern. This pattern can be varied in order to save the energy costs. Using Oak Street storage reservoir in conjunction with the HSPS can also change this pattern. There are several possible combinations of operations patterns, Carollo chose to use the above pattern because it does not include double and triple pumping and it satisfies the minimum 30 percent volume turnover required for the storage reservoirs for water quality purposes.

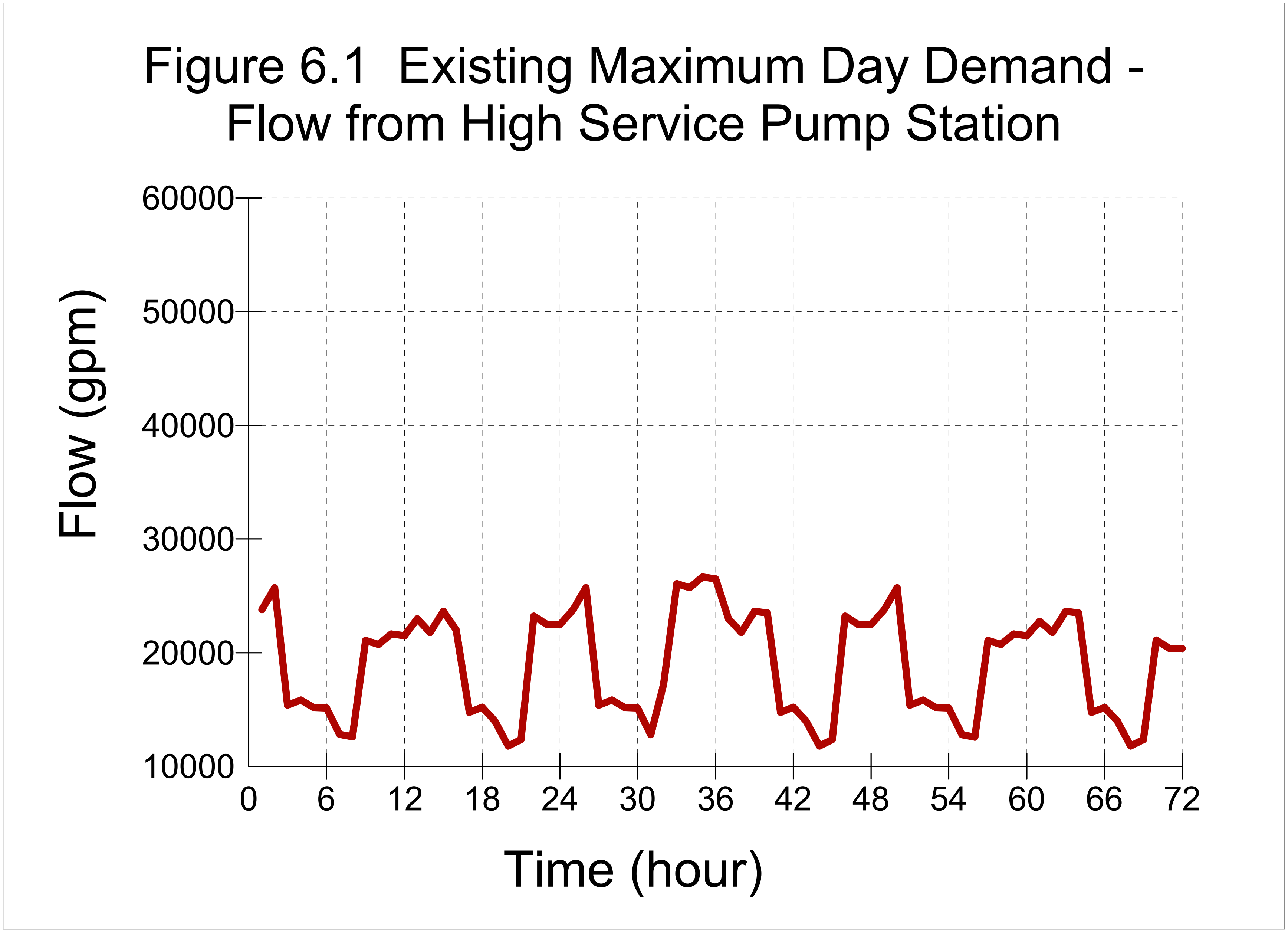


Figure 6.1 Existing Maximum Day Demand -
Flow from High Service Pump Station
Flow (gpm)
60000
50000
40000
30000
20000
10000
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)

- No deficiencies are observed within the system with all the above system conditions.
- Pipe velocities are in the normal range and the pressures in the system are in the normal range. Although there are greater pressure swings in the PSIP area, these pressures are still in the acceptable range. Pressure swing near Carlin Tank is also high but is within the acceptable range.
- No improvements are required based on this scenario; however, a 12-inch parallel pipeline for 5,850 feet to the PSIP area is recommended in order to improve the transmission capacity to this area and to optimize operation of the storage reservoir in this area.

Conclusion from this scenario a parallel pipeline to the PSIP reservoir is recommended in order to enhance the performance of the PSIP reservoir.

6.6.2 Existing Maximum Day Demand Scenario with Commercial Fire in Southport Area (EMDDCF)

This is the EMDD scenario with a Commercial Fire Demand in the Southport Area. The fire is placed at the industrial part of the Southport Area (near the Carlin Tank). The following are the conditions for this scenario:

- The calibrated model was used for the hydraulic analysis; the model was calibrated based on the results obtained from the Hydraulic Stress Test. Calibration methodology is described in detail in Chapter 4 of this report.
- ADD for the Year 2004 is 13.5 mgd. Thus the MDD for the existing condition is 2.0 times the ADD, which is equivalent to 27.0 mgd.
- The pattern obtained from the 24-Hour Demand Pattern is used and is extended to 72-hours for this hydraulic modeling scenario. Demand patterns are described in detail in Chapter 2 of this report.
- EMDD Operations Pattern is used for this scenario, this pattern does not allow for double and triple pumping within the distribution system, i.e., no reservoir fills when the flow is pumped from another reservoir.
- Six storage reservoirs are in operation within the distribution system.
- The storage reservoir operations are based on a volume turnover of about 30 percent in each of the reservoirs.
- A Commercial Fire Demand of 5,000 gpm for five hours is applied in Southport Area at the Southport industrial area near Carlin Tank.

- A 12-inch parallel pipeline for 5,850 feet is installed in the model to improve the transmission to the PSIP area.

- All the reservoirs in the system are filling during the fire except for the Carlin Tank, as the Carlin Tank booster pumps are pumping to meet the fire demands.

The results for this scenario are presented in Table 6.1; Case 3 indicates the results obtained for this scenario. The flow from the HSPS, the pressures at the nodes near reservoirs, and the levels in the reservoirs are indicated on the figures in Appendix F (all Figures indicated as EMDDCF in the title), Section 6.5.1 describes the flow pattern indicated on flows from HSPS graph.

- No deficiencies are observed within the system with all the above system conditions.

- Pipe velocities are in the normal range and the pressures in the system are in the normal range. Although there are greater pressure swings in the PSIP area, the pressures are still in the acceptable range. Pressure swing at Carlin Tank is also high but is within the acceptable range.

- No Improvements are required based on this scenario; however, a 12-inch parallel pipeline for 5,850 feet to the PSIP area is recommended in order to improve the transmission capacity to this area and to optimize operation of the storage reservoir in this area.

- Special operations are required to refill the Carlin Tank after it is substantially drained due to the fire demand.

Conclusion from this scenario is that there are no improvements required within the distribution system except for the parallel pipeline recommended in the PSIP area in the EMDD scenario.

6.6.3 Existing Maximum Day Demand Scenario with Residential Fire in Southport Area (EMDDRF)

This is the EMDD scenario with Residential Fire Demand in the Southport Area. The fire is placed at the residential part of the Southport Area (north of PAIK Communities). The following are the conditions for this scenario:

- The calibrated model is used for the hydraulic analysis; the model is calibrated based on the results obtained from the hydraulic stress test. Calibration methodology is described in detail in Chapter 4 of this report.

- ADD for the Year is 13.5 mgd. Thus the MDD for the existing condition is 2.0 times the ADD, which is equivalent to 27.0 mgd.

- The pattern obtained from the 24-Hour Demand Pattern is used and is extended to 72-hours for this hydraulic modeling scenario, demand patterns are described in detail in Chapter 2 of this report.
- EMDD Operations Pattern is used for this scenario, this pattern does not allow for double and triple pumping within the distribution system, i.e., no reservoir fills when flow is pumped from another reservoir.
- Six storage reservoirs are in operation within the distribution system.
- The storage reservoir operations are based on a volume turnover of about 30 percent in each of the reservoirs.
- A Residential Fire Demand of 4,000 gpm for four hours is applied in the Southport Area in a community north of the PAIK community.
- A 12-inch parallel pipeline for 5,850 feet is installed in the model to improve the transmission to the PSIP area.
- All the reservoirs in the system are filling except for the Southport Reservoir that is supplying flows for the fire demand.

The results for this scenario are presented in Table 6.1, Case 4 indicates the results obtained for this scenario. The flow from the HSPS, the pressures at the nodes near reservoirs, and the levels in the reservoirs are indicated on the figures in Appendix F (all Figures indicated as EMDDRF in the title), Section 6.5.1 describes the flow pattern indicated on flows from HSPS graph.

- No deficiencies are observed within the system with all the above system conditions.
- Pipe velocities are in the normal range and the pressures in the system are in normal range. Although there are greater pressure swings in the PSIP area, the pressures are still in the acceptable range. The pressure near the fire nodes fell below 35 (<40 psi) psi, but is acceptable since the pressure at the fire nodes is allowed to fall to 20 psi.
- No improvements are required based on this scenario; however, a 12-inch parallel line for 5,850 feet to the PSIP area is recommended in order to improve the transmission capacity to this area and to optimize operation of the storage reservoir in this area.
- Special operations are required to refill the Southport Reservoir after it is substantially drained due to the fire demand.

Conclusion from this scenario is that there are no improvements required within the distribution system except for the parallel pipeline recommended in the PSIP area in the EMDD scenario.

6.6.4 Existing Maximum Day Demand Scenario with Commercial Fire in North Area (EMDDCFN)

This is the EMDD scenario with Commercial Fire Demand in the North Area of the City. The fire is placed at the industrial part of the North Area (near the PSIP Tank). Two conditions were observed for this scenario: in one condition, PSIP Pumps are ON and in the other condition PSIP pumps are OFF. The following are the conditions for this scenario:

- The calibrated model is used for the hydraulic analysis; the model is calibrated based on the results obtained from the hydraulic stress test. Calibration methodology is described in detail in Chapter 4 of this report.
- ADD for the Year 2004 is 13.5 mgd. Thus the MDD for the existing condition is 2.0 times the ADD, which is equivalent to 27.0 mgd.
- The pattern obtained from the 24-Hour Demand Pattern is used and is extended to 72-hours for this hydraulic modeling scenario. Demand patterns are described in detail in Chapter 2 of this report.
- EMDD Operations Pattern is used for this scenario, this pattern does not allow for double and triple pumping within the distribution system, i.e., no reservoir fills when flow is pumped from another reservoir.
- Six storage reservoirs in operation within the distribution system.
- Storage reservoir operations based on a volume turnover of about 30 percent in each of the reservoirs.
- A Commercial Fire Demand of 5,000 gpm for five hours was applied near the PSIP area.
- A 5,850 feet 12-inch parallel pipeline for installed in the model to improve the transmission to the PSIP area.
- All the reservoirs in the system are filling except for the PSIP. The PSIP reservoir is supplying flows to meet the fire demands in this area.
- The results for this scenario are presented in Table 6.1; Case 5 indicates the results obtained for this scenario. The flow from the HSPS, the pressures at the nodes near reservoirs, and the levels in the reservoirs are indicated on the figures in Appendix E (all Figures indicated as EMDDCFN in the title), Section 6.5.1 describes the flow pattern indicated on flows from HSPS graph.

- With two conditions, there are deficiencies in the system when PSIP pumps are not operational, whereas, there are no deficiencies observed when PSIP pumps are operational. The existing PSIP pumps are sized for a different zone that pump water up to 100 psi of pressure, but the existing system pressures at this location are less than 70 psi, these pumps cannot be operational. Therefore, these pumps need to be replaced with pumps that can pump the water from PSIP reservoir to the existing distribution system pressures.

- The pumps at the PSIP need to be replaced in order to meet the fire demands in this area. Without proper pumping at this reservoir, the pressures in this area fall below the allowable pressure during the fire. Once the pumps are operational, although the pressures fell considerably at the fire nodes, the pressures remain in the acceptable range. Therefore, the replacement of pumps at PSIP reservoir is necessary to meet the commercial fire demands in this area. In addition, the installation of 5,850 feet of a 12-inch parallel pipeline for will help the water transmission to this area.

- Special operations are required to refill the PSIP Reservoir after it is substantially drained due to the fire demand.

Conclusions from this scenario are that the existing PSIP pumps need to be replaced with new pump that can pump water from PSIP reservoir to the system pressures, and the installation of a 12-inch parallel pipeline to the PSIP reservoir will improve the transmission capacity and pressures in the PSIP area during the event of a commercial fire in the PSIP area.

6.6.5 Existing Maximum Day Demand Scenario with Residential Fire in North Area (EMDDRFN)

This is the EMDD scenario with Residential Fire Demand in the North Area. The fire is placed in a residential area near the Northeast Reservoir. The following are the conditions for this scenario:

- The calibrated model is used for the hydraulic analysis; the model is calibrated based on the results obtained from the hydraulic stress test. Calibration methodology is described in detail in Chapter 4 of this report.

- ADD for the Year 2004 is 13.5 mgd. Thus the MDD for the existing condition is 2.0 times the ADD, which is equivalent to 27.0 mgd.

- The pattern obtained from 24-Hour Demand Pattern is used and is extended to 72-hours for this hydraulic modeling scenario, demand patterns are described in detail in Chapter 2 of this report.

- EMDD Operations Pattern is used for this scenario, this pattern does not allow for double and triple pumping within the distribution system, i.e., no reservoir fills when the flow is pumped from another reservoir.
- Six storage reservoirs in operation within the distribution system.
- The storage reservoir operations are based on a volume turnover of about 30 percent in each of the reservoirs.
- A Residential Fire Demand of 4,000 gpm for four hours is applied to the residential area north of Sacramento Avenue.
- A 12-inch parallel pipeline for 5,850 feet is installed in the model to improve the transmission to the PSIP area.
- All the reservoirs in the system are filling except the Northeast Reservoir. Northeast Reservoir's booster pumps are pumping in order to meet the fire flow demands in this area.

The results for this scenario are presented in Table 6.1; Case 6 indicates the results obtained for this scenario. The flow from the HSPS, the pressures at the nodes near reservoirs, and the levels in the reservoirs are indicated on the figures in Appendix E (all Figures indicated as EMDDRFN in the title), Section 6.5.1 describes the flow pattern indicated on flows from HSPS graph.

- No deficiencies are observed within the system with all the above system conditions.
- Pipe velocities are in the normal range and the pressures in the system are in the normal range, except that there are greater pressure swings in the PSIP area but the pressures are still in the acceptable range.
- No improvements are required based on this scenario, but a 12-inch parallel pipeline for 5,850 feet to the PSIP area is recommended in order to improve the transmission capacity to this area and to optimize operation of the storage reservoir in this area.
- Special operations are required to refill the Northeast Reservoir after it is substantially drained due to the fire demand.

Conclusion from this scenario is that there are no improvements required within the distribution system except for the parallel pipeline recommended in the PSIP area in the EMDD scenario.

6.6.6 Conclusion from EMDD Scenarios

All the hydraulic scenarios evaluated for the EMDD indicate that the system is efficient for the maximum day demand scenario and there are no deficiencies identified in the system.

However, the PSIP area in the distribution system indicates some deficiencies during the fire demand scenarios. Therefore, from all the hydraulic analysis for the existing conditions, the following improvements are recommended for the existing distribution system:

- A 12-inch parallel pipeline for 5,850 feet towards the PSIP reservoir in order to improve the transmission capacity and to improve the pressures in the PSIP area.
- The existing pumps at PSIP Reservoir need to be replaced with new pumps in order to pump flows from PSIP Reservoir to the existing distribution system pressures. At present, the pumps at this reservoir are not useful, except for a jockey pump. In the event of a fire in this area, one of the big pumps at this reservoir should be operational to improve pressures during the fire.

Even after evaluating different operational patterns within the distribution system, the system operation is efficient and meet hydraulic criteria defined in this Master Plan.

The above improvements will make system operation more efficient during various demand conditions. The resulting pipe sizes after all model runs and associated costs for the new improvements are presented in Chapter 8.

6.7 BUILDOUT SYSTEM HYDRAULIC ANALYSIS

The buildout distribution system represents a significant expansion of the existing distribution system. While developing the buildout distribution system, it is assumed that the City is 100 percent developed as presented in the City's General Plan. The elements and features of the future distribution system are described in detail in Chapter 4 of this report. The distribution system demands are described in detail in Chapter 2 of this report. In order to perform the hydraulic analysis of the buildout system, an operations pattern was created by Carollo based on the buildout storage reservoir volume and volumetric turnover for water quality reasons. Like the operations pattern for existing conditions, the operations pattern results in no double or triple pumping in the distribution system. The following are the operations patterns used for the analysis of the existing distribution system:

- Buildout Maximum Day Demand (BOMDD) Operations Pattern.
- BOMDD with demands in the Yarborough area, a future community in the southwestern corner of the Southport area.

All the above described operation patterns are presented in Appendix E of this report. The following demand conditions are used for the analysis of the existing distribution system:

- BOMDD
- BOMDD with Industrial, School, and/or Residential Fires

The hydraulic analysis of the buildout system is performed with a combination of above demand conditions and operations patterns. In order to determine the deficiencies in the system a certain group of hydraulic analysis are performed that will stress the distribution system. In addition, the following improvements are made relative to the existing distribution system:

- An expanded Southport distribution network is connected to the existing distribution system with minimum of 16-inch diameter T-mains. Within each new Southport development, all the T-mains are connected with a minimum of 12-inch diameter T-mains.
- New storage reservoirs are installed at the Rivers (1.9 MG), Triangle and Pioneer Bluff Communities (4.8 MG), North of PAIK Communities (2.2 MG), PAIK Communities (4.2 MG), Richland Communities (4.0 MG), and Bridgeway Lakes II (2.85 MG).
- Replacing the existing 1.0 MG reservoir and pump station at the existing Southport reservoir location with a new 3.0 MG reservoir and new pumps.
- Additional 1.6 MG reservoir at the existing PSIP reservoir location and replacing the existing pumps with new pumps.

The storage reservoir projects described above provide the 23.6 MG of storage required between now and buildout.

The scenarios performed with the above improvements. Numerous hydraulic scenarios performed to check the efficiency of the distribution system; the scenarios and the summary of findings of the corresponding scenarios are presented in Table 6.2. The following are the hydraulic runs performed in order to determine the deficiencies in the distribution system.

6.7.1 Buildout Maximum Day Demand Scenario (BOMDD)

The Buildout MDD (BOMDD) scenario indicates the scenario that resembles the buildout system, i.e., when the City is 100 percent developed as per the City's General Plan and the demands in the system are the MDD at the buildout conditions. The following are the conditions for this scenario:

- The calibrated EMDD model was used for the hydraulic analysis of the buildout model. The model is expanded reflecting the future growth area with demands in these areas. The demands in the system were obtained from the City's General Plan Land Use data. Calibration methodology for EMDD is described in detail in Chapter 4 of this report.
- ADD for the Year is 26.0 mgd. Thus the MDD for the existing condition is 2.0 times the ADD, which is equivalent to 52.0 mgd.

Table 6.2 Description of Model Runs - Buildout Analysis
Water Master Plan Update
City of West Sacramento

Case	Description	Scenario Conditions	Difference from Current Operating Conditions	Pressures at Various Nodes at Reservoirs (PSI) (values rounded-off to the nearest integer)																								Low Pressure at Fire Nodes (PSI)	Pressures Description	Description on Reservoir Levels	Description on Pipe Velocities	Improvements from Existing Conditions	Conclusion from the Scenario
				Oak		Northeast		Rivers		PSIP		Central		Tr. & PB		Southport		Carlin		Newport		PAIK		Rchlnd.		YAR							
				High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low						
1	Buildout Maximum Day Demand	BOMDD demands without double pumping. Also in the File is EMDD Demand Scenario with 27.0 mgd dmd.	No double and triple pumping Pump Operations follow Demand Pattern.	66	62	66	54	66	54	65	36	62	39	62	39	64	39	64	22	66	19	66	19	66	19	66	19	N/A	Big Pressures Swings in Southport Area	Reservoir Levels are Varying, not sufficient head to fill back the Resv's in Southport	High Velocities in Some pipe stretches. See Figure	Base Run with Calibrated Model with New Operations Scheme.	System is deficient for buildout conditions, pressure and velocity criteria are not satisfied and reservoirs are not filling to their full level.
2	Buildout Maximum Day Demand **with In-Line Booster Pump Sta.**	BOMDD conditions without double pumping with In-Line Booster Pump Station.	No double and triple pumping Pump Operations follow Demand Pattern.	66	64	66	54	66	54	66	36	65	42	65	42	70	70	70	58	72	50	72	50	72	50	70	53	N/A	Pressures in Southport improved significantly, PSIP pres. are still less than 40 psi.	Reservoir Levels are Varying during a day Nothing Unusual	High Velocities in Some pipe stretches.	In-Line Booster Pump Sta. Near Barge Canal between North and Southport Area	In-Line Booster Pump Station greatly helps Southport area pressures, Additional imps. To eliminates high velocities.
3A	Buildout Maximum Day Demand **with In-Line Booster Pump Sta.** 24-inch in North & 16-inch to PSIP	BOMDD + In-Line Booster Pump Station and 24-inch Parallel in North Area	No double and triple pumping Pump Operations follow Demand Pattern.	66	64	64	58	64	58	66	50	64	56	64	56	70	70	70	58	72	50	71	50	71	50	71	53	N/A	Pressures improved at PSIP and Central Resv's significantly	Reservoir Levels are Varying during a day Nothing Unusual	High Velocities in Some pipe stretches.	In-Line Booster, 16-inch to PSIP and 24-inch for 20,100 feet.	All the improvements greatly helps the pressures in North area and Southport area.
3B	Buildout Maximum Day Demand **with In-Line Booster Pump Sta.** 24-inch in North & 16-inch to PSIP	BOMDD + In-Line Booster Pump Station and 24-inch Parallel in North Area	No double and triple pumping Pump Operations follow Demand Pattern.	66	62	66	58	66	58	66	49	65	53	65	53	70	70	70	58	72	50	71	50	71	50	71	53	N/A	Pressures improved at PSIP and Central Resv's significantly	Reservoir Levels are Varying during a day Nothing Unusual	High Velocities in Some pipe stretches.	In-Line Booster, 16-inch to PSIP and 24-inch for 5,500 feet.	Pressures improved in North area and Southport area. Only 5,500' of 24-inch compared to 20,100' in Case 3A.
3C	Buildout Maximum Day Demand **with In-Line Booster Pump Sta.** All Pipe Improvements	BOMDD + In-Line Booster Pump Station and Other Pipeline imps., (Not file, Scenario)	No double and triple pumping Pump Operations follow Demand Pattern.	66	62	66	58	66	58	66	49	65	53	65	53	70	70	70	58	72	50	71	50	71	50	71	53	N/A	Pressures improved significantly in the system.	Reservoir Levels are Varying during a day Nothing Unusual	Few High Vel. Pipes.	In-Line Booster, 16-inch to PSIP, 24-inch for 5,500' & other pipeline Imps.	Pressures improved in the system and most of the bottlenecks are eliminated.
4	Buildout Maximum Day Demand **with In-Line Booster Pump Sta.** 36-inch in North & 16-inch to PSIP	BOMDD demands with none of the improvements in in North Area	No double and triple pumping Pump Operations follow Demand Pattern.													70	70	70	58	72	50	71	50	71	50	71	53	N/A	Pressures improved at PSIP and Central Resv's significantly	Reservoir Levels are Varying during a day Nothing Unusual	High Velocities in Some pipe stretches.	In-Line Booster, 16-inch to PSIP and 36-inch for 13,800 feet.	City has to make decision on North Pipeline improvements based on Cases 3A, 3B, and 4.
5	Buildout Maximum Day Demand **Case 3B with Industrial Fire in PSIP area (BOMDDBP24NIF)**	Case 3B with PSIP pumps turn On during Fire and no flow into PSIP Resv during fire (scenario)	No double and triple pumping Pump Operations follow Demand Pattern.	66	62	64	48	64	48	64	40	64	54	64	54	70	70	70	58	72	50	71	50	71	50	71	53	**0**	Pressures in System OK, but at Fire nodes reach Zero. Improvements are required.	Special operations required to fill back the Res'v drained during Fire.	Velocities are **over 10 fps** near fire nodes.	Extend the 16-inch Pipeline improvements to the industrial fire areas.	The Parallel pipeline to PSIP in Case 3B shall be stretched all the way to industrial area.
5A	Buildout Maximum Day Demand **Case 5 with recommended Imps (BOMDDBP24NIFIMP)**	Case 3B with PSIP pumps turn On during Fire and no flow into PSIP Resv during fire (scenario)	No double and triple pumping Pump Operations follow Demand Pattern.	66	62	64	48	64	48	66	49	64	54	64	54	70	70	70	58	72	50	71	50	71	50	71	53	25	Pressures in System OK, but at Fire nodes are OK.	Special operations required to fill back the Res'v drained during Fire.	Velocities are below 10 fps near fire nodes.	16-inch pipeline improvements to the Industrial Fire areas.	After the 16-inch pipeline improvements to the industrial areas, the system is OK during Industrial Fire demands.
YARBROUGH EVALUATIONS																																	
6	Buildout Maximum Day Demand **with Yarbrough Demands**	Case 3C with Yarbrough Demands.	No double and triple pumping Low Flow from PSIP.	66	62	66	45	66	45	66	46	65	51	65	51	70	68	70	54	70	42	70	42	71	58	72	53	N/A	Pressures are OK in the System.	Reservoir Levels are Varying during a day Nothing Unusual	Pipe Velocities in Normal Range	All the improvements made in Case 3C & New Storage of 4.0 MG	By adding Yarbrough developments, all the improvements made in Case 3C and new Storage are sufficient.
7	Buildout Maximum Day Demand **with Yarbrough Demands w/ School & Rs. Fire in Southport**	Case 3C with Yarbrough Demands+Fire in Southport (Not File, Scenario)	No double and triple pumping Low Flow from PSIP.	66	62	64	45	64	45	66	48	65	51	65	51	70	68	70	54	70	42	70	42	71	58	72	53	44	Pressures are OK in the System.	Special operations required to fill back the Res'v drained during Fire.	Pipe Velocities in Normal Range	All the improvements made in Case 3C & New Storage of 4.0 MG	By adding Yarbrough developments, all the improvements made in Case 3C and new Storage are sufficient.
8	Buildout Maximum Day Demand **with Yarbrough Demands w/ 2 School & Rs. Fire in SP**	Case 3C with Yarbrough Demands+Fire in Southport (Not File, Scenario)	No double and triple pumping Low Flow from PSIP.	66	62	64	45	64	45	66	48	65	51	65	51	70	68	70	54	70	42	70	42	71	58	72	53	44	Pressures are OK in the System.	Special operations required to fill back the Res'v drained during Fire.	Pipe Velocities in Normal Range	All the improvements made in Case 3C & New Storage of 4.0 MG	By adding Yarbrough developments, all the improvements made in Case 3C and new Storage are sufficient.

Notes:
(1) The Total Demand in the System is 56.0 mgd (36,110 gpm) for all the runs. Industrial Fire Demand values are 8,000 gpm for Five hours, applied from hours 34 through 38. School Fire Demand values are 4,000 gpm for Four hours, applied from hours 34 through 37. Residential Fire demands are 2,000 gpm for two hours applied from hours 34 through 35.
(2) The Daily pattern obtained from 24-Hour Demand Test is applied for all the runs for Three consecutive days, except for Case 7.
(3) The values Highlighted in yellow indicate the deficiencies within the system during the corresponding hydraulic analysis.

- The 24-Hour Demand Pattern was used and extended to 72-hours for this hydraulic modeling scenario, demand patterns are described in detail in Chapter 2 of this report.
- Buildout MDD operations pattern is used for this scenario. This pattern does not allow for double and triple pumping within the distribution system.
- A total of 12 storage reservoirs are operating for this scenario; six- new storage reservoirs; four- existing storage reservoirs, one reservoir replacement with higher volume reservoir; and one reservoir addition (with additional storage) at one of the existing reservoir sites.
- The storage reservoir operations are based on a volumetric turnover of approximately 30 percent in each of the reservoirs.
- No fire demand is applied to the distribution system.
- All the required improvements for buildout conditions are completed within the distribution system and the new operations pattern for buildout conditions has been implemented.

The results for this scenario are presented in Table 6.2; Case 1 indicates the results obtained for this scenario. The flow from the HSPS, the pressures at the nodes near reservoirs, and the levels in the reservoirs are indicated on the figures in Appendix E (all Figures indicated as BOMDD in the title), Section 6.6.1 describes the flow pattern indicated on flows from HSPS graph.

- The flow from HSPS is indicated on Figure 6.2 and the flow from HSPS and BPS is synchronous with the demand pattern applied to the distribution system i.e., the reservoirs are filling during low demand periods and draining during the high demand periods.
    - ➢ The operations pattern is different from the current operations of the distribution system.
    - ➢ The average demand during a day for this scenario is 52.0 mgd but the graph indicates HSPS low flow values between 25.0 mgd and 28.0 mgd during hours 03:00 to 08:00 & 17:00 to 21:00 and high flow values between 64.5 mgd and 68.5 mgd during hours 01:00 to 2:00, 09:00 to 16:00, and 22:00 to 24:00. This pattern has two-cycles of filling and draining within the distribution system.
    - ➢ The low flow values from HSPS indicate that the reservoirs in the distribution system are draining during these hours and the high flows from HSPS indicate that the reservoirs in the distribution system are filling during these hours.

- These flows from HSPS are based on the generic operations pattern that is relative to the demand pattern. This pattern can be varied in order to save the energy costs. This pattern can also be changed by using Oak Street storage reservoir in conjunction with the HSPS. There are several possible combinations of operations patterns, Carollo chose to use the above pattern since it does not include double and triple pumping and this pattern satisfies the minimum 30 percent volume turnover required for the storage reservoirs for water quality purposes.

- There are deficiencies observed within the system, with all the above system conditions the existing distribution system is not sufficient to handle the MDD for the buildout conditions. The pressures in some parts of the North area and in the Southport area are less than the minimum allowable pressures i.e., less than 40 psi. Hence, various transmission improvements are required within the distribution system in order to improve pressures.

- High pipe velocities are observed in various pipe stretches indicating bottlenecks in transmitting flows from one area to another. Various pipeline improvements are required in order to eliminate the bottlenecks within the distribution system.

- Storage reservoir improvements are required per the storage requirements in the system, apart from the storage improvements better water transmission facilities are required to transmit water from North area of the City to the Southport area of the City. Either large T-mains or a booster pumping station are required in order to improve pressures in the Southport area.

Conclusions from this scenario are that the system is deficient for the BOMDD and various improvements are required to improve the distribution system, which will eliminate the pressure and velocity problems. The following improvements will be analyzed to improve the distribution system performance:

- An In-Line Booster Pump Station (ILBPS) to boost system pressures from the North area to the Southport area of the City. A new pressure zone will be created in the Southport area when the pump station is in operation. This pump station will help improve the pressures in the Southport area of the City, thus eliminating the existing pressure problems and severe pressure problems projected at Buildout in the Southport area.

- T-main improvements are required in the North and Southport areas of the City in order to improve the velocity problems in pipes with high velocities. Carollo performed various evaluations for T-main improvements within the North and Southport areas of the City and identified constructible alternatives for T-main improvements. These alternatives are described in detail later in this chapter.

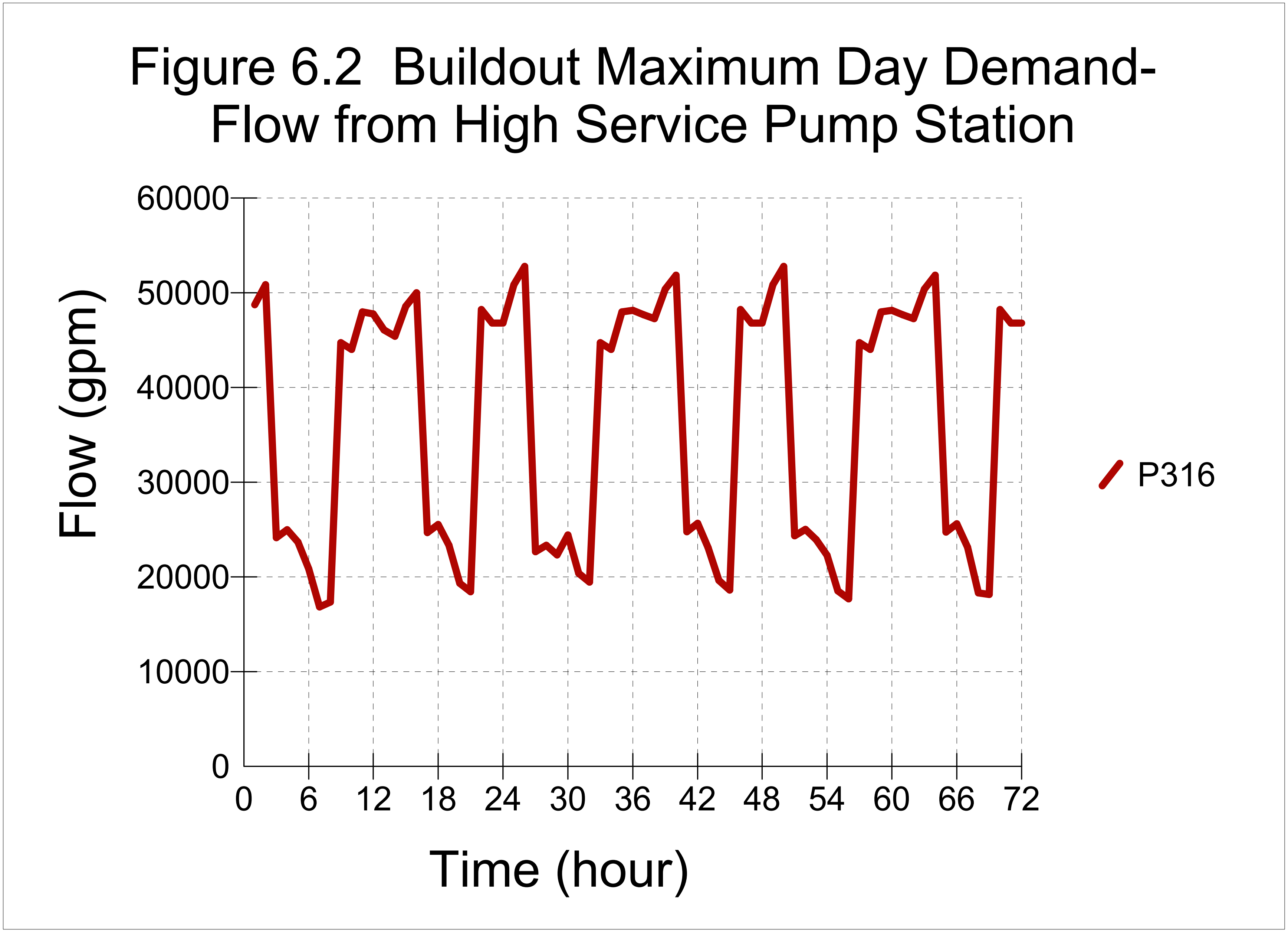


Figure 6.2 Buildout Maximum Day Demand-
Flow from High Service Pump Station
Flow (gpm)
60000
50000
40000
30000
20000
10000
0
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
P316

6.7.2 Buildout Maximum Day Demand Scenario with Improvements in the System (BOMDDBP24N)

This is the BOMDD scenario with ILBPS and T-main improvements within the distribution system. This scenario includes a ILBPS between the North area distribution system and T-main improvements to decrease the high velocities in pipes. This scenario is performed in order to determine the performance of the system with improvements to the BOMDD scenario. The basic objective of this scenario is to identify the most cost and performance effective solution to address the deficiencies in the distribution system. The following are the conditions used for this scenario:

- The BOMDD model was used for the hydraulic analysis of this scenario. The reservoir improvements (described above) for the BOMDD are applied for this scenario.
- ADD for the Year is 26.0 mgd. Thus, the MDD for the existing condition is 2.0 times the ADD, which is equivalent to 52.0 mgd.
- The pattern obtained from 24-Hour Demand Pattern is used and is extended to 72-hours for this hydraulic modeling scenario, demand patterns are described in detail in Chapter 4 of this report.
- BOMDD Operations Pattern is used for this scenario. This pattern does not allow for double and triple pumping within the distribution system.
- A total of 12 storage reservoirs are operating for this scenario; six- new storage reservoirs; four- existing storage reservoirs, one-reservoir replacement with higher volume reservoir; and one reservoir addition at one of the existing reservoir sites.
- The storage reservoir operations are based on a volumetric turnover of about 30 percent in each of the reservoirs.
- No fire demand is applied to the distribution system.

The following improvements are applied to the distribution system:

- A ILBPS between the North and Southport area to create a high pressure zone south of the barge canal.
- A 5,850 feet of 16-inch parallel T-main towards PSIP reservoir for.
- A 5,500 feet of 24-inch parallel T-main either on Park Boulevard or on Maryland Avenue for about. (See Section 6.6.4 for additional description of this improvement)

The results for this scenario are presented in Table 6.1; Case 3C indicates the results obtained for this scenario. The flow from HSPS and BPS is indicated on Figure 6.3. This figure indicates the similar flow pattern from HSPS and BPS. In addition, this figure indicates the operational patterns at BPS. Pressures at the nodes near reservoirs, and the levels in the reservoirs are indicated on the figures in Appendix E (all Figures indicated as BOMDDBP24N in the title), Section 6.6.1 describes the flow pattern indicated on flows from HSPS graph.

- No deficiencies are observed within the system with all the above system conditions.
- Pipe velocities in a few pipes are higher than the normal range but are still acceptable and the pressures in the system are in normal range, except that there are greater pressure swings in the system during BOMDD conditions relative to the EMDD.
- All the above-listed improvements are required in order to improve the distribution system and improve the distribution systems performance. The parallel T-main to the PSIP area shall be 16-inches in diameter instead of the 12-inch diameter T-Main recommended during the EMDD scenarios.

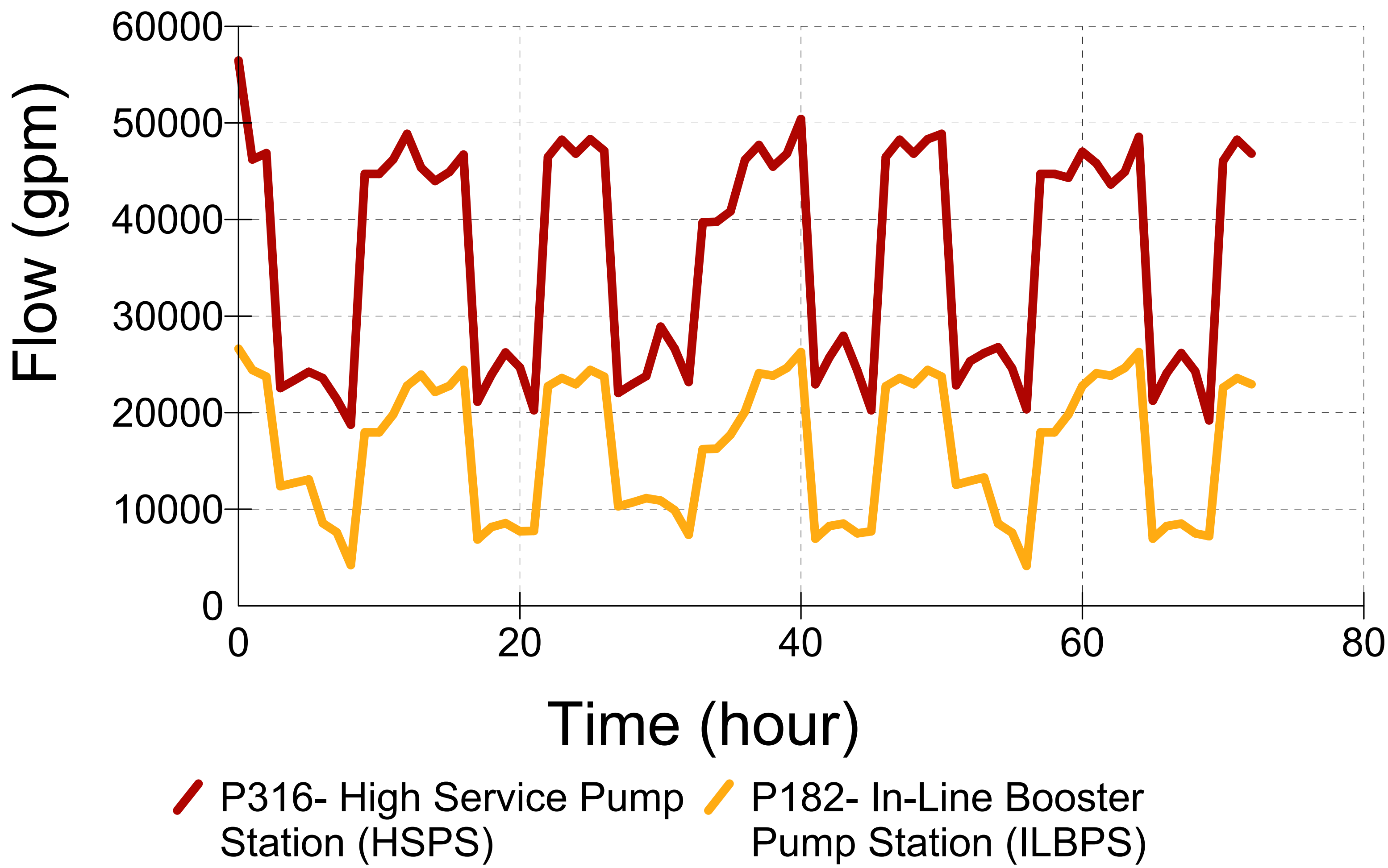
Conclusion from this scenario is that the above-listed improvements are required to improve the deficiencies within the distribution system for better performance of the distribution system. A detailed cost analysis of the improvements in the North and the Southport area are presented in detail in Chapter 7 of this report.

6.7.3 Buildout Maximum Day Demand Scenario with Improvements in the System and Industrial Fire in PSIP area (BOMDDBP24NIF)

This is the EMDD scenario with an Industrial Fire Demand in the PSIP Area. The fire is placed at the industrial part of the PSIP Area (north of Barge Canal). Since the system is operating fine for the BOMDD conditions and with all the improvements, the system is tested for highest possible fire demands at a location with insufficient T-main capacity. Therefore, an industrial fire demand is applied to the PSIP area. The following are the conditions for this scenario:

- The BOMDD model is used for the hydraulic analysis of this scenario. The reservoir improvements to the BOMDD are applied for this scenario.
- ADD for the Year is 26.0 mgd. Thus, the MDD for the existing condition is 2.0 times the ADD, which is equivalent to 52.0 mgd.
- The pattern obtained from the 24-Hour Demand Pattern is used and is extended to 72-hours for this hydraulic modeling scenario, demand patterns are described in detail in Chapter 2 of this report.

Figure 6.3 Buildout Maximum Day Demand- Flow from HSPS and ILBPS



- BOMDD Operations Pattern is used for this scenario. This pattern does not allow for double and triple pumping within the distribution system.
- A total of 12 storage reservoirs are operating for this scenario; six- new storage reservoirs; four- existing storage reservoirs, one-reservoir replacement with higher volume reservoir; and one reservoir addition at one of the existing reservoir sites.
- The storage reservoir operations are based on a volumetric turnover of about 30 percent in each of the reservoirs.
- A Fire Demand of 8,000 gpm for five hours is applied near the PSIP area. During the fire demands, the reservoir near the proximity of the fire is pumping and all other reservoirs are filling indicating that the system is stressed with high demands in various parts of the distribution system.

The following improvements are applied to the distribution system:

- A ILBPS between the North and Southport areas in order to create a higher pressure zone south of the barge canal.
- 5,850 fee of 16-inch parallel T-main towards PSIP reservoir.
- 5,500 feet of 24-inch parallel T-main either on Park Street or on Maryland Avenue. (See Section 6.6.4 for al the additional description of this improvement)

The results for this scenario are presented in Table 6.2; Case 5 indicates the results obtained for this scenario. The flow from the HSPS, the pressures at the nodes near reservoirs, and the levels in the reservoirs are indicated on the figures in Appendix E (all Figures indicated as BOMDDBP24NIF in the title), Section 6.6.1 describes the flow pattern indicated on flows from HSPS graph.

- The T-mains to the PSIP area are not sufficient to fulfill the demands and the fire demands in this area. The T-main improvements are required in order to improve the transmission capacity to the fire nodes in the area.
- Pipe velocities near the fire demand nodes are higher than 10 feet per second, which is not acceptable for better performance of the distribution system since this velocity violates the velocity criteria. Hence, these pipes need to be paralleled for better transmission to the fire demand nodes in the PSIP area.
- Another run is performed by extending the new 16-inch parallel pipeline from PSIP reservoir to the Seaport Boulevard in the PSIP. This improvement resulted in better transmission capacity and improved pressures in the PSIP area during industrial fire demand. Although the pressures in this area are less than 40 psi during these fire demands, they are in the acceptable range during the fire demands.

Conclusion from this scenario is that the new 16-inch parallel pipeline to the PSIP area should be extended 350 feet in order to improve the pressures in the PSIP area during an industrial fire. The new 16-inch parallel pipeline should be 6,200 feet instead of 5,850 feet as described for earlier scenarios.

6.7.4 Analysis of T-main Improvements in the Distribution System

New T-mains are required in the North and Southport areas of the distribution system for better transmission of water. These pipelines are evaluated in detail for cost effectiveness and constructability.

6.7.4.1 New Parallel T-main in the North Area

There is a deficiency in the North area transmission capacity, which results in a reduction in pressures at the southern part of the North area i.e., near the Barge Canal. In order to eliminate this deficiency, various alternatives are evaluated. The three alternatives evaluated for transmission capacity improvements in the North area are indicated on Figure 6.4. The following are the alternative options for transmission capacity improvements in the North area:

- **Option 1**: A 36-inch parallel T-main from Sacramento Avenue to Stone Boulevard near the Barge canal for 13,800 feet. This line runs through various streets from north to south.

- **Option 2**: A-24-inch parallel T-main from Sacramento Avenue to Stone Boulevard near the Barge canal for 20,100 feet. The line runs along the South River Road in the North area of the City.

- **Option 3**: A 24-inch parallel T-main from Webster Street to Stone Boulevard near Barge canal for 5,500 feet. This line runs along Park Boulevard or Maryland Avenue or Virginia Avenue (streets parallel to Park Boulevard).

An evaluation is performed for the above options and is presented in Table 6.3.

Based on the table, Option 3 is cost effective and the most desirable option. This option is based on routing a 24-inch main through Park Boulevard or Maryland Avenue. The City considers constructing the T-main along Park Boulevard to be non-feasible due to recent pavement improvements. Thus, this new T-main can be aligned on Maryland Avenue or through any other parallel street to Park Boulevard. In such case, the length of the T-main will increase slightly. All the capital improvement cost estimates and the CIP will be based on using Option 3 T-main improvements in the North area.

Table 6.3 North Area T-main Evaluation Water Master Plan Update City of West Sacramento			
Item Description	**Option 1**	**Option 2**	**Option 3**
T-Main Size	36-inch	24-inch	24-inch
T-Main Length	13,800 feet	20,100 feet	5,500 feet
Constructability	Very Complex	Complex	Complex
Probable Costs	$8,000,000	$6,500,000	$1,800,000
Hydraulic Improvement	High	Low	Moderate
Desirable Alternative	Moderately Desirable	Least Desirable	Highly Desirable
Ranking	**Second**	**Third**	**First**

6.7.5 Conclusion from BOMDD Scenarios

The hydraulic scenario for the BOMDD indicated significant deficiencies within the distribution system. The following system improvements are required for better performance of the distribution system. These improvements supersede any improvements described for the EMDD conditions of this chapter.

- A parallel 16-inch pipeline for 6,200 feet towards the PSIP reservoir in order to improve the transmission capacity and to improve the pressures in the PSIP area.
- An ILBPS at the barge canal in order to create higher-pressure zone south of the barge canal. The following advantages are identified with the ILBS:
    - The ILBPS alternative is the most cost-effective and constructible option in order to boost water from North area to Southport area.
    - The ILBPS option will eliminate the need for T-main improvements that run for miles and costs much higher than the ILBPS. This option will eliminate the T-main construction on busy Jefferson Boulevard.
    - In addition, the ILBPS option will eliminate the new pipeline crossing across the barge canal. Since construction across the barge cannel will be difficult and also the future pipe maintenance will be highly complicated.
    - The ILBPS option will create a separate pressure zone in Southport area, providing greater flexibility to the operations staff i.e., the operations staff can turn-on and turn-off the pumps based on the demand and pressure requirements in the Southport area.

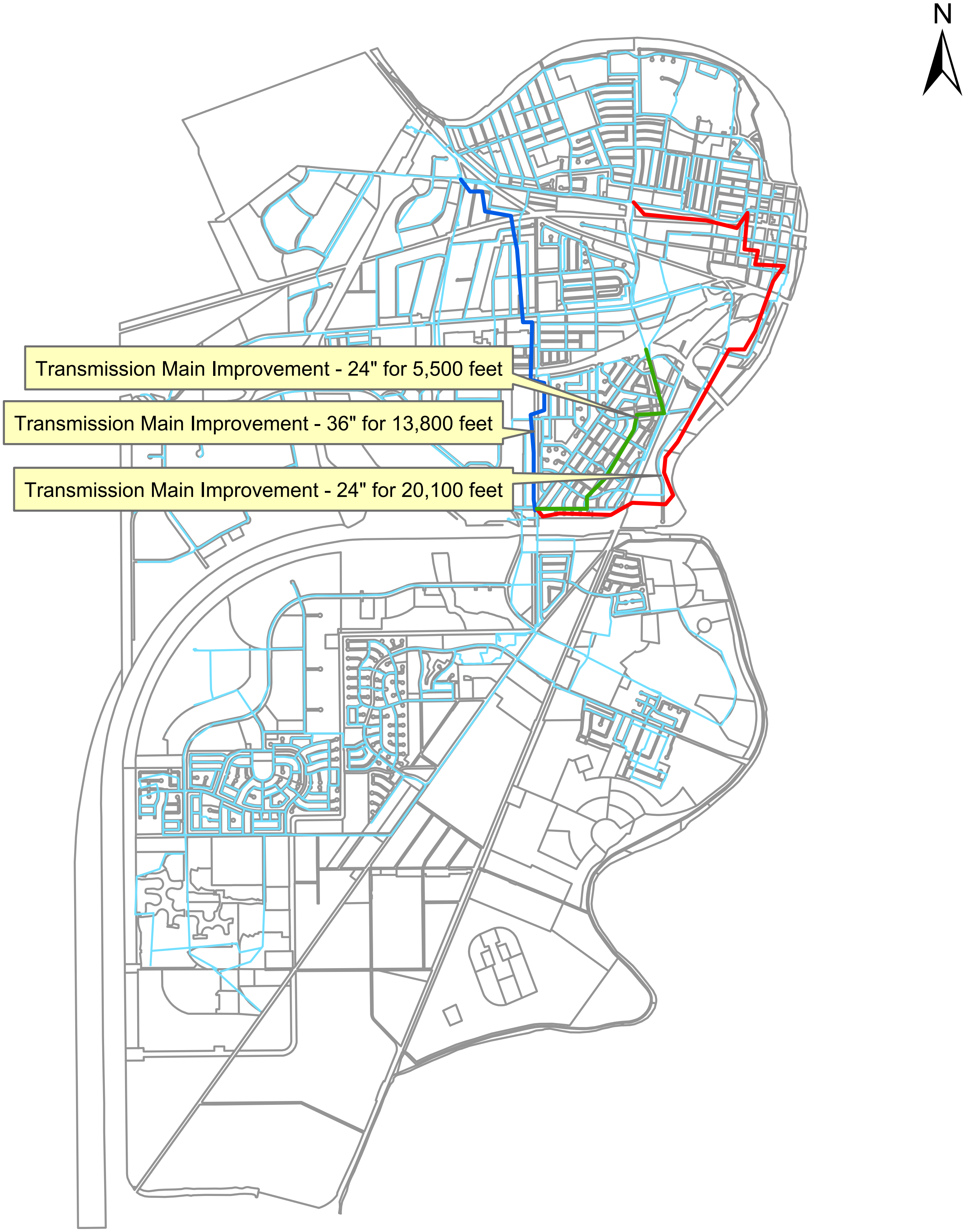


Figure 6.4 North Area Pipeline Improvement Alternatives
Water Master Plan Update
City of West Sacramento

    - The ILBPS option has minimal interference with the public access areas in regards to traffic and dewatering issues during construction.

    - The ILBPS will become an essential facility for the distribution system operation in order to accommodate for increase in demands.

    - No site acquisition is required since the ILBPS can be constructed in the space available near the central reservoir.

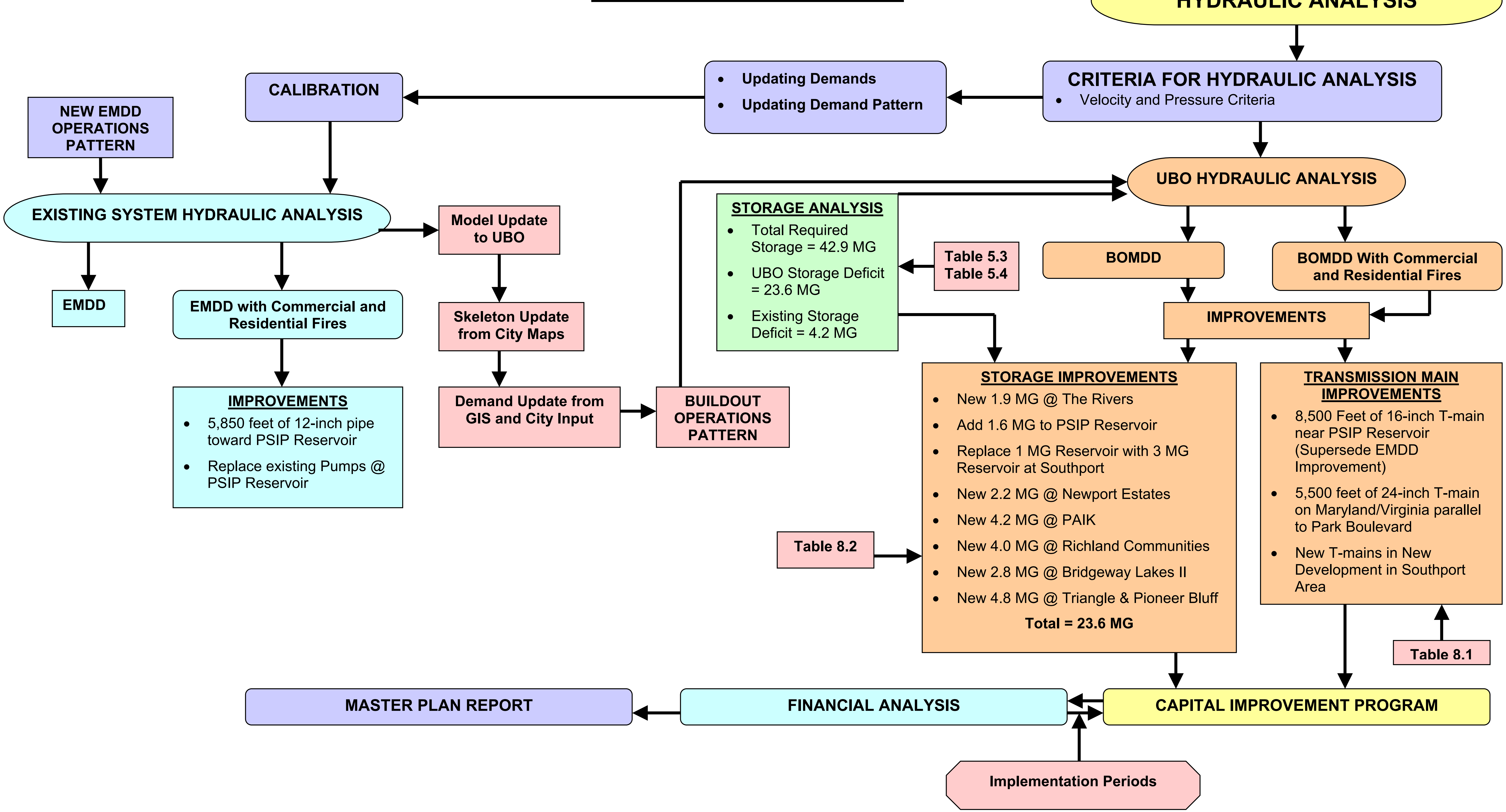
- New storage reservoirs as described in the above sections.

- Parallel 24-inch T-main on Maryland Avenue or Virginia Avenue for about 5,500 feet.

- Other improvements related to the new developments.

The above improvements will make the system operate efficiently during various demand conditions. The actual pipes and costs for the new improvements are presented in future chapters of this report.

CHAPTER 6 HYDRAULIC ANALYSIS SUMMARY FLOW CHART
WATER MASTER PLAN UPDATE
CITY OF WEST SACRAMENTO



METER IMPLEMENTATION PLAN

7.1 BACKGROUND

The City currently meters all non-residential customers. Meters are installed on these commercial and industrial services and these customers are charged according to the size of the water service and the amount of water used within the billing period. Apartment and mobile home complexes are billed similarly, and are qualified (along with the commercial and industrial customers) as General Service, metered accounts. Altogether, and as of November 30, 2004, there are 1,184 accounts that are billed under this General Service, metered customer class.

A meter implementation plan is recommended to provide similar infrastructure, meter reading, and accounting capabilities for all residential customers of the City. These residential customers are currently billed on a flat rate established for: single family with a 3/4-inch service size; single family with a 1-inch service size; single family with a second unit; and duplexes. The residential customers will ultimately be charged based on meter size and volume of actual water used, which reflects capacity and commodity rate components, respectively.

Many of the City's residential customers already have meters within meter boxes on their water service line, as these facilities were mandated for new construction starting in 1992. However, these meters are not read since all residential customers are charged based on the flat rate structure, not according to water use. Radio read meters were installed starting in 1997. Transmitters must still be installed in these meter boxes to actuate the radio read meters, as transmitters and their limited-life batteries were purposely not installed with the meter. About 34 percent of the City's 10,277 residential customer buildings were constructed after 1997, and as such, only installation of the transmitters with batteries are required for these customers. However, the 66 percent of residential customers (those in housing built prior to 1997) require a range of improvements from installing a meter and transmitter in an existing meter box to installing a new water service line with meter box, meter, and transmitter.

This chapter provides information and recommendations on the infrastructure, administrative, and accounting improvements required to fully meter all customers in the City. The recommended metered rate structure is presented in the Financial Analysis chapter, Chapter 9.

7.2 CENTRAL VALLEY PROJECT CONTRACTOR REQUIREMENTS

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. This bill was enacted in order to prevent the loss of water supplies by CVP municipal contractors, which fail to comply with federal water metering requirements. AB 514 applies to all municipal water suppliers that receive CVP water, including the City, as well as other cities such as Roseville and Fresno. Water meter implementation recently started in the City of Sacramento based on requirements of recent legislation other than AB 514, as Sacramento does not receive CVP water.

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 customers for water based on actual volume used commencing no later than March 1, 2013.

The cost of providing services related to the purchase, installation, and operation and maintenance of water meters may be recovered from rates, fees, and charges. Additional information on the affect of AB 514 on the City water policy is presented in the Kronick, Moskovitz, Tiedemann & Girard, December 5, 2003, memorandum: Update on AB 514 Requiring Central Valley Project Municipal Contractors to Install and Operate Water Meters. A copy of this memorandum is presented in Appendix E.

7.3 EXISTING METERING INFRASTRUCTURE

The initial step in estimating the extent of meter implementation for the City is to define the existing metering infrastructure. Based on information provided from the City's accounting department, residential flat rate customers' information is provided in Table 7.1. This information is based on the number of accounts as of November 30, 2004.

The grand total of flat rate services, including the five services, which are qualified as General Service, flat rate accounts, is 10,277 (10,272 + 5 general services) services. Out of this total, 66 accounts (62 Residential and 4 General Service) are billed on a citywide basis, as a convenience for customers who own multiple residential and/or commercial properties.

The City also provides water service to all commercial and industrial customers, as well as apartment and mobile home complexes. All of these services are fully metered and are charged based on the volume of water used during a billing period. These customers are qualified as General Service, metered customers, totaling 1,184 accounts. The total number of water service accounts (as of November 30, 2004) are 11,570, which includes 109

Table 7.1	Residential Flat Rate Accounts Water Master Plan Update City of West Sacramento				
Type/Size of Meter	**Broderick and Bryte**	**Southport**	**Central**	**Billed as Citywide**	**Total**
3/4-inch	2,727	3,094	2,504	41	8,366
1-inch	225	1,220	51	6	1,502
2nd unit	147	93	147	15	402
Duplex	1	0	1	0	2
Total	3,100	4,407	2,703	62	10,272

Notes:

(1) There are an additional 5 General Service Flat Rate accounts, which require meters.

(2) 485 new homes, which are pending sale in the Southport Area, have been included.

(3) Billed as City wide accounts are for property owners with multiple accounts.

irrigation meters at public parks and along median strips. Thus, residential flat rate accounts are 89 percent of the total number of accounts. However, based upon higher water usage by the General Service Metered customers, water used by residential flat rate accounts ranges between 60 to 70 percent of the total water produced by the City.

Meters have been installed for all residential water services starting in 1992. These services include a meter box and radio read meter, but excludes the MXU transmitter. The City purposely did not install these transmitters, as the battery life is limited in these transmitters to about ten years. Thus, these transmitters, if installed, would need to be replaced once the City started reading meters on residential accounts. Instead, the City and meter suppliers stored the transmitters for later installation. Installation and testing of the transmitters can be done relatively quickly, within a 30-minute period, which will activate the radio read meters. The number of new residential permits, by fiscal year (July 1st through June 30th), is presented in Table 7.2. These 3,823 residences are almost all located in the Southport area, which has experienced a huge increase in new residences, starting in Year 2000. Assuming that all these residences are located in Southport, the number of residential units constructed prior to 1992 in Southport is 584; therefore, there are a total of 4,407 (3823 + 584) residential accounts in Southport (Table 7.1).

Radio read meters were installed starting in 1997. Thus, a total of 3,524 residential services constructed since 1997 will only require installation of the MXU transmitters. Those remaining residential services in Southport, 299 (during FY 1996-97, there are a total of six meters of which three are assumed to be pre-1997 permits) services between 1992 and 1997, and 584 services prior to 1992, were installed with older-type meters, not the radio-read meters which are in accordance with the City's current standard. These 883 meters will need to be replaced with radio-read meters with transmitters. There are 104 backyard services in Southport that will be replaced with the Main Replacement Program.

Table 7.2	Residential Permits Since 1992 Water Master Plan Update City of West Sacramento		
Fiscal Year	**Subtotal Period**	**Number of Permits**	**Subtotal**
1992-93		100	
1993-94		156	
1994-95		22	
1995-96		18	
1996-97	1992-1997	6	299
1997-98		7	
1998-99		35	
1999-2000		123	
2000-01		945	
2001-02		748	
2002-03		653	
2003-04		713	
2004-05	1997-2005	300*	3,524
TOTAL		**3,823**	**3,823**
* Estimate for July 1 through November 30, 2004.			

The City has kept account of meter retrofit installations in the northern part of the City, which were installed as part of pipeline replacement projects over the previous 10 years. Meter boxes were installed on existing residential water service lines, with jumpers (not meters) installed in the meter box. These jumpers have valves so they can be readily removed to make space for a water meter. The City was planning ahead with these projects, as construction for replacing water mains was combined with the installation of new services lines and meter boxes at parcels along the water main alignment. Based on discussions with City staff, improvements were also made to 438 individual residential services over the past few years. Shut off valves were necessary at these residences and the City installed these and jumpers within the meter boxes. These projects, with the number of water service lines retrofitted with a meter box, are listed in Table 7.3. A total of 1,564 services will require installation of radio read meter with the MXU transmitter.

Table 7.3	Meter Box Installations in the North Area Water Master Plan Update City of West Sacramento	
Year	**Main Replacement Project Location**	**Number of Meter Boxes Installed**
1994	Alabama Avenue, 15th & 19th Streets	163
1995	Riverbank Road, Water Street	36
1997	6th Street	213
1998	Vermont Avenue	199
1999	Elkhorn Village	258
2000	Westacre Subdivision	236
2001	Jefferson Boulevard	21
-	Individual Water Service Line Improvements	438
	TOTAL	**1,564**
Note: Only water meters with transmitters will be installed at these services.		

Based on the information provided in the tables above, the following improvements and number of residential services required are:

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

Based on information provided from the City on their Main Replacement Program (which is described in Chapter 8), 1,763 services will be replaced with main replacement construction projects by year 2010.The cost for these 1,763 meters and transmitter is included in the meter implementation program (Table 7.4).

7.4 METER INFRASTRUCTURE AND IMPLEMENTATION COSTS

Based on the breakdown of improvements (described above) to fully meter all residential services, the construction and administrative costs of fully metering the City were estimated. Unit construction costs were based on estimates obtained from suppliers and estimates developed for metering implementation plans for other water agencies. Implementation costs were estimated at 30 percent of the construction cost estimate and includes administrative costs, engineering, inspection, and a Public Outreach Plan, which is described in the next section.

The breakdown for the 10,277 residential services is presented in Table 7.4. The overall cost for the meter implementation plan is $4,332,000. Construction and installation will be contracted out to qualified contractors. As an alternative, meter infrastructure could be installed and constructed by City crews. Two crews each with three persons would be required to meet the AB 514 target deadline. It is recommended that the City assign a single City staff member to oversee all aspects of the meter implementation plan including construction contract administration. In addition to construction costs, there are operational costs for meter implementation. The operational cost for FY 2005-06 is estimated at $100,000, including an additional meter reader and associated vehicles/equipment.

The City will have to develop clear bid and contract documents, inspect work performed by the contractor, and provide an interface between customers and contractor work crews. The City will have to tap staff expertise to provide the management and oversight of the metering program. Some tasks, such as construction inspection, can be contracted out.

It is recommended that the City coordinate with the City of Sacramento for information on both public outreach efforts and construction contracting. As both cities are implementing similar programs (albeit the City of Sacramento is much larger and their program includes replacement of many back-yard mains with new street mains), there is an opportunity to optimize costs of the respective programs. Also, pilot programs with qualified contractors for installing metering infrastructure is recommended. A small number of services, perhaps 100, could be metered and the performance of these contractors determined for pre-qualifying contractors for larger contracts.

7.5 PUBLIC OUTREACH PLAN

The benefits, costs, requirements, and funding of a meter implementation plan must be evident and transparent to those who will benefit and pay for the program: the City customers. As has happened in other communities, water metering can be misunderstood and may potentially become a contentious topic within the community. Properly introducing the program to your customers and decision-makers will pay back in the long run. Therefore investment in a public outreach plan is highly recommended.

Table 7.4 Meter Infrastructure and Implementation Costs
Water Master Plan Update
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Meter Installation Type	Number of Installations	Unit Construction Costs	Total Cost ($)	Implementation 0.30	Grand Total ($)
Install MXU Transmitter Only (Note 2)	3,524	$50	$176,200	$52,860	$229,060
Install Meter with MXU Transmitter	1,564	$240	$375,360	$112,608	$487,968
Replace Pre-1997 Meters in Southport (Note 3)	883	$240	$211,920	$63,576	$275,496
Install Box and Meter with MXU Transmitter	2,543	$820	$2,085,260	$625,578	$2,710,838
Install Meter and Transmitter after Mains are Replaced (Notes 4, 5, & 6)	1,763	$240	$423,120	$126,936	$550,056
Totals	**10,277**		$3,271,900	$981,600	**$4,253,000**

Assumptions:
1) Number of flat rate services as of Nov 30, 2004: 10,277
2) There are no existing meters with MXU transmitters already installed (ready for reading). New (2005) housing developments to install MXUs.
3) MXU transmitters have been stored (by City and suppliers since 1997) and need only to be installed on the existing meter and tested.
4) Southport area meters installed prior to 1997 are unlikely to be radio read units. Existing meters will be replaced with radio-reads.
5) 224 backyard services will be replaced as part of the Main Replacement Program. 104 backyard services are in Southport.
6) 1,763 service lines and boxes will be installed with the Main Replacement Program, only the costs for Meter and Transmitter are included.
7) Implementation Costs include Administrative, Public Outreach, and Engineering Costs, estimated at 30 percent of construction costs.

The public outreach plan would first entail defining the community's understanding of meter implementation. Both quantitative and qualitative research will allow the City to establish baseline knowledge about their customers' perceptions of water meters. A telephone survey and focus group research are recommended to determine the public's perception of water supply, water use, metering, and conservation. Based on the research findings a public outreach strategy will be developed.

A major objective of the outreach strategy is to be proactive in all communications related to water metering. There are many opportunities to inform various groups in the City about meter implementation, including presentations and public workshops with:

- Neighborhood associations
- Business groups
- The Chamber of Commerce

These meetings, conducted early in the program, combined with articles in local papers, such as the News Ledger and West Sacramento Press, and on bill stuffers will inform a broad range of the public about the metering program. Program information can also be dispersed during the City's Water Awareness Program (held in May). Interest in and support for water metering will grow as outreach is conducted, and many commonly heard questions can be addressed in a straight-forward and expeditious manner.

The outreach strategy will most likely include establishment of a website and telephone hotline. These communication tools will provide your customers with the means to understand the program and ask pertinent questions. If the need be, an ad hoc group, including customers and community leaders, can be established to oversee the metering program. The more the public is involved in the program, the more likely for success with minimal public contention.

In addition to improving communications, the outreach strategy will outline efforts required during construction to inform customers of specific construction schedules and necessary water shutdowns. These recommendations will be incorporated into project contract requirements to ease construction impacts.

Overall, the public outreach plan will be structured to address the City's specific needs and contribute to a smooth meter implementation.

7.6 WATER CONSERVATION AND METERING MAINTENANCE

The City customers will conserve water after meters are installed and the metered rate structure billing begins. Although difficult to precisely estimate, the (Sacramento Area) Water Forum Process estimated that there could be a reduction of 25 percent of outdoor water use and 10 percent of indoor water use due solely to metering and commodity pricing. Other Best Management Practices (BMPs), including water audits, low flush toilets, and water efficient landscaping and irrigation systems can bring further reductions in water usage of up to 20 percent. The City should consider metering as only one aspect of an overall water conservation program, which can significantly reduce water treatment and pumping costs well into the future.

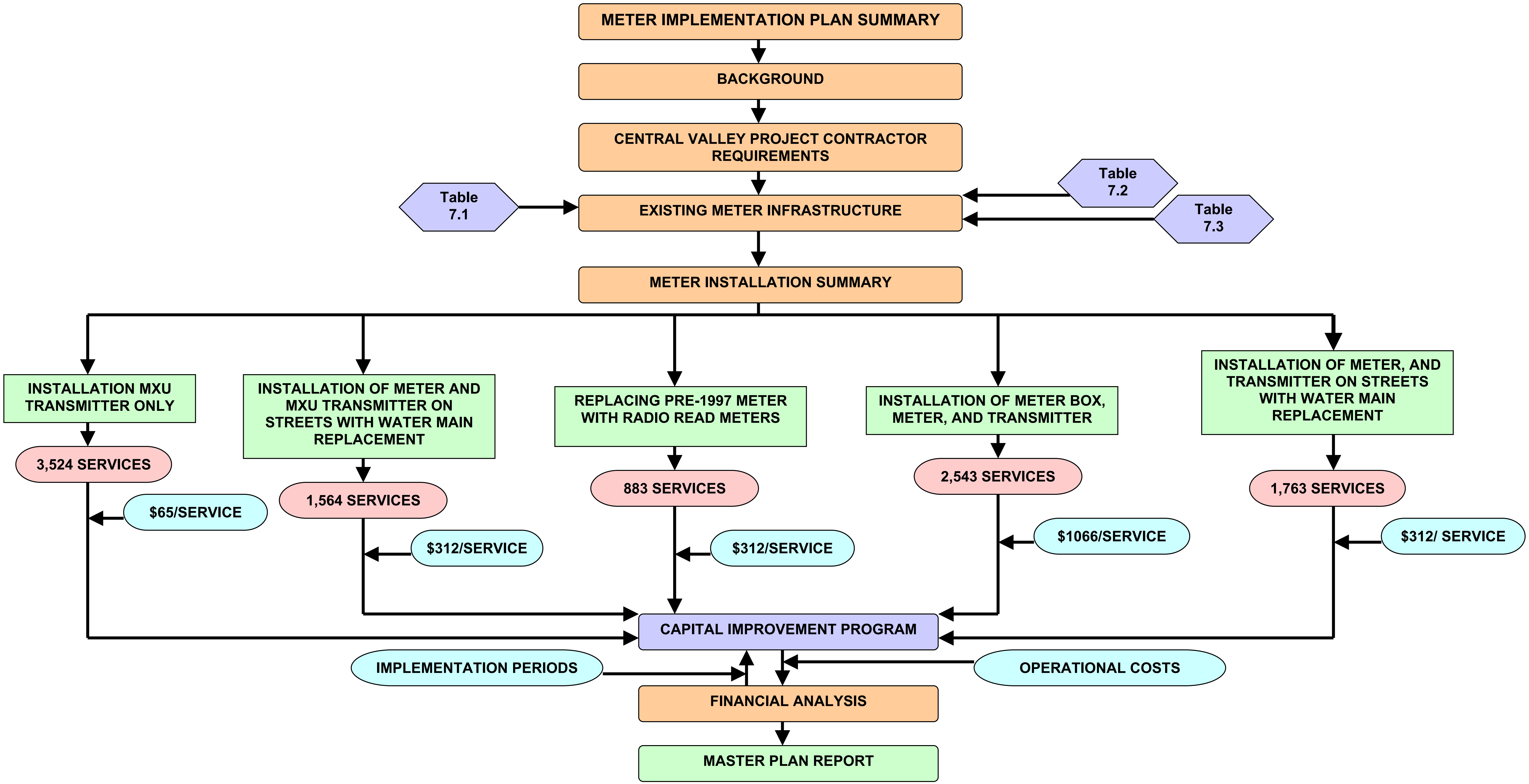
Currently, two meter readers traverse the City over two days to record water use on almost 1,200 commercial and industrial meters. The vast majority of these meters are now radio read as City crews have retrofitted many services over the previous ten years. A hand-held unit is used, which has a 100 to 500 foot reading range.

One meter reader will be required to read meters, on either a monthly or bi-monthly basis, and maintain meters, including replacing transmitter batteries. At least two City staff members should be trained to be able to read and maintain the meters. Vehicle based interrogators have a reading range of approximately 1,000 feet and the entire City can be read during a single day of traversing the City. A small antenna, interrogator unit, and a laptop PC are required. Battery life is estimated at 10 years, and as such an estimated 1,000 units will need replacement every year, which will be more time consuming than the actual meter reading. A vehicle-based system is recommended when residential meters are read.

Discussions with City staff have concluded that calibration and testing of meters 1 inch and less is not a viable economic option instead it is economical to replace these meters with new ones. The useful life of these meters is estimated to be 15-years. All the meters that are larger than one inch should undergo a periodic maintenance that includes testing, calibration, repair work etc. It is more cost effective to perform the regular maintenance on these meters rather than replacing them.

Based on the available operation and maintenance data, the City should estimate the future costs of operation and maintenance for metering implementation. As described in Section 7.4, a budgetary estimate of $100,000 is allocated for FY 2005-06. In addition, a budgetary estimate of $30,000 for calibrating, testing, and repair of the existing meters is allocated for FY 2005-06. These costs are only budgetary allocations for Financial Analysis for FY 2005-06; the actual costs may vary. These costs will increase with the increase in actual number of meters that become operational within the City.

CHAPTER 7 METER IMPLEMENTATION PLAN SUMMARY FLOW CHART
WATER MASTER PLAN UPDATE
CITY OF WEST SACRAMENTO



CAPITAL IMPROVEMENT PROGRAM (CIP)

This chapter presents all the projects recommended in the Water Master Plan Update. The costs and schedules of projects are developed based on the hydraulic model analysis using criteria established at the beginning of this project and through input from City staff. Many projects are related to growth, particularly in the Southport area. The deficiencies within the system and facilities required to accommodate growth were identified and are described in detail in previous chapters. In addition, there are:

- Improvements recommended by operations staff
- Improvements to replace old, leaky, undersized, and backyard water mains and services on streets under Measure K pavement replacement program
- Metering implementation within the City

The current and future financial situations of the City will be considered for implementing the projects identified during the hydraulic analysis. The implementation period of each project will be determined based on the need and the economics of the City's finances. The financial analysis chapter will define the budgetary constraints, if any, for implementing each system improvement project. The basic purpose of the CIP and financial analysis of this report is to allow the scheduled implementation of the recommended projects based on the hydraulic model results and City staff's input, without excessively increasing the water rates. Therefore, many possible alternatives will be considered so that the City could balance the cost of system improvements versus risk of system deficiency to realistically finance these projects.

The CIP for the City is based on the following:

- City's Planning Department projections of various developments within the City boundaries
- City staff input on various deficiencies
- Hydraulic analysis of the existing and future distribution systems
- Site visits to the reservoir and pump station facilities
- Site visit to the City's water treatment facility
- Review of the City's Water Main Replacement Program
- Metering Implementation Plan
- December 1994-Water Master Plan, Final Report

- March 2004-Treated Water Storage Analysis, Final Technical Memorandum
- September 2004-Water Master Plan Update -Basis of Planning, Final Report

After the initial evaluation of the City's distribution system facilities, Carollo established various categories of improvements within the City's distribution system. These categories are:

- T-main Improvements
- Reservoirs and Pump Station Improvements
- Water Main Replacement Projects
- Metering Implementation Plan
- Operational Improvements

All the above improvements are necessary for efficient performance of the distribution system. Most of the improvements are recommended in order to accommodate future growth, based on land use defined within the City's current General Plan (Year 2000). The time-period of each project is determined based on the necessity of each project relative to current deficiencies and the City's future growth pattern. As a part of the CIP, a schedule of the project implementation and associated costs is presented in the following sections and chapters. Once a project is categorized, it is necessary to define the time-period of each project. The planning period for this Master Plan Update will be from Fiscal Year (FY) 2005-06 through FY 2019-20, and is divided into three time frames. These time frames are defined as follows:

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

(Note: FY starts from July 1 of the year and ends on June 30 of the following year.)

The projects are classified into various time-periods based on the significance and the necessity of the project with increasing water consumption demands. Year 2020 is acknowledged by City planning staff to be the horizon of the current General Plan (Year 2000).

The improvements and the time-period of the improvements are described in the following sections:

8.1 TRANSMISSION MAINS (T-MAINS)

These are the improvements to the system to transmit water from treatment source to customers in the distribution system. The T-mains are the larger pipelines in the system, generally 12-inches and larger. The larger pipelines are the backbone to the distribution system and the smaller distribution pipelines are used to transmit water from the T-mains to the customers. The following T-mains are required during various periods within the distribution system.

8.1.1 FY 2005-06 Through FY 2009-10 Improvements

FY 2005-06 through FY 2009-10 improvements are the improvements that are required to the distribution system for the existing conditions as well as new development. These improvements are required to address existing deficiencies and serve new growth areas and shall be constructed and operational within the next five years. The pipelines that need to be installed during this period are indicated on Figure 8.1, some of the pipelines are to improve deficiency in the existing system and some to distribute water to future developments particularly in the Southport area. The following improvements are required during FY 2005-06 through FY 2009-10:

8.1.1.1 Parallel Pipeline toward PSIP Reservoir (Project P01 and P02):

This pipeline is indicated on Figure 8.1. A 16-inch parallel pipeline is required on West Capital Drive from Northrop Drive to PSIP Reservoir for a length of 6,000 feet. This pipeline improvement is required to increase the transmission capacity to the PSIP area, since the existing transmission capacity to the area is not sufficient for the required turnover in volume at the PSIP reservoir. In addition, this T-main bridges reservoir capacity between the PSIP area and the rest of the system. The following are the details of the project:

- The total length of the 16-inch pipeline is 6,000 feet.
- Implementation period of the project is FY 2008-09 for design and FY 2009-10 for construction.
- Funding source for this project is the City (Existing Rate Payers), since this project addresses a deficiency in the existing system. Without the industrial fire demand, a 12-inch pipeline is sufficient in this stretch; the additional capacity is required to meet the industrial fire demand in this area.
- The estimated cost for the project in Year 2005 Dollars is $1,075,200.

Justification: PSIP is an industrial area that formally was in its own zone. Now that it is connected to the rest of the distribution system, the T-mains leading to the PSIP area are not sufficient to meet the fire demands in the area. During the hydraulic analysis, if an industrial fire is applied to the PSIP area, the existing mains are not sufficient to meet

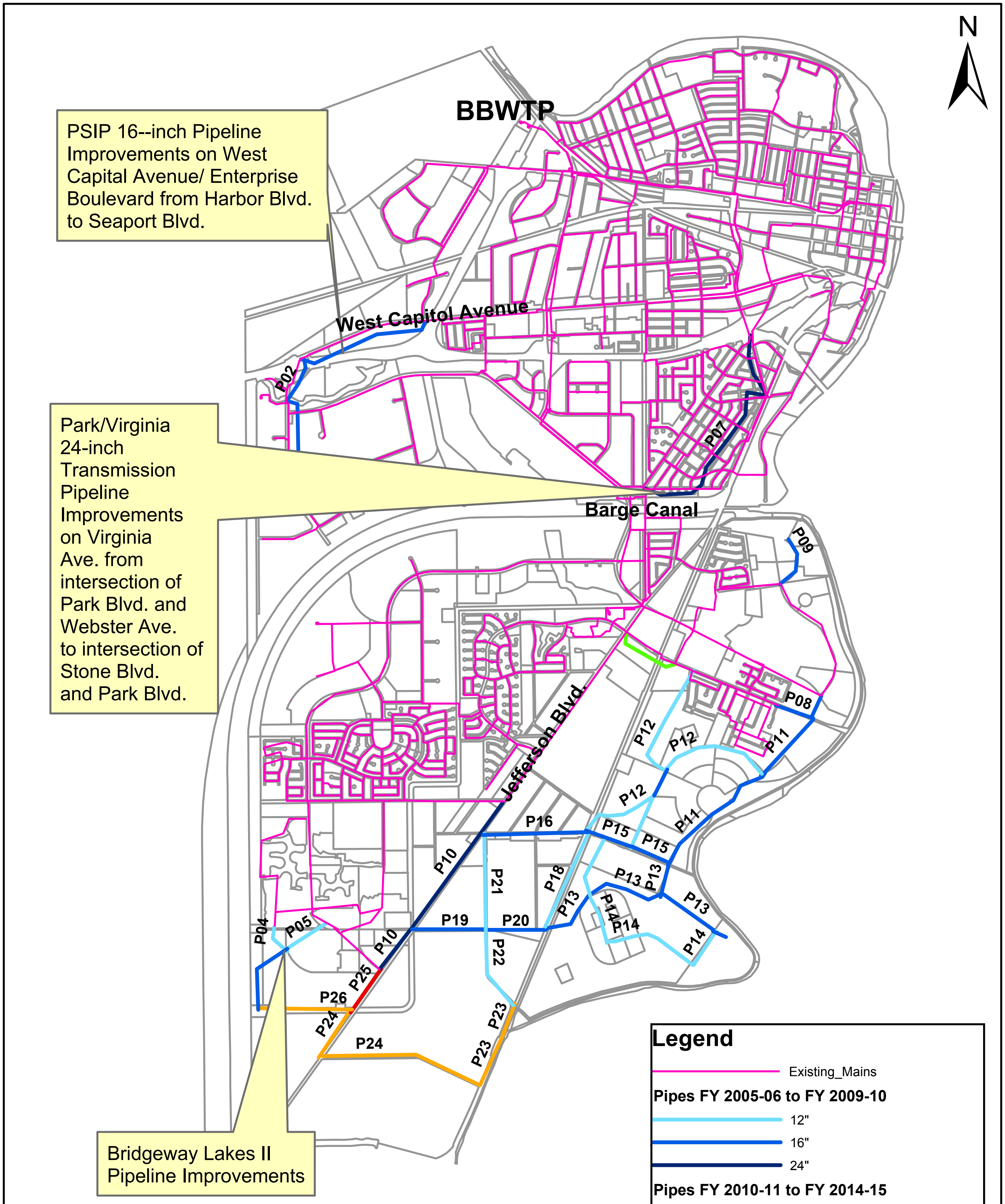


Figure 8.1 Pipeline Improvements
Water Master Plan Update
City of West Sacramento

the fire demands. Hence, this project is necessary to meet the fire demand in the PSIP area.

A summary of the cost details is presented in Table 8.1. Project Numbers P01 and P02 indicate the above-described pipeline.

8.1.1.2 Parallel Pipeline from PSIP Reservoir to Seaport Boulevard (Project P03):

This is a new 16-inch pipeline required to bridge the PSIP reservoir to the industrial area. This pipeline is necessary to meet the industrial fire demands in the PSIP area. The following are the details of the project:

- The total length of the 16-inch pipeline is 2,500 feet.
- Implementation period of the project is FY 2005-06 through FY 2009-10.
- Funding source for this project is the City (Existing Rate Payers), since it is a deficiency in the existing system. The pipeline is required to meet the industrial fire demand in this area.
- The estimated cost for the project in Year 2005 Dollars is $448,000.

Justification: The new 16-inch parallel pipeline assists the existing distribution near the PSIP by providing the necessary water supply to the industrial area of the PSIP in the event of an industrial fire. Without this T-main, it is difficult to supply water to the industrial area during a fire and still maintain minimum required pressure of 20 psi during industrial fire demands of 8,000 gpm for a duration of 5 hours.

A summary of the cost details is presented in Table 8.1. Project Number P03 in the table indicates the above-described pipeline.

8.1.1.3 New Pipeline to the New Reservoir in the Bridgeway Lakes II Area (Project P04, P05, and P06):

This pipeline is indicated on Figure 8.1. These pipelines are the new 12-inch and 16-inch pipelines to the new reservoir in the Bridgeway Lakes II area. The new reservoir is required to fulfill part of the storage deficiency in the existing Southport area distribution system as well as provide storage for the new Bridgeway Lakes II development. The following are the details of the project:

- The total length of 12-inch pipeline is 3,000 feet.
- The total length of the 16-inch pipeline is 2,300 feet.
- Implementation period of the project is FY 2005-06.

Table 8.1 Transmission Main Improvements
Water Master Plan Update
City of West Sacramento

Project Number	Type of Improvement	Street Intersections From	To	Pipe Dia. (inches)	Length (lf)	Unit Cost ($/lf)	Item Costs ($)	Contingencies: Costs of Construction Contingency @ 20% ($)	Costs of Engineering, Legal, and Administrative @ 20%	Total Costs for the Project ($)	Percentage for Customers: Existing Customers	Future Customers	Costs for Customers: Existing Customers ($)	Future Customers ($)	Cost Distribution by Year from FY 2005-06 through FY 2009-10: 2005-06 ($)	2006-07 ($)	2007-08 ($)	2008-09 ($)	2009-10 ($)
PHASE I - YEAR 2005-06 to 2009-10																			
P01	Parallel Pipeline on West Capital Ave.	Northport Drive	Enterprise Blvd.	16	4500	$128	$576,000	$115,200	$115,200	$806,400	100%	0%	$806,400	$0				$60,480	$745,920
P02	Parallel Pipeline on Enterprise Blvd.	West Capital Ave.	PSIP Resv	16	1500	$128	$192,000	$38,400	$38,400	$268,800	100%	0%	$268,800	$0				$20,160	$248,640
P03	Parallel Pipeline on Enterprise Blvd.	PSIP Resv	Seaport Blvd.	16	2500	$128	$320,000	$64,000	$64,000	$448,000	100%	0%	$448,000	$0				$33,600	$414,400
P04	New Pipeline for Bridgeway Lakes II Resv	North (direction)	South (direction)	12	1300	$93	$120,900	$24,180	$24,180	$169,300	0%	100%	$0	$169,300	$169,300				
P05	New Pipeline for Bridgeway Lakes II Resv	Northeast (dir.)	Southwest (dir.)	12	1700	$93	$158,100	$31,620	$31,620	$221,300	0%	100%	$0	$221,300	$221,300				
P06	New Pipeline for Bridgeway Lakes II Resv	From X^{n} of 12"	Resv	16	2300	$128	$294,400	$58,880	$58,880	$412,200	0%	100%	$0	$412,200	$412,200				
P07	Parallel Pipeline on Park/Maryland	Jefferson Blvd.	Stone Blvd.	24	5500	$183	$1,006,500	$201,300	$201,300	$1,409,100	0%	100%	$0	$1,409,100				$105,683	$1,303,418
P08	New Pipeline on Linden Road	South River Road	Bastone Ct	16	1300	$128	$166,400	$33,280	$33,280	$233,000	0%	100%	$0	$233,000		$17,475	$215,525		
P09	New Pipeline to New Resv in Newport Et.	Stonegate Dr.	New Resv	16	1600	$128	$204,800	$40,960	$40,960	$286,700	0%	100%	$0	$286,700		$21,503	$265,198		
P10	New Pipeline on Jefferson Blvd.	Marshall Rd	Southport Pkwy	24	6950	$183	$1,271,850	$254,370	$254,370	$1,780,600	0%	100%	$0	$1,780,600			$133,545	$823,528	$823,528
P11	New 16-inch Pipelines within PAIK	PAIK Area	PAIK Area	16	7900	$128	$1,011,200	$202,240	$202,240	$1,415,700	0%	100%	$0	$1,415,700			$106,178	$654,761	$654,761
P12	New 12-inch Pipelines within PAIK	PAIK Area	PAIK Area	12	8700	$93	$809,100	$161,820	$161,820	$1,132,700	0%	100%	$0	$1,132,700			$84,953	$1,047,748	
P13	New 16-inch Pipelines within Richland	Richland Area	Richland Area	16	8800	$128	$1,126,400	$225,280	$225,280	$1,577,000	0%	100%	$0	$1,577,000			$118,275	$1,458,725	
P14	New 12-inch Pipelines within Richland	Richland Area	Richland Area	12	8300	$93	$771,900	$154,380	$154,380	$1,080,700	0%	100%	$0	$1,080,700			$81,053	$999,648	
P15	New Pipeline on Davis Road	South River Road	Antioch Avenue	16	8800	$128	$1,126,400	$225,280	$225,280	$1,577,000	0%	100%	$0	$1,577,000				$118,275	$1,458,725
P16	New Pipeline on Davis Road	Antioch Avenue	Jefferson Blvd	16	3300	$128	$422,400	$84,480	$84,480	$591,400	0%	100%	$0	$591,400				$44,355	$547,045
P17	New Pipeline on Antioch Avenue	Davis Street	Bevan Road	12	3500	$93	$325,500	$65,100	$65,100	$455,700	0%	100%	$0	$455,700				$34,178	$421,523
P18	New Pipeline on Bevan Street	Jefferson Blvd.	Gregory Avenue	16	2450	$128	$313,600	$62,720	$62,720	$439,000	0%	100%	$0	$439,000				$32,925	$406,075
P19	New Pipeline on Bevan Street	Gregory Ave.	Antioch Avenue	16	1900	$128	$243,200	$48,640	$48,640	$340,500	0%	100%	$0	$340,500				$25,538	$314,963
P20	New Pipeline on Gregory Avenue	Davis Street	Bevan Road	12	3300	$93	$306,900	$61,380	$61,380	$429,700	0%	100%	$0	$429,700				$32,228	$397,473
P21	New Pipeline on Gregory Avenue	Bevan Road	South River Rd	12	2800	$93	$260,400	$52,080	$52,080	$364,600	0%	100%	$0	$364,600				$27,345	$337,255
	PHASE II SUBTOTAL				**88900**		**$11,027,950**	**$2,205,590**	**$2,205,590**	**$15,439,400**			**$1,523,200**	**$13,916,200**	**$802,800**	**$38,978**	**$1,004,725**	**$5,519,174**	**$8,073,724**
PHASE II - YEAR 2010-11 TO YEAR 2014-15																			
P22	New Pipeline Along South River Road	Gregory Avenue	Burrows Avenue	12	2800	$93	$260,400	$52,080	$52,080	$364,600	0%	100%	$0	$364,600					
P23	New Pipeline on Burrows Avenue	South River Road	Jefferson Blvd.	12	5400	$93	$502,200	$100,440	$100,440	$703,100	0%	100%	$0	$703,100					
P24	New Pipeline on Jefferson Blvd.	Southport Pkwy	Burrows Avenue	18	3400	$150	$510,000	$102,000	$102,000	$714,000	0%	100%	$0	$714,000					
P25	New Pipeline for Bridgeway Lakes II Resv	Resv	Jefferson Blvd.	12	2400	$93	$223,200	$44,640	$44,640	$312,500	0%	100%	$0	$312,500					
	PHASE II SUBTOTAL				**14000**		**$1,495,800**	**$299,160**	**$299,160**	**$2,094,200**			**$0**	**$2,094,200**					
PHASE III - YEAR 2015-16 TO YEAR 2019-20																			
P26 (2)	Parallel Pipeline on Linden Road	Jefferson Blvd.	Stonegate Dr.	12	2100	$93	$195,300	$39,060	$39,060	$273,400	0%	100%	$0	$273,400					
	PHASE III SUBTOTAL				**2100**		**$195,300**	**$338,220**	**$39,060**	**$273,400**			**$0**	**$273,400**					
	GRAND TOTALS				**102900**		**$12,523,750**	**$2,504,750**	**$2,504,750**	**$17,533,600**			**$1,523,200**	**$16,283,800**					
													$17,807,000						

Notes:
(1) The Pipeline Cost for the 12-inch distribution mains within each development of Richland Community, PAIK Community, and Newport estates estimate is based on the pipelines in the model.
Carollo estimates these developments need the minimum length indicated in the table, the actual may vary from the above indicated length.
(2) This pipeline improvement is not necessary if the development in PAIK and Newport Estates and surrounding areas is as per the General Plan. This improvement is necessary if the development in these areas is denser than projected in the General Plan.
(3) All costs are based on ENR CCI 20-City Average of 7308 for December 2004.
(4) The Costs for Engineering Design are placed in the Fiscal Year before actual construction Fiscal Year and these Costs are estimated to be 7.50% The percentage of the Engineering Design costs may vary from project to project.
(5) The Total Costs for the pipelines include the costs for all the appurtenances i.e., valves, blow-offs, air release valves, e.t.c.

- Funding source for this project shall be provided by the Developer (impact fees).
- The estimated cost for the project in Year 2005 Dollars is $802,800.

Justification: This storage reservoir is required per the storage requirements for existing and new developments in order to meet the storage criteria. The 12-inch and 16-inch T-mains are required for transmission of water to and from the new storage reservoir. These pipelines are required in the near future as development occurs.

A summary of the cost details is presented in Table 8.1. Project Numbers P04, P05, and P06 indicate the above-described pipeline projects.

8.1.1.4 Parallel Pipeline on Park/Maryland (Project P07):

This is a new 24-inch pipeline required on Park/Maryland/Virginia for better transmission in the North Area. With the increasing demands in the distribution system, more water needs to be routed from one area to the other thus maximizing the capacity of the existing distribution system. The pressures in the North area fell considerably near the barge canal compared to the pressures at the treatment plant, therefore the T-main on Park/Maryland/Virgina is required to bridge the northern and southern parts of the North area. A detailed analysis on bridging the northern and southern parts of the North area is described in detail in the Hydraulic Analysis chapter (Chapter 6). The following are the details of the project:

- The total length of the 24-inch pipeline is 5,500 feet.
- Implementation period of the project is FY 2008-09 to FY 2009-10.
- Funding source for this project is the City (Existing Rate Payers), since it is a deficiency in the existing system.
- The estimated cost for the project in Year 2005 Dollars is $1,409,100.

Justification: With the existing system and with increased demands in the North area the pressures in the southern part (just north of the Barge Canal) of the North area fell considerably below 40 psi (i.e., the existing distribution system is not sufficient to transmit flows at required pressures). The 24-inch parallel line on Park Boulevard, Maryland Avenue, or Virginia Avenue will assist in transmitting water between the northern and southern parts of the North area and improve the pressures near the Barge Canal area.

A summary of the cost details is presented in Table 8.1. Project Number P07 in the table indicates the above-described pipeline.

8.1.1.5 New Pipelines in the Southport Area (Projects P08 through P21):

As indicated on Figure 8.1, several pipelines are required in the Southport area for all the new developments. These T-mains transmit water from treatment source to the new customers in the Southport area. The following new communities need to be provided with new T-mains, these communities include:

- PAIK Community
- Newport Estates and surrounding Communities
- Parlin Ranch
- Richland Communities
- Bridgeway Lakes II

The alignment indicated on Figure 8.1 is just a schematic used for hydraulic analysis. The actual alignment may vary, as the pipelines must be aligned within streets of the new development. As listed in Table 8.1, some of the T-mains are required between FY 2005-06 through FY 2009-10 and other improvements are required in the later years. The timing of the developments will trigger the timing of the infrastructure improvements. The following are the details of the project:

- The total length of the pipelines required is 6,950 feet of 24-inch, 36,0050 feet of 16-inch pipelines and 26,600 feet of 12-inch T-mains.
- Implementation period of the project is FY 2005-06 through 2009-2010.
- Funding source for this project is the Developer (impact fees) of each individual area. The Developer bears the upfront costs of transmission and distribution mains in a new development.
- The estimated cost for the project in Year 2005 Dollars is $11,704,300.

Justification: All new developments requires new T-mains and it is important to have the required T-mains in place before the first customer moves into the development. Although all of these improvements are tentatively scheduled for this time-period, in actuality, these improvements might happen before or after this time-period. These new pipelines will create large 16-inch and 12-inch loops in the Southport area, providing transmission capacity from the north to the new reservoirs required for the new developments.

A summary of the cost details is presented in Table 8.1. Project Number P08 through P21 in the table indicates the above-described pipeline.

8.1.2 FY 2010-11 Through FY 2014-15 Improvements

These are the T-mains required after the City completes all the necessary projects scheduled between FY 2005-06 through FY 2009-10. The pipelines required during this period are indicated on Figure 8.1; the T-mains are required to distribute water to the future developments. The following are the pipelines required during this period:

8.1.2.1 New Pipelines in the Southport Area (Projects P22 through P25):

All these T-mains are required to supply water within the distribution system of the new communities. All the new communities in the Southport area listed in the above sections need 16-inch and 12-inch T-mains. The following are the details of the project:

- The total length of the pipelines required is 3,400 feet of 18-inch and 10,600 feet of 12-inch T-mains.
- Implementation period of the project is FY 2010-11 through FY 2014-15.
- Funding source for this project is the Developer (impact fees) of each individual area. The Developer bears the upfront costs of T-mains in a new development.
- The estimated cost for the project in Year 2005 Dollars is $2,094,200.

Justification: All the new developments need T-mains and it is important to have the required T-mains in place before the first customer moves into the development. Although all of these improvements are tentatively scheduled for this time-period, in actuality, these improvements might happen before or after this time-period.

A summary of the cost details is presented in Table 8.1. Project Number P22 through P25 in the table indicates the above-described T-mains.

8.1.3 FY 2015-16 Through FY 2019-20 Improvements

Most of the improvements required within the distribution system are scheduled prior to this time-period. There are no major improvements scheduled for this time period except for an optional T-main improvement on Linden Road. The improvement scheduled for this time period is indicated on Figure 8.1. The following is the improvement scheduled for this time-period:

8.1.3.1 Parallel Pipeline On Linden Road From Jefferson Boulevard to Stonegate Drive (Project P26):

This pipeline which will parallel an existing 16-inch main with a new 12-inch main from Jefferson Boulevard to Stonegate Drive on Linden Road. This line will improve the transmission capacity of the system from Linden Road to east areas of Jefferson Boulevard. The following are the details of the project:

- The total length of the 12-inch pipeline is 2,100 feet.
- Implementation period of the project is Year FY 2015-16 through FY 2019-20.
- Funding source for this project is by the Developer (Impact fees), since the existing pipeline will be deficient due to increase in demands in the areas east of Jefferson Boulevard.
- The estimated cost for the project in Year 2005 Dollars is $273,400.

Justification: In this stretch, the existing 16-inch pipeline is sufficient if the future development in the area is as per City's General Plan. The velocities in the 16-inch pipe are over six feet per second during a MDD scenario at buildout condition. If the development in this area is any denser than the General Plan, a 12-inch parallel pipeline is required in this stretch for water supply.

A summary of the cost details is presented in Table 8.1. Project Number P26 in the table indicates the above-described pipeline. This project is not required if the development east of Jefferson Boulevard in Newport Estates and PAIK communities is as per the General Plan (Year 2000).

This project is required if the development is denser than the development proposed in General Plan.

8.1.4 Summary of T-main Improvements

The T-main improvements are very important for meeting growing demands in City's distribution system. T-mains enhance the capacity of the distribution system, thus increasing the efficiency of conveying water from treatment source to the customer, who benefits from improved pressures. The existing deficiencies and the timing of the developments will trigger the timing of the T-main improvements. The projects are scheduled for various time-periods based on the currently available information from the City. The scheduled time periods may change since the timing of the new developments could vary.

8.2 RESERVOIR AND PUMP STATION IMPROVEMENTS

The reservoir and pump station improvements are the improvements that enhance the distribution system operationally and increase the flexibility of the system operation. The reservoirs are the storage elements that store water during the low demand periods and deliver water during the high demand periods. The 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 shall be accompanied with a properly sized pump station in order to boost water into the distribution system. Every reservoir contains three types of storage volume, which are:

- Operational Storage
- Emergency Storage
- Fire Storage

The requirements for each type of volume are described in detail in the Storage Criteria Chapter (Chapter 5). The following are the storage improvements required in the distribution system during various periods:

8.2.1 FY 2005-06 Through FY 2009-10 Improvements

The existing system has a storage deficiency of 4.2 MG, so additional storage capacity should be constructed and be operational at the earliest possible time frame. This deficiency is directly related to the existing Year 2004 demands, which have increased by 22 percent as compared to Year 2003 water production. There is also a 0.65 MG of volume shortage for the under-construction Bridgeway Lakes II development in the Southport area. In addition, the existing pump station at the PSIP reservoir needs to be replaced with a new pump station. All the improvements required during this period are indicated on Figure 8.2. The following are the details of the projects required during this period:

- R&PS01: New 1.9 MG reservoir and pump station in the new The Rivers development. Implementation period is FY 2005-06 to FY 2006-07 with a total project cost of $4,082,300 in Year 2005 Dollars.
- R&PS02: The existing pumps at PSIP were sized based on a separate and higher-pressure zone. These pumps will be removed and replaced with new 125 HP and 75 HP pumps, properly sized for the distribution system. Implementation period is FY 2008-09 to FY 2009-10 with a total project cost of $591,500 in Year 2005 Dollars.
- R&PS03: Replace the existing 1.0 MG Southport Reservoir with a new 3.0 MG reservoir at the existing Southport reservoir location. The City has been planning to replace this old reservoir for several years. Implementation period is FY 2007-08 to FY 2008-09 with a total project cost of $4,355,100 in Year 2005 Dollars.
- R&PS04: New 2.2 MG reservoir and pump station in the Newport Estates development. Implementation period is FY 2007-08 to FY 2008-09 with a total project cost of $4,185,500 in Year 2005 Dollars.
- R&PS05: New 2.1 MG reservoir and pump station at PAIK development. Implementation period is FY 2008-09 to FY 2009-10 with a total project cost of $3,895,400 in Year 2005 Dollars.

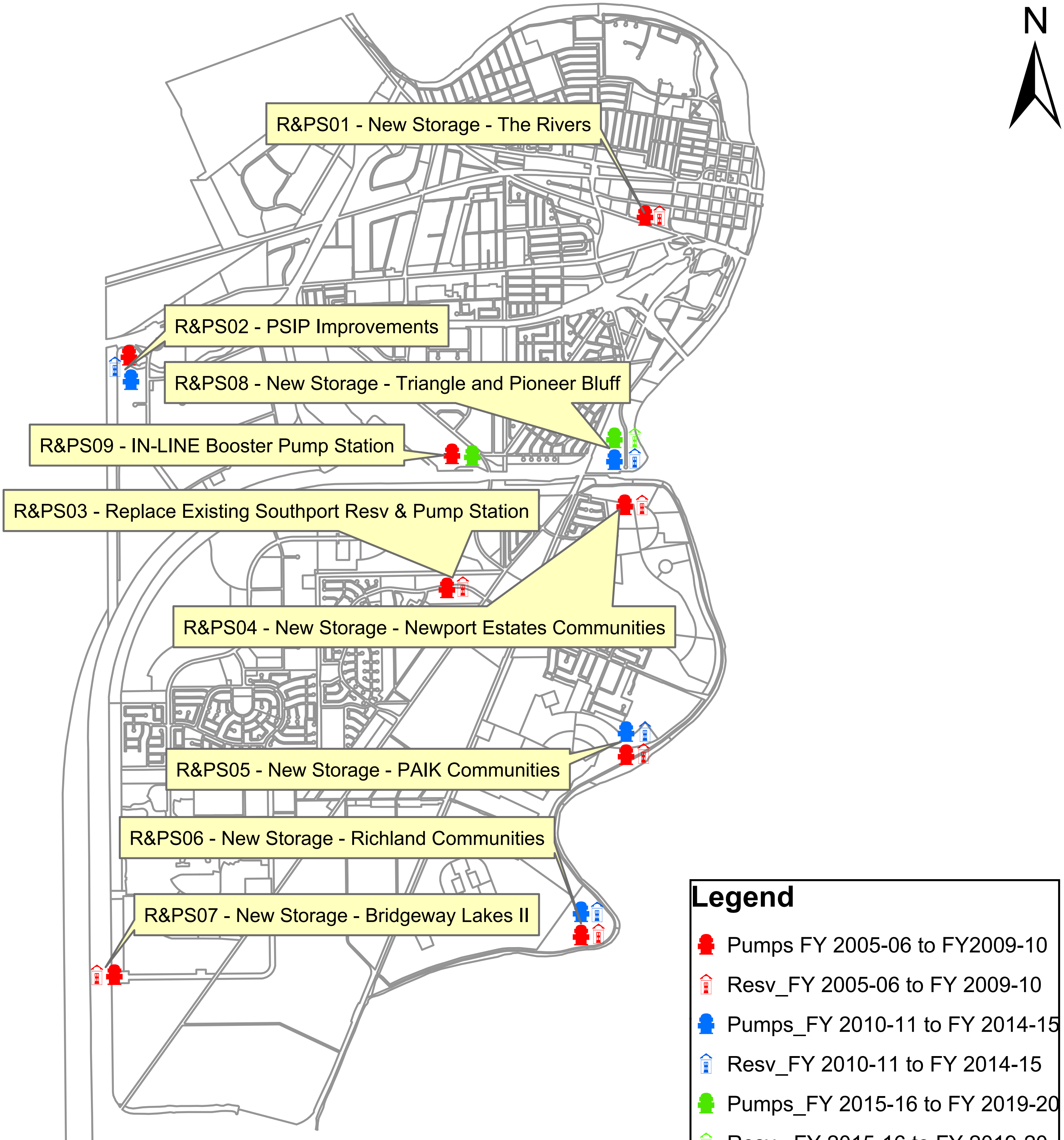


Figure 8.2 Reservoir and Pump Station Improvements
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- R&PS06: New 2.0 MG reservoir and pump station at Richland Communities. Implementation period is FY 2008-09 to FY 2009-10 with a total project cost of $3,877,900 in Year 2005 Dollars.

- R&PS07: Install a new 2.85 MG reservoir and pump station south of the Bridgeway Lakes II development. Implementation period is FY 2005-06 with a total project cost of $4,651,400 in Year 2005 Dollars.

- R&PS08: This project is a new reservoir and pump station for Triangle and Pioneer Bluff areas scheduled during future time frames.

- R&PS09: In addition, new ILBPS that boosts water from the North area to the Southport area. Implementation period is FY 2006-07 to FY 2007-08 with a total project cost of $2,329,200 in Year 2005 Dollars.

- Funding for all the above projects shall be provided by either the City (Existing Rate Payers) or the developer (impact fees). Funding for projects R&PS02 and R&PS03 should be 100 percent provided by the City (existing rate payers). These are the projects to eliminate the deficiencies in the existing distribution system. R&PS02 partially eliminates the existing pumping deficiency at the PSIP reservoir and R&PS03 partially eliminates the existing storage deficiency within the distribution system. All other projects during this time-period are growth related projects and should be funded by the developers (impact fees) of the new developments. Developers will be reimbursed for Regional Improvements through impact fees.

- The estimated costs for the entire reservoir and pump station improvements during this period are $27,968,330 of which $4,946,600 will be paid by the City (existing rate payers) and $23,021,700 will be paid by the developers. The costs paid by the City are to fulfill the existing deficiencies within the distribution system.

Justification: Table 8.2 provides the details and costs for each reservoir and pump station project during this time-period. All distribution systems must have enough operational, fire, and emergency storage. Implementing adequate storage will greatly improve the efficiency and operational flexibility. There are currently operational problems with keeping the Southport Reservoir full during MDD conditions. Additional storage facilities in the Southport area will distribute storage in this area, allowing reservoirs to fill and draw for about 30 percent of the reservoirs volume. Most of the reservoir and pump station improvements are required for the new developments and these improvements are required in order to fulfill the storage requirements and criteria for the distribution system as described in detail in Chapter 5 of this report. The ILBPS project is necessary to boost the pressures from North area to the Southport area. The North area pipelines have sufficient capacity to convey flows to the Barge Canal but not enough capacity to maintain the required pressures in the

Table 8.2 Costs for Reservoir and Pump Station Improvements
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Project No.	Type of Improvements	Costs Share from FY 2005-06 through FY 2009-10										Costs Share from FY 2010-11 through FY 2014-15					Costs Share from FY 2015-16 through FY 2019-20					
		Total for each Project	2005-06	2006-07	2007-08	2008-09	2009-10	Percentage for EXISTING Customers	Percentage for FUTURE Customers	Costs for EXISTING Customers	Costs for FUTURE Customers	Total for each Project	Percentage for EXISTING Customers	Percentage for FUTURE Customers	Costs for EXISTING Customers	Costs for FUTURE Customers	Total for each Project	Percentage for EXISTING Customers	Percentage for FUTURE Customers	Costs for EXISTING Customers	Costs for FUTURE Customers	Grand Total for the Project
		($)			($)	($)	($)			($)	($)	($)			($)	($)	($)			($)	($)	($)
R&PS01	The Rivers, One 1.9 MG Resv	$4,082,321	$306,174	$3,776,147	$0	$0	$0	0%	100%	$0	$4,082,321	$0	0%	100%	$0	$0	$0	0%	100%	$0	$0	$4,082,321
R&PS02	Improvements at PSIP [(2)], Additional 1.6 MG Resv	$591,500	$0	$0	$0	$44,363	$547,138	100%	0%	$591,500	$0	$1,890,742	100%	0%	$1,890,742	$0	$0	0%	100%	$0	$0	$2,482,242
R&PS03	Improvements at Existing Southport [(3)], Additional 2.0 MG Resv	$4,355,130	$0	$0	$326,635	$4,028,495	$0	100%	0%	$4,355,130	$0	$0	0%	100%	$0	$0	$0	0%	100%	$0	$0	$4,355,130
R&PS04	Newport Estates Communities, One 2.2 MG Resv	$4,185,450	$0	$0	$313,909	$3,871,541	$0	0%	100%	$0	$4,185,450	$0	0%	100%	$0	$0	$0	0%	100%	$0	$0	$4,185,450
R&PS05	PAIK Communities, Two 2.1 MG Resv's	$3,895,407	$0	$0	$0	$292,156	$3,603,252	0%	100%	$0	$3,895,407	$1,405,907	0%	100%	$0	$1,405,907	$0	0%	100%	$0	$0	$5,301,314
R&PS06	Richland Communities, Two 2.0 MG Resv's	$3,877,900	$0	$0	$0	$290,843	$3,587,058	0%	100%	$0	$3,877,900	$1,388,400	0%	100%	$0	$1,388,400	$0	0%	100%	$0	$0	$5,266,300
R&PS07	Bridgeway Lakes II, One 2.85 MG Resv	$4,651,400	$4,651,400	$0	$0	$0	$0	0%	100%	$0	$4,651,400	$0	0%	100%	$0	$0	$0	0%	100%	$0	$0	$4,651,400
R&PS08	Triangle & Pioneer Bluff, Two 2.4 MG Resv's	$0	$0	$0	$0	$0	$0	0%	100%	$0	$0	$4,492,536	0%	100%	$0	$4,492,536	$1,515,536	0%	100%	$0	$1,515,536	$6,008,072
R&PS09	IN-LINE Booster Pump Station	$2,329,217	$0	$349,382	$1,979,834	$0	$0	0%	100%	$0	$2,329,217	$0	0%	100%	$0	$0	$411,038	0%	100%	$0	$411,038	$2,740,255
		$27,968,325	$4,957,574	$4,125,530	$2,620,378	$8,527,397	$7,737,447			$4,946,630	$23,021,700	$9,177,600			$1,890,742	$7,286,800	$1,926,600			$0	$1,926,600	
			$27,968,325							$27,968,330					$9,177,542					$1,926,600		

Notes:

(1) A 15 percent Construction Contingency and another 15 percent contingency for Engineering, Legal, and Administrative services is factored in the cost estimates.
(2) PSIP site already has a pad in-place for a new reservoir. The existing pumps need to be replaced, but piping for pumps is already in-place. The Costs include the cost for new wireless antenna at this reservoir site.
(3) For Southport Reservoir the existing reservoir will be demolished, hence additional costs are included in reservoir cost estimates. Costs are reduced for pump station, since only the pumps need to be replaced.
(4) The Costs of any EIR Study is not included in the above cost estimate. Also it is assumed that the connection to the system from reservoir need 150 feet of pipe.
Reservoirs: Site Work and Site Acquisition costs are included when the first reservoir at the site is being constructed and during other times only reservoir constructions costs are included.
Costs for Site Acquisition= $250,000/Acre
Area Required: 1.0 Acre for Single Resv's with 2.1 MG or less, 1.5 Acres for Single Resv's 2.1 MG or more and Dual Resv's upto Total volume of 4.4 MG, and 2.0 Acres for all Dual Reservoir with Total Volume greater than 4.4 MG.
Sitework Costs are based on the bids received for "Carlin Tank and Pump Station Improvements Project", PSIP, and Southport costs are different from the bid costs since they are already existing sites. Sitework costs are adjusted based on Reservoir size and site conditions.
Pump Stations: 75% of the costs are included when the first pumps are being installed, since all the piping for the pumps will be finished during that time and only 25% for later construction for installing other pumps.
(5) SOURCE: Marshall Valuation Service (Marshall & Swift Publishing Company, Section 61, page 3. Nov., 2004
Costs are adjusted for Sacramento, CA.
Costs are based on average costs for surface reservoirs including typical tank ancillaries such as roofs, ladders, painting, fittings on tank, etc. Sand and gravel foundations with steel retaining rings are included on those of 1,000,000 gallons capacity or less, concrete foundations on larger tanks.
(6) All costs are based on ENR CCI 20-City Average of 7308 for December 2004.
(7) The engineering costs are high for this task since this design involves hydraulic evaluations and control strategy for SCADA controls.
(8) The Costs for Engineering Design are placed in the Fiscal Year before actual construction Fiscal Year and these Costs are estimated to be 7.5% The percentage of the Engineering Design costs may vary from project to project.
(9) All the reservoir and pump station costs are in relative to Carlin Reservoir and Pump Station, the construction of which is completed in Year 2004. The City and Carollo agreed on using the costs of Carlin Reservoir and Pump Station project as a referrence in order to develop the costs for future reservoir and pump stations.

Southport area during high demand periods. Therefore, either a large transmission pipeline (48-inch or larger) bridging the center of the North area to the center of the Southport area or an In-Line Booster Pump Station is required to maintain sufficient pressures throughout the system. The advantages of ILBPS are as follows:

- Design and construction costs for the new pump station are much less than the design and construction of T-main improvements. Property acquisition and/or easements are not required for ILBPS, whereas property acquisition and/or easements may be required for T-main improvements.

- Large T-main construction would be disruptive to existing roads and vehicular traffic. In addition, large T-mains do not function efficiently during low demand periods as the velocity in the large pipes falls below the acceptable range.

Another major advantage of the ILBPS is that the City operations staff will have total control on the operations in the Southport area, i.e., the City operations staff can shut-off the pumps during the low demand periods and still maintain sufficient pressures within the Southport area.

In addition, City staff can maintain pressures in the Southport area independent of the North area, which is not possible with a large T-main. The ILBPS is also very economical to construct.

A summary of the cost and details is presented in Table 8.2. Project Number R&PS01 through R&PS09 in the table indicates the above-described storage and pump station projects.

Based on the EMDD condition, the system has a storage deficiency of 4.2 MG in Southport and 0.65 MG storage required for the new Bridgeway Lakes II Community. It is important to construct necessary facilities to eliminate this storage deficit and provide sufficient storage volume for new developments. In addition, new pumps are required at PSIP in order to utilize the reservoir effectively.

8.2.2 FY 2010-11 Through FY 2014-15 Improvements

As the demands increase in the distribution system, the required storage volume increases. The following are the project details for new reservoirs and pump stations required during this period:

- R&PS01: This project will be completed between FY 2005-06 to FY 2009-10.

- R&PS02: New 1.6 MG Reservoir and expand pump station at the existing PSIP reservoir. Total project cost during this period is $1,890,700 in Year 2005 Dollars.

- R&PS03: This project will be completed between FY 2005-06 to FY 2009-10.

- R&PS04: This project will be completed between FY 2005-06 to FY 2009-10.
- R&PS05: New 2.1 MG reservoir and expand the pump station at the PAIK development. Total project cost during this period is $1,405,900 in Year 2005 Dollars.
- R&PS06: New 2.0 MG reservoir and expand the pump station at the Richland Communities. Total project cost for this period is $1,388,400 in Year 2005 Dollars.
- R&PS07: This project will be completed between FY 2005-06 to FY 2009-10.
- R&PS08: New 2.4 MG reservoir and pump station at the Triangle and Pioneer Bluff. Total project cost during this period is $4,492,500 in March 2005 Dollars.
- R&PS09: This project will be partially completed between FY 2005-06 to FY 2009-10 and partially between FY 2015-16 to FY 2019-20.
- Implementation period of all the above projects is FY 2010-11 to FY 2014-15.
- The Developers of the Southport area should provide the upfront funding for all the above-described projects, except for the PSIP improvements since this reservoir is required for growing demands within the existing system in the North area. Developers will be reimbursed for Regional Improvements through impact fees.
- The estimated costs for all the reservoir and pump station improvements during this period are $9,177,600.

Justification: The reservoir and pump station improvements during this period are required for new developments in order to fulfill the storage requirements. Storage criteria for the distribution system are described in detail in Chapter 5 of this report.

A summary of the cost and details are presented in Table 8.2.

8.2.3 FY 2015-16 Through FY 2019-20 Improvements

As the demands increase in the distribution system additional storage volume is required. The following are the project details for new reservoirs and pump station during this period:

- R&PS01: This project will be completed between FY 2005-06 to FY 2009-10.
- R&PS02: This project will be completed between FY 2005-06 to FY 2014-15.
- R&PS03: This project will be completed between FY 2005-06 to FY 2009-10.
- R&PS04: This project will be completed between FY 2005-06 to FY 2009-10.
- R&PS05: This project will be completed between FY 2005-06 to FY 2014-15.
- R&PS06: This project will be completed between FY 2005-06 to FY 2014-15.

- R&PS07: This project will be completed between FY 2005-06 to FY 2009-10.
- R&PS08: New 2.4 MG Reservoir and expand Pump Station at the Triangle and Pioneer Bluff reservoir. Total project cost for this period is $1,515,500 in Year 2005 Dollars.
- R&PS09: Expand the In-Line Booster Pump Station that boosts water from the North area to the Southport area. Total project cost for this period is $411,000 in Year 2005 Dollars.
- Implementation period of these projects is FY 2015-16 to FY 2019-20.
- The Developers of new developments shall provide the upfront funding for all the above-described projects. Developers will be reimbursed for Regional Improvements through impact fees.
- The estimated costs for all the reservoir and pump station improvements during this period are $1,926,600.

Justification: The reservoir and pump station improvements are required for the new developments in order to fulfill the storage requirements. Storage criteria for the distribution system are described in detail in Chapter 5 of this report. The ILBPS project includes additional pumps, required due to increasing demands in the Southport Area.

A summary of the cost and details is presented in Table 8.2.

8.2.4 Summary of Reservoir and Pump Station Improvements

Storage reservoirs are required to meet the operational, emergency, and fire storage criteria within in the distribution system. There is an existing storage deficiency of 4.2 MG that shall be fulfilled in the near future. The pump station facilities will boost the water from storage reservoirs into the distribution system. Since the change in ground surface elevation is minimal within the City, all the storage reservoirs need pumping facilities. Apart from 4.2 MG, the rest of the storage reservoirs and pumping facilities are required for future customers. Therefore, the City (Existing Rate Payers) will pay for deficiency in the existing system and all the storage and pump station improvements will be paid by the Developers (Impact Fees) of the new developments. In addition, the ILBPS will enhance the operations in the Southport area as described in detail in Chapter 8.

8.3 WATER MAIN REPLACEMENT PROJECTS

These are the pipeline improvements within the distribution system that the City has to complete before the pavement replacement on these streets. The ‘Measure K’ program funds the pavement replacement projects. In order to save significant pavement replacement costs, the City has to complete all the pipeline replacements on these streets prior to the pavement replacement project. The cost of pipeline replacement projects on these streets during various time-periods are presented in Table 8.3. The City's Water Enterprise Fund (Existing Rate Payers) will fund all the costs for these pipeline improvements only, the Measure K program funds the pavement replacement costs. The City has determined the time frame of each project under this program; the projects under this task shall be completed before the scheduled pavement replacement time-period. The streets funded under the Measure K program are indicated on the drawing in Appendix F.

In addition, water main replacement projects include the projects to upsize undersized mains (4-inches and smaller), projects to install new water meters and projects to relocate backyard mains into the public right-of-way.

8.4 METERING IMPLEMENTATION PLAN

The Meter Implementation Plan, described in Chapter 7, must be initiated soon, as all residential services must be metered by January 1, 2013 per Assembly Bill 514. The metering program should be started with development of a Public Outreach Plan, also described in Chapter 7. This plan will introduce the program to The City's customers and decision makers prior to the start of any meter retrofit installations. Based on recent conversations with public outreach consultants, the budget for the Public Outreach Plan should range between $100,000 and $175,000 based on the extent of services that the consultant would accomplish. Most of this work will be done in the initial year of the program i.e., during the FY 2005-06.

Construction of the metering infrastructure improvements should be spread evenly over FY 2006-07 through FY 2011-12. With 10,277 services requiring some level of meter infrastructure, 1,713 units will need to be installed each FY. Meter installation and construction projects should be evenly spread throughout West Sacramento neighborhoods so that one neighborhood does not see extensive construction at a particular time.

Individual construction projects could be packaged with between 400 and 500 services, so that the City administers three or four contracts per FY. These three or four projects would be located in different neighborhoods so that one neighborhood is not overly inconvenienced with the work. Construction efforts will be more intensive in the north area, as trenching will be required where meter boxes do not exist. Some trenching and pavement replacement and improvements will be required in streets where service laterals must be replaced. Any main replacement projects within the next seven FY's should include metering improvements.

The total construction and implementation cost of this program has been estimated at $4,253,000 (see Table 7.4), with $3,271,900 estimated for construction and meter installation, and $991,600 estimated for implementation costs. Implementation costs include public outreach, engineering, inspection, and the City's administration of the program.

Table 8.3 Water Main Replacement Project
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Project No.	Project Description	Fiscal Year	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	20010-15	Total Costs	Existing Customers	Future Customers	Costs for Customers: Exitsting Customers	Costs for Customers: Future Customers
1	Arlington Oaks Neighborhood (1)	2004-5 through 2005-6	$55,000	$172,500						$227,500	100%	0%	$227,500	$0
2	Bryte Area Neighborhood (1)	2004-5 through 2006-7	$276,500	$1,323,000						$1,599,500	100%	0%	$1,599,500	$0
3	Pecan Street and Walnut Street	2005-6 through 2006-7		$46,000	$431,000					$477,000	100%	0%	$477,000	$0
4	Elkhorn Broderick Neighborhood (1)	2005-6 through 2007-8		$345,000	$2,333,500					$2,678,500	100%	0%	$2,678,500	$0
5	Meadowdale Park Neighborhood	2005-6 through 2007-8		$126,500	$526,500					$653,000	100%	0%	$653,000	$0
6	Maryland/ Delaware/ Pennsylvannia	2005-6 through 2007-8		$190,000	$1,119,000					$1,309,000	100%	0%	$1,309,000	$0
7	Westmore Oaks School Neighborhood/South River Road/ Linden Road East (1)	2006-7 through 2008-9			$443,000	$4,128,000				$4,571,000	100%	0%	$4,571,000	$0
8	Memorial Park Neighborhood	2006-7 through 2008-9			$239,000	$1,742,000				$1,981,000	100%	0%	$1,981,000	$0
9	Westfield Neighborhood Riverside Center/Riverpoint Center (1)	2007-8 through 2009-10				$124,500	$485,000			$609,500	100%	0%	$609,500	$0
10 (6)	Water Main Replacement Projects	2008-09 through 2009-10					$112,500	$1,387,500		$1,500,000	100%	0%	$1,500,000	$0
11 (6)	Water Main Replacement Projects	2010-11 through 20014-15							$9,000,000	$9,000,000	100%	0%	$9,000,000	$0
	TOTALS		**$331,500**	**$2,203,000**	**$5,092,000**	**$5,994,500**	**$597,500**	**$1,387,500**	**$9,000,000**	**$24,606,000**			**$24,606,000**	**$0**

Notes:
(1) Accelerated Measure K Program.
(2) Project schedule based on installing new water mains prior to Road Rehabilitation Construction.
(3) Backyard Services-Require additional coordination and construction for retrofit due to existing backyard water service location.
(4) Time period and total costs were referenced from the Measure K Funds Proposed Road Rehabilitation Program 2003-04 through 2008-09.
(5) All costs are based on ENR CCI 20-City Average of 7308 for December 2004.
(6) There is no data on the number of services that will be installed from FY 2009-10 through FY 2014-15, therefore, it is assumed that a total of 1,800 meters will be installed from FY 2009-10 through FY 2014-15.
(7) There is no count for the number of services that will be installed from FY 2009-10 through FY 2014-15, therefore, it is assumed that a total of 1,800 meters will be installed from FY 2009-10 through FY 2014-15.

The public outreach effort is scheduled for FY 2005-06 and some in-house administrative efforts are necessary in this FY. Thus, $200,000 of the program cost has been allocated for FY 2005-06. Cost by planning period is presented in Table 8.4.

Table 8.4 Meter Implementation Program Costs
Water Master Plan Update
City of West Sacramento

Planning Period	Number of Installations	Cost, ($)
FY 2005-06	Public Outreach Plan and Administration	$200,000
FY 2005-06 through FY 2009-10	1,713 installations per year Total of 6,851 installation	$1,133,700
FY 2010-11 through FY 2011-12	1,713 installations per year Total of 3,426 installations	$2,919,700
Total	**10,277 installations**	**$4,253,000**

Although the date of actual meter reading has not been set, it is recommended that the MXU transmitters be installed with all new meter installations for new residential construction. The City should make this a policy for developer installations starting in FY 2005-06. New residences should start using metered rates when they begin service, for existing customers, comparative billing information should be provided for at least 12 months prior to switchover from a flat rate to a metered water rate.

8.5 OPERATIONAL IMPROVEMENTS

During the 24-Hour Demand Test and Hydraulic Stress Test of the water distribution system, Carollo had an opportunity to participate in the operations of the water distribution system. This experience helped Carollo verify data in the hydraulic model and better understand the challenges the water operators overcome to deliver potable water to the customers. The reason operators double and triple pump water from reservoir to reservoir is to accommodate present distribution system dynamics and to provide an opening in the system to relieve pressure spikes. By developing new control methods with the operators and by making some system modifications it should be possible to deliver a more consistent water pressure to all of the City's residents and save money on electrical costs.

Working with the water distribution operators led to the development of several CIP Projects listed in Table 8.5. The justifications for all the improvements presented in the table are as follows:

- *Relocation of Discharge Flowmeter at the High Service Pump Station (HSPS)*: The current location of the HSPS flowmeter does not actually indicate the flow entering the distribution system due to turbulence in fittings upstream of the flowmeter. In order to improve accuracy, the existing flowmeter must be relocated downstream of its existing location. The probable costs and the implementation period for this project is presented in Table 8.5, Project Number M1 indicates this project.

- *HSPS Pump #4 - Electrical Installation*: The existing Pump #4 at HSPS is not supplied with power to operate. Electrical installation is necessary in order to operate the pump. The probable costs and the implementation period for this project is presented in Table 8.5, Project Number M2 indicates this project.

- *Engine/ Generator replacement at HSPS*: The existing standby power at HSPS is insufficient for the growing demands within the distribution system; hence a new engine/generator shall be installed to increase the standby power capacity. The probable costs and the implementation period for this project is presented in Table 8.5, Project Number M3 indicates this project.

- *Oak Street and Central Reservoirs Pipeline Improvements*: The pipeline and motorized valve improvements are required at these reservoirs to direct flow away from the north-to-south T-main. This improvement optimizes the use of the large T-mains. The probable costs and the implementation period for this project is presented in Table 8.5, Project Number M4 indicates this project.

- *Inspect 36-inch T-main under the deep-water channel*: The only sources of water from HSPS to the Southport area are the two 36-inch mains crossing the deep-water channel (one subsurface and on Palamidessi Bridge). Carollo recommends inspecting the subsurface pipeline and performing all necessary repairs. The probable costs and the implementation period for this project is presented in Table 8.5, Project Number M5 indicates this project.

- *Surge Analysis of the System*: Since the distribution has been consistently growing, Carollo recommends a comprehensive surge analysis of the distribution system in order to prevent any damage to the distribution system due to vapor cavity formation and resulting pressure spikes. The probable costs and the implementation period for this project is presented in Table 8.5, Project Number M6 indicates this project.

- *Standby Power at all Reservoirs*: Carollo recommends standby power facilities at all the reservoirs for efficient operation of the reservoirs during emergencies and power-outages. The probable costs and the implementation period for this project is presented in Table 8.5, Project Number M7 indicates this project.

- *Northeast Reservoir Improvements*: The Northeast reservoir should be coated with a layer of light green paint in order to accommodate the requests of the surrounding residents. The probable costs and the implementation period for this project is presented in Table 8.5, Project Number M8 indicates this project.

Table 8.5 Costs for Operational Improvements
Water Master Plan Update
City of West Sacramento

Project Number	Project Type	No. of Units	Unit Costs ($)	Costs for the Project ($)	Construction and Other Contingencies @ 40%	Total Costs with Contingencies ($)	Percentage for Customers: Existing Customers	Percentage for Customers: Future Customers	Costs for Customers: Existing Customers ($)	Costs for Customers: Future Customers ($)	Cost Distribution from FY 2005-06 to FY 2009-10: 2005-06 ($)	2006-07 ($)	2007-08 ($)	2008-09 ($)	2009-10 ($)	Costs from FY 2010-11 through FY 2014-15 ($)	Costs from FY 2015-16 through FY 2019-20 ($)
High Service Pump Station Improvements																	
M1	HSPS Discharge Flowmeter, Relocation	1	$100,000	$100,000	$40,000	$140,000	100%	0%	$140,000	$0	$140,000						
M2 (3)	HSPS Pump #4 Electrical Installation	1	$10,000	$10,000	$4,000	$14,000	0%	100%	$0	$14,000	$14,000						
M3	Engine/Generator	1	$250,000	$250,000	$100,000	$350,000	0%	100%	$0	$350,000		$350,000					
Distribution System Pipeline Improvements																	
M4	Oak Street and Central Res'v Pipeline Imps.	1	$25,000	$25,000	$10,000	$35,000	100%	0%	$35,000	$0		$35,000					
M5	Inspect 36-inch T-main under deep water channel	1	$50,000	$50,000	$0	$50,000	100%	0%	$50,000	$0	$50,000						
Surge Analysis																	
M6	Surge Analysis of the System	1	$50,000	$50,000	$0	$50,000	100%	0%	$50,000	$0	$50,000						
Distribution System Pump Station Improvements																	
M7	Standby Power at all Reservoirs	6	$100,000	$600,000	$240,000	$840,000	100%	0%	$840,000	$0			$840,000				
M8	Northeast Reservoir Improvements	1	$25,000	$25,000	$10,000	$35,000	100%	0%	$35,000	$0		$35,000					
M9	VFD's at all Reservoirs	6	$100,000	$600,000	$240,000	$840,000	100%	0%	$840,000	$0				$420,000	$420,000		
M10	Separate Reservoir Inlet and Outlet pipes	6	$100,000	$600,000	$240,000	$840,000	100%	0%	$840,000	$0					$840,000		
M11 (2)	Reservoir Coatings for Existing Tanks	1	$3,250,000	$3,250,000	$0	$3,250,000	100%	0%	$3,250,000	$0				$650,000	$1,000,000	$1,600,000	
Water Treatment Improvements (3)																	
M12	Storage Building at BBWTP	1	$50,000	$50,000	$20,000	$70,000	50%	50%	$35,000	$35,000	$70,000						
M13	Security Camera closed circuit TV at BBWTP	1	$75,000	$75,000	$30,000	$105,000	50%	50%	$52,500	$52,500		$105,000					
M14	Port of Sacramento Industrial Park WTP remote telemetry system	1	$60,000	$60,000	$24,000	$84,000	100%	0%	$84,000	$0	$84,000						
M15	BBWTP Reclaimed Basins Influent Valve Actuators	1	$25,000	$25,000	$10,000	$35,000	100%	0%	$35,000	$0	$35,000						
M16	BBWTP Filters Generator Load Bank	1	$20,000	$20,000	$8,000	$28,000	100%	0%	$28,000	$0		$28,000					
M17	BBWTP Intake Structure Security Fencing	1	$25,000	$25,000	$10,000	$35,000	100%	0%	$35,000	$0		$35,000					
M18	Actiflo Maturation Mixer Gearbox and Seals	1	$45,000	$45,000	$18,000	$63,000	100%	0%	$63,000	$0	$63,000						
M19 (3)	BBWTP Pump Repairs	1	$100,000	$100,000	$0	$100,000	100%	0%	$100,000	$0	$20,000	$20,000	$20,000	$20,000	$20,000		
M20 (3)	BBWTP Future Improvements	1	$3,400,000	$3,400,000	$0	$3,400,000	100%	0%	$3,400,000	$0			$330,000	$330,000	$330,000	$1,205,000	$1,205,000
Vulnerability Assessment Improvements (4)																	
M21	Improvements from Vulnerability Assessment	1	$75,000	$75,000	$0	$75,000	100%	0%	$75,000	$0	$75,000						
M22	Improvements from Vulnerability Assessment	1	$396,000	$396,000	$0	$396,000	100%	0%	$396,000	$0		$99,000	$99,000	$99,000	$99,000		
						$10,835,000	**Grand Total for all Projects**		**$10,835,000**		**$601,000**	**$707,000**	**$1,289,000**	**$1,519,000**	**$2,709,000**	**$2,805,000**	**$1,205,000**

Notes:
(1) All the Costs are place-holder costs, the real costs may vary after detailed evaluation of each improvement.
(2) Costs includes recoating for existing reservoirs. FY 2008-09 for Northeast that would cost $650,000, FY 2009-10 for Central and Oak Street that would cost $1,000,000 and $1,600,000 for coating to other reservoirs between the timeperiod FY 2010-11 through FY 2014-15.
(3) Operational Improvements recommended by the Operations Staff. Includes a budgetary allowance of cost indicated per year for minor operational improvements within the City from FY 2005-06 through FY 2019-20.
(4) The details of these improvements are presented in a separate report to the City.
(5) **Phase I**: from FY 2005-06 through FY 2009-10, **Phase II**: from FY 2010-11 through FY 2014-15, and **Phase III**: from FY 2015-16 through FY 2019-20.
(6) All costs are based on ENR CCI 20-City Average of 7308 for December 2004.

- *Variable Frequency Drives (VFD) at all reservoirs*: VFD's improve the efficiency of the pumps and help save energy costs. Turning down the motor speeds will allow City operations staff to use the larger pumps more frequently. Carollo recommends VFD's be installed on all large pumps at all the pump stations. The probable costs and the implementation period for this project is presented in Table 8.5, Project Number M9 indicates this project.

- *Separate Reservoir inlet and outlet pipes*: Carollo recommends these improvements in order to improve tank mixing, chlorine residual, and water quality. The probable costs and the implementation period for this project is presented in Table 8.5, Project Number M10 indicates this project.

- *Reservoir Coating for Existing Tanks*: This is the budgetary allowance for maintaining existing facilities during the time-period FY 2005-06 through FY 2014-15. The City's operations staff estimated that it would cost around $3,250,000 for recoating of the existing reservoirs. The costs and the implementation period for this project is presented in Table 8.5, Project Number M11 indicates this project.

- *Water Treatment Improvements*: These are the improvements recommended by City's operations staff. These improvements are required to improve the existing Water Treatment Plant facilities. In addition, these costs include a budgetary allowance of costs indicated on M19 and M20 per year from FY 2005-06 through FY 2019-20. The probable costs and the implementation period for this project is presented in Table 8.5, Project Number M12 through M20 indicates these projects.

- *Vulnerability Assessment Improvements*: The details of these improvements are presented to the City in a separate report. Due to security reasons, specific description of these projects, which improve security at the Bryte Bend WTP and reservoir and pump station sites, are not listed in this document. The probable costs and the implementation period for this project is presented in Table 8.5, Project Number M21 and M22 indicate this project.

In cases where operational improvements were identified that did not require a capitol expense, Carollo shared information with the water operators so improvements in water distribution system operation could be made immediately. Recommendations on reservoir pumping schedules and ideas about pumping times will help increase chlorine residual at the reservoirs and minimize double pumping.

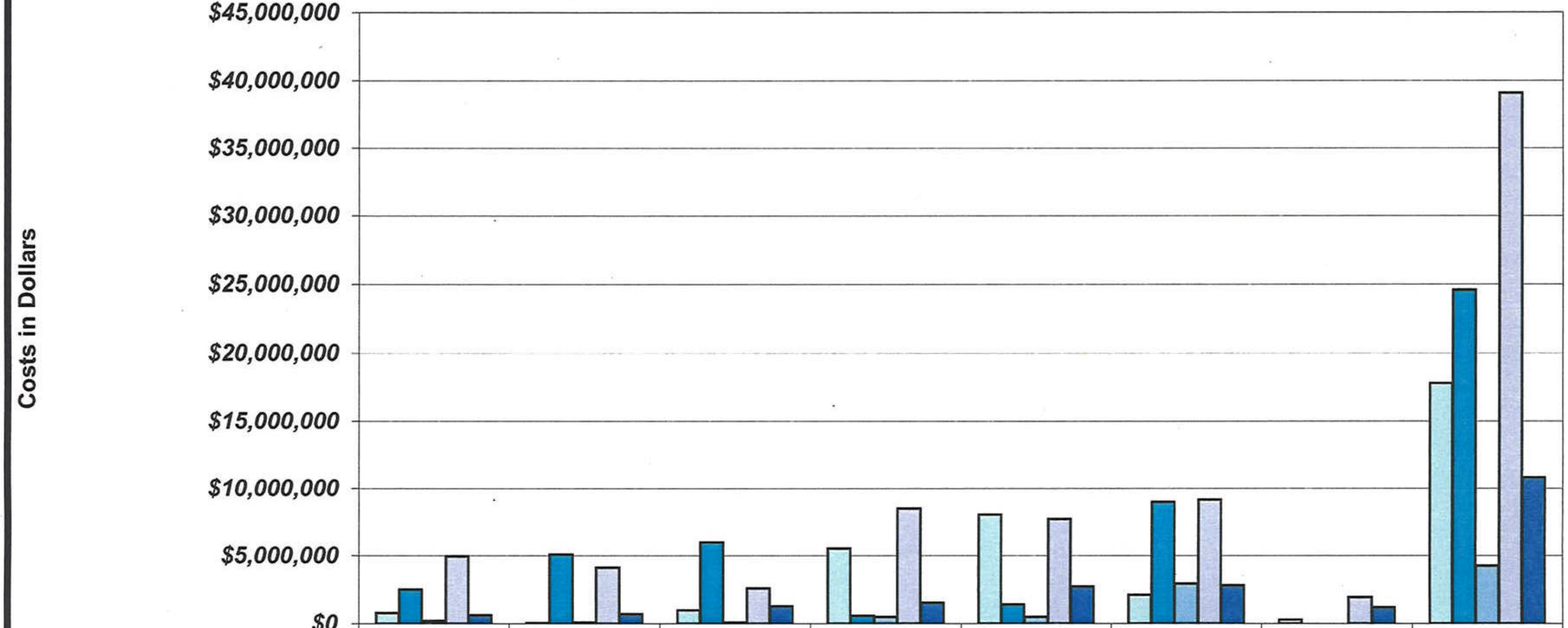
All the above-mentioned operational improvements increase the efficiency of the distribution system and enhance the existing operational conditions. Thus, all operational improvements are allocated to existing rate payers.

8.6 CAPITAL IMPROVEMENT PROGRAM SUMMARY

The summary of costs for all the improvements during each time period is indicated on Figure 8.3. As indicated on the Figure, most of the improvements are required during FY 2005-06 through FY 2009-10. Since most of the new developments are expected to start between these years, a major portion of the costs required for improvements is scheduled within this time-period. The cost share for customers is presented in Figure 8.4, most of the deficiencies in the existing system will be paid by the City (Existing Rate Payers) and all the future developments will be paid by the Developer (Impact Fees). The CIP presents an overview of expenditures to the City for water distribution system infrastructure improvements within the City during various time periods. This CIP does not include any improvements required for the Bryte Bend WTP.

A financial analysis was prepared based on the improvements presented in this chapter. The Financial analysis also considers other expenditures, including: loans, repayment to developer, Bryte Bend WTP improvements, etc., in order to determine the water rates for the customers. The water rates for the customers and City water fund financial analysis is described in detail in Chapter 9 of this report.

Figure 8.3 Cost Comparison During Various Time Periods
Water Master Plan Update
City of West Sacramento



	2005-06, Total= $9,095,900	2006-07, Total= $10,041,500	2007-08, Total= $10,986,600	2008-09, Total= $16,640,000	2009-10, Total= $20,408,500	2011-2015, Total= $25,996,400	2016-2020, Total= $3,405,000	Total= $96,574,000
Transmission Mains	$802,800	$38,978	$1,004,725	$5,519,174	$8,073,724	$2,094,200	$273,400	$17,807,000
Water Main Replacement (1)	$2,534,500	$5,092,000	$5,994,500	$597,500	$1,387,500	$9,000,000	$0	$24,606,000
Metering Implementation	$200,000	$78,008	$78,008	$476,913	$500,807	$2,919,661	$0	$4,253,000
Reservoirs & Pump Stations	$4,957,574	$4,125,530	$2,620,378	$8,527,397	$7,737,447	$9,177,542	$1,926,600	$39,072,000
Operational Improvements	$601,000	$707,000	$1,289,000	$1,519,000	$2,709,000	$2,805,000	$1,205,000	$10,835,000

Time Period

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

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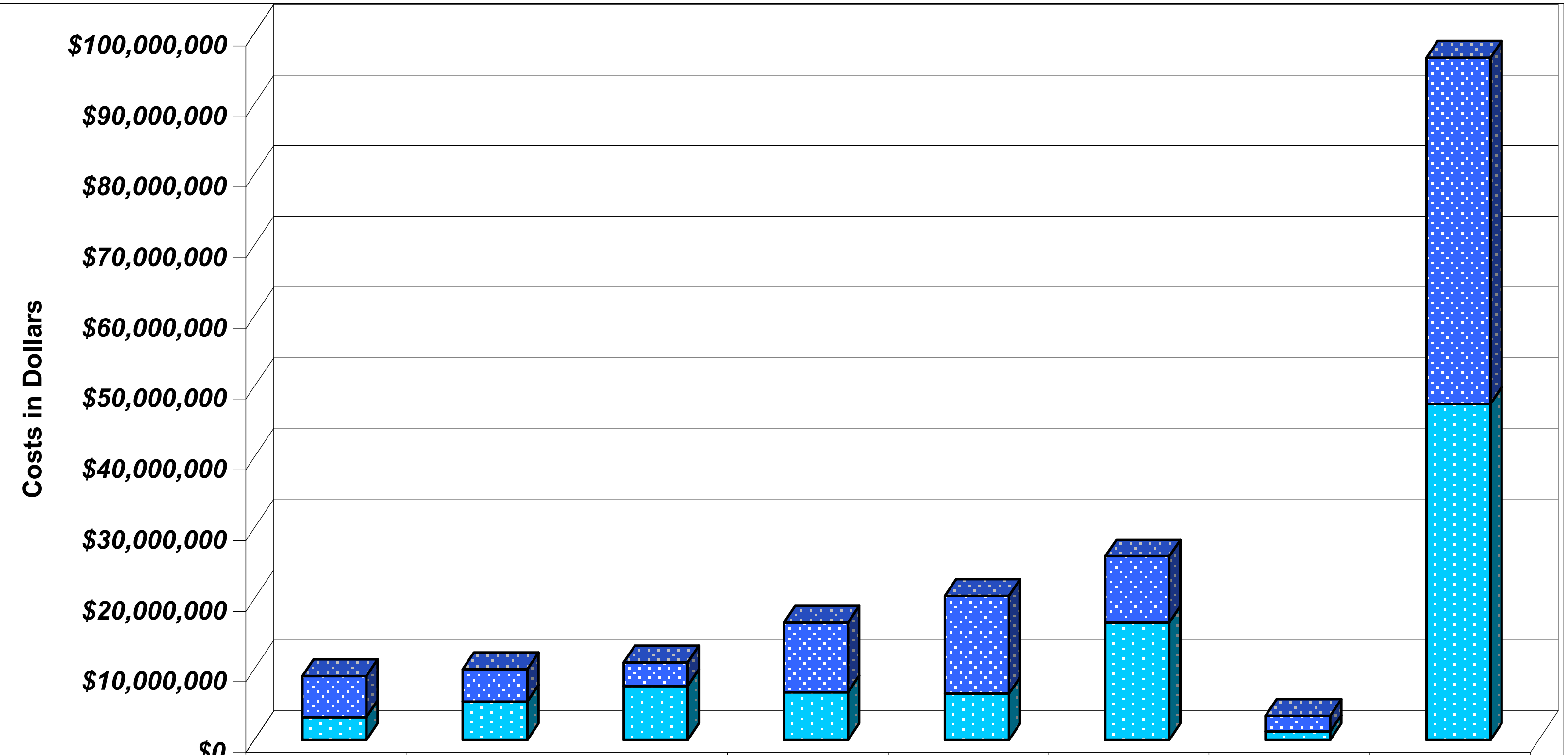
Cost CompA

Figure 8.4 Cost Share to Customers
Water Master Plan Update
City of West Sacramento



	2005-06	2006-07	2007-08	2008-09	2009-10	2010-2015	2016-2020	Total
Costs for Future Customers	*$5,809,000*	*$4,567,500*	*$3,298,000*	*$9,859,000*	*$13,855,000*	*$9,381,000*	*$2,199,971*	*$48,969,000*
Costs for Existing Customers	*$3,286,500*	*$5,475,008*	*$7,688,008*	*$6,780,913*	*$6,553,307*	*$16,615,000*	*$1,205,000*	*$47,604,000*

Time-Period

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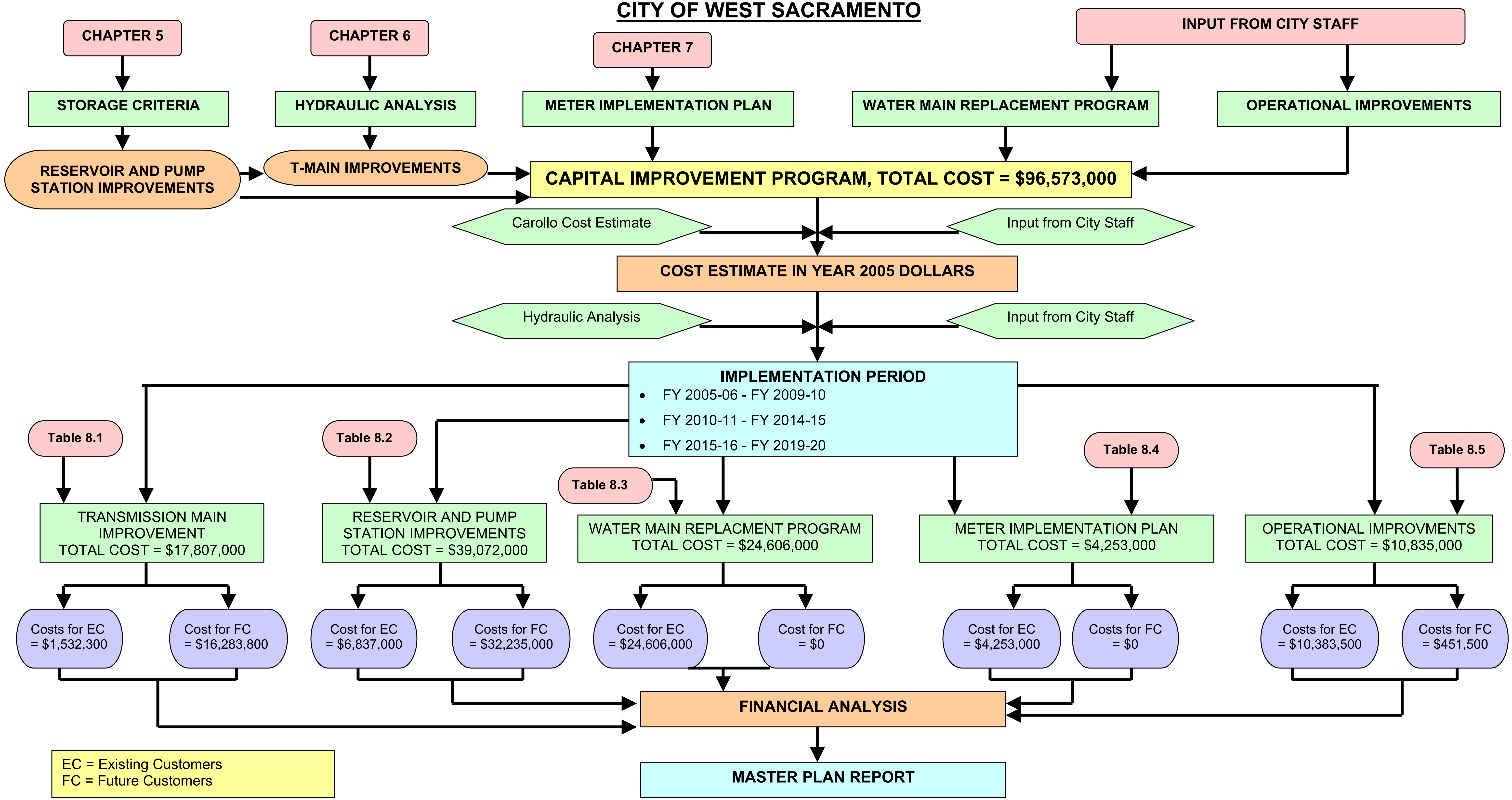
CHAPTER 8 CAPITAL IMPROVEMENT PROGRAM SUMMARY FLOW CHART
WATER MASTER PLAN UPDATE
CITY OF WEST SACRAMENTO



FINANCIAL ANALYSIS

9.1 INTRODUCTION AND SUMMARY OF RECOMMENDATIONS

This chapter describes the multi-year financial plan for the City's water utility based on Water Master Plan Update recommendations and the current and future financial obligations of the water utility. This chapter also includes recommendations for the City's water rates and water system impact fees (new development connection fees).

The financial plan was developed to cover the same 15-year planning period as the Water Master Plan Update (through 2020). The financial plan includes estimated operating and maintenance costs, debt service obligations, and capital improvement needs. Water system costs are primarily met through a combination of water rates paid by customers of the water utility and water system impact fees paid by new development. Other revenues, including revenues from the City's Measure K, are also reflected in financial analysis.

The 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. Greater detail is provided in the first five years of the planning period, and estimated water rate schedules are provided for this period. Financial estimates through 2020 are provided for information purposes. The analysis of future conditions reflects underlying assumptions described in this chapter. While all assumptions contained herein are believed reasonable and were reviewed with staff, conditions are dynamic and events may unfold differently than reflected herein, particularly beyond the first five years of the planning period. This does not reduce the value of long-range planning, but reinforces the importance of periodic updates.

9.1.1 Financial Plan Findings and Recommendations

Details of the financial plan analysis, underlying assumptions, and financial strategy recommendations are presented in Section 9.2. Significant findings and recommendations resulting from the analysis include:

- The City's water utility is generally self-sufficient, generating revenues primarily from water rates and water system impact fees to meet obligations of operating the water system, making debt service payments, and constructing needed water system improvements. Revenues derived from sales tax revenues under the City's Measure K help to lower water rates for all customers (about $3 per month for single family customers). Measure K's support of the water utility is assumed to continue throughout the planning period.

- Annual operating and maintenance costs of the water system are estimated to total about $4.7 million in FY 05-06. Operating costs are expected to increase in the future due to inflation, a growing customer base, and new laws and regulatory requirements. Improving economies of scale as well as operating efficiencies resulting from increased automation and technology improvements will offset cost increases.

- Current annual debt service totals about $4.41 million per year. About $2.56 million of the annual debt service is attributable to expansion of the Bryte Bend WTP and should be paid with water system impact fee revenues. The remaining $1.85 million per year is attributable to past water system improvements and should be paid from water rate revenues.

- About $3.4 million per year (increasing annually at the rate of inflation) should be transferred from the Water Operating Fund to the Capital Replacement/Upgrade Reserve (described in Section 9.2) to help cover the costs associated with water system rehabilitation and upgrades. This breakdown is illustrated in Figure 9.1.

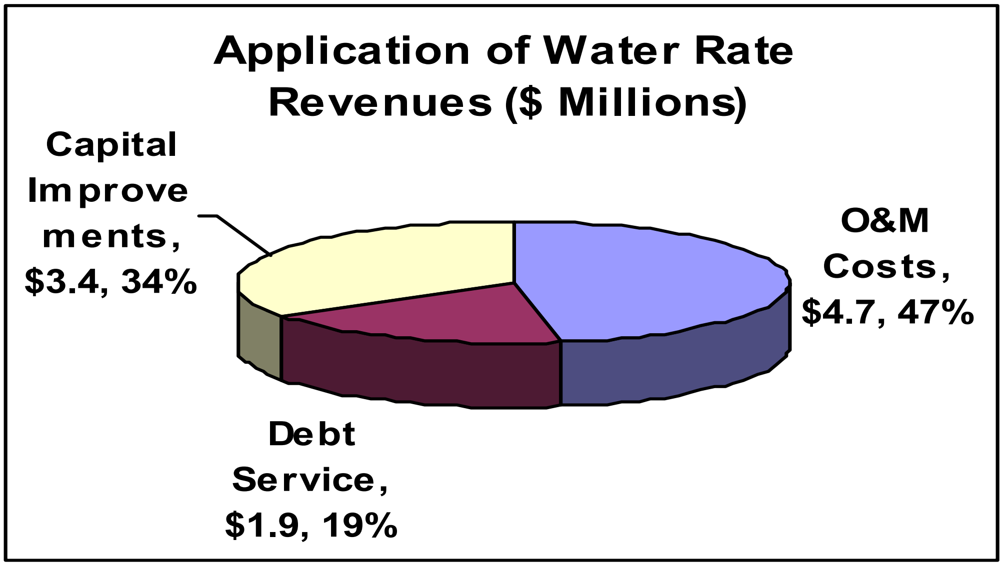
- Planned capital improvement projects total about $96.2 million (in 2005 dollars) over the next 15 years (as presented previously in this report). However, capital improvement projects totaling about $66.5 million are scheduled for the next 5 years. Roughly one-half of planned capital improvement project costs are associated with replacing and upgrading the existing water system, and about one-half is associated with expanding the water system to meet the needs of new development. Near-term capital improvements that must be supported by water rates include water main replacements in advance of road improvements (Measure K projects), the installation of water meters on existing water services, and additional storage capacity.

- Many planned capital improvement projects will be financed with a portion of water rate revenues and water system impact fees. In addition, the financial plan assumes that most expansion-related capital improvements will be constructed by developers and dedicated to the City. Developers will receive credits against a portion of their water system impact fees for constructed facilities, and may be reimbursed for costs that exceed credits from water system impact fees paid by other new development.

- Based on financial plan analyses, it appears that the City will not need to issue any additional long-term debt to finance planned capital improvements. However, an interfund loan of $2.5 million may be required in FY 08-09 to provide sufficient funds for planned capital improvements. Staff has indicated that such an interfund loan may be possible, particularly if it avoids the need for external borrowing. The loan is assumed to be repaid over a 10-year period at an interest rate of 4.0 percent.

- To meet the financial needs of the water utility, water rates should be increased by the following amounts over the next five years. Details of the rate recommendations are contained below and in Section 9.3.

Figure 9.1 Application of Water Rate



- FY 05-06 5.0%
- FY 06-07 5.0%
- FY 07-08 5.0%
- FY 08-09 5.0%
- FY 09-10 3.0%

- To ensure that new development is paying the costs of expanding the water system, water system impact fees should be increased by about 3.2 percent, as described below and in Section 9.4.

Additional details regarding the financial analyses, underlying assumptions, and financial strategy recommendations are presented in Section 9.2.

9.1.2 Water Rate Recommendations

The City's current water rates include flat monthly rates for the City's residential customers and metered rates for non-residential customers. Metered rates include a fixed monthly service charge based on the size of the water meter and a uniform commodity rate applicable to all units of water consumption [1].

Proposed water rate schedules for the next five years are summarized in Table 9.1. The proposed rates include gradual increases to residential flat rates and monthly service charges. It is recommended that the uniform commodity rate applicable to metered rate customers gradually be decreased. This change is intended to help improve revenue stability as the City begins to consider billing residential customers on the metered rates.

Revenues generated by Measure K, approved in November 2002, help to support the water utility and reduce water rates. The residential flat rates proposed in Table 9.1 are about $3.00 per month lower than would otherwise be required without Measure K. Metered rates are also similarly lower (about 9 percent) due to Measure K revenues being used to offset water system costs.

It is recommended that the City begin efforts to plan for and implement a metering implementation program (see Chapter 7), including efforts to convert residential customers from flat rates to metered rates. Initial steps that should be considered by the City include (1) beginning to read all existing residential water meters on an ongoing basis, (2) placing all new residential service connections on metered rates, and (3) allowing existing residential customers to voluntarily switch from flat rates to metered rates. Additional details regarding water rate recommendations are included in Section 9.3.

[1] One unit of water usage is 100 cubic feet (1 CCF), which equals 748 gallons. Typical single-family usage is estimated to average at about 560 gallons per day (gpd), or about 23 CCF per month. Actual water usage varies across seasons and between customers for a variety of reasons.

Table 9.1 Current and Proposed Water Rates Water Master Plan Update City of West Sacramento						
	Current	**FY 05-06**	**FY 06-07**	**FY 07-08**	**FY 08-09**	**FY 09-10**
Flat Water Rates						
Residential Flat Rates (1, 2, or 3 units) - $/month						
Up to 3/4” meter	$29.93	$31.45	$33.00	$34.65	$36.40	$37.50
1” meter	$30.89	$32.45	$34.05	$35.75	$37.55	$38.70
Additional Units	$16.37	$17.20	$18.05	$18.95	$19.90	$20.50
General Service Flat Rates - $/month						
5/8” x 3/4” meter	$34.02	$35.70	$37.50	$39.40	$41.35	$42.60
3/4” meter	$37.75	$39.65	$41.65	$43.75	$45.95	$47.35
1” meter	$73.49	$77.15	$81.00	$85.05	$89.30	$92.00
1-1/2” meter	$141.59	$148.65	$156.10	$163.90	$172.10	$177.25
Metered Water Rates						
General Service Charges - $/month						
Up to 3/4” meter	$4.96	$6.50	$8.05	$9.70	$11.45	$12.55
1” meter	$8.28	$10.80	$13.40	$16.15	$19.05	$20.90
1-1/2” meter	$16.51	$21.55	$26.70	$32.20	$38.05	$41.70
2” meter	$26.43	$34.55	$42.80	$51.60	$60.95	$66.80
3” meter	$52.88	$69.10	$85.65	$103.25	$121.90	$133.65
4” meter	$82.65	$108.00	$133.85	$161.35	$190.50	$208.85
6” meter	$165.24	$215.90	$267.55	$322.55	$380.90	$417.55
8” meter	$264.42	$345.50	$428.15	$516.15	$609.50	$668.15
10” meter	--	$496.55	$615.40	$741.90	$876.05	$960.40
12” meter	$557.79	$728.80	$903.20	$1,088.85	$1,285.75	$1,409.50
Commodity Rates - $/CCF						
All water use	$1.486	$1.45	$1.40	$1.35	$1.30	$1.25

9.1.3 Water System Impact Fee Recommendations

Water system impact fees are one-time fees paid for each new water service connection. The fees are intended to reflect the estimated reasonable cost of providing capacity in the water system, and are proportionate to the potential demand each new connection may place on the water system. The current water system impact fee is $7,283 for a typical 3/4-inch water service connection. Table 9.2 summarizes the proposed water system impact fees.

Under the proposed fee schedule the fee for a typical 3/4-inch water service connection would be $7,519 or about 3.2 percent higher than the current fee.

Table 9.2 Proposed Schedule of Water System Impact Fees Water Master Plan Update City of West Sacramento				
	Water System Buy-in Component	**Water Treatment Plant Debt Service**	**Infrastructure Expansion Component**	**Total Water System Impact Fee**
General Water Service				
3/4” meter	$2,379	$2,401	$2,739	**$7,519**
1” meter	$3,973	$4,010	$4,573	**$12,556**
1-1/2” meter	$7,922	$7,996	$9,119	**$25,038**
2” meter	$12,680	$12,799	$14,596	**$40,075**
3” meter	$25,384	$25,622	$29,220	**$80,226**
4” meter	$39,658	$40,030	$45,651	**$125,339**
6” meter	$79,292	$80,036	$91,275	**$250,603**
8” meter	$126,872	$128,062	$146,046	**$400,979**
10” meter	$182,397	$184,109	$209,963	**$576,469**
12” meter	$340,989	$344,188	$392,522	**$1,077,699**
Private Fire Protection	$2,379	$2,401	$2,739	**$7,519**
Multiple Dwelling Units				
3 Bedroom Units	$2,379	$2,401	$2,739	**$7,519**
2 Bedroom Units	$2,141	$2,161	$2,465	**$6,767**
1 Bedroom Units	$1,903	$1,921	$2,191	**$6,015**
Mobile Home Park				
Up to 4 units per Acre	$2,379	$2,401	$2,739	**$7,519**
5 or 6 Units per Acre	$2,141	$2,161	$2,465	**$6,767**
7 or 8 Units per Acre	$1,903	$1,921	$2,191	**$6,015**
9 or More Units per Acre	$1,665	$1,681	$1,917	**$5,265**

The proposed water system impact fee has three components:

1. A buy-in component to pay for a share of portions of the existing water system used by new customers.

2. A Bryte Bend WTP debt service component to pay for a proportionate share of the cost of expanding the water treatment plant.

3. An infrastructure expansion component reflecting a proportionate share of the costs of expanding the water system to serve new development.

Developers that construct water system facilities for the City should receive credits against the infrastructure expansion component of the water system impact fee, and may also receive reimbursement of construction costs incurred for infrastructure expansion facilities from the fees paid by other development.

Details of the proposed water system impact fees are contained in Section 9.4 of this chapter.

9.2 MULTI-YEAR FINANCIAL PLAN ANALYSES

This section describes the multi-year financial plan developed for the City's water utility. The financial plan reflects the utility's operating and maintenance costs, debt service obligations, and capital improvement needs, as well as the various sources of revenues and the reserves maintained by the water utility for various purposes. The financial planning model covers a 15-year planning period consistent with the Water Master Plan Update planning period.

The financial plan is used to determine annual water rate revenue requirements. The annual water rate revenue requirement is the amount of revenue needed from water rates to cover planned operating, debt service, and capital program costs with consideration of water system impact fees, Measure K funds, and other revenue, as well as financial reserves.

9.2.1 Fund Structure and Cash Flows

The multi-year financial plan is an annual cash flow model. As a cash flow model, it differs from the financial accounting income statements and balance sheets. The financial plan models the sources and uses of money into and out of the various funds and reserves of the water utility.

The financial plan model was developed based on the fund and account structures used by the City's Water Operating Fund (Fund 506). However, the model also includes separate reserves for replacement and upgrade capital projects and for water system impact fee revenues. In addition, the model reflects recommendations for maintaining a minimum operating reserve within the operating fund. By presenting the water utility in this manner the nexus between revenues and expenditures is more readily apparent.

First and foremost the water utility must generate sufficient revenues to maintain ongoing operations. Second, the water utility must meet the financial obligations accepted when the City issued long-term debt for the utility. Finally, the water utility must meet the needs of replacing, upgrading, and expanding the water system to meet current and future needs. Water system impact fees, presented later in this chapter, are intended to help ensure that new development pays a fair and proportionate share of the costs associated with providing capacity in the water system.

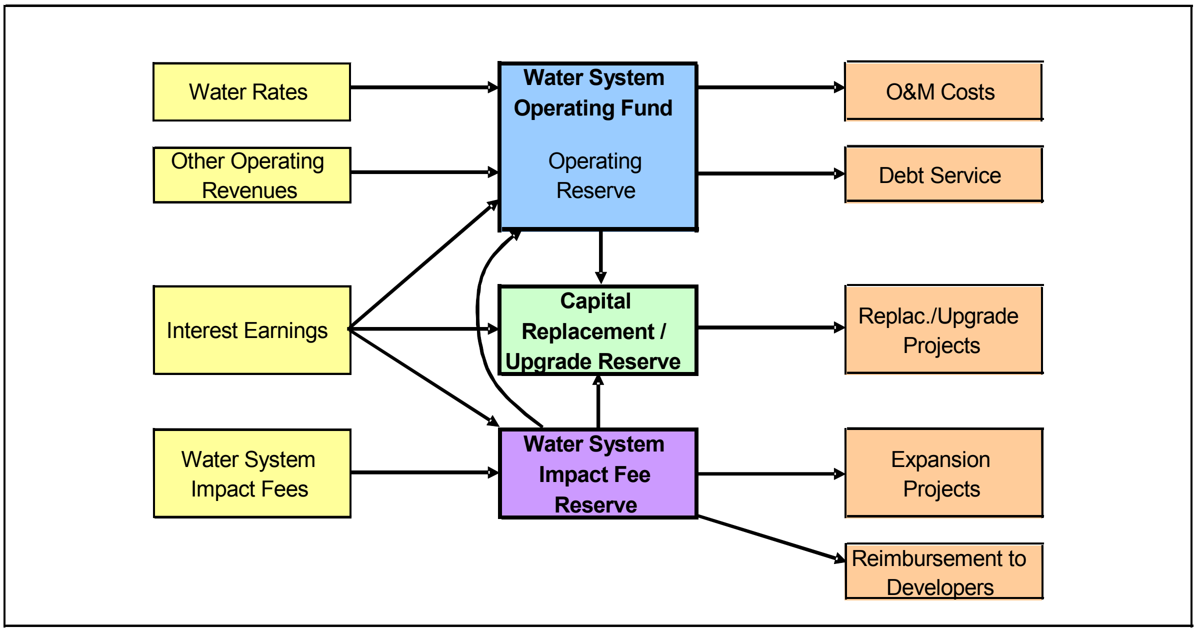
Figure 9.2 summarizes the fund/reserve structure used in the financial planning model. It also illustrates the major revenues, expenditures, and cash flows within the utility. An understanding of the fund/reserve structure and cash flows is important in understanding the financial plan tables presented as Table G.1 of Appendix G. Each fund and reserve is summarized below.

- Water Operating Fund (Fund 506) – The Water Operating Fund is the primary fund of the water utility. Most water system revenues, including water rates and miscellaneous operating revenues, flow into the Water Operating Fund. All water system operating and maintenance expenditures are paid out of this fund. Interest accrues to the fund based on cash balances within the fund. Existing debt service is paid from the Water Operating Fund, although a portion of debt service is covered by funds transferred from the Water System Impact Fee Reserve. Within the Water Operating Fund the financial plan model maintains a minimum Operating Reserve, as described below.

    - *Operating Reserve* – An operating reserve equal to 25 percent of annual operating expenditures, excluding debt service, is recommended and assumed maintained throughout the planning period. The Operating Reserve is intended to reduce the financial risk to the water utility by providing a minimum balance for working capital and providing a source of funds for unanticipated emergencies. At present, the balance in the Water Operating Fund exceeds the recommended minimum Operating Reserve balance. The amount in excess of the minimum Operating Reserve is shown as Uncommitted Fund Balance in the financial plan model, and is used to reduce rate increases (i.e., excess fund balance is used to offset otherwise required rate increases).

- ***Capital Replacement/Upgrade Reserve*** – The Capital Replacement/Upgrade Reserve is not currently part of the water utility's fund/reserve structure. However, this type of reserve is helpful for managing the financing needs of the utility's capital improvement program. The Capital Replacement/Upgrade Reserve is a common mechanism used by utilities to support rehabilitation and upgrade of facilities. The Capital Replacement/Upgrade Reserve should be established and used to set aside funds over a period of time to replace and upgrade existing capital facilities. It is common to support this type of fund through annual transfers from the Water Operating Fund, and to include the replacement/upgrade contribution in the rate base. When capital facility replacements or upgrades are required the projects are budgeted and moneys spent from the Capital Replacement/Upgrade Reserve. This funding mechanism improves rate stability by providing a constant draw on the rate base even though annual replacement and upgrade expenditures may vary significantly from one year to the next.

Figure 9.2 Financial Plan Model Fund/Reserve Structure and Cash Flow Schematic



Some utilities use annual accounting depreciation as the amount to be contributed to a capital replacement/upgrade reserve each year. Depreciation is usually a non-cash accounting entry used to expense an asset over time, and may have little relevance to actual replacement/upgrade needs. Alternatively, utilities may tie the annual replacement/upgrade transfer to average planned annual expenditures. This requires having a reasonably well defined capital improvement plan covering a multi-year period. The Water Master Plan Update provides the information required to estimate annual transfers to the Capital Replacement/Upgrade Reserve. An annual transfer from the Water Operating Fund to the Capital Replacement/Upgrade Reserve beginning at $3.4 million in FY 05-06 is proposed, with annual increases equal to the rate of inflation. The manner in which this amount was derived is described in further detail later in this section.

- ***Water System Impact Fee Reserve*** – Government Code Section 66013 contains requirements for water system connection fees and capacity charges (impact fees). The statute includes requirements for the accounting of impact fees. The financial plan model uses the proposed Water System Impact Fee Reserve to account for estimated future water system impact fee revenues and expenditures. As described in Section 9.4, proposed water system impact fees are comprised of three components and are used to (1) cover a portion of the City's debt service obligations, (2) cover the cost of planned expansion projects, (3) reimburse developers for costs incurred to construct water system facilities for the City, and (4) buy into the existing water system.

9.2.2 Financial Plan Assumptions

The financial analyses presented herein reflect a number of assumptions and financial objectives. The financial plan model was developed based on the City's FY 04-05 water utility operating budget, the capital improvement plan as presented in this Water Master Plan Update, debt obligations as presented in official statements pertaining to the water utility's 2002 and 2003 debt issues, customer and water use data from the City's utility billing system, and other data and information provided by the City. While the financial planning model reflects a number of assumptions, the model starts with the line-item level of detail contained in the City's budget documents and accounting system. Beyond FY 04-05, estimates of future operating costs are based on the current operating budget, as well as specific adjustments that are described below.

Table 9.3 summarizes some of the underlying assumptions reflected in the financial planning model. These and other assumptions described below have been reviewed with staff, and are believed reasonable. It is important to note, however, that long-range plan estimates are sensitive to some of the underlying assumptions. The financial planning model is valuable for planning and decision-making purposes. However, the plan should be

Table 9.3 **Summary of Financial Plan Assumptions**
Water Master Plan Update
City of West Sacramento

	FY 04-05	FY 05-06	FY 06-07	FY 07-08	FY 08-09	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19	FY 19-20
Financial and Growth Assumptions																
Interest Rate		2.0%	2.5%	3.0%	3.5%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Inflation Rate		3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Growth Rate		4.7%	4.8%	4.8%	4.7%	4.7%	4.8%	4.8%	4.8%	4.8%	4.8%	4.7%	4.8%	4.8%	4.7%	4.7%
Minimum Operating Reserve		25%	of budgeted operating and maintenance expense, excluding debt service.													
Debt Service Coverage Requirement		115%	of annual debt service.													
Customer Account Data																
Flat Rate Accounts	10,277	10,765	11,283	11,832	12,397	12,987	13,613	14,277	14,971	15,696	16,465	17,256	18,091	18,970	19,862	20,802
Metered Residential Accounts	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metered General Accounts	1,182	1,238	1,296	1,356	1,419	1,486	1,556	1,629	1,705	1,786	1,870	1,958	2,049	2,145	2,246	2,352
Metered Irrig. Accounts	109	115	121	127	133	139	145	151	158	165	172	180	188	197	206	215
Total Accounts	**11,568**	**12,118**	**12,700**	**13,315**	**13,949**	**14,612**	**15,314**	**16,057**	**16,834**	**17,647**	**18,507**	**19,394**	**20,328**	**21,312**	**22,314**	**23,369**
3/4" Equiv. Meters	16,900	17,700	18,540	19,420	20,340	21,300	22,310	23,370	24,480	25,640	26,860	28,130	29,460	30,860	32,320	33,850
New 3/4" Equiv. Meters		800	840	880	920	960	1,010	1,060	1,110	1,160	1,220	1,270	1,330	1,400	1,460	1,530
Estimated Water Use (CCF)																
Flat Rate	2,836,000	2,971,000	3,114,000	3,266,000	3,422,000	3,584,000	3,757,000	3,940,000	4,132,000	4,332,000	4,544,000	4,763,000	4,993,000	5,236,000	5,482,000	5,741,000
Metered Resid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metered Gen'l.	2,306,000	2,417,000	2,530,000	2,648,000	2,771,000	2,901,000	3,038,000	3,180,000	3,328,000	3,486,000	3,649,000	3,821,000	3,998,000	4,185,000	4,382,000	4,588,000
Metered Irrig.	121,000	127,000	134,000	140,000	147,000	154,000	160,000	167,000	175,000	182,000	190,000	199,000	208,000	218,000	228,000	238,000
Total	5,263,000	5,515,000	5,778,000	6,054,000	6,340,000	6,639,000	6,955,000	7,287,000	7,635,000	8,000,000	8,383,000	8,783,000	9,199,000	9,639,000	10,092,000	10,567,000
Total (AF)	12,082	12,661	13,264	13,898	14,555	15,241	15,966	16,729	17,528	18,365	19,245	20,163	21,118	22,128	23,168	24,258
Unaccounted for Losses	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%
Water Production	**13,277**	**13,913**	**14,576**	**15,273**	**15,994**	**16,748**	**17,546**	**18,383**	**19,261**	**20,182**	**21,148**	**22,157**	**23,207**	**24,317**	**25,459**	**26,658**

viewed as an indicator of future conditions, not as a precise forecast. Primary assumptions reflected in the financial planning model include:

- ***Inflation Rates*** – General inflation and construction inflation are both assumed to be 3.0 percent per year through the 15-year planning period. While inflation rates can vary from year to year, this value is reflective of long-term average and considered reasonable in the current economic environment. The inflation rate is applied to all operating and maintenance costs. The capital improvement project costs presented elsewhere in this report are expressed in current (2005) value. The financial plan escalates these costs to future years based on the 3.0 percent inflation rate.

- ***Interest Rates*** – Interest rates are currently near historic lows. Interest earnings on the water utility's financial reserves are currently about 2.0 percent per year. However, historic interest rates on investments (based on LAIF) are about 4.0 to 5.0 percent. The financial plan assumes that the current 2.0 percent interest rate will gradually increase to 4.0 percent over the next five years, and then remain at 4.0 percent through the end of the planning period. Interest earnings are estimated in the financial planning model based on beginning-of-year fund/reserve balances. Interest accrues to each fund/reserve. Interest on existing long-term debt is that amount shown on debt service schedules. A 4.0 percent interest rate is assumed for the proposed interfund loan.

- ***Current Customer Base and Growth Assumptions*** – The City's water utility currently has about 11,600 active water service customers including about 10,300 single-family customers. All single-family customers are flat rate customers, and nearly all non-residential customers are metered rate customers. While the City will need to move all residential customers to metered rates by 2013, no decisions have been made regarding the timing and strategy for switching customers from flat to metered rates. The financial plan has the ability to model a transition to metered rates. However, for purposes of this report all single-family customers are shown to pay flat rates (it should be noted, however, that whether on flat or metered rates the costs attributable to the single family customer group would be the same, and the revenues to be generated from this group should be the same).

  The *Financial Plan for the Bryte Bend WTP Expansion*, updated in June 2002, contained estimates of future connections to the water system. The estimates contained in that report included annual new connections varying annually between 800 and 1,800 new connections per year. The growth rate contained in that report averaged 4.74 percent per year. Staff has indicated that actual growth has reasonably tracked the estimates contained in the 2002 report. Following discussions with staff, the financial analyses presented herein are based on a uniform 4.74 percent growth rate through the planning period. Using this assumption the number of new connections starts at 800 in FY 05-06 and gradually increases to 1,530 by 2020.

This assumption is consistent with the 2002 report, but is also somewhat more conservative, from the financial perspective.

It should be noted that the financial condition of the water utility is sensitive to the assumed growth rate. The growth rate affects water system impact fee revenues, water rate revenues, and certain operating and maintenance cost estimates. As a result, using a somewhat conservative assumption was recommended and is used herein.

- ***Water Sales and Water Production*** – Water sales and water production are both estimated based on recent metered water use data, estimates of single-family water usage, and water production records. Single-family residential water use is assumed to average about 23 CCF per month (equivalent to the 560 gpd cited elsewhere in this Water Master Plan Update). Water production is always greater than water sales to customers due to unaccounted for system losses. A 9 percent loss factor is assumed. Total water production is estimated at about 13,900 acre-feet (AF) in FY 05-06 and increases to nearly 26,700 AF by 2020 [2]. Water sales and production are assumed to increase at the same rate as the customer growth rate (i.e., average consumption per account remains the same during the planning period).

- ***Operating and Maintenance Costs*** – All operating and maintenance costs are inflated from the FY 04-05 budget based on the annual inflation rate of 3.0 percent. Furthermore, variable operating and maintenance costs are also escalated based on customer growth. For example, utility costs, chemical costs, and maintenance expenses are escalated based on both inflation and growth rates. Public Works staff costs, including administrative support, are also escalated based on both general inflation and customer growth. While the number of staff will not increase in proportion to the number of customers, staff costs, including insurance and benefit costs, tend to increase at a rate greater than general inflation. Therefore, the assumptions contained should reasonably reflect future staff cost trends.

- ***Long-Term Debt Obligations*** – The City's water utility issued long-term debt on several occasions during its history. At present, the water utility has repayment obligations under debt issued in 2002 and in 2003. The financial plan assumes that existing long-term debt obligations will be repaid as scheduled. In addition, the water utility is required to maintain a debt service coverage factor of 1.15. While the coverage factor does not control the financial analysis, the model estimates the coverage factor each year of the planning period. Table 9.4 summarizes existing and estimated future debt service obligations.

[2] One acre-foot is equal to 435.6 CCF or 325,851 gallons.

Table 9.4 Summary of Debt Service Obligations
Water Master Plan Update
City of West Sacramento

	FY 04-05	FY 05-06	FY 06-07	FY 07-08	FY 08-09	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19	FY 19-20
2002 Revenue Bonds																
Principal	90,000	95,000	100,000	105,000	110,000	115,000	120,000	125,000	130,000	135,000	145,000	150,000	155,000	165,000	170,000	180,000
Interest	1,235,500	1,231,450	1,227,175	1,222,675	1,217,950	1,213,000	1,207,825	1,202,425	1,196,800	1,190,950	1,184,605	1,177,790	1,170,740	1,163,455	1,155,700	1,147,625
2003C Water Revenue Bonds																
Principal	1,485,000	1,140,000	1,160,000	1,185,000	1,210,000	1,235,000	1,265,000	1,305,000	1,350,000	1,400,000	1,450,000	1,530,000	1,610,000	1,670,000	1,740,000	1,810,000
Interest	1,602,968	1,946,563	1,923,763	1,900,563	1,876,863	1,849,638	1,817,528	1,779,578	1,736,513	1,687,238	1,633,338	1,557,213	1,476,888	1,412,488	1,345,688	1,273,913
2008 Interfund Loan																
Principal						208,227	216,556	225,219	234,227	243,597	253,340	263,474	274,013	284,974	296,372	
Interest						100,000	91,671	83,009	74,000	64,631	54,887	44,753	34,214	23,254	11,855	
Total Debt Service Payments	4,413,468	4,413,013	4,410,938	4,413,238	4,414,813	4,720,865	4,718,580	4,720,230	4,721,540	4,721,415	4,721,170	4,723,230	4,720,855	4,719,170	4,719,615	4,411,538

FY 08-09 Interfund Loan			
Amount of Issue	2,500,000	2,500,000	Net Proceeds
Interest Rate	4.0%	0.0%	Issuance Costs
Term	10	No	Debt Service Reserve
Annual Payment	308,200		

Based on the purposes and uses of debt proceeds in 2002 and 2003, it is estimated that about 58 percent of existing annual debt service is associated with expansion of the Bryte Bend WTP and therefore allocable to new development. About 42 percent of annual debt service is related to past improvements and the refunding of past debt, and should appropriately be paid from water rate revenues [3].

One objective reflected in the financial analysis was to avoid or minimize the need for additional long-term debt. However, there is a concentration of capital improvement costs during the next five years, and unreasonably high water rate increases would be required to fund all capital projects, as scheduled, without additional debt. City staff indicated that limited funds may be available internally within the City and loaned to the water utility to avoid the need for external borrowing. As a result, the financial plan reflects a $2.5 million interfund loan to the water utility in FY 08-09. That loan is also assumed to be repaid over ten years with equal principal and interest payments and a 4.0 percent interest rate.

- ***Capital Improvement Program*** – The capital improvement program reflected in the financial plan analyses is consistent with the program presented elsewhere in this Water Master Plan Update. All costs (presented in 2005 dollars elsewhere in the report) have been escalated to future years using the 3.0 percent inflation factor. Capital project costs attributable to rehabilitating or upgrading the existing water system are reflected as expenses from the Capital Replacement/Upgrade Reserve. Expansion-related capital improvements are largely assumed to be constructed by developers (subject to potential reimbursement). Expansion-related projects to be constructed by the City are shown being paid for from the Water System Impact Fee Reserve.

  One of the critical underpinnings of the financial analyses presented herein is that most expansion-related projects will be constructed by developers and dedicated to the City. In affect, developers provide the financing of most expansion-related facilities. This is to be accomplished through development agreements, credits against a portion of water system impact fees, and potential reimbursement of costs from fees paid by other developers. If developers do not construct and dedicate needed facilities in this manner, the City will likely need to issue additional long-term debt in order to finance planned expansion-related facilities when they are needed.

- ***Water System Impact Fee Revenues*** – Water system impact fees are the revenues paid by new development at time of connection to the water system. Proposed water system impact fees are described in Section 9.4. Annual water system impact fee revenues are estimated in the financial planning model based on the number of new

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3 One hundred percent of the 2002 debt and 40 percent of the 2003 debt is associated with the expansion of the Bryte Bend WTP.

connections and the proposed fee schedule. The plan further assumes that the proposed fees will be increased at the rate of inflation each year.

- ***Water Rate Revenues*** – The financial plan is used to estimate the annual water rate revenue requirement for each year of the planning period. Specific rate schedules are then derived from annual revenue requirements for FY 05-06 through FY 09-10, as presented in Section 9.3. Annual water rate revenue requirements are determined based on operating and maintenance costs, debt service obligations, contributions to the Capital Replacement/Upgrade Reserve, and other revenues and transfers reflected in the model. Water rate revenue increases in each year reflect both general rate increases as well as growth in the customer base.

9.2.3 Financial Plan Results and Recommendations

The City's water utility has benefited from the addition of new customers resulting from recent growth and new development. However, the capital improvement needs contained in the Water Master Plan Update will require increases in both water rates and water system impact fees. Fortunately, with continued new development only moderate annual rate and fee increases are expected to be required.

The City's water utility is generally self-sufficient, generating revenues primarily from water rates and water system impact fees. Revenues derived from the City's Measure K are used to offset water system operating costs. Residential water bills are currently about $3.00 dollars lower than would otherwise be required due to the availability of Measure K funds. This equates to about a 9 percent lower water bill for residential customers. As water rates increase over time, the $3.00 Measure K offset will represent a smaller portion of the water bill. It is estimated that by FY 09-10, the $3.00 offset will represent about 7.5 percent of the cost of service.

As described previously, the water utility's debt service obligations have been split between existing customers (water rates) and new development (water system impact fees). The water system impact fees (presented in Section 9.4) include a Bryte Bend WTP debt service component that reflects each unit of development's fair share of debt service costs. However, revenues from that component alone may not be adequate to meet the annual debt service payment requirements attributable to new development. To reduce financial risk to the water utility and to protect ratepayers, revenues from other water system impact fee components should be applied to the growth portion of debt service, if necessary. According to the financial plan model, by the end of the planning period, all financial obligations are fairly met through the combination of water system impact fees and water rates.

The proposed Capital Replacement/Upgrade Reserve reflects planned capital expenditures to rehabilitate and upgrade the water system. The cost of these projects is covered through annual transfers from the Water Operating Fund, as well as available revenues from the buy-in component of the proposed water system impact fee. Based on the cost and timing of projects, as well as estimates of water system impact fee revenues, the projects included in the Capital Replacement/Upgrade Reserve can be nearly fully funded if the City transfers $3.4 million from the Water Operating Fund in FY 05-06 and increase this amount annual at the rate of inflation. However, due to a concentration of projects over the next five years or so, an interfund loan of $2.5 million is shown to be required in FY 08-09 to overcome a cash shortfall in the capital program. The City should reevaluate its financial situation prior to that time to assess whether such a loan will actually be required (or a different amount), based on conditions at that point in time.

In order to meet all financial obligations of the water utility, it is recommended that the City increase water rates by the following amounts:

- FY 05-06 5.0%
- FY 06-07 5.0%
- FY 07-08 5.0%
- FY 08-09 5.0%
- FY 09-10 3.0%

With these water rate increases (as well as the proposed increases in water system impact fees) the water utility is expected to:

- Cover all operating, maintenance, and debt service costs and obligations.
- Meet financial requirements for replacing pipelines in advance of road improvements (Measure K projects) and for installing water meters on existing unmetered services within the statutorily required deadline.
- Maintain an Operating Reserve in the Water Operating Fund equal to 25 percent of annual operating and maintenance costs.
- Avoid the need to issue additional bonds to financial water system improvements.
- Avoid significant major rate increases, which may be required if moderate increases are not implemented in a timely manner.

Detailed tables of the financial plan model are included in Appendix G of this report.

9.3 WATER RATES

This section describes the development of water rate recommendations for the City's water utility. It includes a description of the current water rates, as well as the calculation of proposed water rates. Specific rate schedules are proposed for the next five years.

9.3.1 Current Water Rates

The City's current water rate structure includes fixed monthly service charges for all residential customers and metered water rates for non-residential customers. The metered water rate structure includes a fixed service charge based on the size of the water meter and a uniform commodity rate applicable to each unit of water use. Table 9.5 summarizes the current water rates of the City, which were implemented in January 2004.

Table 9.5 Current Water Rates
Water Master Plan Update
City of West Sacramento

Flat Water Rates	
Residential Flat Rates (1, 2, or 3 units) - $/month	
Up to 3/4" meter	$29.93
1" meter	$30.89
Additional Units	$16.37
General Service Flat Rates - $/month	
5/8" x 3/4" meter	$34.02
3/4" meter	$37.75
1" meter	$73.49
1-1/2" meter	$141.59
Metered Water Rates	
General Service Charges - $/month	
Up to 3/4" meter	$4.96
1" meter	$8.28
1-1/2" meter	$16.51
2" meter	$26.43
3" meter	$52.88
4" meter	$82.65
6" meter	$165.24
8" meter	$264.42
12" meter	$557.79
Commodity Rates - $/CCF	
All water use	$1.486

The City's metered water rates rate characterized as conservation-oriented because about 87 percent of metered rate revenue is generated from the commodity rate. About 13 percent of metered rate revenue is derived from service charges. This structure is acceptable when most customers pay flat rates (which provide stable revenues). However, as the City considers metering all customers the current metered structure could lead to greater revenue volatility and unnecessary financial risk. This issue is addressed with the rate structure recommendations presented herein.

Based on discussions with staff, the current water rate structure is generally performing as intended from the perspective of generating stable and predictable revenues. A few unmetered non-residential customers are subject to general service flat rates. Due to physical constraints, it has been impractical to install water meters on these services.

It is estimated that a typical single-family residential customer uses an average of 23 CCF of water per month. Based on this water usage and a typical 3/4-inch residential water meter, the monthly water bill for a residential customer under the City's current general service metered rates would be $39.14, or about $9.21 higher than the typical single family flat rate. This difference suggests a possible imbalance between the flat rates and metered rates. The water rate recommendations included herein are intended to rectify any inequity between customer classes and rate structure.

In early 2005, City staff proposed that the City Council approve an increase to the City's water rates. The proposal included a $2.00 per month increase to the typical single-family flat rate (3/4-inch meter). The City Council declined to act on that proposal, pending the results of the Water Master Plan Update and the rate recommendations presented herein.

9.3.2 Water Rate Calculations

The calculation of water rates involves a three-step process. First, the annual water rate revenue requirement must be determined. The water rate revenue requirement is that amount of revenues to be generated annually to meet operating, debt service, and capital program needs with consideration of other water system revenues and reserves. Annual water rate revenue requirements were determined using the multi-year financial planning model described in the previous section. The second step in the rate setting process is a cost of service analysis accomplished by the allocation of water system costs to rate components. Finally, the third step in the process is rate design and the development of water rate schedules.

9.3.2.1 Annual Water Rate Revenue Requirement

The annual water rate revenue requirements were determined for the period FY 05-06 through FY 09-10 using the financial planning model. The annual revenue requirements are as summarized below, and are also contained in the financial plan tables included in Appendix G.

- FY 05-06 $8.10 million
- FY 06-07 $8.68 million
- FY 07-08 $9.32 million
- FY 08-09 $10.02 million
- FY 09-10 $10.61 million

Current water rates have been estimated to generate about $7.52 million during FY 04-05. The water rate schedules developed for each of the next five years are intended to generate the amount of revenue listed above. Rate calculations also reflect assumptions for new development, which adds to the number of customers receiving water service each year.

9.3.2.2 Cost of Service Analysis

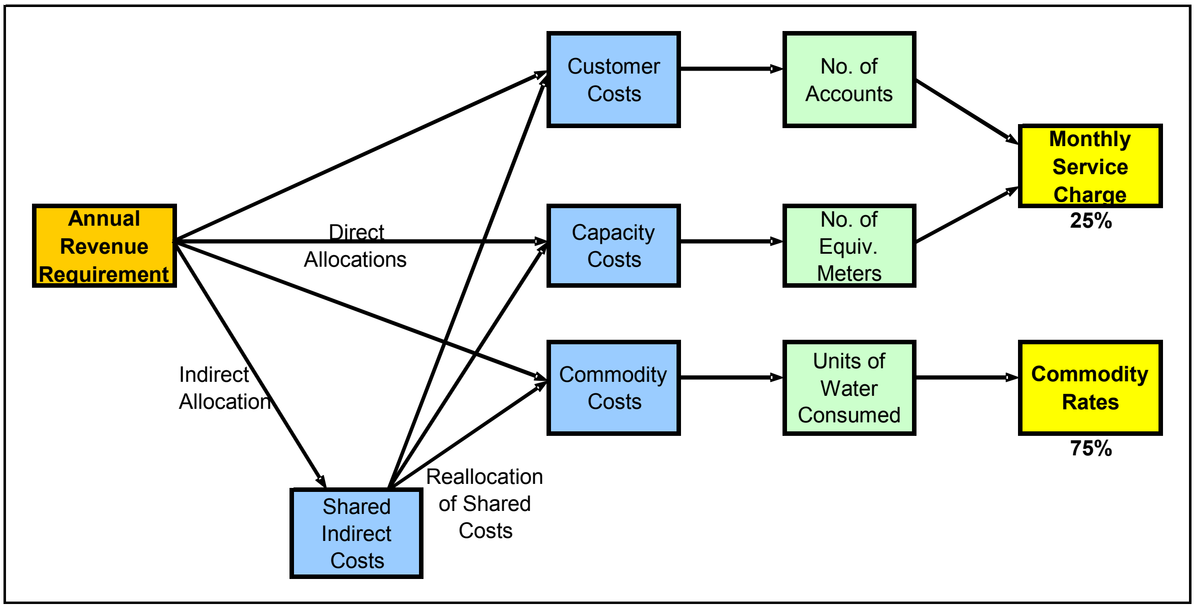
Cost allocation is the method by which the annual water rate revenue requirement is recovered from each customer class based on the cost of providing water service. The cost allocation process is shown schematically in Figure 9.3. There are a number of ways to allocate costs for rate setting purposes. Some are rather complex and require detailed knowledge of water system costs, cost drivers, and customer water use characteristics (including peaking characteristics). Others are somewhat simpler to understand and administer. The approach used herein is commensurate with available data that categorizes water system costs into three specific categories. These include:

- ***Customer Costs*** – Customer costs such as meter reading, billing, and customer service are fixed costs that tend to vary as a function of the number of customers served. Customer costs are allocated equally to all customers based on the total number of accounts, and are included in the monthly service charge calculation.

- ***Capacity Costs*** – Capacity costs are also fixed costs. However, they tend to vary in relation to the capacity of the water system. Customers that can place greater or lesser demands on the water system should bear greater or lesser shares of these costs. The water system is sized to meet peak demands. The demand that each customer could potentially place on the water system is reflected in the size and capacity of the water meter. Capacity costs include fixed operating costs, water system maintenance, and debt service. Capacity costs are allocated to each customer based on the size and capacity of the water meter, and are included in the monthly service charge calculation.

- ***Commodity Costs*** – Commodity costs include those costs that vary with the amount of actual water usage. Water treatment and pumping costs are the most significant examples. In addition, other costs that may not be truly variable are often allocated based on water usage because allocating these costs to each customer based on water usage is an equitable basis. Commodity costs are used to determine the commodity rates of a rate structure. As such they become part of the variable revenue of the rate structure. Many utilities also place what may be considered fixed costs into the variable commodity component as a means of encouraging water conservation. It is fairly typical for commodity rates to account for 75 to 85 percent of water rate revenues, even when a majority of costs might be considered fixed. Contributions to the Capital Replacement/Upgrade Reserve are included in the rate analysis are commodity costs.

Figure 9.3 Cost Allocation Flow



Some cost items are not directly allocated to any of the three components identified above. Instead these costs are first allocated as shared (indirect) costs, and subsequently reallocated to each of the three components based on the percentage of costs that were directly allocated to these components.

The allocation of costs to each cost component occurs at the individual line-item level of detail in the City's water utility budget and account structure. Most costs are allocated directly to the customer, capacity, or commodity components, although some are categorized as shared costs then reallocated indirectly. As shown in Figure 9.3, an allocation of costs that results in 25 percent of water rate revenues being derived from service charges and 75 percent from commodity rates is recommended. This allocation places greater emphasis on the service charge than the current water rate structure, and will be prudent when the City begins to convert single family residential customers from flat rates to metered rates.

Because changes in the rate structure can be disruptive, it is recommended that the proposed cost allocation be reflected in the rate structure gradually. The proposed water rate scheduled presented below include a five-year transition period for this change.

9.3.2.3 Water Rate Design and Proposed Rate Schedules

Water rate design and the development of rate schedules took place after the annual water rate revenue requirement has been determined, and after the cost of service analysis has been performed. The metered water rates developed in this study include a fixed monthly service charge based on the size of the water meter and a uniform commodity rate. Flat rates are based on the current rates and reflect the adjustments that (1) should make them consistent with the metered rates over time, and (2) anticipated that the flat rates will eventually be phased out entirely (though not in the five-year period covered herein).

The monthly service charge is intended to recover the costs allocated to fixed customer and capacity components in the cost allocation process. Service charges vary based on meter size, reflecting the capacity associated with each meter size. Commodity rates are intended to recover the costs allocated to the commodity component, including costs that may not be strictly variable with water usage, as described previously.

It is recommended that the transition in the water rate structure to place greater emphasis on the monthly fixed service charge be achieved over a five-year period. This will minimize any disruptive aspect of the rate structure change. This proposed strategy includes gradual increases to service charges and gradual decreases to the uniform commodity rate. Flat rates are proposed to increase gradually during this period.

Table 9.6 presents details of cost of service water rate calculations for FY 09-10. FY 09-10 is selected for presentation since it coincides with the end of the proposed transition period. The water rate calculation is based on the estimated number of customers, annual water

Table 9.6 **Water Rate Calculation for FY 09-10**
Water Master Plan Update
City of West Sacramento

	No. of Accounts by Meter/Connection Size											
	2nd Unit	**Up to 3/4"**	**1"**	**1 1/2"**	**2"**	**3"**	**4"**	**6"**	**8"**	**10"**	**12"**	**Total**
No. of Accounts												
Flat Rate	887	10,177	1,921	2								12,987
Metered Residential		-	-	-								-
Metered General		213	399	309	470	7	59	24	1	-	4	1,486
Metered Irrigation		20	27	20	70	-	2					139
Total Accounts	887	10,410	2,347	331	540	7	61	24	1	-	4	14,612
Hydraulic Capacity Factor	0.67	1.00	1.67	3.33	5.33	10.67	16.67	33.33	53.33	76.67	112.50	
No. of 3/4" Equiv. Meters												
Flat Rate	594	10,177	3,208	7	-	-	-	-	-	-	-	13,986
Metered Residential	-	-	-	-	-	-	-	-	-	-	-	-
Metered General	-	213	666	1,029	2,505	75	984	800	53	-	450	6,775
Metered Irrigation	-	20	45	67	373	-	33	-	-	-	-	538
Total 3/4" Equiv. Mtrs.	594	10,410	3,919	1,102	2,878	75	1,017	800	53	-	450	21,299
Monthly Service Charge Calculation												
Customer Cost	$ 1.60	$ 1.60	$ 1.60	$ 1.60	$ 1.60	$ 1.60	$ 1.60	$ 1.60	$ 1.60	$ 1.60	$ 1.60	
Capacity Cost	$ 0.64	$ 0.95	$ 1.58	$ 3.16	$ 5.05	$ 10.12	$ 15.81	$ 31.60	$ 50.56	$ 72.69	$ 106.66	
Debt Service Cost	$ 5.68	$ 8.47	$ 14.15	$ 28.21	$ 45.15	$ 90.38	$ 141.21	$ 282.33	$ 451.74	$ 649.44	$ 952.94	
Total Service Charge	**$ 7.91**	**$ 11.01**	**$ 17.32**	**$ 32.96**	**$ 51.80**	**$ 102.09**	**$ 158.61**	**$ 315.52**	**$ 503.90**	**$ 723.73**	**$ 1,061.20**	
Est. Annual Revenues	$ 84,147	$ 1,375,866	$ 487,909	$ 130,915	$ 335,644	$ 8,576	$ 116,099	$ 90,870	$ 6,047	$ -	$ 50,938	$ 2,687,010

Cost Summary	Total	Fixed	Variable
Customer Cost	$ 279,680	$ 279,680	$ -
Capacity Cost	$ 242,330	$ 242,330	$ -
Debt Service Cost	$ 2,165,000	$ 2,165,000	$ -
Capital Replac. Cost	$ 3,826,000	$ -	$ 3,826,000
Commodity Cost	$ 4,098,990	$ -	$ 4,098,990
Total Revenue Rqmt.	$ 10,612,000	$ 2,687,010	$ 7,925,000
		25%	75%

Commodity Rate Calculation	Use (CCF)	Rate ($/CCF)	Est. Ann. Revenues
Flat Rate	3,422,000	$ 1.250	$ 4,277,500
Metered Residential	-	$ 1.250	$ -
Metered General	2,771,000	$ 1.250	$ 3,463,750
Metered Irrigation	147,000	$ 1.250	$ 183,750
Totals	6,340,000		$ 7,925,000

usage, and revenue requirements that are anticipated for FY 09-10. The rate model calculation anticipates that residential customers would be on metered rate by that time, although decisions regarding the conversion to metered billing have not yet been made.

Table G.2 in Appendix G provides additional details on the revenue requirement and the allocation of costs for the rate calculations presented in Table 9.6

Table 9.7 presents the proposed water rate schedules for FY 05-06 through FY 09-10 for the City's water utility. The proposed rates are intended to meet the annual revenue needs of the water utility, as estimated in the financial plan. The proposed rates include gradual increases in residential flat rates as well as monthly service charges for metered rates. Commodity rates are proposed to decrease slightly each year to achieve the rate restructuring described above. The proposed rate schedule for FY 09-10 in Table 9.7 differs from the schedule determined and presented in Table 9.6. The difference is due to the fact that decisions regarding conversion to metered rates have not yet been made by the City. The proposed rate schedules in Table 9.7 assume continuation of the residential flat rates. Until the metering implementation plan and timetable is developed, it would be premature to present rate schedules that assume when that conversion may occur.

Most of the City's water service customers are single-family residences. These customers currently pay about $29.93 per month. Under the proposed rates, the typical single-family monthly water bill would increase by $1.52, $1.55, $1.65, $1.75, and $1.10 in each of the next five years. These increases are about 5.0 percent in each of the first four years, and about 3.0 percent in the fifth year.

9.3.3 Transition to Metered Rates

The City is required to convert all customers to metered billing by 2013. Chapter 7 of this report describes the requirements for installing meters and the time and cost that may be required in greater detail. The City, however, has not explored the details of the conversion of single-family residential customers from flat rates to metered rates. It is recommended that the City examine this issue during the planned metering implementation planning study scheduled for FY 05-06.

The proposed water rate changes over the next five years are intended, in part, to aid in the City's transition to full metered billing. The metered rate structure changes increase the amount of fixed revenue (from service charges) while reducing commodity rates. This will assist to reduce revenue volatility and financial risk as the water utility moves from predominately flat rate revenue to metered rate revenue. The financial and water rate analysis presented herein does not reflect a specific strategy or timeframe for the transition to metered billing, although the financial and rate models are easily adapted for this purpose. Based on previous experience with other water utilities confronted with this same issue, The Reed Group, Inc. offers the following suggestions for the City's consideration.

Table 9.7 Current and Proposed Water Rates Water Master Plan Update City of West Sacramento						
	Current	**FY 05-06**	**FY 06-07**	**FY 07-08**	**FY 08-09**	**FY 09-10**
Flat Water Rates						
Residential Flat Rates (1,2, or 3 units) - $/month						
Up to 3/4” meter	$29.93	$31.45	$33.00	$34.65	$36.40	$37.50
1” meter	$30.89	$32.45	$34.05	$35.75	$37.55	$38.70
Additional Units	$16.37	$17.20	$18.05	$18.95	$19.90	$20.50
General Service Flat Rates - $/month						
5/8” x 3/4” meter	$34.02	$35.70	$37.50	$39.40	$41.35	$42.60
3/4” meter	$37.75	$39.65	$41.65	$43.75	$45.95	$47.35
1” meter	$73.49	$77.15	$81.00	$85.05	$89.30	$92.00
1-1/2” meter	$141.59	$148.65	$156.10	$163.90	$172.10	$177.25
Metered Water Rates						
General Service Charges - $/month						
Up to 3/4” meter	$4.96	$6.50	$8.05	$9.70	$11.45	$12.55
1” meter	$8.28	$10.80	$13.40	$16.15	$19.05	$20.90
1-1/2” meter	$16.51	$21.55	$26.70	$32.20	$38.05	$41.70
2” meter	$26.43	$34.55	$42.80	$51.60	$60.95	$66.80
3” meter	$52.88	$69.10	$85.65	$103.25	$121.90	$133.65
4” meter	$82.65	$108.00	$133.85	$161.35	$190.50	$208.85
6” meter	$165.24	$215.90	$267.55	$322.55	$380.90	$417.55
8” meter	$264.42	$345.50	$428.15	$516.15	$609.50	$668.15
10” meter	--	$496.55	$615.40	$741.90	$876.05	$960.40
12” meter	$557.79	$728.80	$903.20	$1,088.85	$1,285.75	$1,409.50
Commodity Rates - $/CCF						
All water use	$1.486	$1.45	$1.40	$1.35	$1.30	$1.25

The City should begin reading existing residential meters on a regular basis as soon as practical. The financial analysis presented herein includes $100,000 beginning in FY 05-06 for an additional meter reader and the vehicle/equipment needed for meter reading. As described in Chapter 7, the transmitters required to radio-read the meters need to be installed.

- The City should consider placing all new residential customers on metered rates, rather than flat rates. The general service metered rates, as proposed herein, are appropriate for single family as well as non-residential customers.

- The City should consider making the metered rates available to flat rate customers on a voluntary basis. Once meter reading commences the City should be able to make a customer's own water use data available upon request, and assist customers in assessing their water use and potential water bills under both flat and metered rates. Many customers would pay less for water service under metered rates, than under flat rates. The voluntary switch from flat to metered rates should be permanent and one-way.
- The metering implementation program, to be developed in FY 05-06 should include developing a timetable and strategy for converting all flat rate customers to metered rates. Some utilities convert customers as meters are installed, while others have decided to wait until all meters are installed before requiring customers to switch to metered rates. Development of the metering implementation program should include public outreach and community input elements. Additional water rate analyses, reflecting a conversion strategy, may be warranted at that time.

9.4 WATER SYSTEM IMPACT FEES

This section describes the calculation of proposed water system impact fees paid by new development at the time of connection to the water system. The proposed fees include a water system buy-in component, a water treatment debt service component, and an infrastructure expansion component. The water system impact fee is intended to reflect the estimated reasonable cost of providing water system capacity for new development.

9.4.1 Current Water System Impact Fees

The City's current water system impact fees are shown in Table 9.8. The current fees were adopted in February 2004 and adjusted for inflation in January 2005. The current fees are comprised of distribution and treatment components, and reflect costs associated with both new and existing water system facilities.

9.4.2 Legal Requirements for Water System Impact Fees

The City has broad authority to charge users for capital facilities. The limitations of that authority are encompassed by the requirement that charges on new development bear a *reasonable relationship* to the needs created by, and the benefits accruing to that development. California courts have long used that *reasonableness* standard or *nexus* test to evaluate the constitutionality of exactions, including water system capital facility fees.

During the 1988 session of the California Legislature sections of the Government Code were added to codify constitutional and decisional law related to fees imposed on new development. Assembly Bill 1600 (AB 1600) enacted Government Code Sections 66000-66003 related to development fees. These code sections generally contain three

Table 9.8	**Current Schedule of Water System Impact Fees Water Master Plan Update City of West Sacramento**		
	Distribution	**Treatment**	**Total**
General Water Service			
3/4” meter	$4,672	$2,611	**$7,283**
1” meter	$7,786	$4,352	**$12,138**
1-1/2” meter	$15,572	$8,703	**$24,275**
2” meter	$24,916	$13,924	**$38,840**
4” meter	$77,861	$43,514	**$121,375**
6” meter	$155,723	$87,027	**$242,750**
8” meter	$249,156	$139,244	**$388,400**
10” meter	$358,162	$200,163	**$558,325**
12” meter	$699,607	$374,218	**$1,073,825**
Private Fire Protection	$4,672	$2,611	**$7,283**
Multiple Dwelling Units			
3 Bedroom Units	$4,672	$2,611	**$7,283**
2 Bedroom Units	$4,205	$2,350	**$6,555**
1 Bedroom Units	$3,737	$2,089	**$5,826**
Mobile Home Park			
Up to 4 Units per Acre	$4,672	$2,611	**$7,283**
5 or 6 Units per Acre	$4,205	$2,350	**$6,555**
7 or 8 Units per Acre	$3,737	$2,089	**$5,826**
9 or more Units per Acre	$3,270	$1,828	**$5,098**

requirements:

1. Local agencies must follow a process set forth in the statutes and made certain determinations regarding the purpose and use of the fee and to establish a nexus or connection between a development project and the public improvement being financed with the fee.

2. The fee revenue must be segregated from the general fund in order to avoid commingling of capital facility fees and the general fund.

3. If a local agency has unspent or uncommitted development fees for five years or more, then it must make annual findings describing the continuing need for that money, or it must refund the fees.

Since the passage of AB 1600 various code sections have been added and modified to further clarify and expand the requirements related to developer fees. In particular, Government Code Section 66013 contains requirements specific to water connection fees and capacity charges. The most pertinent part of Section 66013 states:

> …when a local agency imposes fees for water connections or sewer connections, or imposes capacity charges, those fees or charges shall not exceed the estimated reasonable cost of providing the service for which the fee or charge is imposed…

The key to the statutory requirements for water connection fees and capacity charges is that they shall not exceed the *estimated reasonable cost* of providing service. The City's water system impact fees should also meet the reasonable relationship standard or nexus test mentioned earlier and should reflect consideration of the following criteria, which would likely be considered by a court in evaluating the validity of these fees:

- ***Need*** – Water system impact fees should only be imposed on development that will need capacity in facilities provided by the City (i.e., development with a water connection).
- ***Benefit*** – Improvements to be funded (or reimbursed) by fees should satisfy the service needs related to the development on which the fees are imposed (i.e., new development is served by the facilities paid for by the fees).
- ***Amount*** – The amount of the fees should reflect the reasonable cost of providing service capacity, and the share of the costs attributable to the service needs of new development (i.e., the fees should reflect a proportionate share of costs).
- ***Earmarking*** – Revenue from water system impact fees should be segregated from other funds and used solely to pay for the facilities for which the charge was imposed.
- ***Timely Expenditure*** – Revenue from water system impact fees should be expended within a reasonable time after it is collected.

Applying these criteria to the City's situation requires an understanding of how improvement needs are established, how capacity is provided to new development, how costs are estimated and allocated, and how fee revenues are accounted for and spent.

9.4.3 Calculation of Water System Impact Fees

Proposed water system impact fees are based on a calculation methodology similar to the existing fees. However, the proposed fees include an additional component, which more clearly separates and distinguishes different elements of the fee.

The proposed water system impact fee includes three separate components, as described herein. The components each represent the proportionate share of costs of different elements of the water system. The water system buy-in component represents the cost of existing facilities that comprise of the core of the existing water system (excluding the cost of water treatment facilities, which is included in the second component). The existing water system is valued based on depreciated replacement cost with adjustments for long-term debt financing costs. The second component is the water treatment plant debt service component. This component represents the proportionate share of cost associated with expanding the Bryte Bend WTP to provide treatment capacity for new development. Because the City financed the expansion of the treatment plant this component includes interest costs associated with the financing. The third component relates to the cost of extending infrastructure to newly developing areas. Developers will construct most of the needed new facilities as the need arises. However, costs should be shared by all new development. Developers constructing new facilities will receive credits against this fee component, and may receive reimbursement of excess costs from fees paid by other new development.

Details of the calculation of each of the three components of the water system impact fee are described below.

9.4.3.1 Water System Buy-In Component

The water system buy-in component of the water system impact fee represents the current value of capacity in the existing water system. New development will benefit from this “backbone” system, including transmission and distribution pipelines and other facilities that serve to make the entire integrated water system.

The value of existing water system infrastructure is based on the depreciated replacement cost of water system assets as recorded in the City’s fixed asset records. The depreciated replacement cost was determined using the historical cost of each asset, the service life for accounting purposes, and the *Engineering News Record’s* 20-Cities Construction Cost Index. Table G.3 in Appendix G summarizes the valuation of existing water system facilities.

The valuation included in Table G.3 in Appendix G exclude water treatment plant assets because these are included in the water treatment plant debt service component. Also excluded from the analysis are short-lived assets (less than 10 years), equipment, meters, and service lines. It may be reasonable to include at least some of these excluded assets. However, the fee calculation is somewhat more conservative without them. In addition, cash in dedicated capital reserves is also excluded from the water system valuation, also making the fee calculation somewhat conservative.

In calculating the water system buy-in component certain adjustments to the valuation are made for debt financing. The present value of historical interest costs on long-term debt is added to the cost of existing facilities. In addition, outstanding principal on remaining long-term debt is deducted from the valuation. The City (and the predecessor East Yolo Community Services District) has used several long-term debt issues to help acquire and construct elements of the water system. The City’s long-term debt issues for the water system have included:

- 1983 East Yolo Community Services District Water Revenue Bonds, Series A, in the amount of $6 million for acquisition of the water system from a private water company.
- 1984 East Yolo Community Services District Water Revenue Bonds, Series B, in the amount of $11.5 million for improvements to the water system.
- 1986 East Yolo Community Services District Water Revenue Refunding Bonds, Series 1986, in the amount of $22.195 million to refinance Series A and Series B bonds.
- 1992 West Sacramento Financing Authority Revenue Bonds, Series 1992, in the amount of $29.965 million to refinance the Series 1986 bonds and provide new funds for water system improvements.
- 2002 West Sacramento Financing Authority Revenue Bonds, Series 2002, in the amount of $25.2 million to provide funds for expansion of the Bryte Bend WTP.
- 2003 California Statewide Communities Development Authority Water Revenue Bonds (Pooled Financing Program), Series 2003C, in the amount of $45 million for the City to provide funds for expansion of the Bryte Bend WTP and other water system improvements.

One hundred percent of the 2002 bonds and about 40 percent of the 2003 bonds were used to help financing expansion of the Bryte Bend WTP. Interest costs associated with these portions of those bonds were excluded from the buy-in analysis. Historical interest costs on the remaining debt service was adjusted to present value using the consumer price index and added to the value of existing water system assets. In addition, $23.764 million of outstanding principal on the bonds (again excluding the portion related to expansion of the Bryte Bend WTP) was deducted from the water system buy-in valuation.

The existing water system valuation is divided by the current number of water service connections, expressed in equivalent 3/4-inch meters, to arrive at the base amount for the water system buy-in component of the water system impact fee. Table 9.9 summarizes the water system impact fee calculation. The top portion of Table 9.9 indicates that the water system buy-in component is equal to $2,379 for a 3/4-inch meter.

9.4.3.2 <u>Water Treatment Plant Debt Service Component</u>

In 2002 the City began construction of an expansion of the Bryte Bend WTP. The treatment plant is being expanded from 24 mgd to 58 mgd. Net proceeds of $24.17 million from the bonds issued in 2002 were applied to the expansion of the water treatment plant. In addition, an estimated $17.53 million from the 2003 bond issue is being used to help finance the expansion of the water treatment plant. Expansion of the plant has

Table 9.9 Water System Impact Fee Calculation
Water Mater Plan Update
City of West Sacramento

Water System Buy-In Component		
Depreciated Replacement Cost (1)		
Land	$1,927,000	
Infrastructure	$27,850,000	
Work in Progress	$3,047,000	
Total Buy-In Assets	**$32,824,000**	
Adjustments		
Plus Adjusted PV of Past Interest Costs (2)	$33,568,000	
Less Outstanding Principal on Water System (2)	$(26,187,000)	
Total Water System Buy-In Value	**$40,205,000**	
Number of Existing 3/4" Equivalent Meters	16,900	
Water System Buy-in Components	**$2,379**	
Water Treatment Plan Debt Service Component		
Construction Cost of Bryte Bed WTP Expansion (3)	$41,700,000	
PV of Interest Costs (4)	$31,197,000	
Total Cost of Bryte Bend WTP Expansion	**$72,897,000**	
Added Capacity to Bryte Bend WTP	34.0	mgd
Capacity per 3/4" Equivalent Meter (2.0 x ADD)	1,120	gpd
Number of 3/4" Equivalent Meters that Could be served by Expanded WWTP	30,537	
Water Treatment Plant Debt Service Component	**$2,401**	
Infrastructure Expansion Component (5)		
Current Reimbursable Costs	$1,826,000	
Present Value of Future Water System Expansion Costs (6)	$44,592,000	
Total Future Costs	**$46,418,000**	
Number of Future 3/4" Equivalent Meters During Planning Period	16,950	
Infrastructure Expansion Cost Component	**$2,739**	
Total Water System Impact Fee (3/4" meter)	**$7,519**	

Notes:

(1) Does not include water treatment facilities, equipment, short-lived assets, water meters, or service lines.
(2) Excludes portion related to expansion of Bryte Bend WTP.
(3) Expansion from 24 mgd to 58 mgd. Also includes 36" transmission main.
(4) Includes historical interest costs adjusted based on the CPI and future interest cost discounted at 4.0 percent.
(5) Includes both City- and developer-constructed expansion projects contained in Master Plan Update
(6) Net present value of future costs using a 4 percent discount rate.

been estimated to total about $41.7 million. This includes $35.7 million for the treatment plant and $6 million for a 36-inch transmission main extending from the plant.

The present value of past and future interest to be paid on the bonds used to expand the water treatment plant are estimated at nearly $31.0 million based on the CPI for past interest costs and an assumed discount rate of 4.0 percent on future interest costs.

The cost of expanding the Bryte Bend WTP is divided by the total number of new connections, expressed in 3/4-inch equivalent meters, that can be served with new capacity added to the treatment plant. Using an average annual demand of 560 gpd and a maximum day demand (MDD) peaking factor of 2.0, each new 3/4-inch connection will require 1,120 gpd of treatment capacity. Therefore the 34 mgd expansion (58 mgd less the existing 24 mgd capacity) will provide capacity to serve an additional 30,357 new 3/4-inch equivalent meters.

Dividing the total water treatment plant expansion cost by the number of new connections that can be served results in a Bryte Bend WTP debt service component of $2,401 for a 3/4-inch meter. This calculation is summarized in the middle portion of Table 9.9.

9.4.3.3 Infrastructure Expansion Component

The infrastructure expansion component of the water system impact fee reflects the proportionate share of costs associated with extending the water system into the areas of new development. Expansion related facilities and costs were identified in previous chapters of this Master Plan Update. Expansion related facilities consist primarily of transmission pipelines, water storage reservoirs, and pumping facilities. The facilities included in the analyses herein will be constructed over the next 15 years, and have a net present value of $44.6 million. Also included in this component is about $1.83 million for recently constructed facilities for which reimbursement to developers who constructed the facilities is due. The cost of these expansion facilities is spread across the new development expected to occur over the next 15 years. Based on the growth assumptions presented earlier in this chapter, about 16,950 additional 3/4-inch equivalent meters are expected to be added to the water system over the planning period through 2020.

The resulting infrastructure expansion component is equal to $2,739 for a 3/4-inch water meter, as shown in the bottom portion of Table 9.9.

9.4.4 Schedule of Proposed Water System Impact Fees

A complete schedule of proposed water system impact fees is presented in Table 9.10. The fee schedule separately identifies each of the three fee components and also the amount of the fee for various sizes of water meters. The amount of the fee varies across meter sizes based on the hydraulic capacity (rated flow capacity) associated with each meter size. The capacity of each meter represents the potential demand that each new service connection could place on the water system.

Table 9.10 Proposed Schedule of Water System Impact Fees Water Master Plan Update City of West Sacramento				
	Water System Buy-In Component	**Water Treatment Plant Debt Service**	**Infrastructure Expansion Component**	**Total Water System Impact Fee**
General Water Service				
3/4" meter	$2,379	$2,401	$2,739	**$7,519**
1" meter	$3,973	$4,010	$4,573	**$12,556**
1-1/2" meter	$7,922	$7,996	$9,119	**$25,038**
2" meter	$12,680	$12,799	$14,596	**$40,075**
3" meter	$25,384	$25,622	$29,220	**$80,226**
4" meter	$39,658	$40,030	$45,651	**$125,339**
6" meter	$79,292	$80,036	$91,275	**$250,603**
8" meter	$126,872	$128,062	$146,046	**$400,979**
10" meter	$182,397	$184,109	$209,963	**$576,469**
12" meter	$340,989	$344,188	$392,522	**$1,077,699**
Private Fire Protection	$2,379	$2,401	$2,739	**$7,519**
Multiple Dwelling Units				
3 Bedroom Units	$2,379	$2,401	$2,739	**$7,519**
2 Bedroom Units	$2,141	$2,161	$2,465	**$6,767**
1 Bedroom Units	$1,903	$1,921	$2,191	**$6,015**
Mobile Home Park				
Up to 4 Units per Acre	$2,379	$2,401	$2,739	**$7,519**
5 or 6 Units per Acre	$2,141	$2,161	$2,465	**$6,767**
7 or 8 Units per Acre	$1,903	$1,921	$2,191	**$6,015**
9 or More Units per Acre	$1,665	$1,681	$1,917	**$5,265**

9.4.5 Water System Impact Fee Administration

Based on the proposed water system impact fee and an estimated 800 new connections (3/4-inch equivalent meters) per year, annual water system impact fee revenues would total nearly $6.3 million annually.

The City should separately account for water system impact fee revenue. The financial planning model presented in this report includes a Water System Impact Fee Reserve to show the fee revenues as well as application towards paying debt service, constructing expansion facilities (by the City), reimbursing developers for costs they incur to construct expansion facilities, and application toward other water system improvements. Water system impact fees should be applied on an annual basis as follows:

- FIRST, water system impact fee revenue should first be used to pay debt service costs associated with expansion of the Bryte Bend WTP. One hundred percent of the debt service on the 2002 bonds, as well as 40 percent of the debt service on the 2003 bonds totals about $2.56 million per year. It should be noted that based on the proposed amount of the Bryte Bend WTP debt service component that about 1,064 new 3/4-inch equivalent meters would need to be added to the water system each year (based on the FY 05-06 level of the water treatment plant debt service component). Because new connections to the water system are lower than this number at present, revenues from other fee components will initially need to be applied against this portion of debt service. This will help reduce the financial risk to the City and to ratepayers of having to pay for debt service related to expansion of the water system. Over time, as the water system impact fee increases, and as the number of new connections increases, revenues from the water treatment plant debt service component should exceed the annual debt service to be paid from water system impact fees (annual debt service remains essentially fixed for the term of repayment).

- SECOND, water system impact fee should be used to pay any expansion-related project constructed by the City. Most expansion-related projects are expected to be constructed and initially paid for by developers. However, the parallel pipeline on Park/Maryland (P07), pipelines on Jefferson Boulevard (P10 and P24), and the in-line booster pump station (R & PS09) are expected to be constructed by the City. Water system impact fees should be used to pay for these projects.

- THIRD, revenues from the water system buy-in component should be transferred to the Capital Replacement/Upgrade Reserve to help pay for other water system improvements. The amount transferred annual should be limited to the revenue generated from this fee component though it may be reduced depending on the needs of either of the items listed above.

- FOURTH, revenues from the infrastructure expansion component should be used to reimburse developers for reimbursable costs associated with constructing expansion related water facilities. The amount of annual fee revenue available for reimbursement may be limited by requirements for making debt service payments as well as funding City-constructed expansion-related facilities. The financial planning model presented in Table G.1 in Appendix G indicates that funds generated during the planning period should be sufficient to repay all developers for reimbursable water system infrastructure costs.

To the extent that a developer constructs and dedicates water system expansion facilities for the City they may be eligible to receive credits against the infrastructure expansion component of the water system impact fee. All new development should be required to pay the water system buy-in component and the Bryte Bend WTP debt service component of the fee.

To the extent that a developer constructs and dedicates water system expansion facilities for the City and the cost exceeds the amount of infrastructure expansion fee credits, then the developer should be eligible for reimbursement of costs from the infrastructure expansion fee component paid by other developers.

ABBREVIATION LIST

- Referenced Sources
- Abbreviations List

List of Sources Utilized	
1	December 1994 - Water Master Plan
2	December 13, 2000 (Revised July 31, 2002) - Urban Water Management Plan
3	October 24, 2003 (updated March 8, 2004) - Treated Water Storage Analysis
4	Year 2002 and Year 2003 - Production and Cost Analysis Data from the City
5	Water production data from City (through email from the City on 05/03/2004)
6	Field visits of City facilities
7	Meetings with City staff

ABBREVIATIONS LIST	
AB 514	Assembly Bill No. 514
ADD	Average Day Demand
BPS	Booster Pump Station
Bryte Bend WTP	Bryte Bend Water Treatment Plant
BOMDD	Buildout Maximum Day Demand
CIP	Capital Improvement Program
Carollo	Carollo Engineers
CVP	Central Valley Project
City	City of West Sacramento
du	Dwelling Unit
EMDD	Existing Maximum Day Demand
EMDDCF	Existing Maximum Day Demand with Commercial Fire
EMDDRF	Existing Maximum Day Demand with Residential Fire
EMDDCFN	Existing Maximum Day Demand with Commercial Fire in North Area
EMDDRFN	Existing Maximum Day Demand with Residential Fire in the North Area
EPS	Extended Period Simulation
FY	Fiscal Year
gpd	Gallons Per Day
GIS	Geographic Information System
HSPS	High Service Pump Station
ILBPS	In-Line Booster Pump Station
MDD	Maximum Day Demand
MG	Million Gallons
mgd	Million Gallons Per Day
NE	Northeast
NDWA	North Delta Water Agency
PHD	Peak Hour Demand
PRV	Pressure Reducing Valve
Res'v	Reservoir
SP	Southport
T-mains	Transmission Mains
UBO, buildout	Ultimate Buildout
VFD	Variable Frequency Drives
General Plan	Year 2000 - General Plan

Appendix B

24-HOUR DEMAND TEST PROTOCOL

24 Hour Demand Test Protocol
Water Master Plan Update
City of West Sacramento

June 7, 2004

Purpose

The 24 Hour Demand Test will allow Carollo and the City to define system demand fluctuations over a 24 hour period. This "diurnal demand pattern" is an essential input required for modeling extended period simulations of the distribution system. The more accurate this diurnal pattern is, the more accurate results from the hydraulic model will be relative to actual distribution system operations. System demands will be determined by summing up flows into the distribution system from those facilities equipped with flow meters. Any flow diverted into a system reservoir during the test will be subtracted.

Timing

The demand test should be scheduled for a high demand day, but not a day of maximum demand. The demand test will hydraulically stress the system, as many reservoirs and pump stations cannot be used during the 24-hour period. The demand test should be started at 7 AM and end at 7 AM to coincide with operator shifts at the WTP. Based on recent discussions with operations staff, the demand test is scheduled to start on June 8. The weather forecast is for a cooling trend over the next two days, so June 8 is an appropriate date.

Metering Flows

Accurate flow metering is essential during the demand test. There are flow meters at the BBWTP, which will be used to measure flow into the clearwells. The High Service Pump Station (HSPS) pulls from the clearwell and delivers water into the distribution system. The Annubar flow device on the discharge of the HSPS is not accurate and will not be used as the primary flow meter (although trended for comparison purposes). Clearwell elevations will be monitored and recorded during the test to adjust for volume gained/lost.

The magmeter for measuring flows pumped from the Carlin Reservoir Pump Station is assumed to be accurate. Volumetric reductions in the reservoir water surface elevation during the demand test will be calculated to verify magmeter readings. None of the other reservoir sites (PSIP, Southport, Central, Northeast, nor Oak Street) have flow meters, and thus, these facilities will NOT be used (filled or pumped from) during the demand test.

Previous to 24-hour Test Period

- All reservoirs in the distribution system should be brought to near full, especially the Carlin Reservoir. By 6:59 AM Carlin Reservoir should be filled to near overflow elevation (3.0 MG capacity). However, one reservoir, Oak Street, should be only 50% full to accept flows if high distribution system pressures need to be quickly vented.
- The clearwells at the WTP should be "near-full" (24 ft). Thus almost 8 MG will be available.
- Operational data, as previously defined by Carollo (email of May 21), shall be trended. Influent flow meter shall be included with the trending data.
- Pressure settings to actuate altitude valves and pumps on all reservoirs shall be disabled. Pressure settings to actuate pumps (automatically) at Carlin shall be disabled. Pumps and altitude will only be started or opened manually during this test.

- New Surge Tank is operational.
- Carlin Reservoir's altitude and isolation valves should be checked to verify that water is not bleeding back into the reservoir during pumping periods.
- Carlin Reservoir's pumps should be tested to determine the number and speed settings required so that approximately 2500 gpm can be pumped away from the reservoir site during the 24 hour demand test.

Termination of Test
The test may be terminated due to pressure constraints or volume constraints or fire suppression needs or operator discretion. Reservoirs other than Carlin and the clearwells will be near full and pumps will be capable of adding flows and pressures into the system. See "Caution Signs" section below concerning responses as constraint conditions are approached.

Demand Test Schedule

7 AM - 10 AM

Test starts during a high demand hour. Pump(s) are actuated (in manual) at Carlin Reservoir (manually) and VFD(s) are set to discharge about 2,500 gpm. Carlin storage drops 0.45 MG over this 3 hour period. All other demands in system are met by HSPS. Pumps ramp up and down at HSPS to keep pressure at about 62 +/- 3 psi at HSPS.

10 AM - 3 PM

Average to low demand hours. Carlin Reservoir pump(s) are shut off manually at 10 AM. All demands are met from the HSPS. Carlin Reservoir's altitude valve can be opened if pumps at HSPS start dropping off or ramping back (because system demands decrease) during these hours.

3 PM - 10 PM

Average to high demand hours. Carlin Reservoir pumps should already be shut off. Close Carlin Reservoir altitude (or isolation) valve if it was opened anytime during the previous period (10 AM to 3 PM). All demands are met from the HSPS.

10 PM to 7 AM

Peak demand hours (due to irrigation demand). Pump(s) are actuated at Carlin to maintain about 2,500 gpm discharge . Carlin storage drops another 1.35 MG from reservoir over this 9 hour period (-1.80 MG total assuming no filling done during test period).

7 AM

Test concluded. Carlin Reservoir is still, at least, 40 percent full. Southport Reservoir pumps actuated to keep pressures elevated in Southport. System operations brought back to normal.

Pressure Monitoring
Pressures shall be checked throughout the system. Pressures shall be in 40 to 65 psi range for areas north of the channel/canal. Pressures can peak up to 70 psi near Carlin PS and in Southport area. Operations staff to note where and when pressures drop below 40 psi. IF 40 psi is reached, then operations to check that HSPS is putting out 62 +/- 3 psi. HSPS pumps to be set in automatic to maintain this discharge pressure range.

Caution Signs

- Pressure drops to 40 psi anywhere in system. Response to Caution Sign: First - verify that appropriate number of HSPS pumps are on and delivering 62 +/- 3 psi. Second - verify the Carlin Reservoir pump(s) are actuated and delivering pressure into system.
- Carlin Reservoir level drops to one-quarter full (about 8 feet from bottom). Response to Stop Sign: Turn off all pumps at Carlin PS and closely monitor system pressures.
- The clearwell water surface elevations fall to Elevation 31 (about 21 feet from the bottom). Response to Caution Sign: Produce more water from the WTP to match HSPS discharge flows. Conversely, if the clearwell rises to elevation 34 (about 24 feet from the bottom) than less water should be produced at the WTP.
- Fire department (City staff will inform Mike before the test) requires water for fire suppression. Response to Caution Sign: Stop test immediately by actuating pump(s) at reservoir(s) near the fire. However continue to trend data.

If above responses to cautionary signs do not work, then actuate a pump at a reservoir in the distribution system. Continue to trend data until 7 AM.

If the demand test is terminated, then the test should be restarted two days later. The day following can be used to re-fill Carlin and setup the system as listed above. Testing will begin at the hour when the test was terminated and run until 7 AM.

Carollo Contacts
Scott Joslyn: 202-0166 - cell - any hour
Gary Meyer: 565-4888 - Carollo Engineers - office hours

Appendix C

AREA AND DEMAND SUMMARY

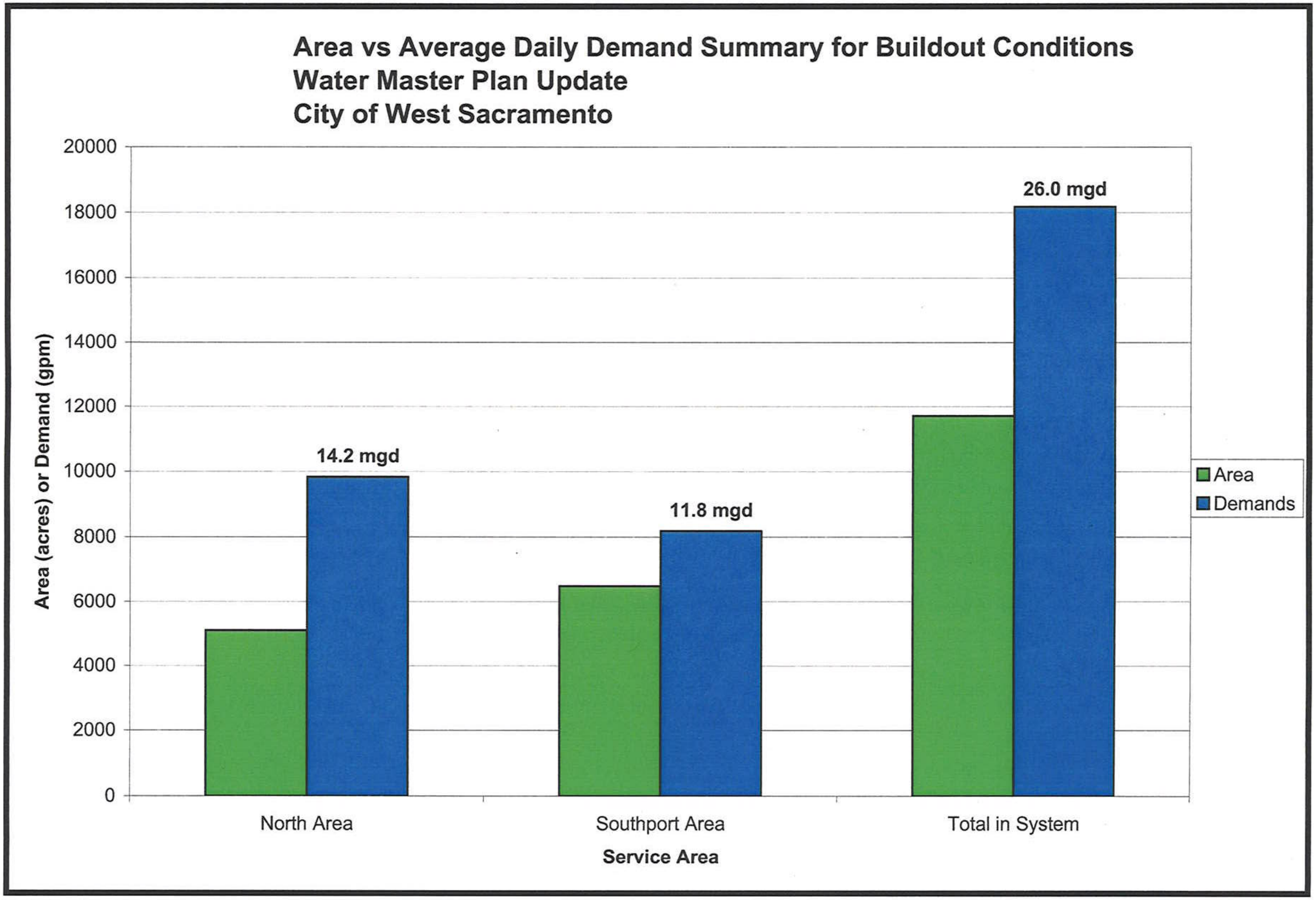
- Summary of Area and Calculated Demands
- Area vs. Average Daily Demand Summary for Buildout Conditions

Summary of Area and Calculated Demands for Buildout Conditions
Water Master Plan Update
City of West Sacramento

Service Area	Sub-Area	A-1	BP	C-1	C-2	C-3	CBD	CE	CH	CW	M-1	M-2	M-3	ML	MU	NC	PO	PQP	R1-A	R1-B	R-2	R-3	RE	RP	RRA	WF	Totals (gpm)	Totals (mgd)
Total	Area	1408.00	342.00	84.00	225.00	90.00	122.00	0.00	68.00	11.00	533.00	1121.00	649.00	124.00	0.00	71.00	111.00	723.00	944.00	1634.00	794.00	385.00	498.00	318.00	627.00	832.00	11714.00	
	No.Of Units	N/A	N/A	27.72	2160.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3964.80	7353.00	7622.40	7700.00	159.36	N/A	N/A	N/A	28987.28	
	Demand	0.00	0.00	172.08	460.94	184.38	249.93	0.00	139.31	22.53	1091.91	2296.49	1329.55	254.03	0.00	0.00	227.40	0.00	1541.87	2859.50	2964.27	1550.69	61.97	397.50	195.07	0.00	15999.41	23.04
North Area																												
Triangl Area [3]	Area																									181.00	181.00	
	Demand																									1131.90	1131.90	1.63
Pioneer Bluff [3]	Area																									135.00	135.00	
	Demand																									618.00	618.00	0.89
Riverside Center	Area		49.00		4.00				8.00		54.00			69.00			69.00										253.00	
	Demand		0.00		8.19				16.39		110.63			141.35			141.35										417.92	0.60
Riverpoint	Area				79.00	18.00																					97.00	
	Demand				161.84	36.88																					198.72	0.29
The Rivers [3]	Area																									286.00	286.00	
	Demand																									416.60	416.60	0.60
North Delta Water Agency	Area	4.00	82.00	6.00	102.00	26.00			8.00		54.00			85.00			69.00	539.00	403.00		85.00	70.00		23.00		320.00	1876.00	
	Demand	0.00	0.00	12.29	208.96	53.26			16.39		110.63			174.13			141.35	0.00	658.23		317.33	281.94		28.75		0.00	2003.28	2.88
Northern Area	Area	141.00	99.00	14.00	194.00	77.00	122.00		68.00		369.00	812.00	385.00	124.00			111.00	605.00	868.00		227.00	169.00		41.00		683.00	5109.00	
	No.Of Units	N/A	N/A	4.62	1862.40	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3645.60	0.00	2179.20	3380.00	0.00	N/A	N/A	N/A	11071.82	
	Demand	0.00	0.00	28.68	397.43	157.74	249.93		139.31		755.94	1663.47	788.72	254.03			227.40	0.00	1417.73		847.47	680.69		51.25		0.00	7659.78	11.03
Southport Area																												
Agriculture and Others in Southport	Area	1267.00		13.00	30.00													13.00	15.00	31.00	35.00	11.00	394.00		326.00	75.00	2210.00	
	Demand	0.00		26.63	61.46													0.00	24.50	54.25	130.67	44.31	49.03		101.42	0.00	492.27	0.71
Richland Communities	Area			6.00														10.00		316.00	29.00	20.00		85.00	61.00		527.00	
	Demand			12.29														12.29		553.00	108.27	80.56		106.25	18.98		891.63	1.28
Southport Business Park	Area		108.00	12.00							73.00	301.00			7.00			5.00				28.00					534.00	
	Demand		0.00	24.58							149.55	0.00			0.00			0.00				112.78					286.91	0.41
Areas South of Bridgeway	Area			13.00														17.00		159.00	58.00	12.00		9.00			268.00	
	Demand			26.63														0.00		278.25	216.53	48.33		11.25			581.00	0.84
Bridgeway Lakes- 1	Area																			123.00	23.00			11.00	15.00		172.00	
	Demand																			215.25	85.87			13.75	4.67		319.53	0.46
Bridgeway Lakes- 2	Area																		18.00	30.00	20.00		29.00				97.00	
	Demand																		29.40	52.50	74.67		3.61				160.18	0.23
North of Richland Communities	Area			8.00						8.00								32.00		306.00	57.00	43.00		28.00	137.00		619.00	
	Demand			16.39						16.39								0.00		535.50	212.80	173.19		35.00	42.62		1031.89	1.49
North North of Richland Communities	Area			8.00				3.00										20.00		243.00	191.00	43.00		50.00		47.00	605.00	
	Demand			16.39				0.00										0.00		425.25	713.07	173.19		62.50		0.00	1390.40	2.00
Area East of Bridgeway Island	Area			13.00														17.00		159.00	58.00	12.00		9.00			268.00	
	Demand			26.63														0.00		278.25	216.53	48.33		11.25			581.00	0.84
The Classics	Area																			71.00				13.00			84.00	
	Demand																			124.25				16.25			140.50	0.20
Bridgeway Island	Area		38.00															10.00		124.00	93.00			13.00			278.00	
	Demand		77.85															0.00		217.00	347.20			16.25			658.30	0.95
Southport Area	Area	1267.00	243.00	61.00	30.00	13.00		3.00		4.00	164.00	301.00	264.00		7.00	8.00		118.00	76.00	1634.00	560.00	204.00	498.00	255.00	627.00	149.00	6486.00	
	No.Of Units	N/A	N/A	20.13	288.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	319.20	7353.00	5376.00	4080.00	159.36	N/A	N/A	N/A	17595.69	
	Demand	0.00	0.00	124.97	61.46	26.63		0.00		8.19	335.97	616.63	540.83		0.00	0.00		0.00	124.13	2859.50	2090.67	821.67	61.97	318.75	195.07	0.00	8186.44	11.79

Notes:
(1) The calculated demands are Average Day Demands for buildout conditions based on the land use.
(2) All the calculations are based on City's Year 2000 General Plan Land Use data.
(3) These are the River Front area, City has provided the data to establish demands for these developments.

H:\Client\WestSac_Sac\6954A.00\Data Check\DemandCalcs.xls.xls
Summary



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AresVsDmdSum

Appendix D

EXISTING STORAGE IN THE DISTRIBUTION SYSTEM

Storage in the Distribution System
Water Master Plan Update
City of West Sacramento

Reservoir	Base Elevation (feet) (1)	Top Elevation of Water in Reservoir (feet) (2)	High Water Level (feet) (3)	Diameter (feet)	Existing usable Volume ($feet^3$)	Existing usable Volume (MG)
Carlin	13.1	44.8	29.0	130	385096	3.00
PSIP	16.8	38.2	21.5	106	189817	1.40
Southport	15.0	36.5	21.5	90	136838	1.00
Central	20.5	48.5	28.0	110	266212	2.00
Northeast	26.3	54.3	28.0	110	266212	2.00
Oak Street(6)	18.25	46.3	28.0	110	266212	2.00

Notes:

(1) The City has provided Base Elevations for the reservoirs, except PSIP and Southport elevations are based on contour data.

(2) The Top Elevation is water is calculated by adding Base Elevation and High Water Level, The City shall check these values for Oak Street, Central, and Northeast and provide these values for reservoirs.

(3) The values were provided by the City staff. The difference between the Base and Top elevation Water in Reservoir does not match the High Water Level for Carlin Reservoir.

(4) The Elevation of Fire Hydrant hose's at South River Road and at Half Moon Bay are 25 feet and 7.5 feet respectively.

Appendix E

HYDRAULIC ANALYSIS AND METER IMPLEMENTATION PLAN

- Existing Maximum Day Demands (EMDD)
  - ➢EMDD Operations Pattern
  - ➢EMDD
  - ➢EMDDCF
  - ➢EMDDRF
  - ➢EMDDCFN
  - ➢EMDDRFN
- Buildout Maximum Day Demand (BOMDD)
  - ➢BOMDD Operations Pattern
  - ➢BOMDD
  - ➢BOMDDBP24N
  - ➢BOMDDBP24NIF
- Copy of “Kronick Moskovitz Tiedemann & Girard - December 5, 2003 Memorandum”

EMDD - Operations Pattern

		2		2		1.4		2		1		3			Fill Values					
Hour	Northeast 2MG 550gpm, 1800gpm		Central 2MG 550gpm, 1800gpm		PSIP 1.4MG 25HP = 500 gpm		Oak 2MG 700gpm, 1750gpm		Southport 1MG 500gpm, 1750gpm		Carlin 3MG 1400gpm, 2800gpm		Actual Flow from reservoirs MG	Actual Flow from reservoirs MGD	Northeast	Central	PSIP	Oak	Southport	Carlin
	Time	Flow	Time	Flow	Time	Flow	Time	Flow	Time	Flow	Time	Flow								
															12000	**11700**	**6500**	**9600**	**6000**	**14800**
1													0	0.0	2100			1200		1635
2													0	0.0		1950		1200		1635
3	60	2100	60	1950	60	200	60	1600					0.351	8.4						
4	60	2100	60	1950	60	200	60	1600					0.351	8.4						
5	60	2100	60	1950	60	200	60	1600					0.351	8.4						
6					60	200	60	1600			60	2600	0.264	6.3						
7					60	200	60	1600			60	2600	0.264	6.3						
8					60	1100					60	2600	0.222	5.3						
9													0	0.0	500	1950	900	1200		
10													0	0.0	500	1950	900	1200		
11													0	0.0	500	1950	900	1200		
12													0	0.0	2100	1950	900			
13													0	0.0		1950	900		1500	1635
14													0	0.0			900		1500	1635
15													0	0.0			900		1500	1635
16													0	0.0					1500	1635
17	60	500	60	1950	60	1100			60	1500	60	1400	0.387	9.3						
18	60	500	60	1950	60	1100			60	1500	60	1400	0.387	9.3						
19	60	500	60	1950	60	1100			60	1500	60	1400	0.387	9.3						
20	60	2100			60	1100			60	1500	60	1400	0.366	8.8						
21	60	2100					60	1600			60	1400	0.306	7.3						
22													0	0.0	2100			1200		1635
23													0	0.0	2100			1200		1635
24													0	0.0	2100			1200		1635
															12000	***11700***	**6300**	**9600**	***6000***	***14715***
															0	0	-200	0	0	-85
	MG=	0.72	MG=	0.7	MG=	0.39	MG=	0.58	MG=	0.36	MG=	0.89	3.64							
		36%		35%		28%		29%		36%		30%							-285	

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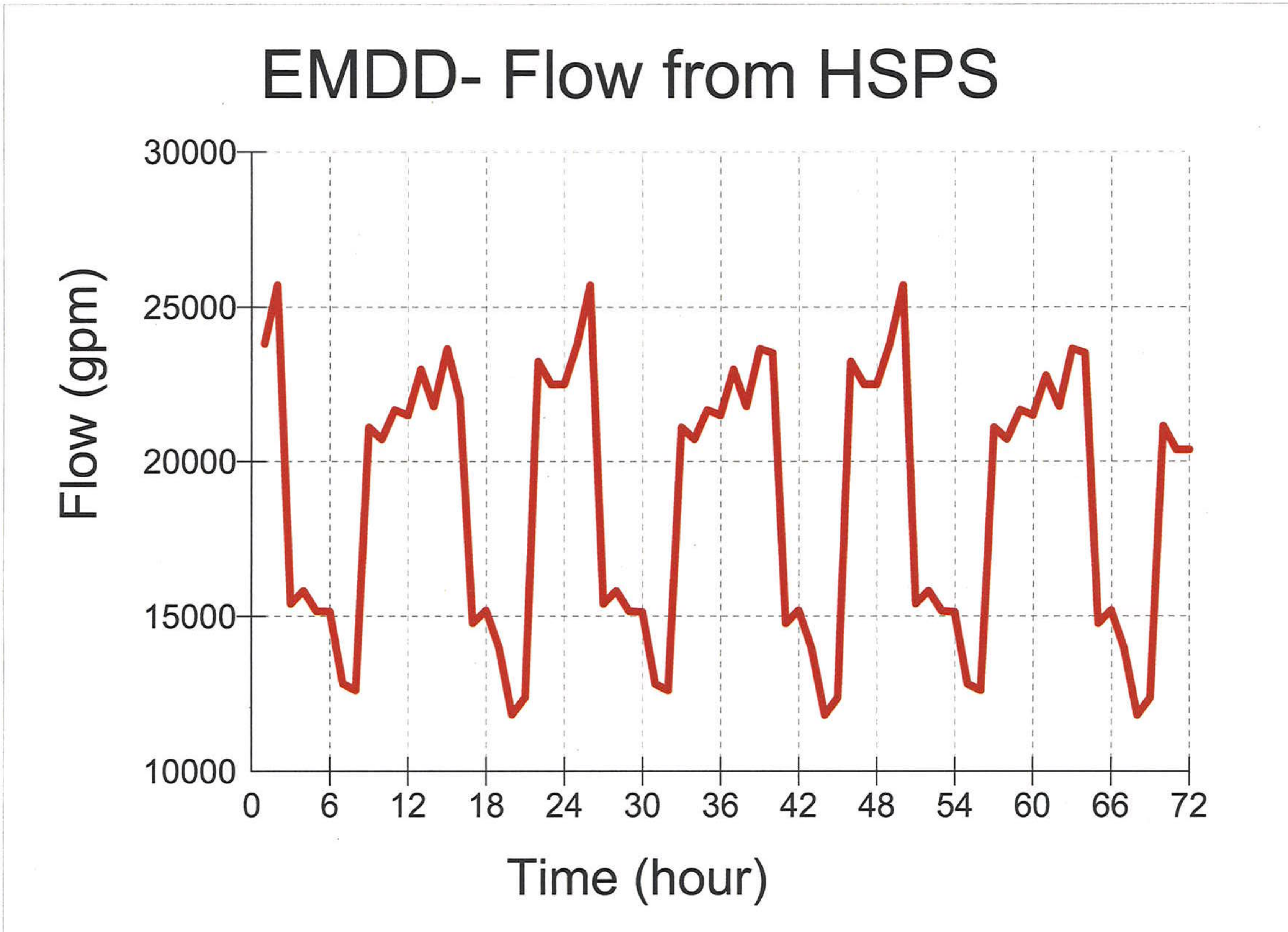
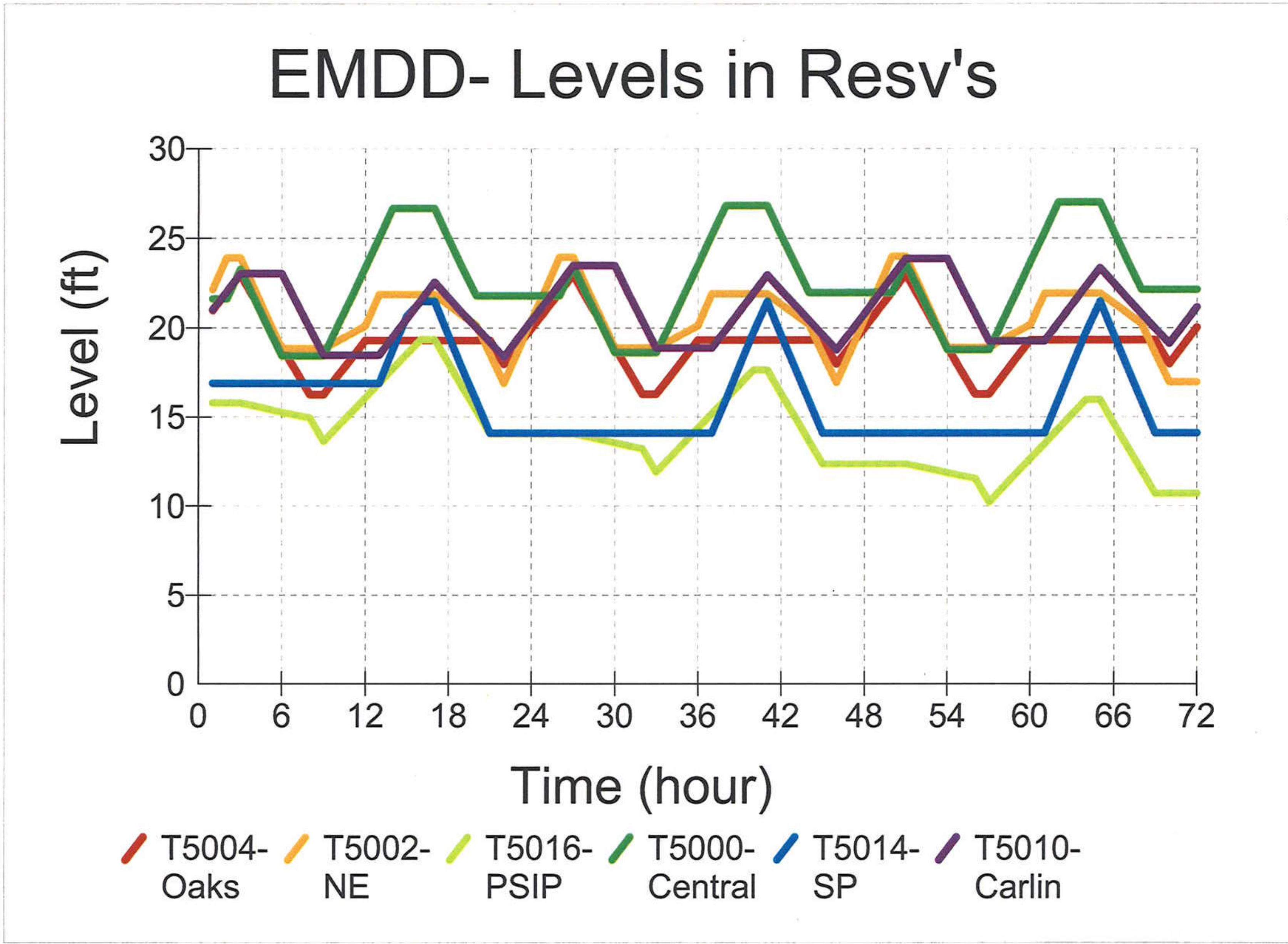
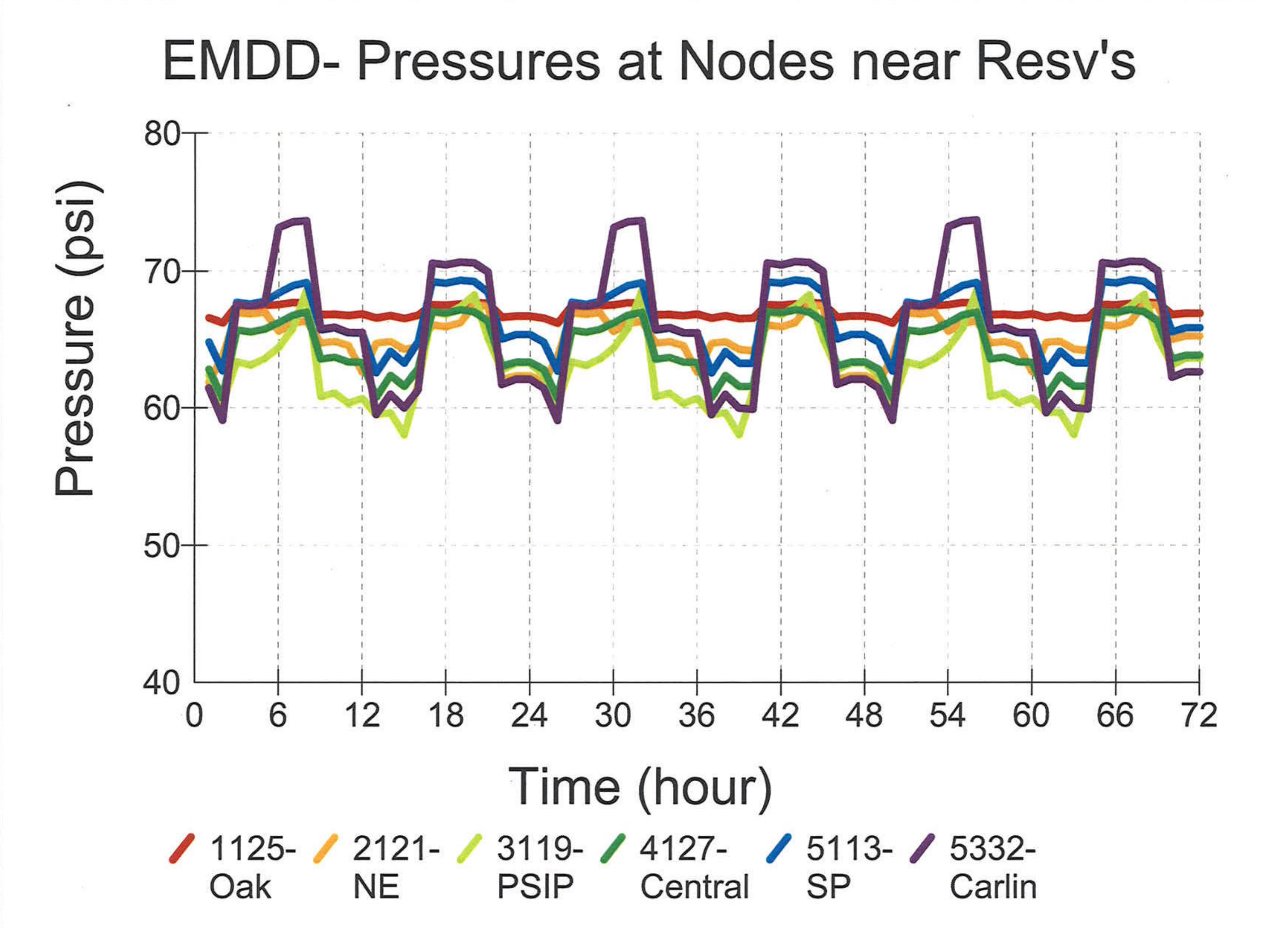
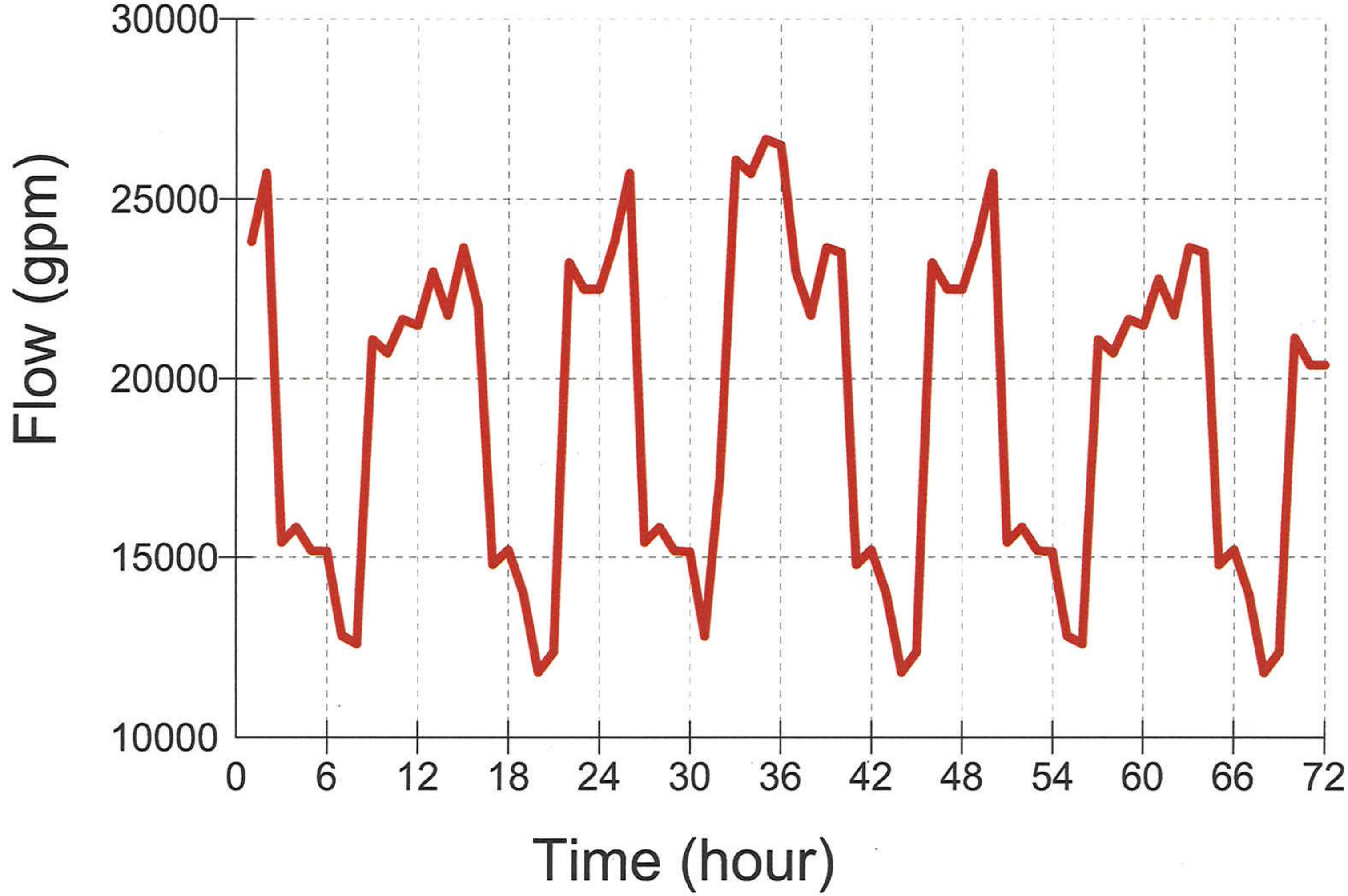
EMDD


EMDD- Flow from HSPS
Flow (gpm)
30000
25000
20000
15000
10000
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)

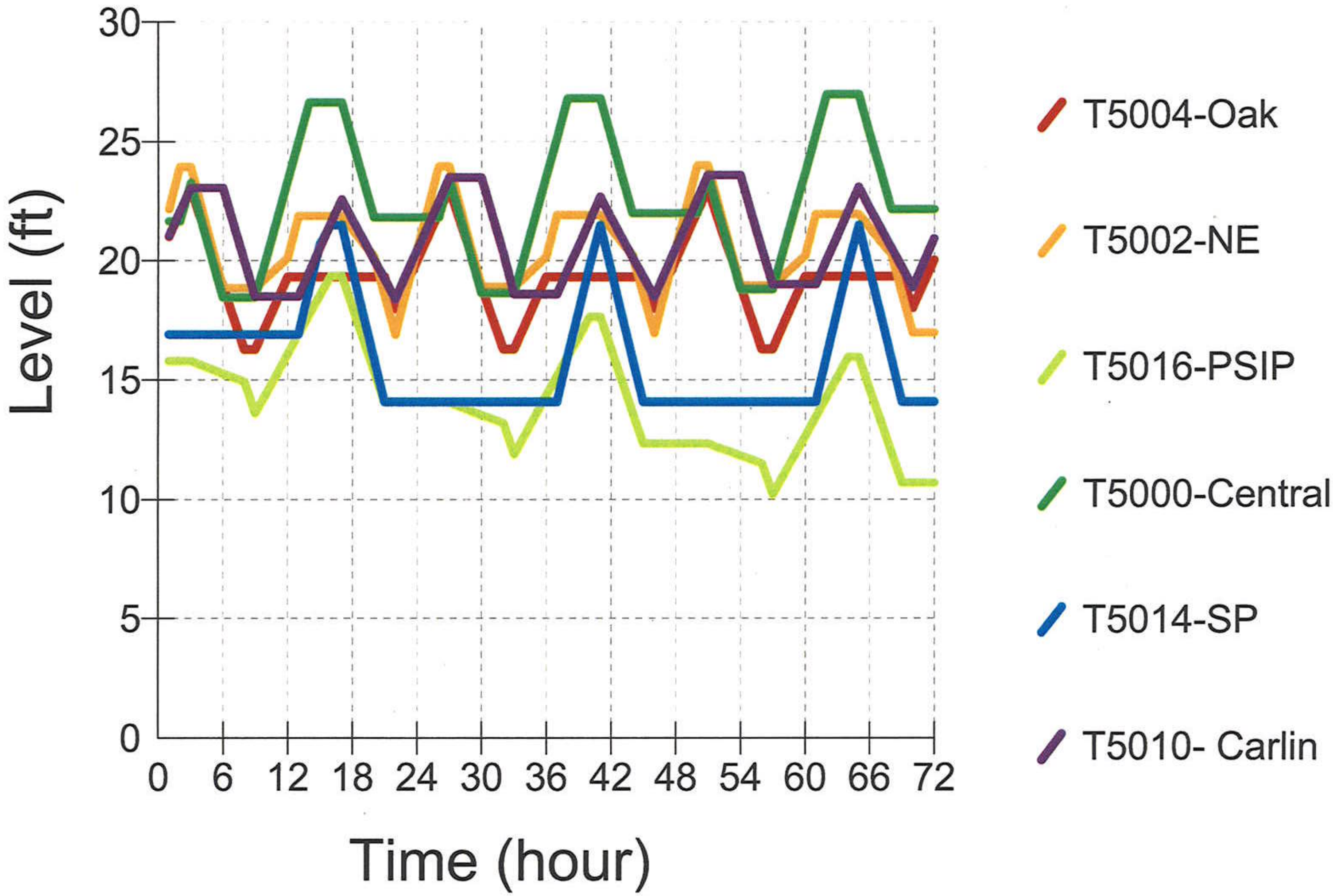

EMDD- Levels in Resv's
Level (ft)
30
25
20
15
10
5
0
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
T5004- Oaks
T5002- NE
T5016- PSIP
T5000- Central
T5014- SP
T5010- Carlin

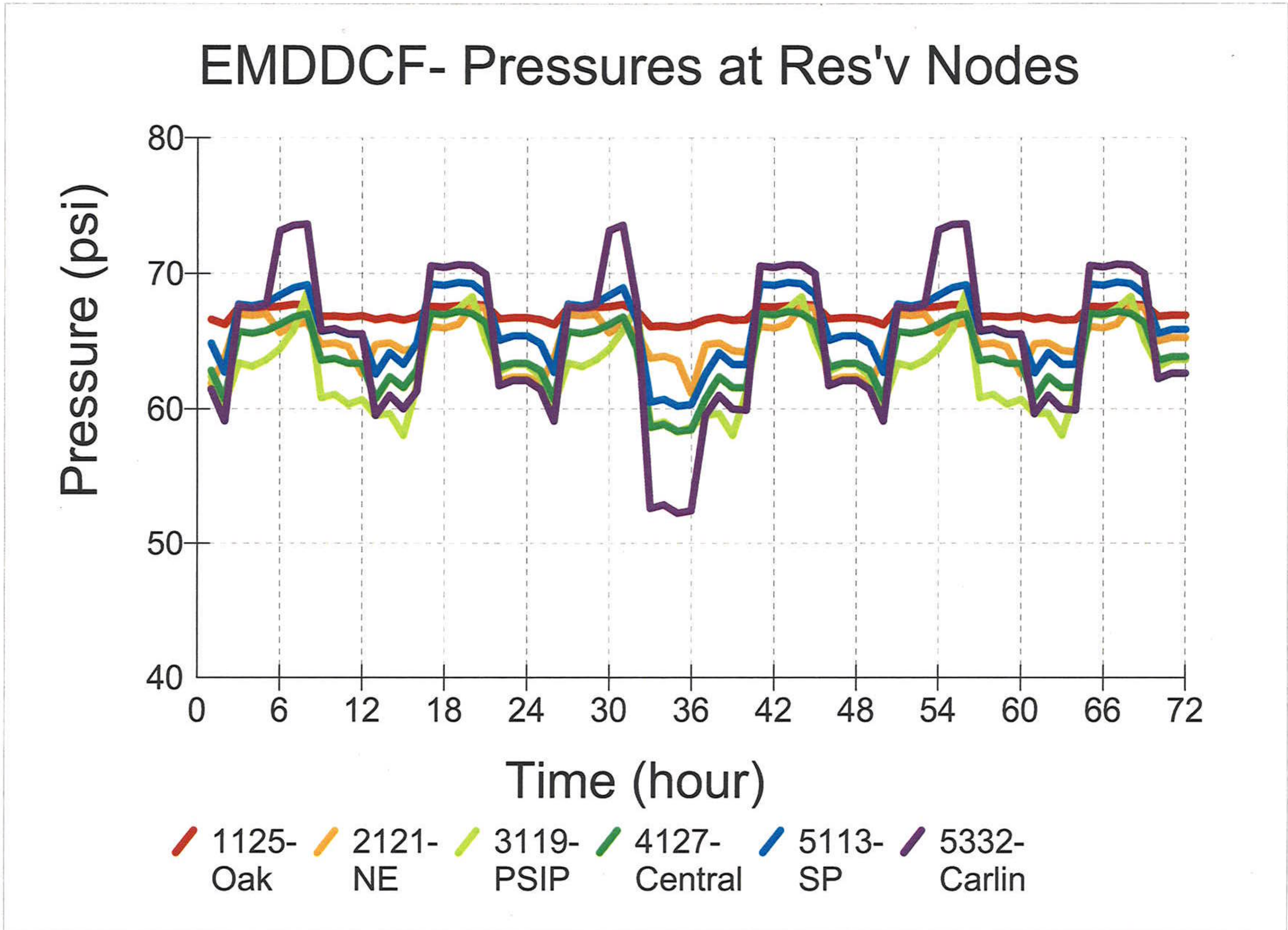

EMDD- Pressures at Nodes near Resv's
Pressure (psi)
80
70
60
50
40
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
1125- Oak
2121- NE
3119- PSIP
4127- Central
5113- SP
5332- Carlin

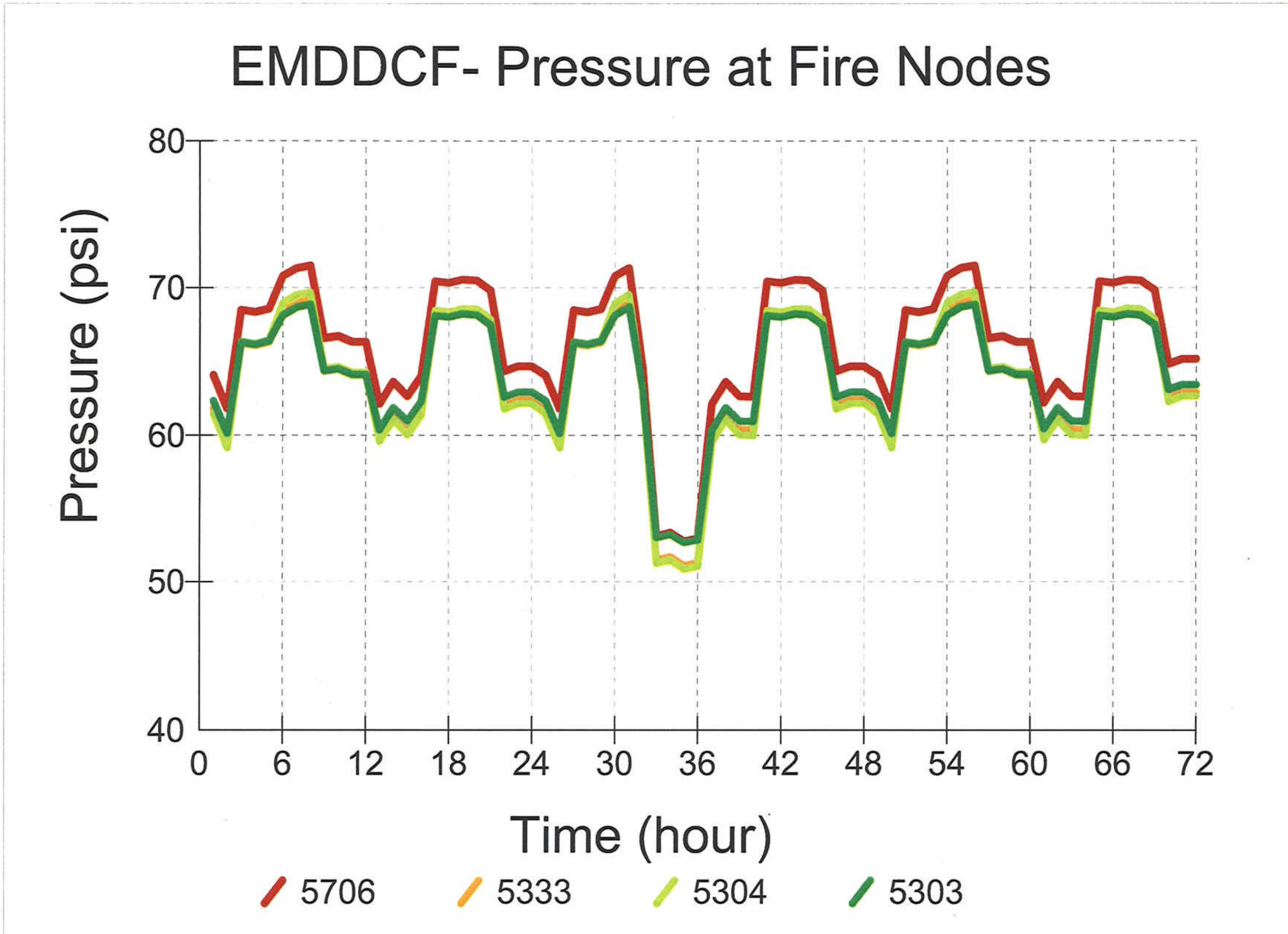
EMDDCF- Flow from HSPS

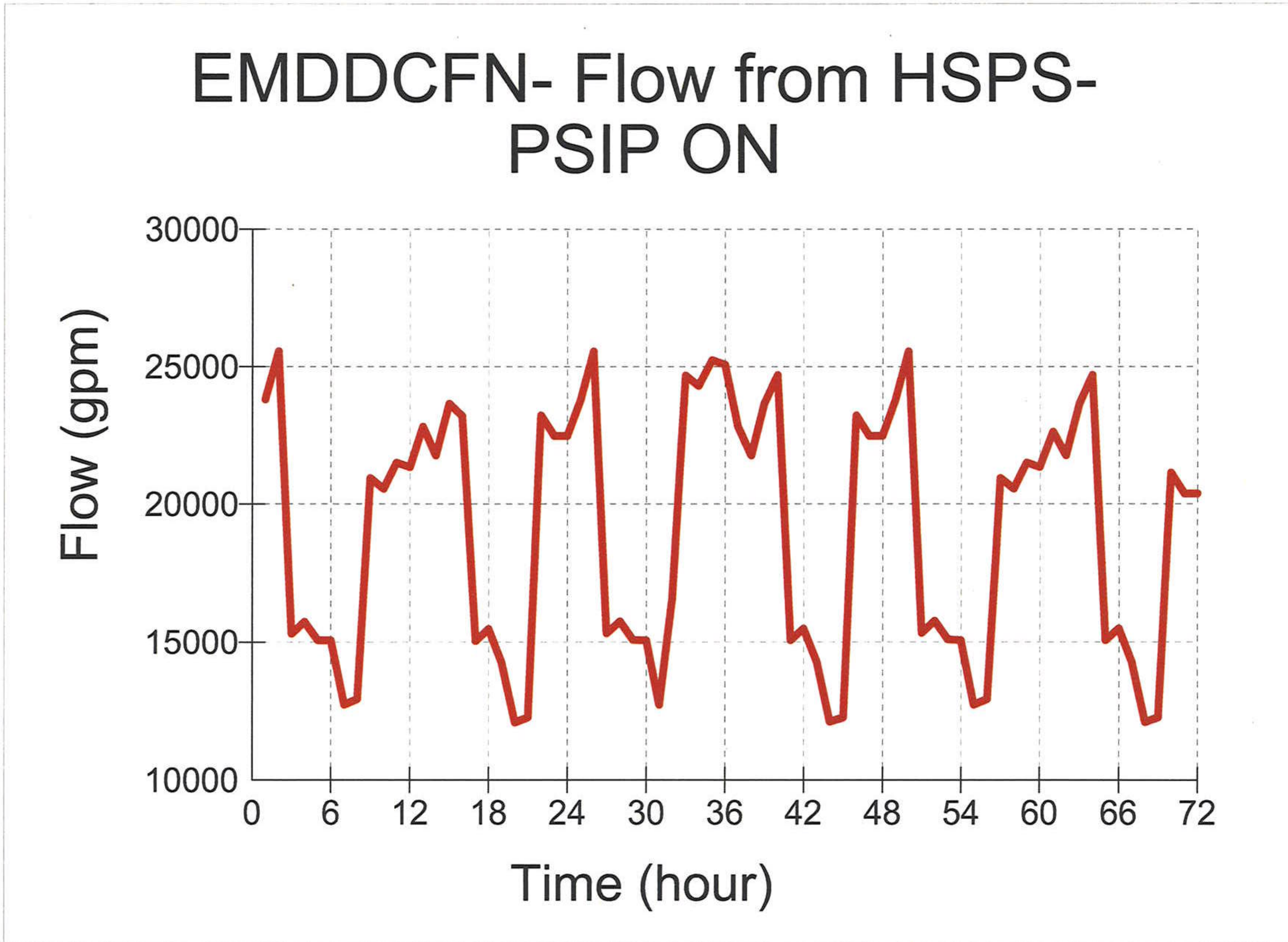


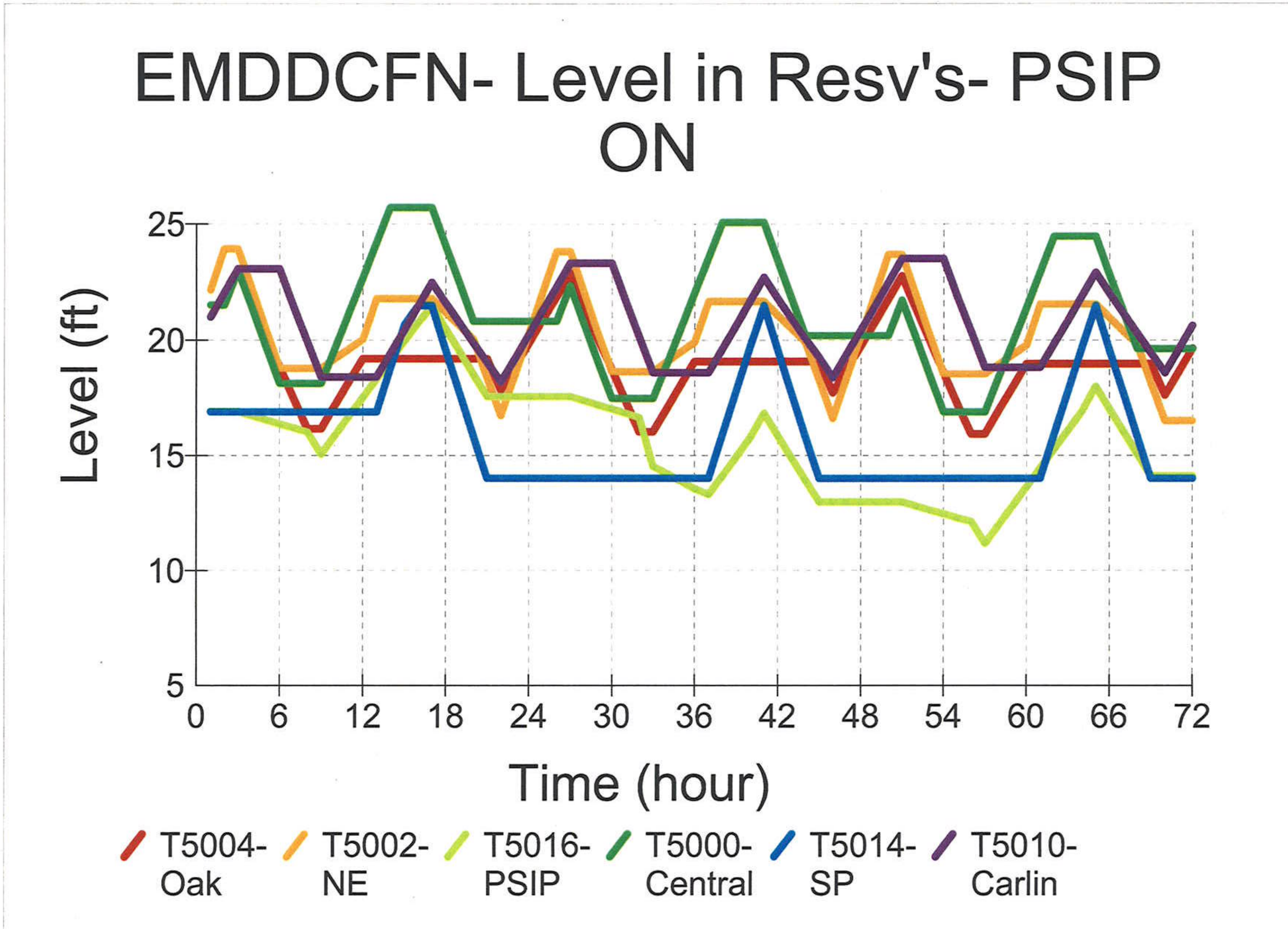
EMDDCF- Levels in Res'v

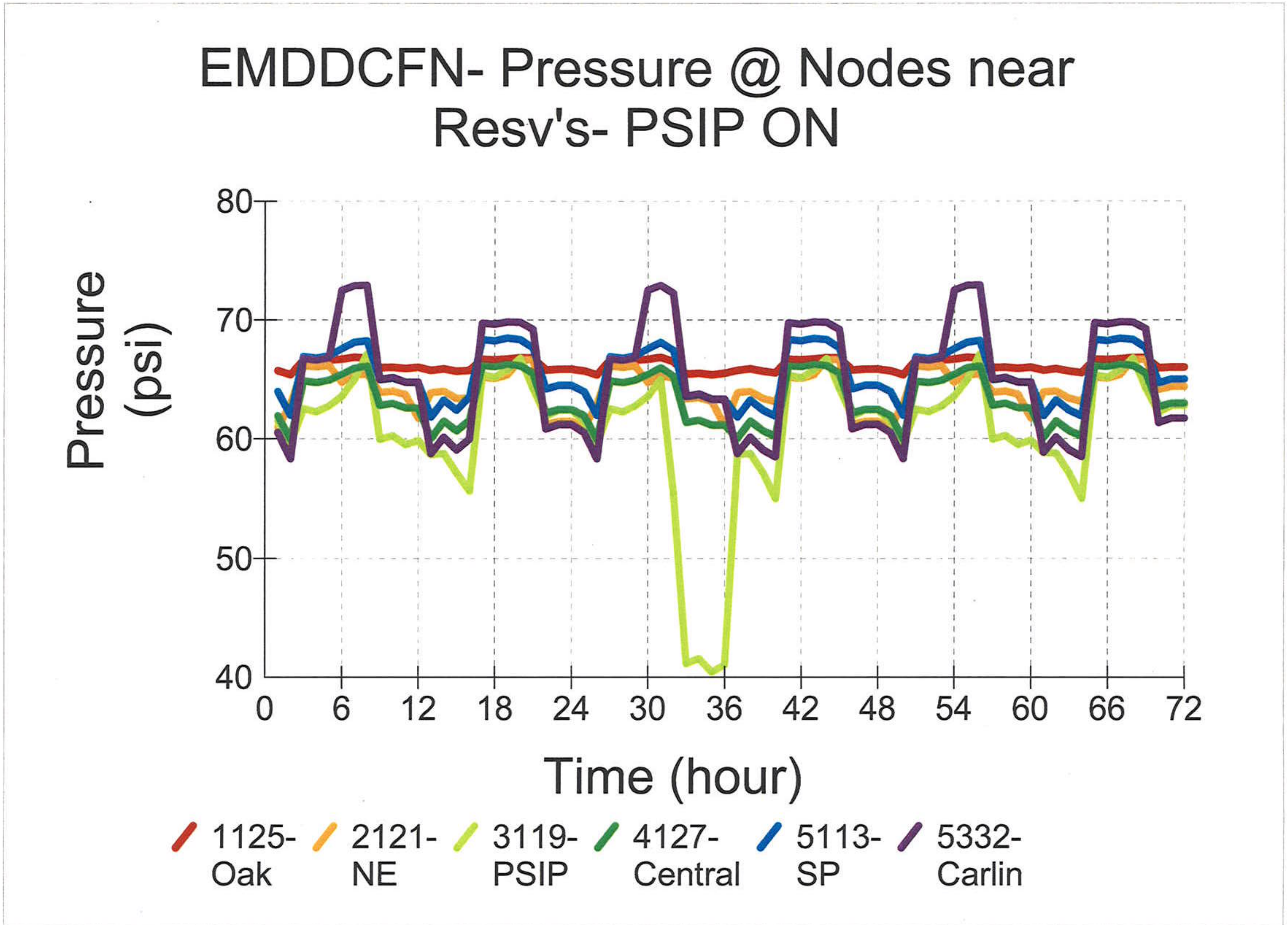


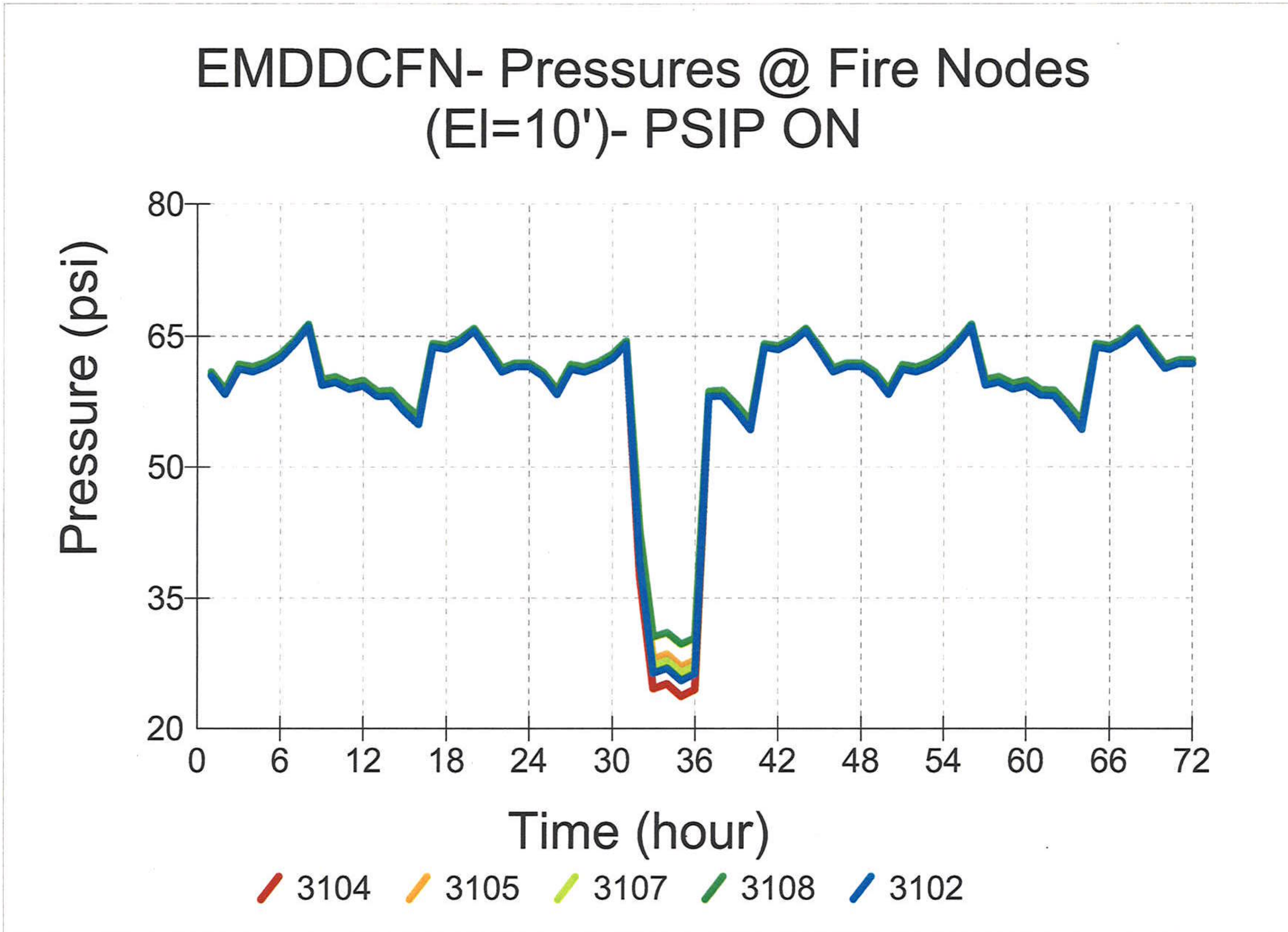

EMDDCF- Pressures at Res'v Nodes
Pressure (psi)
80
70
60
50
40
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
1125-Oak
2121-NE
3119-PSIP
4127-Central
5113-SP
5332-Carlin

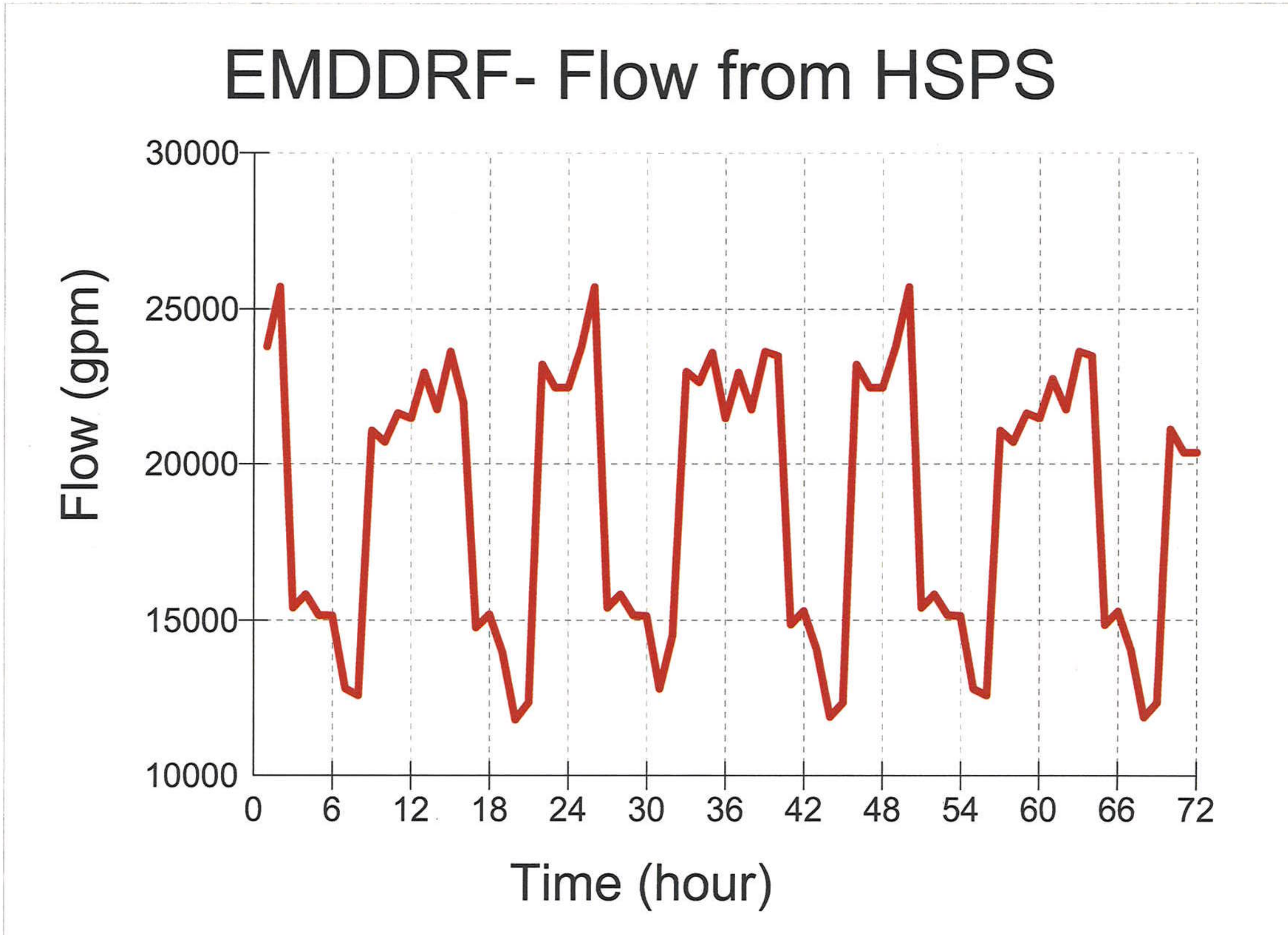

EMDDCF- Pressure at Fire Nodes
Pressure (psi)
80
70
60
50
40
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
5706
5333
5304
5303

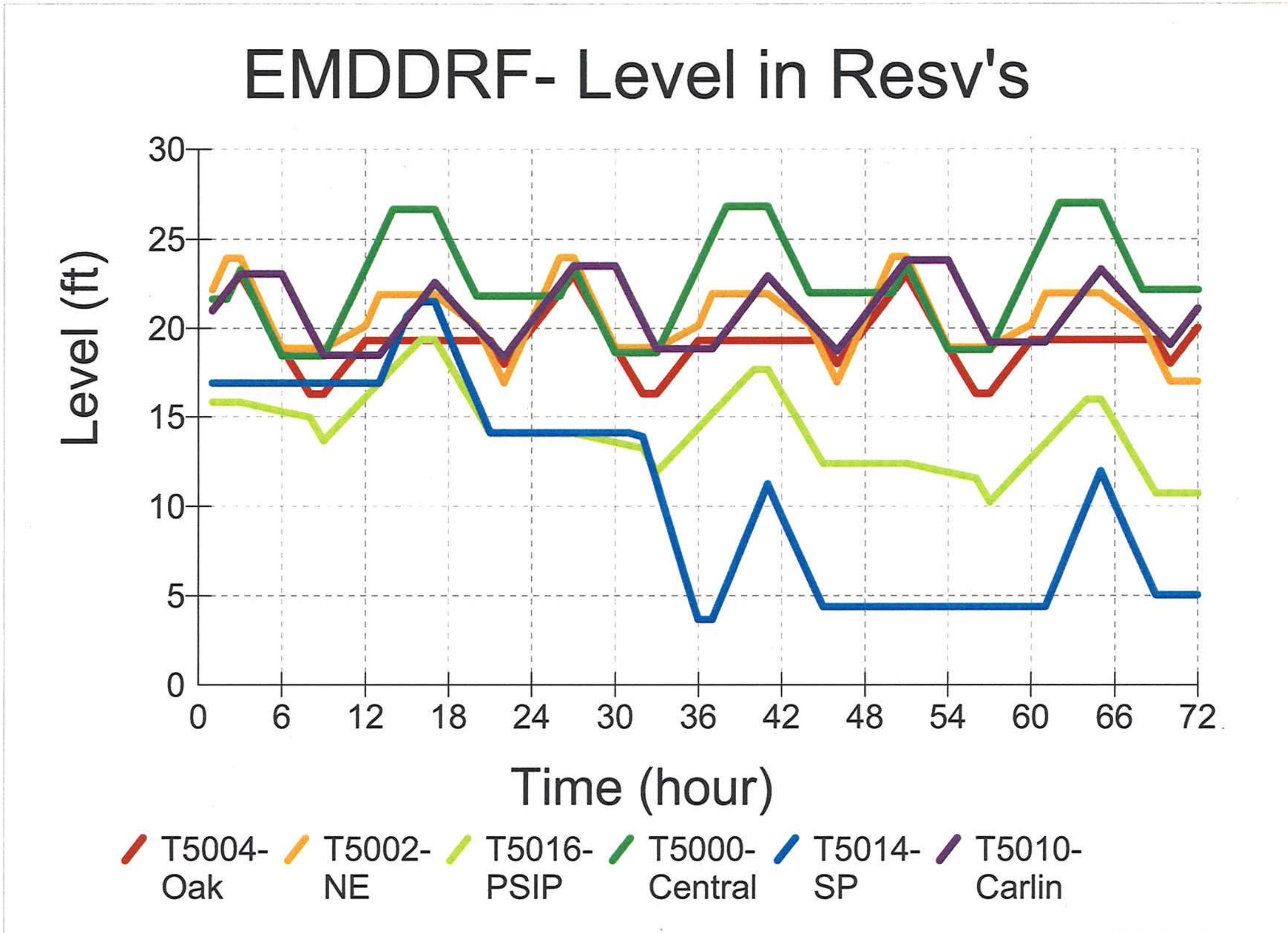

EMDDCFN- Flow from HSPS-
PSIP ON
Flow (gpm)
30000
25000
20000
15000
10000
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)


EMDDCFN- Level in Resv's- PSIP
ON
Level (ft)
25
20
15
10
5
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
T5004-Oak
T5002-NE
T5016-PSIP
T5000-Central
T5014-SP
T5010-Carlin

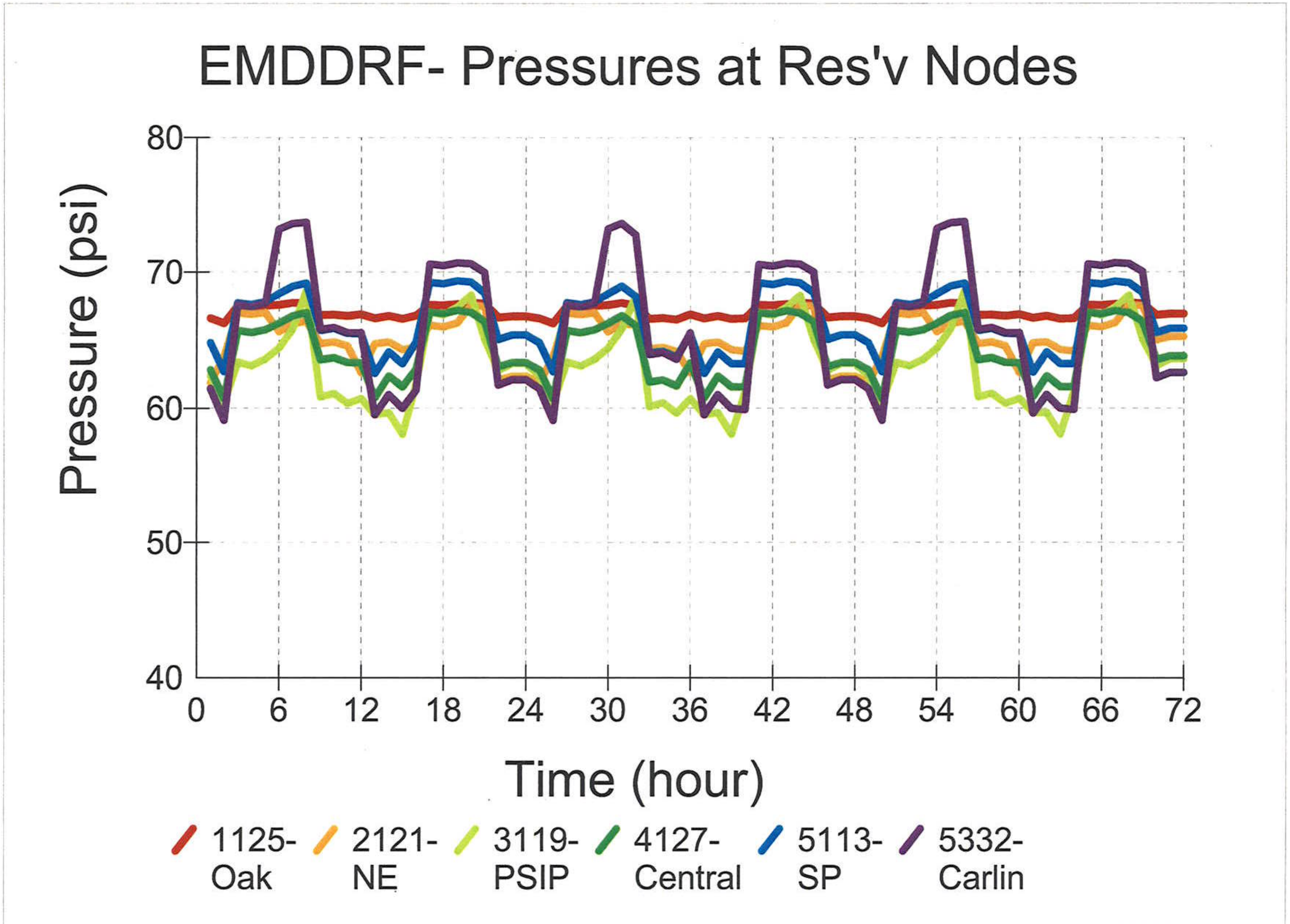

EMDDCFN- Pressure @ Nodes near Resv's- PSIP ON
Pressure (psi)
80
70
60
50
40
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
1125-Oak
2121-NE
3119-PSIP
4127-Central
5113-SP
5332-Carlin

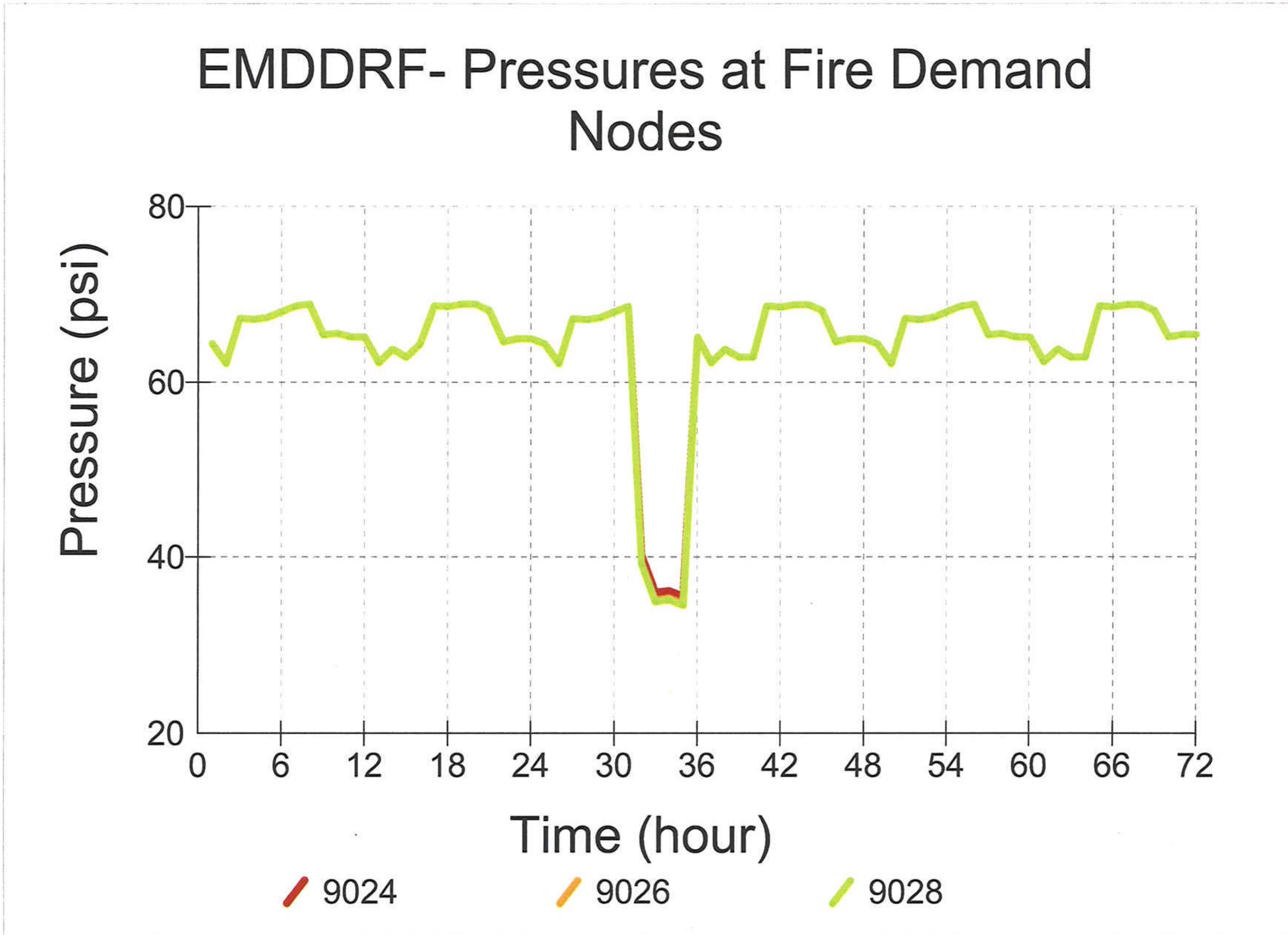

EMDDCFN- Pressures @ Fire Nodes
(El=10')- PSIP ON
Pressure (psi)
80
65
50
35
20
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
3104
3105
3107
3108
3102

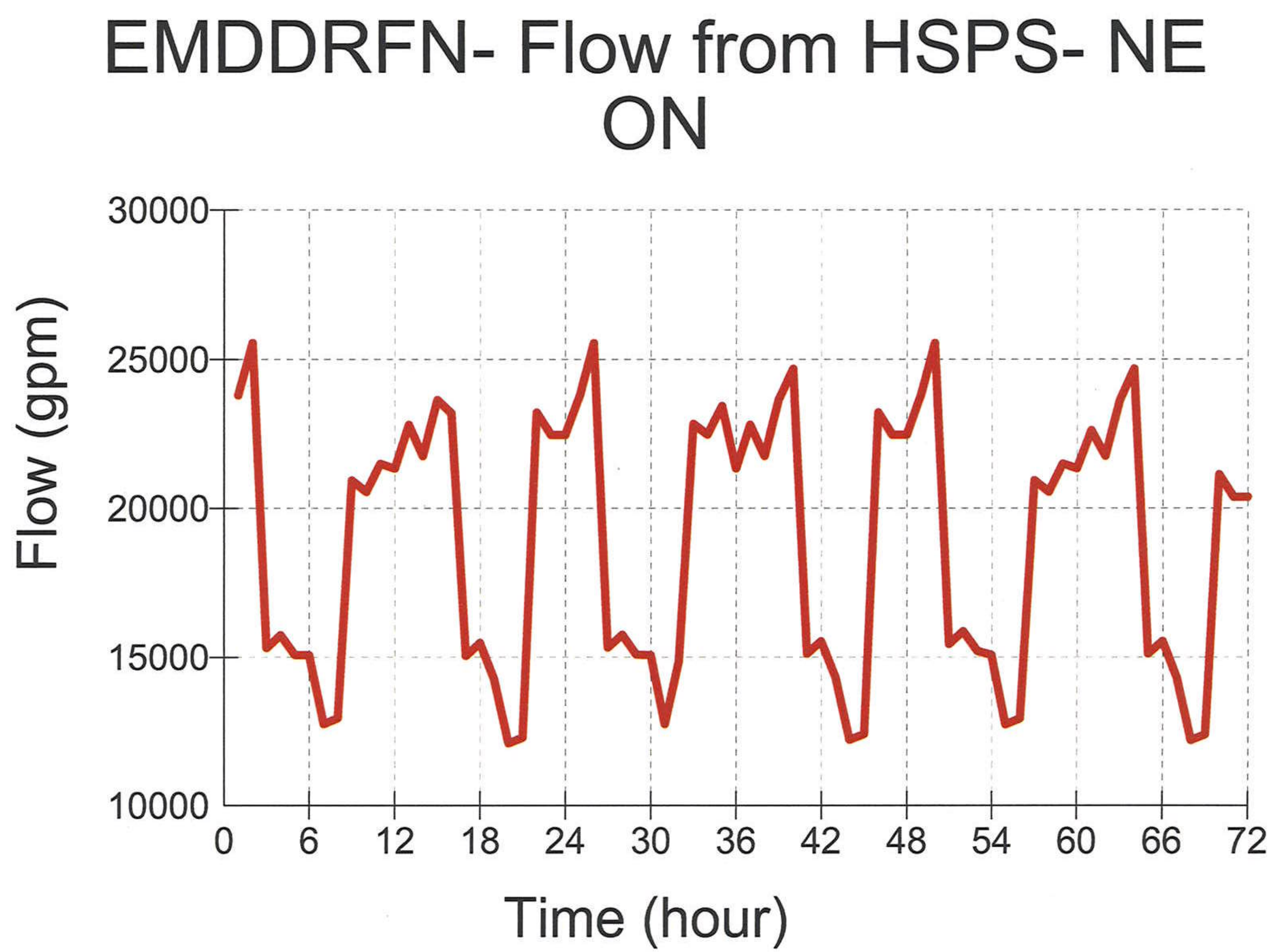

EMDDRF- Flow from HSPS
Flow (gpm)
30000
25000
20000
15000
10000
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)

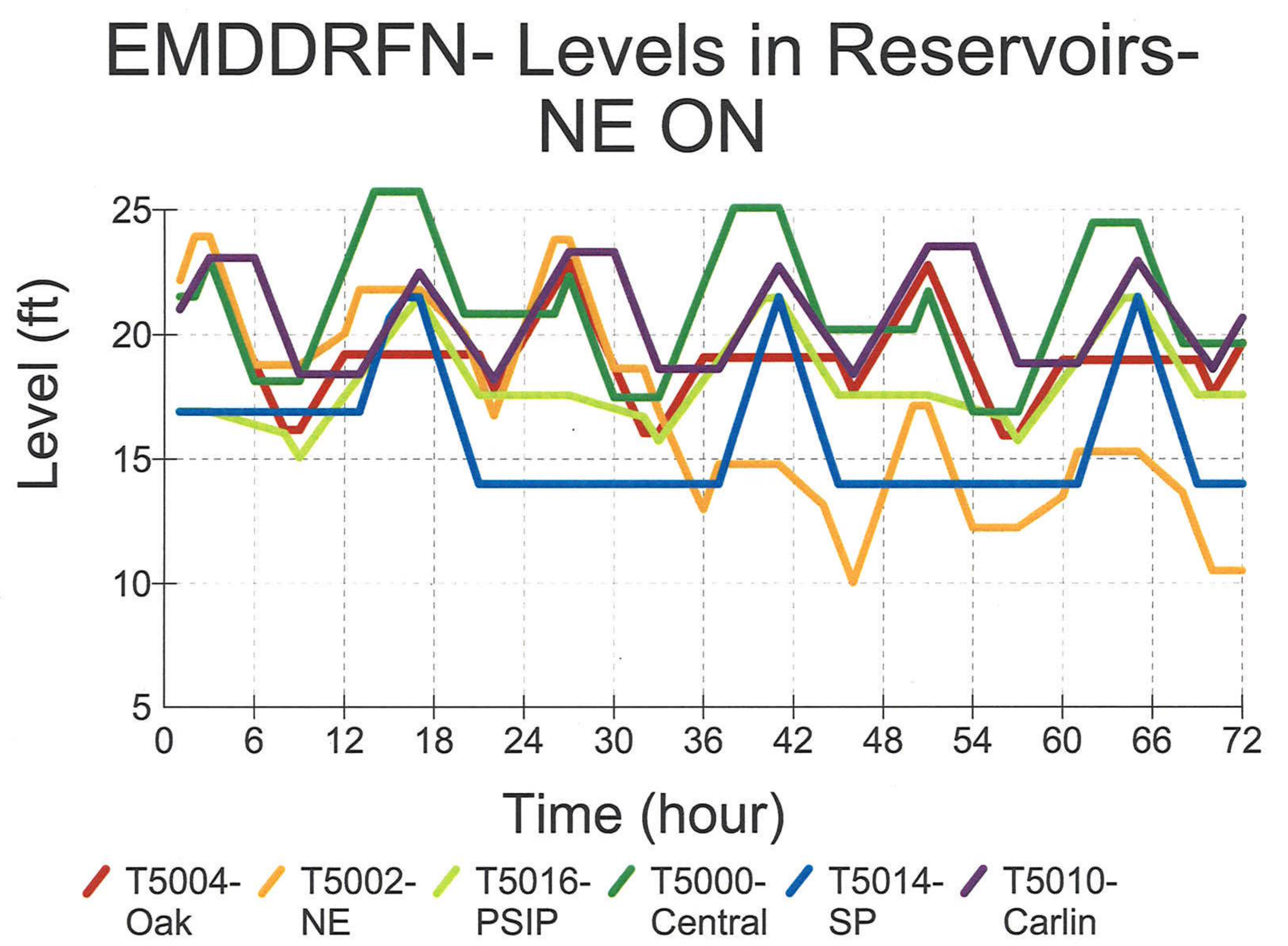


EMDDRF- Level in Resv's
Level (ft)
0
5
10
15
20
25
30
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
T5004- Oak
T5002- NE
T5016- PSIP
T5000- Central
T5014- SP
T5010- Carlin

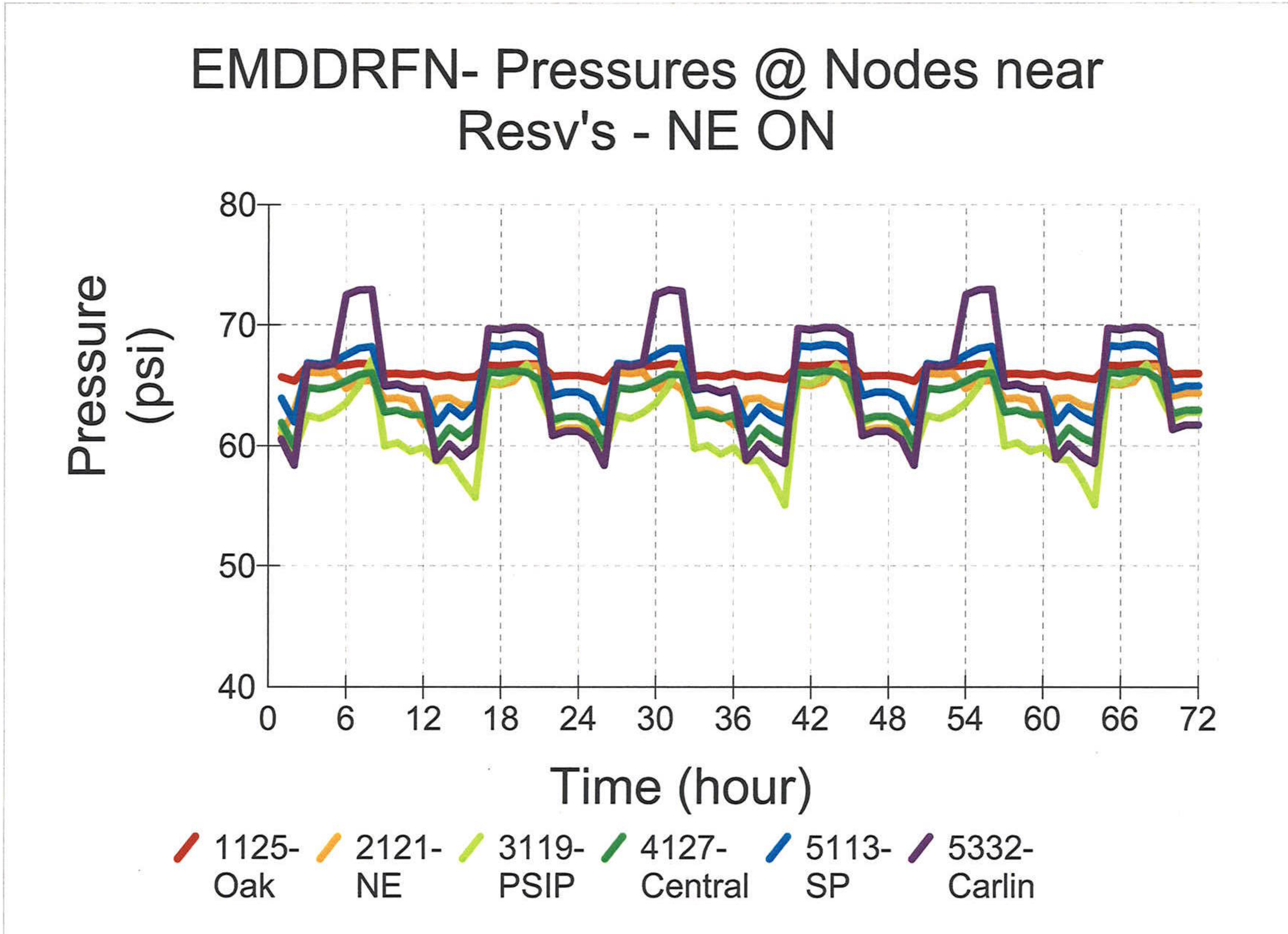

EMDDRF- Pressures at Res'v Nodes
Pressure (psi)
80
70
60
50
40
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
1125- Oak
2121- NE
3119- PSIP
4127- Central
5113- SP
5332- Carlin

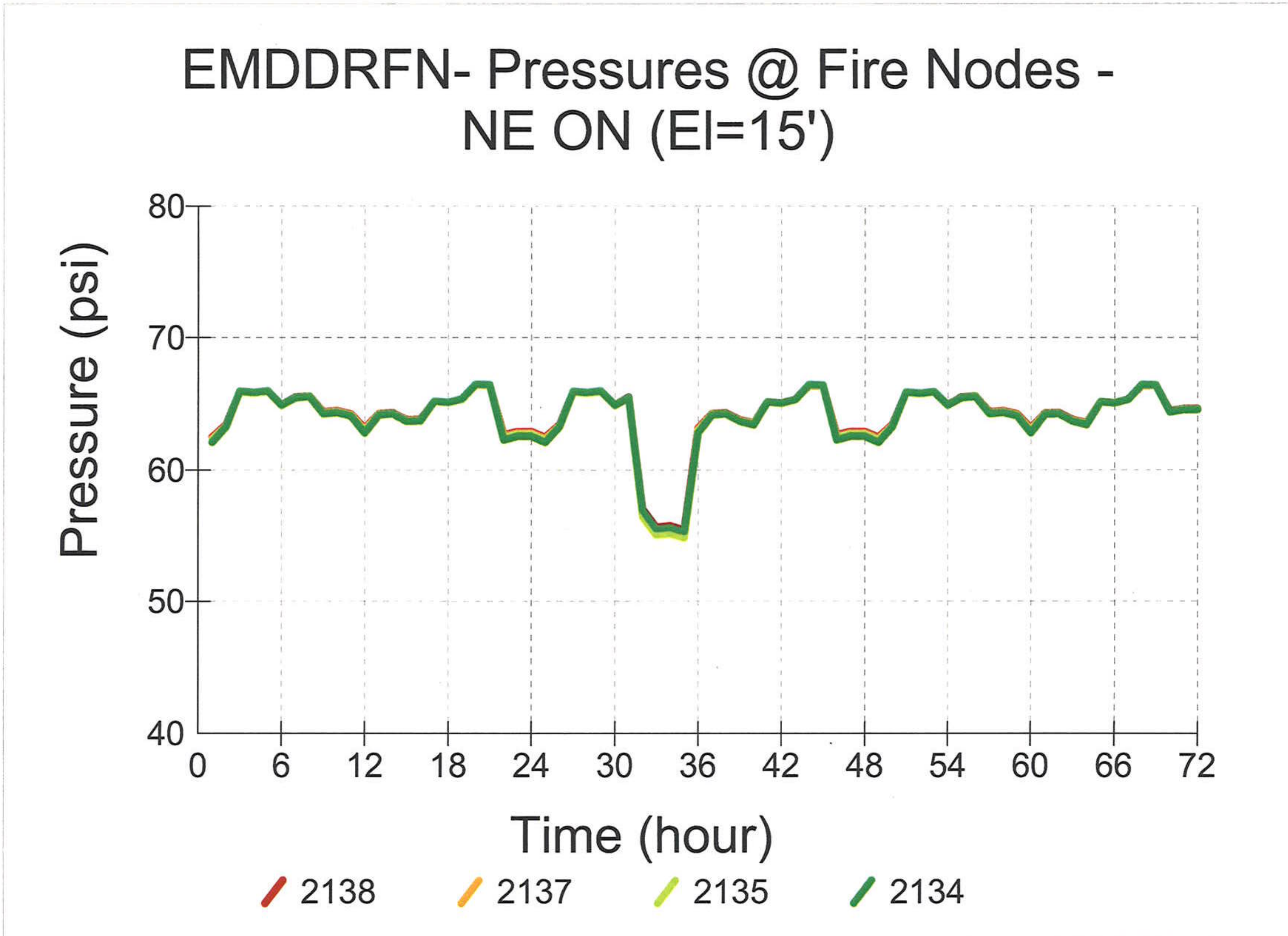

EMDDRF- Pressures at Fire Demand Nodes
Pressure (psi)
80
60
40
20
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
9024
9026
9028


EMDDRFN- Flow from HSPS- NE
ON
Flow (gpm)
30000
25000
20000
15000
10000
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)



EMDDRFN- Levels in Reservoirs- NE ON
Level (ft)
25
20
15
10
5
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
T5004- Oak
T5002- NE
T5016- PSIP
T5000- Central
T5014- SP
T5010- Carlin


EMDDRFN- Pressures @ Nodes near
Resv's - NE ON
Pressure
(psi)
80
70
60
50
40
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
1125-
Oak
2121-
NE
3119-
PSIP
4127-
Central
5113-
SP
5332-
Carlin


EMDDRFN- Pressures @ Fire Nodes - NE ON (El=15')
Pressure (psi)
80
70
60
50
40
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
2138
2137
2135
2134

Maximum Day Demand in the System = 52 mgd

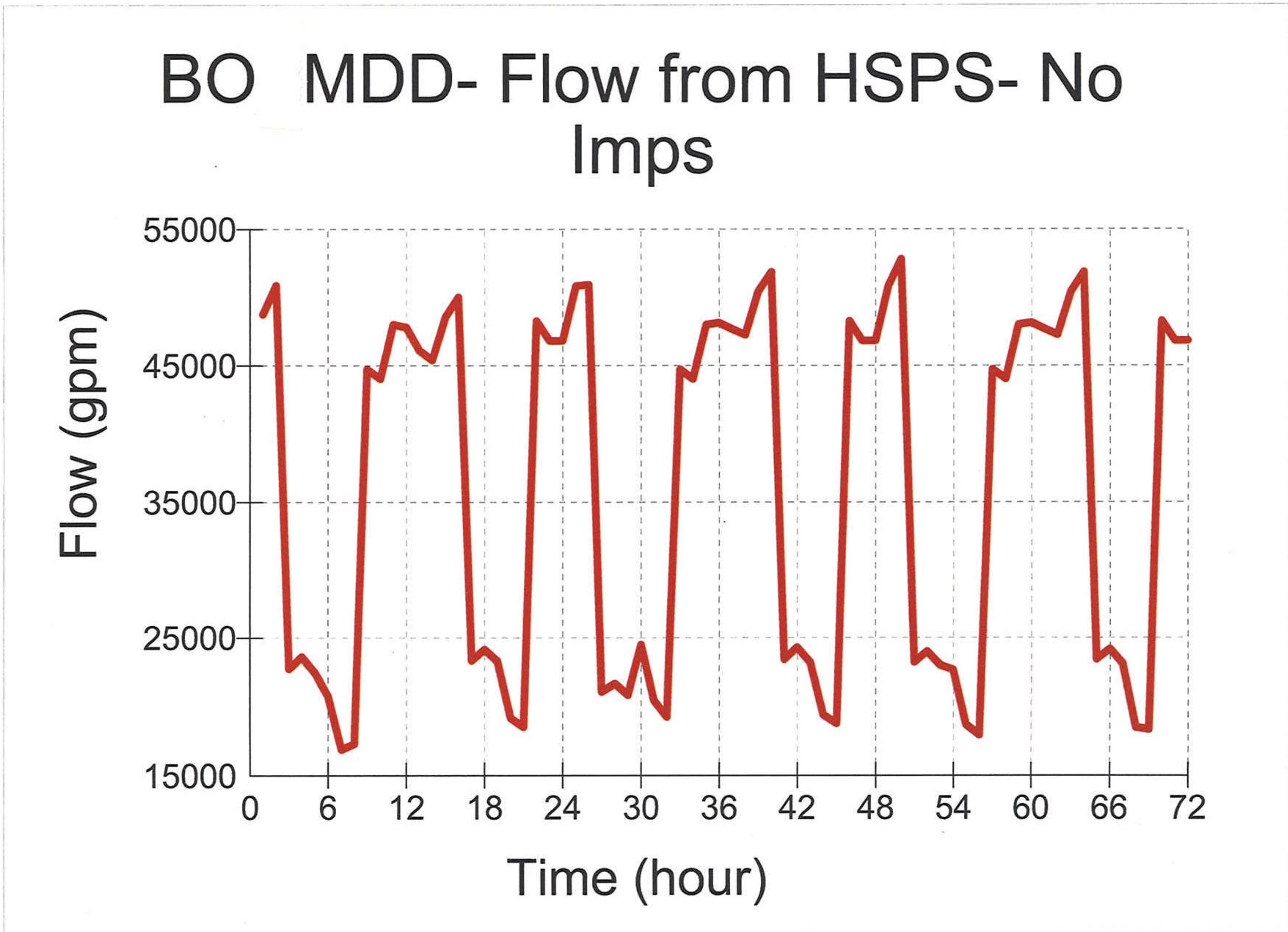
BOMDD- Operations Pattern

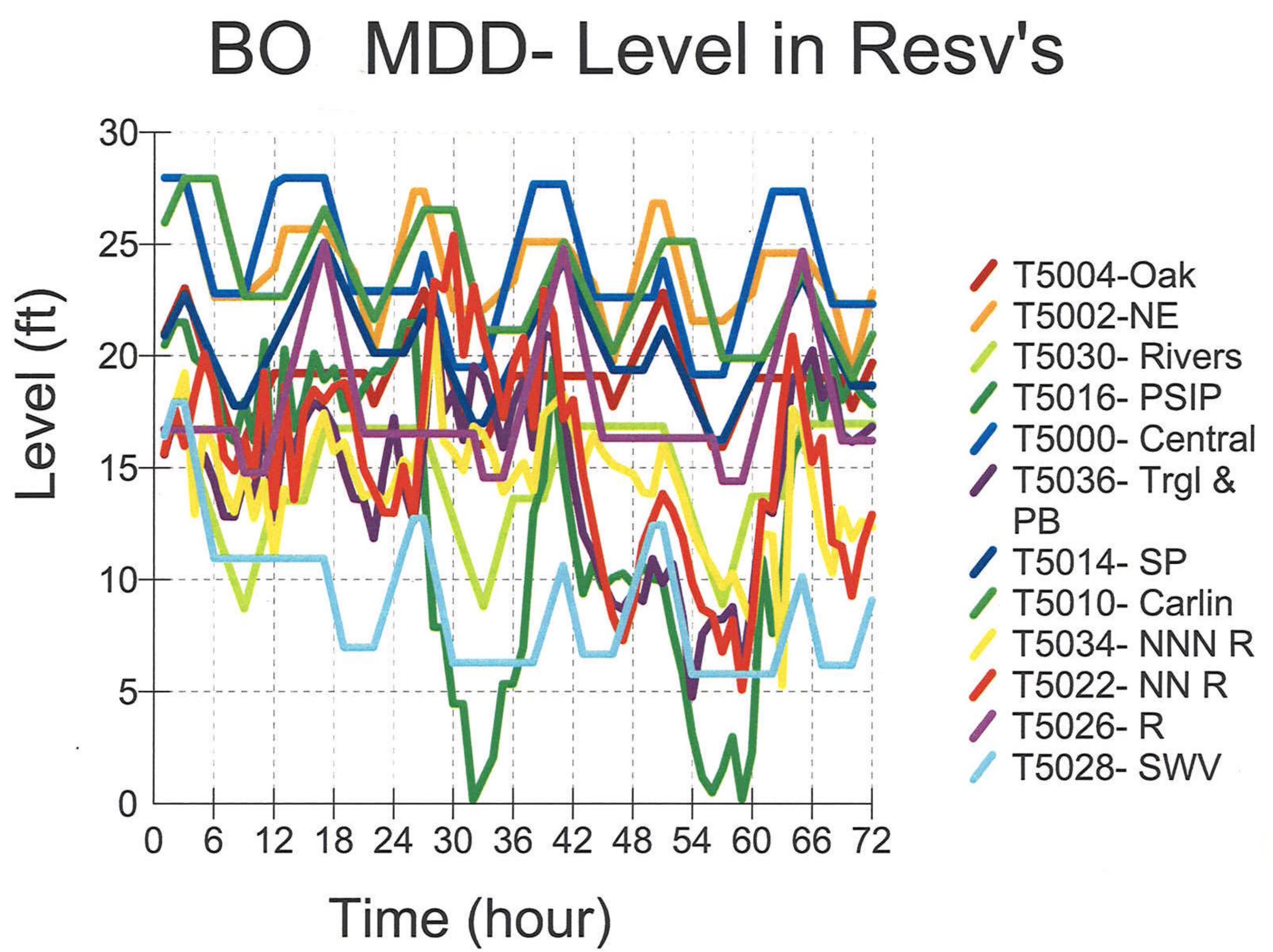
Hour	Hourly Pattern	Flow from BBWTP	Northeast	Central	PSIP	Oak	Southport	Carlin	The Rivers 2-125 hp	Triangle & Pioneer Bluff 4-125 hp	NNN of Richland Volume 4-125 hp	NN of Richland Volume 4-125 hp	Richland Volume 2-125 hp	Southwest Village 2-125 hp	Actual Flow from reservoirs MG	Actual Flow from reservoirs MGD
			2	2	3	2	3	3	1.9	4.8	4.4	4.2	2.3	2.3		
			Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow		
1	0.93	69.72													0	0.0
2	0.93	69.86													0	0.0
3	1.00	28.18	2100	1950	1400	1600	1500		1400	2600	1400			2600	0.993	23.8
4	1.11	33.98	2100	1950	1400	1600	1500		1400	2600	1400			2600	0.993	23.8
5	1.13	35.05	2100	1950	1400	1600	1500		1400	2600	1400			2600	0.993	23.8
6	1.15	36.54			2600	1600	1500	2600	1400	1400	2600	2600			0.978	23.5
7	1.11	34.31			2600	1600	1500	2600	1400	1400	2600	2600			0.978	23.5
8	1.04	31.11			2600			2600	1400		2600	4000	2600		0.948	22.8
9	0.91	65.30													0	0.0
10	0.88	63.92													0	0.0
11	0.88	66.77													0	0.0
12	0.86	64.65													0	0.0
13	0.91	69.74													0	0.0
14	0.89	65.19													0	0.0
15	0.90	65.11													0	0.0
16	0.94	67.59													0	0.0
17	1.04	30.12		1950	1400		1500	1400		2600	2600		2600	2600	0.999	24.0
18	1.08	31.97		1950	1400		1500	1400		2600	2600		2600	2600	0.999	24.0
19	1.16	38.32		1950			1500	1400		2600	1400	4000	2600		0.927	22.2
20	1.18	38.82	2100				1500	1400		2600	1400	4000	2600		0.936	22.5
21	1.11	36.45	2100			1600	1500	1400		2600	1400	4000			0.876	21.0
22	0.96	69.16													0	0.0
23	0.92	66.64													0	0.0
24	0.97	69.62													0	0.0
			10500	11700	14800	9600	15000	14800	8400	23600	21400	21200	13000	13000		
			0.63	0.702	0.888	0.576	0.9	0.888	0.504	1.416	1.284	1.272	0.78	0.78	10.62	
			32%	35%	30%	29%	30%	30%	27%	30%	29%	30%	34%	34%		

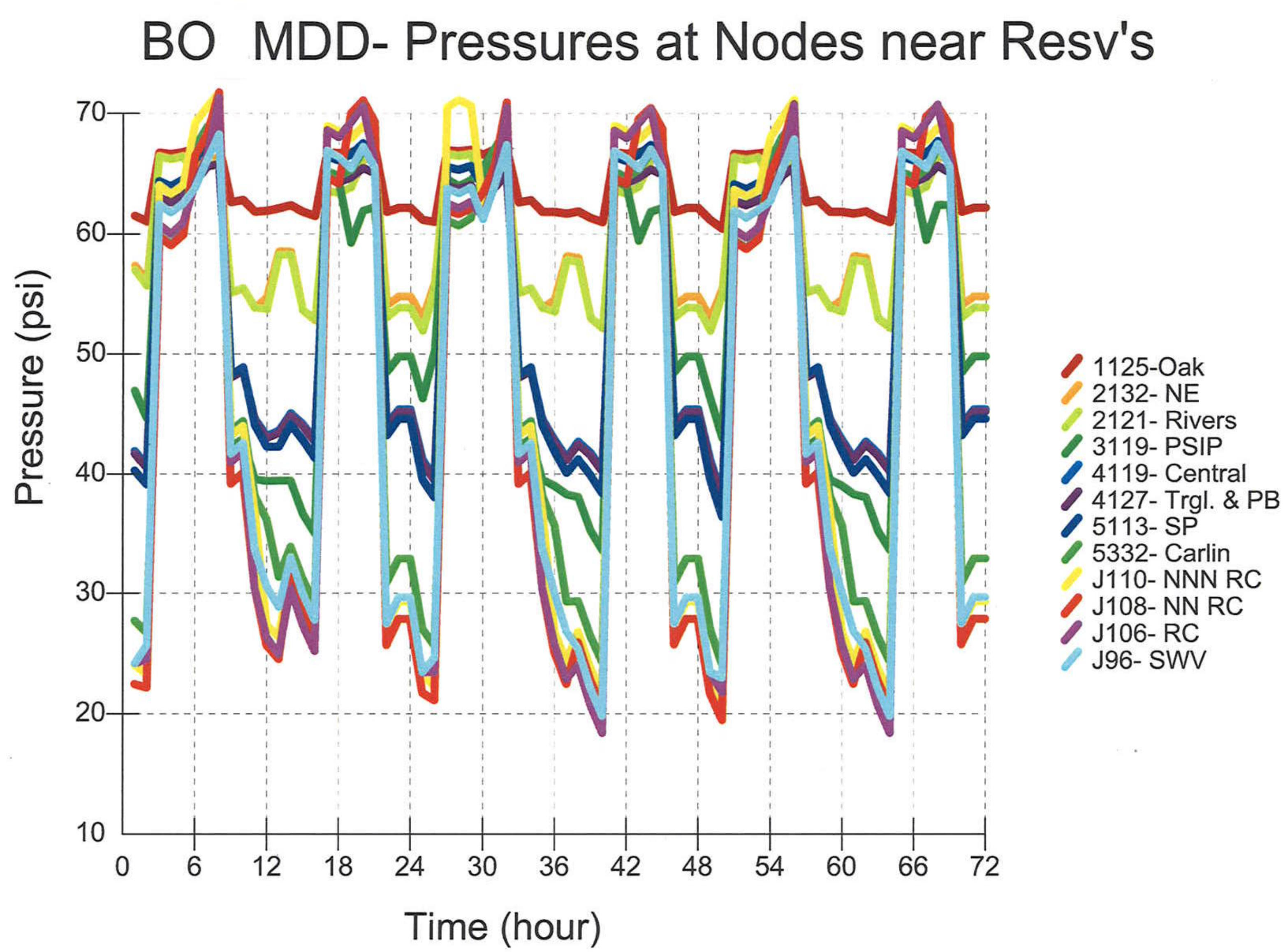
Fill Values

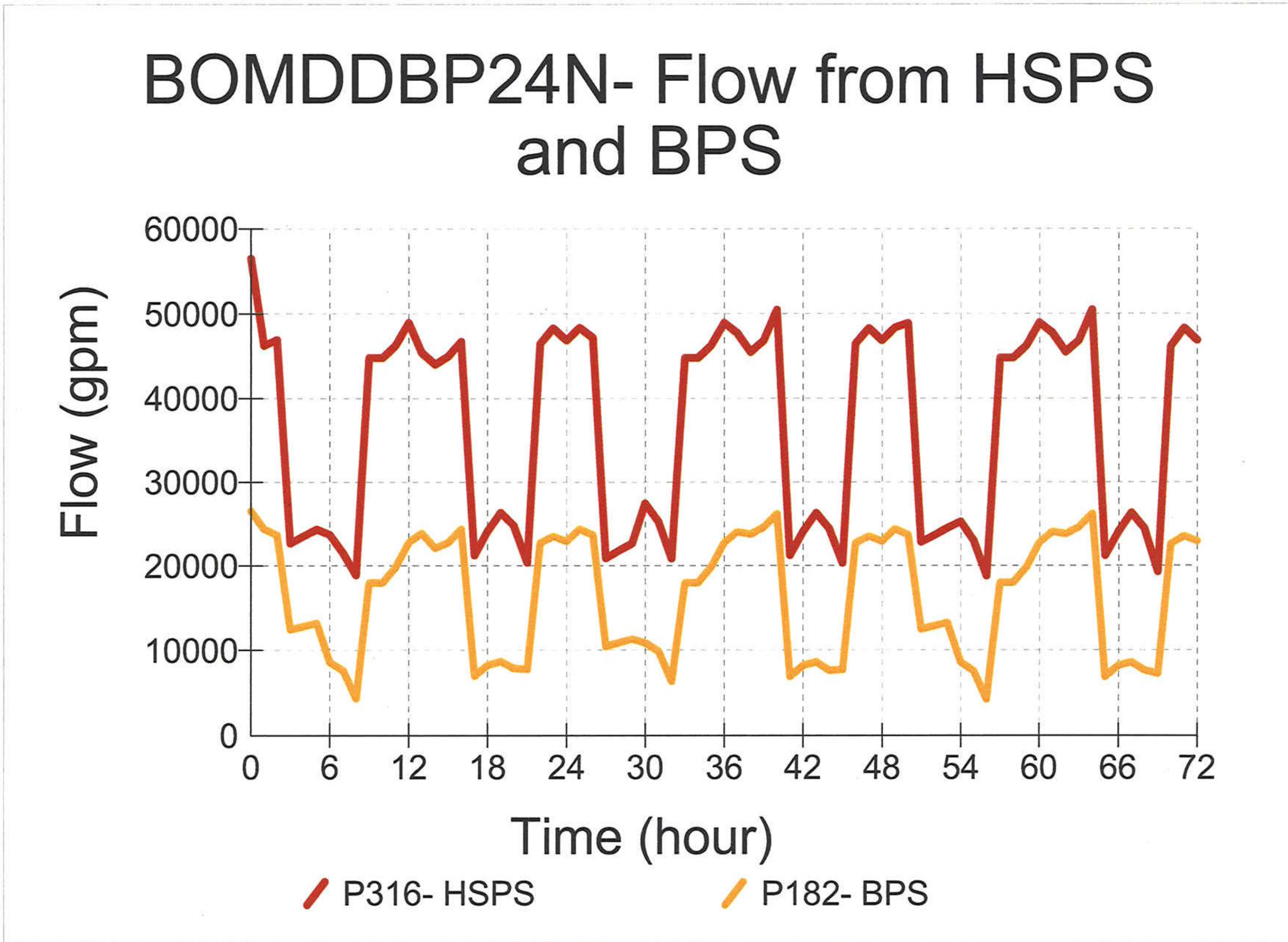
Hour	Northeast	Central	PSIP	Oak	Southport	Carlin	The Rivers	Triangle & Pioneer Bluff	NNN of Richland Volume	NN of Richland Volume	Richland Volume	Southwest Village	Actual Flow into reservoirs MG	Actual Flow into reservoirs MGD
	10500	**11700**	**14800**	**9600**	**15000**	**14800**	**8400**	**23600**	**21400**	**21200**	**13000**	**13000**		
1	2100			1200	1500	1635		2150	2150	2125		1850	0.8826	21.1824
2	2100	1950		1200	1500	1635		2150	2150	2125			0.8886	21.3264
3													0	0
4													0	0
5													0	0
6													0	0
7													0	0
8													0	0
9		1950	1850	1200	1500		1675	2150		2125			0.747	17.928
10		1950	1850	1200	1500		1675	2150		2125			0.747	17.928
11		1950	1850	1200	1500		1675	2150		2125	2175		0.8775	21.06
12		1950	1850		1500			2150	2150	2125	2175		0.834	20.016
13		1950	1850		1500	1635		2150	2150	2125	2175		0.9321	22.3704
14			1850		1500	1635		2150	2150		2175	1850	0.7986	19.1664
15			1850		1500	1635	1675		2150		2175	1850	0.7701	18.4824
16			1850		1500	1635	1675		2150		2175	1850	0.7701	18.4824
17													0	0
18													0	0
19													0	0
20													0	0
21													0	0
22	2100			1200		1635		2150	2150	2125		1850	0.7926	19.0224
23	2100			1200		1635		2150	2150	2125		1850	0.7926	19.0224
24	2100			1200		1635		2150	2150	2125		1850	0.7926	19.0224
	10500	***11700***	**14800**	**9600**	***15000***	***14715***	***8375***	***23650***	***21500***	***21250***	***13050***	***12950***		
	0	0	0	0	0	-85	-25	50	100	50	50	-50		
														90

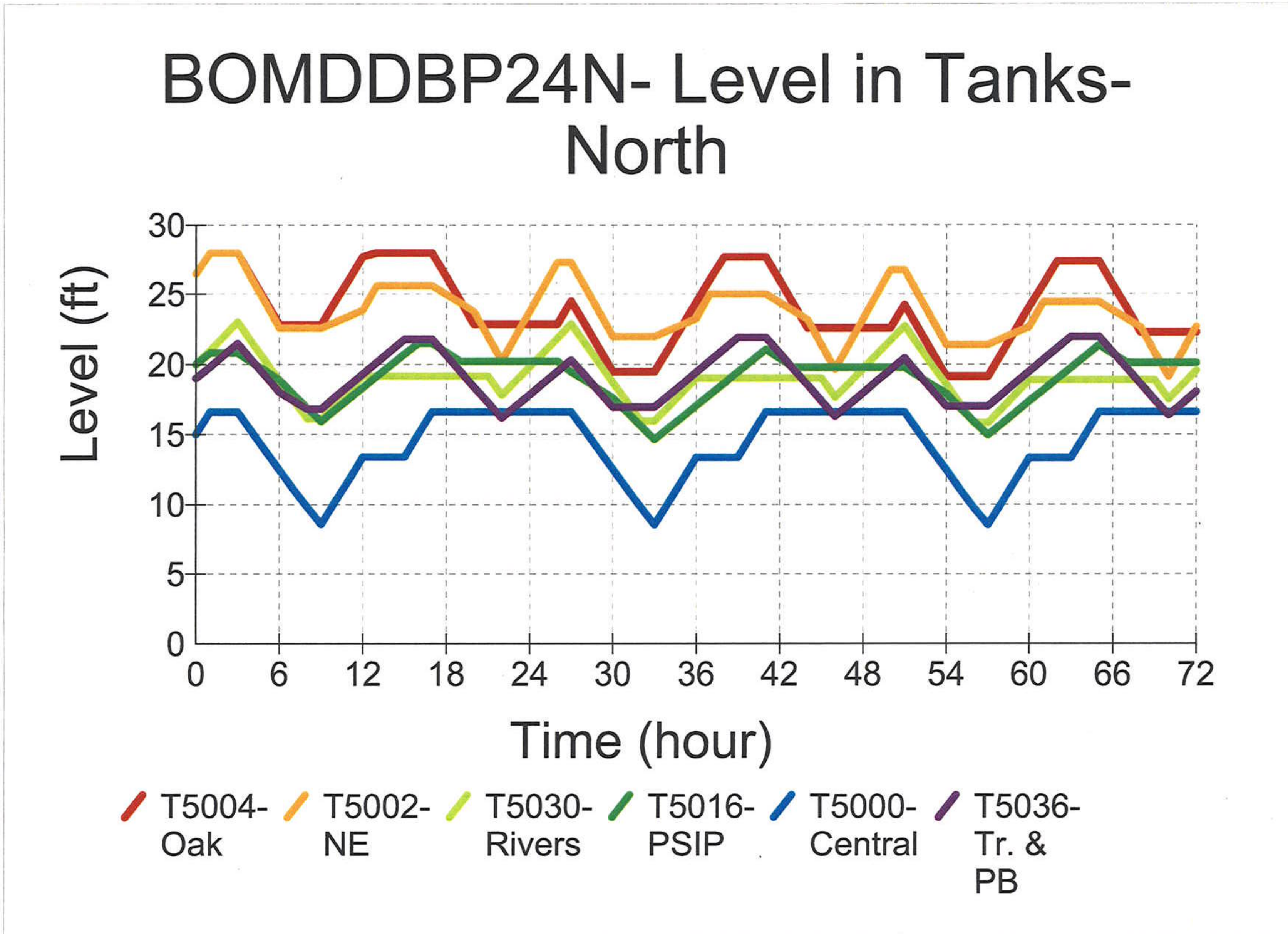
H:\Client\WestSac_Sac\6954A.00\Data Check\Operations\FutureModelOpsAlts.xls
BOMDD

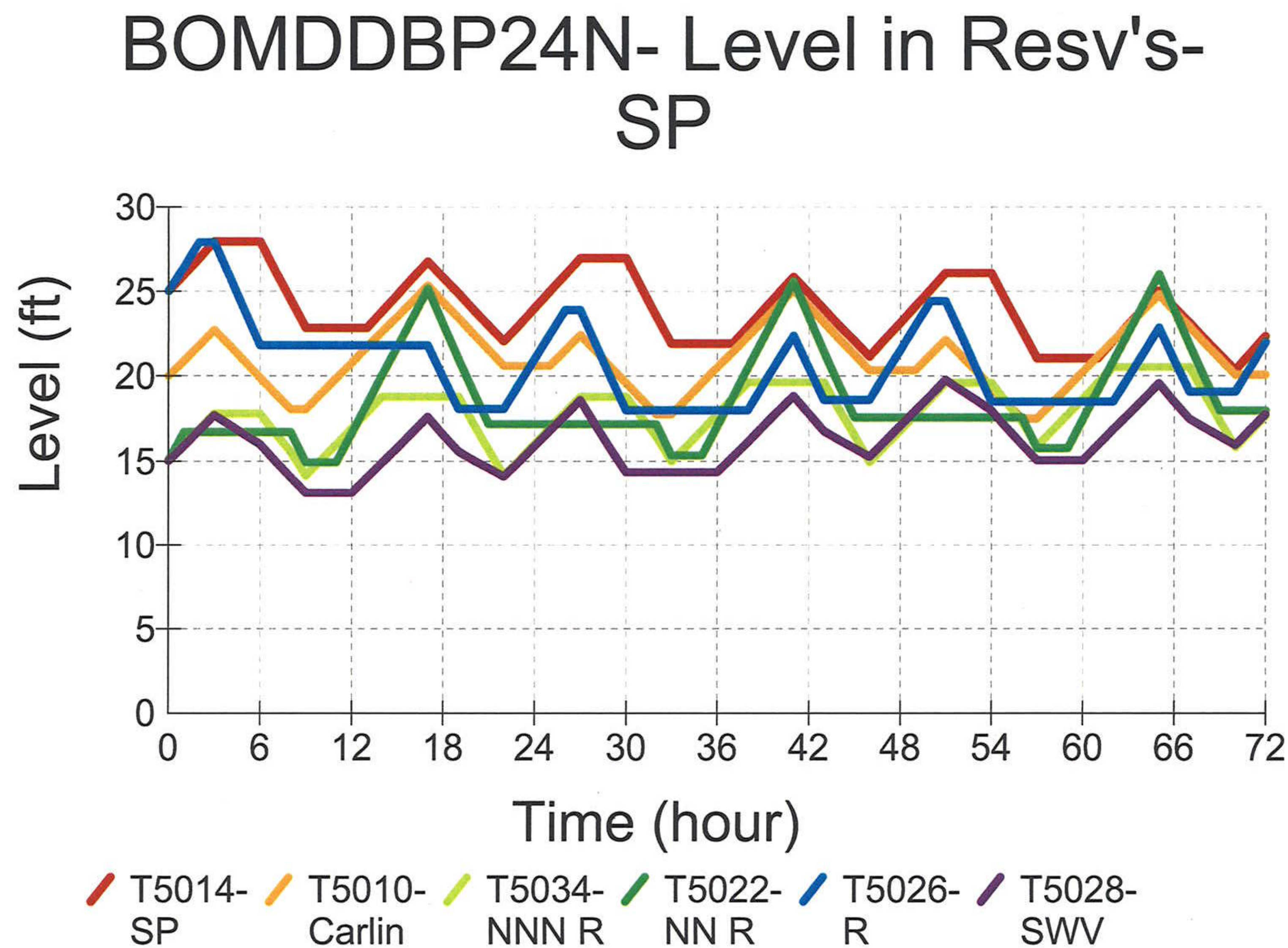

BO MDD- Flow from HSPS- No Imps
Flow (gpm)
55000
45000
35000
25000
15000
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)


BO MDD- Level in Resv's
Level (ft)
30
25
20
15
10
5
0
0 6 12 18 24 30 36 42 48 54 60 66 72
Time (hour)
T5004-Oak
T5002-NE
T5030- Rivers
T5016- PSIP
T5000- Central
T5036- Trgl & PB
T5014- SP
T5010- Carlin
T5034- NNN R
T5022- NN R
T5026- R
T5028- SWV

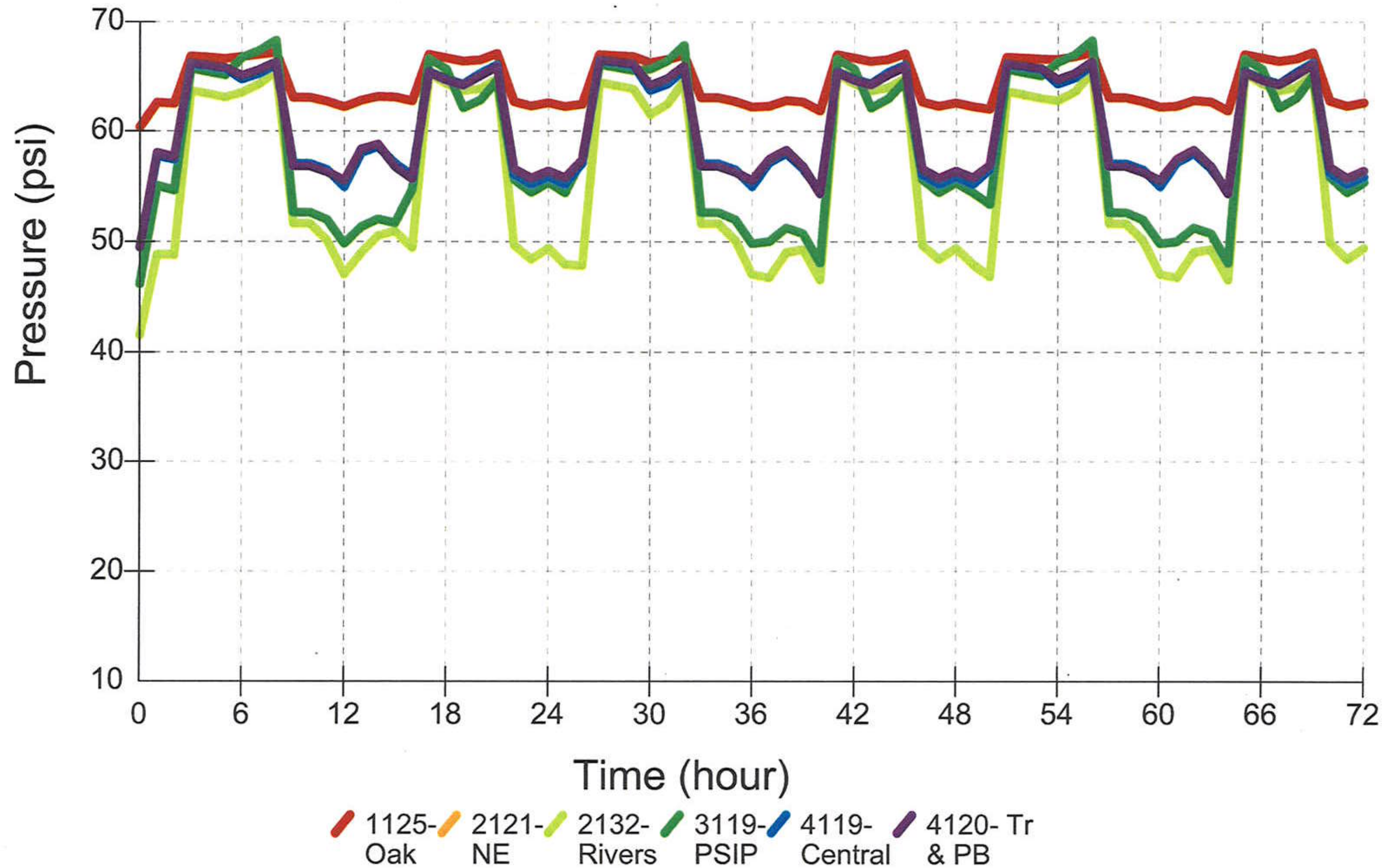

BO MDD- Pressures at Nodes near Resv's
Pressure (psi)
70
60
50
40
30
20
10
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
1125-Oak
2132- NE
2121- Rivers
3119- PSIP
4119- Central
4127- Trgl. & PB
5113- SP
5332- Carlin
J110- NNN RC
J108- NN RC
J106- RC
J96- SWV

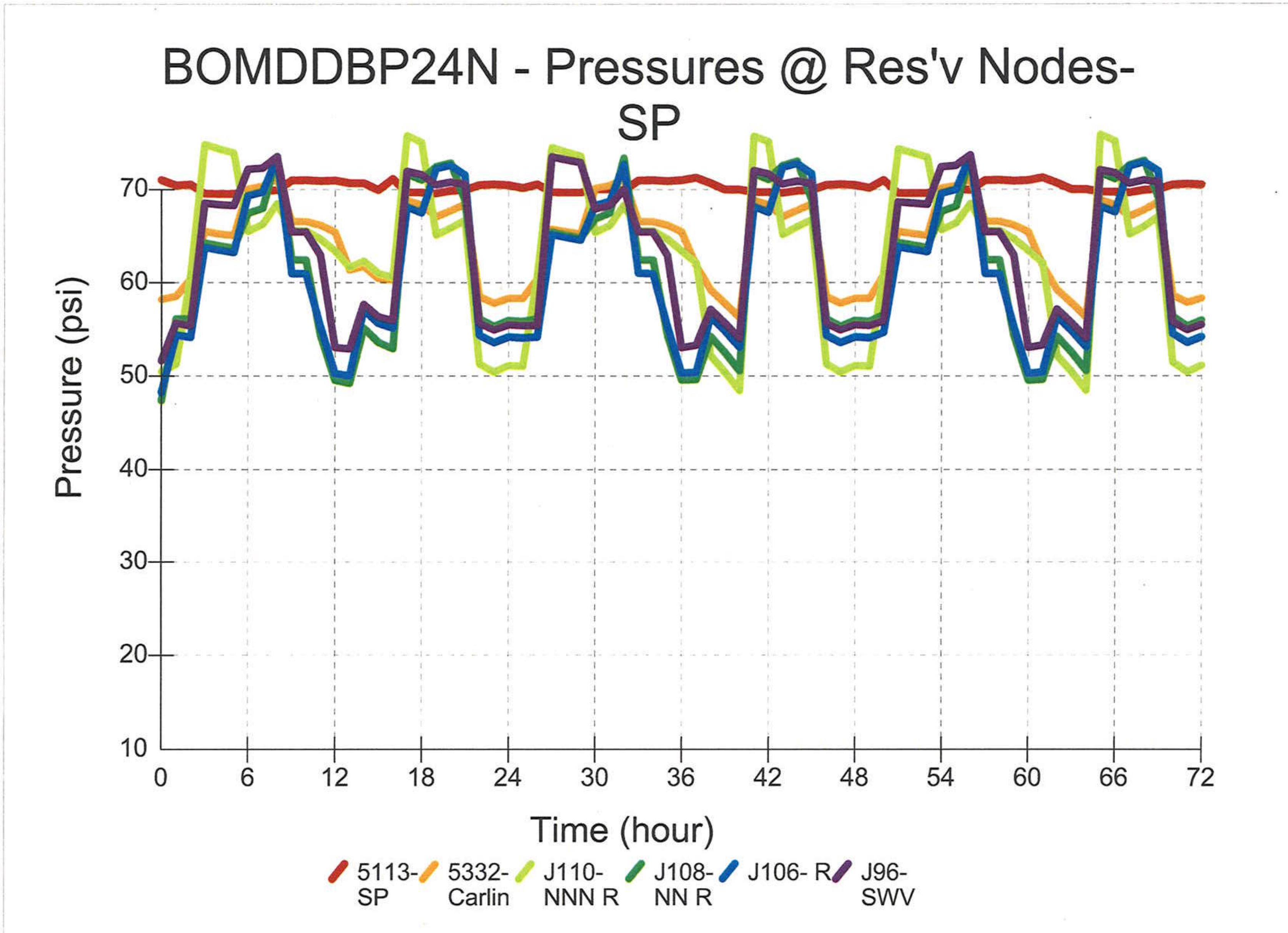

BOMDDBP24N- Flow from HSPS and BPS
Flow (gpm)
60000
50000
40000
30000
20000
10000
0
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
P316- HSPS
P182- BPS

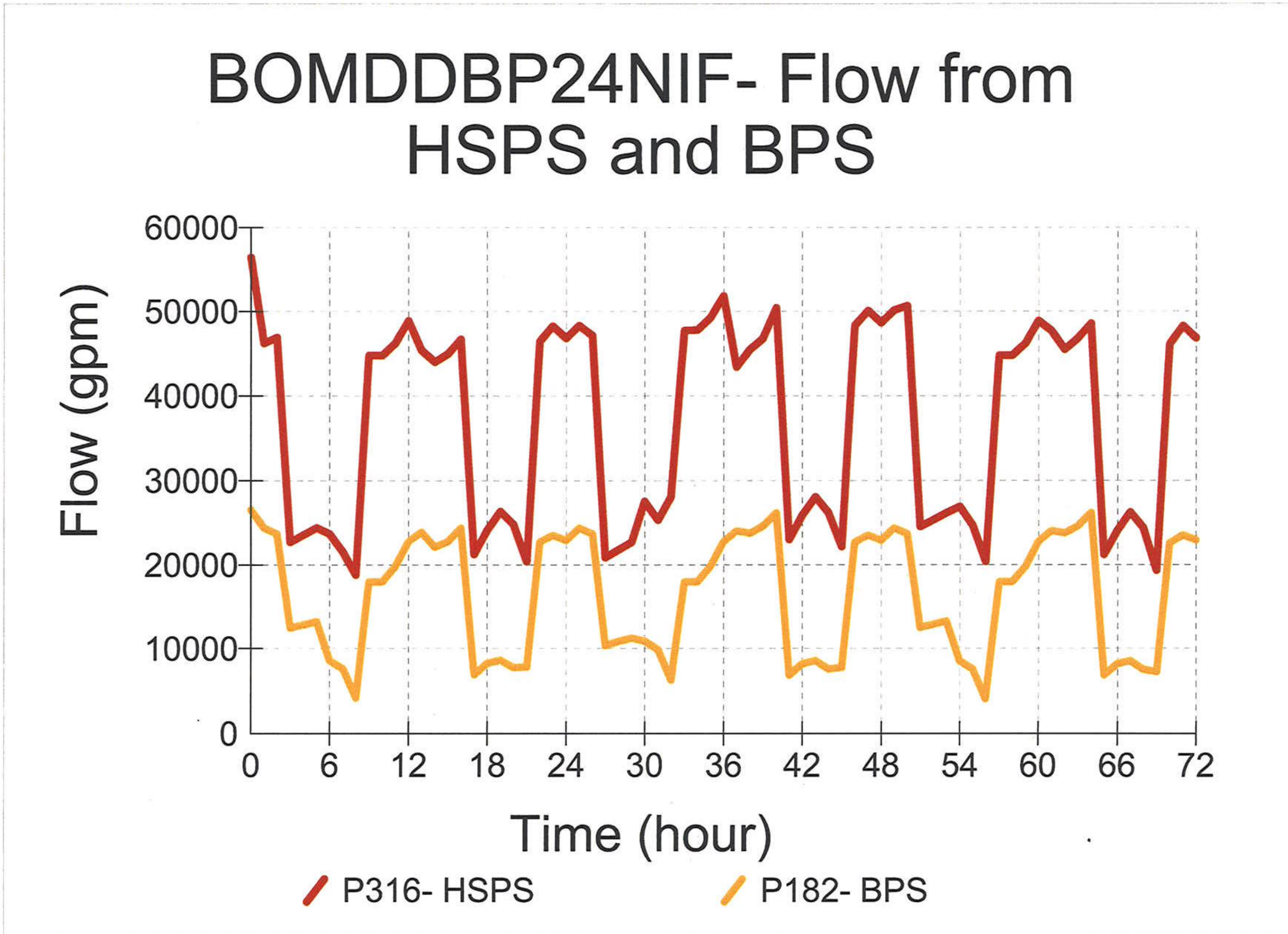

BOMDDBP24N- Level in Tanks-
North
Level (ft)
30
25
20
15
10
5
0
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
T5004-Oak
T5002-NE
T5030-Rivers
T5016-PSIP
T5000-Central
T5036-Tr. & PB

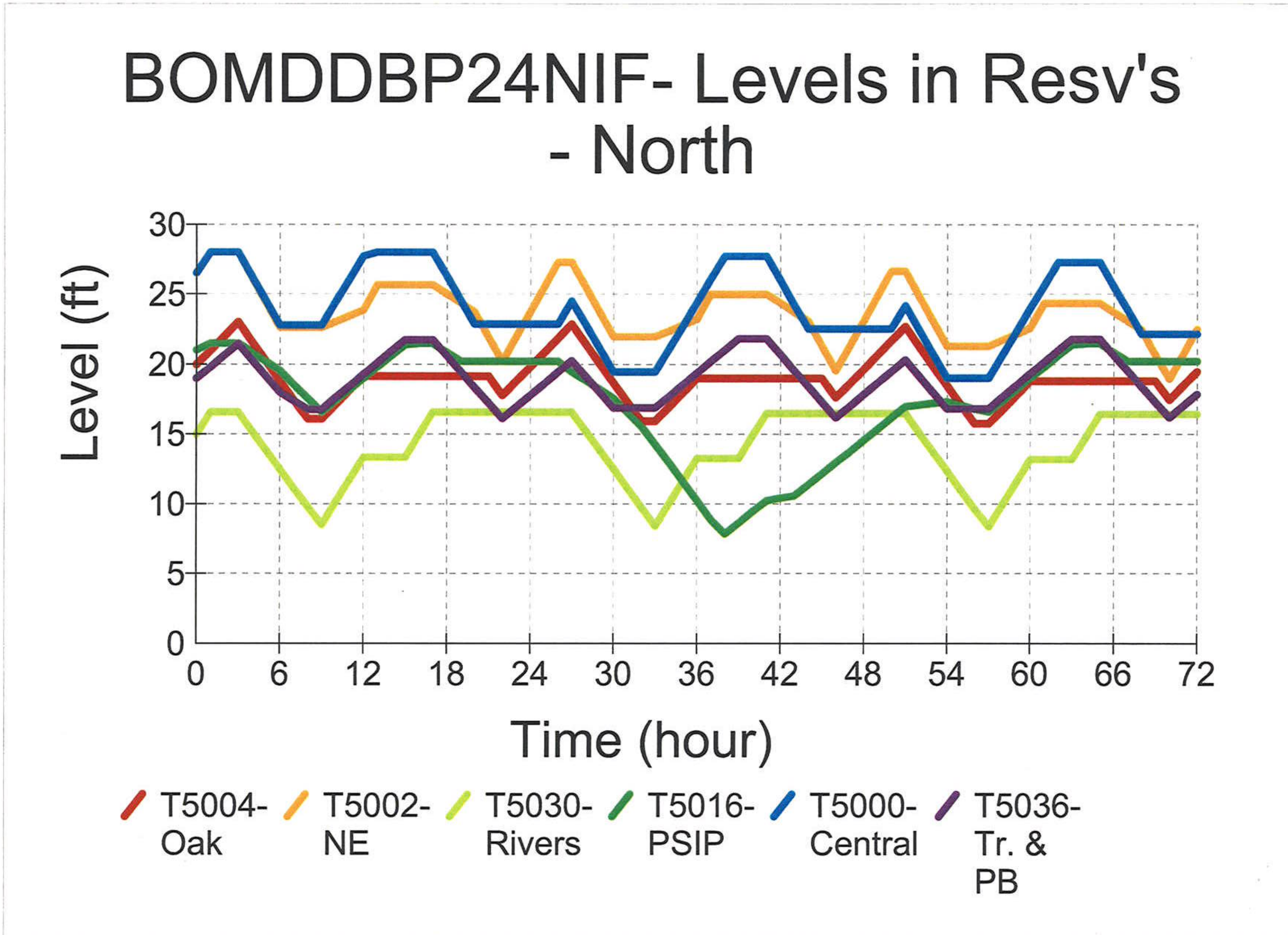

BOMDDBP24N- Level in Resv's-
SP
Level (ft)
0
5
10
15
20
25
30
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
T5014-
SP
T5010-
Carlin
T5034-
NNN R
T5022-
NN R
T5026-
R
T5028-
SWV

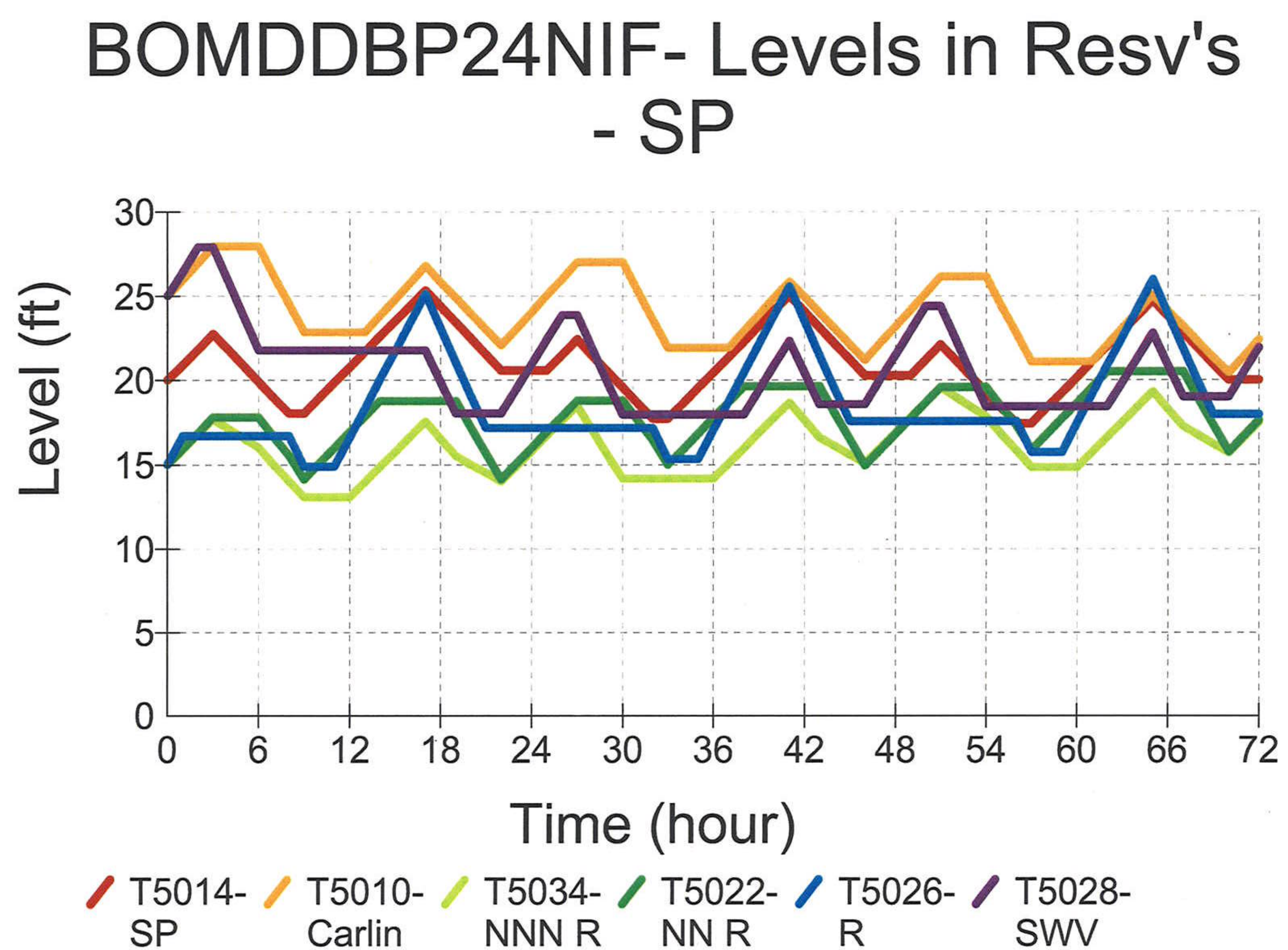
BOMDDBP24N- Pressures @ Res'v Nodes in North Area

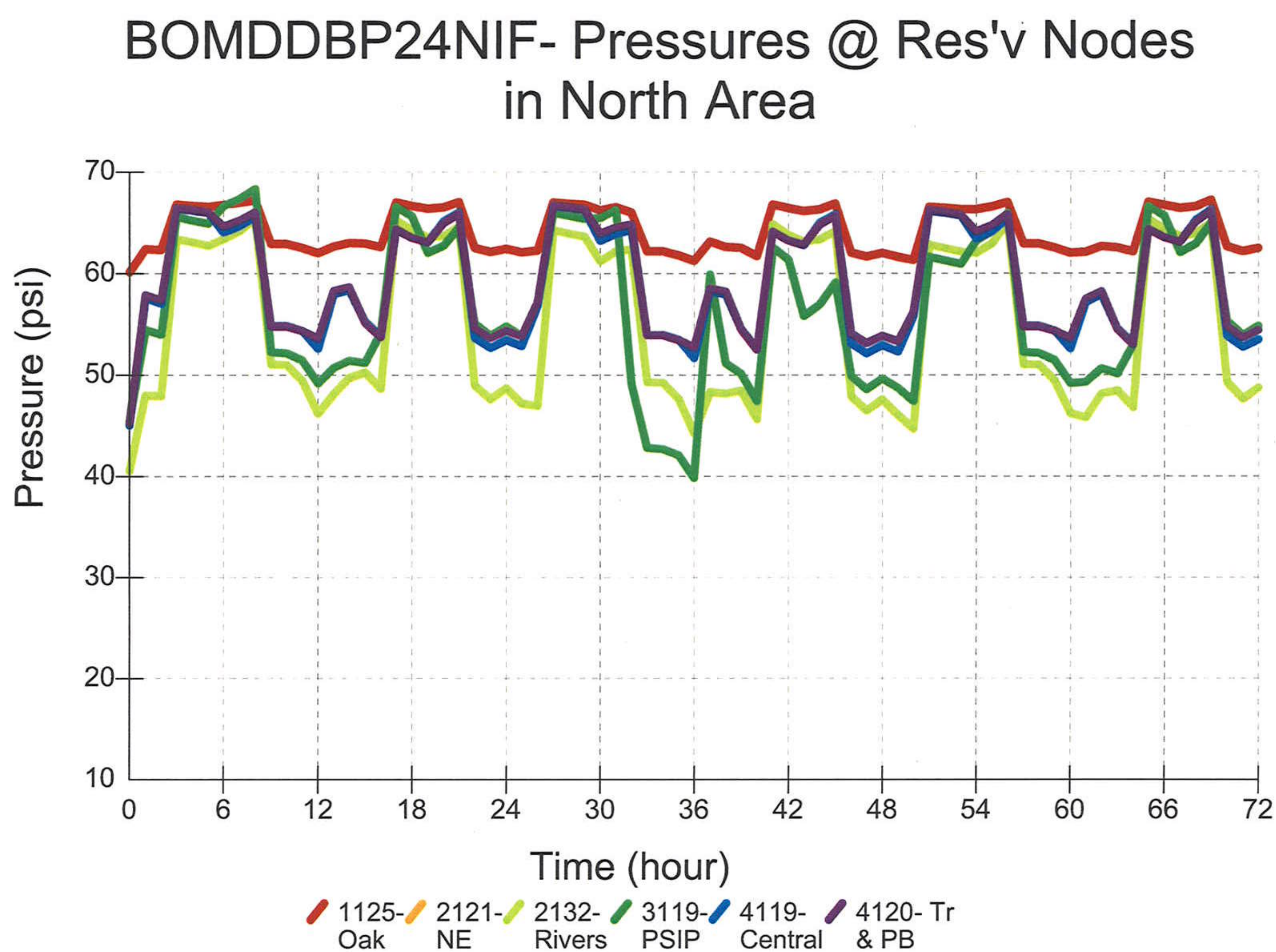


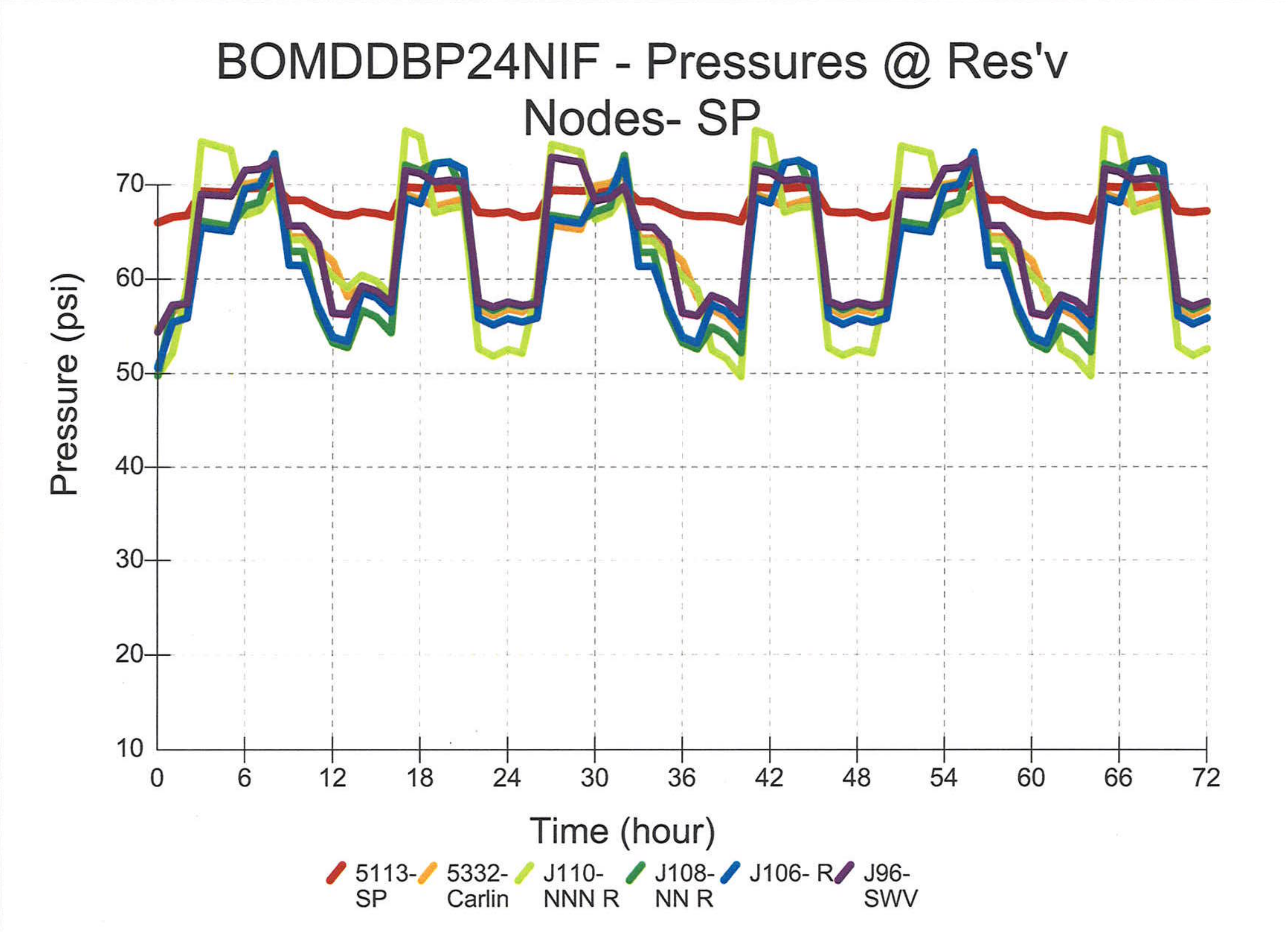

BOMDDBP24N - Pressures @ Res'v Nodes-SP
Pressure (psi)
70
60
50
40
30
20
10
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
5113-SP
5332-Carlin
J110-NNN R
J108-NN R
J106- R
J96-SWV


BOMDDBP24NIF- Flow from HSPS and BPS
Flow (gpm)
60000
50000
40000
30000
20000
10000
0
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
P316- HSPS
P182- BPS

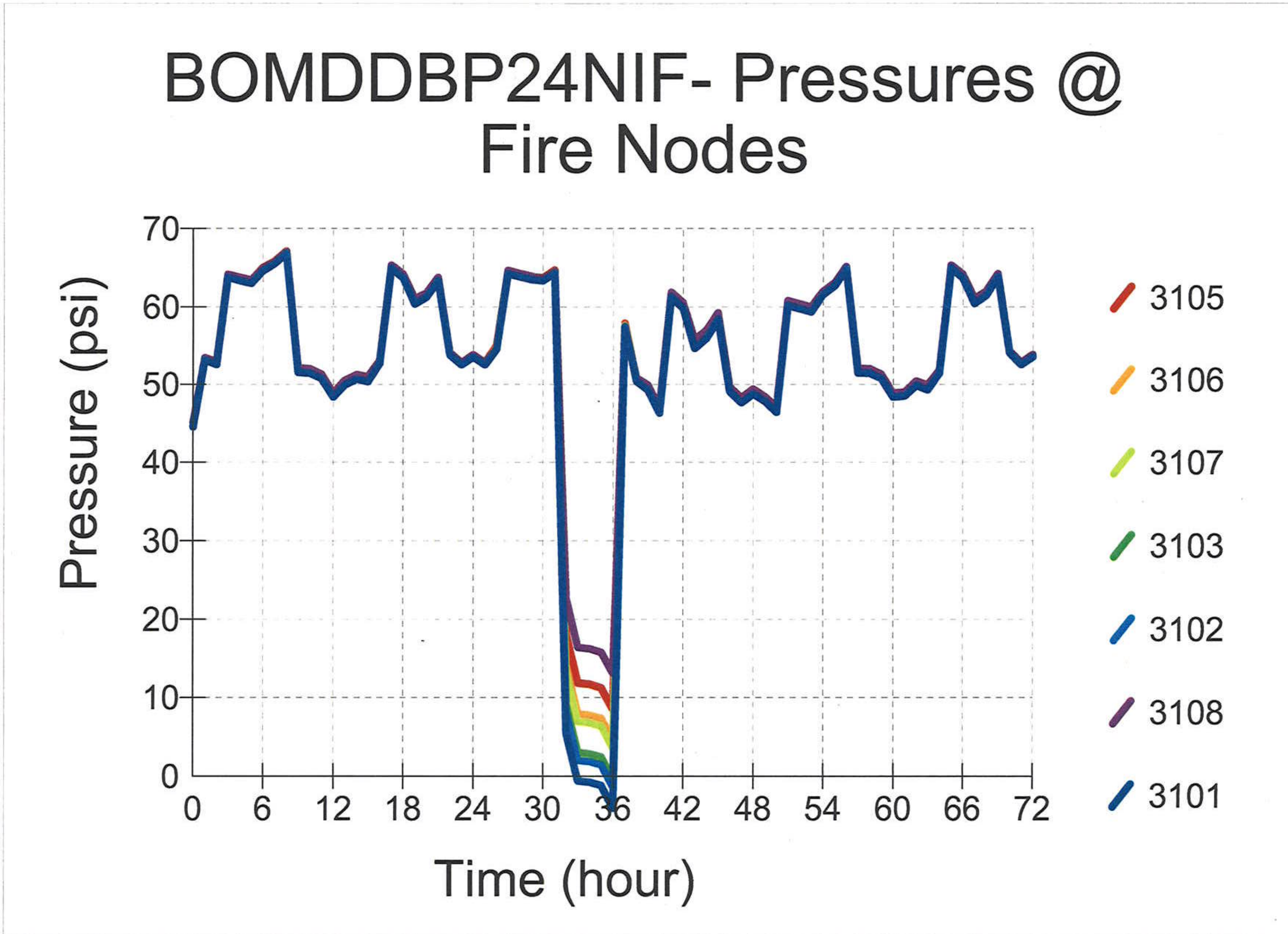

BOMDDBP24NIF- Levels in Resv's - North
Level (ft)
30
25
20
15
10
5
0
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
T5004-Oak
T5002-NE
T5030-Rivers
T5016-PSIP
T5000-Central
T5036-Tr. & PB

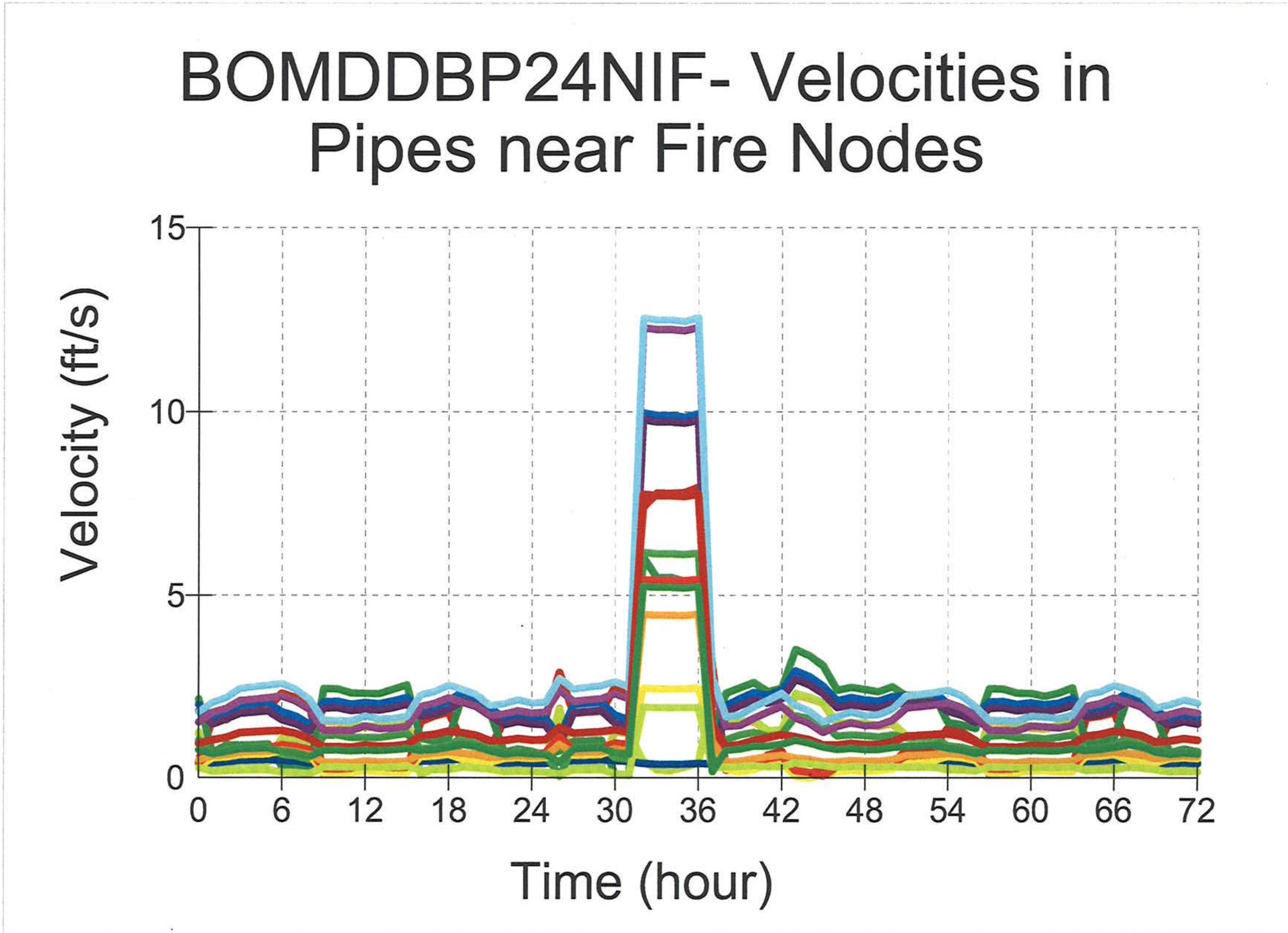

BOMDDBP24NIF- Levels in Resv's - SP
Level (ft)
30
25
20
15
10
5
0
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
T5014-SP
T5010-Carlin
T5034-NNN R
T5022-NN R
T5026-R
T5028-SWV


BOMDDBP24NIF- Pressures @ Res'v Nodes
in North Area
Pressure (psi)
70
60
50
40
30
20
10
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
1125-Oak
2121-NE
2132-Rivers
3119-PSIP
4119-Central
4120- Tr & PB



BOMDDBP24NIF - Pressures @ Res'v Nodes- SP
Pressure (psi)
70
60
50
40
30
20
10
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
5113-SP
5332-Carlin
J110-NNN R
J108-NN R
J106- R
J96-SWV


BOMDDBP24NIF- Pressures @
Fire Nodes
Pressure (psi)
70
60
50
40
30
20
10
0
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)
3105
3106
3107
3103
3102
3108
3101


BOMDDBP24NIF- Velocities in Pipes near Fire Nodes
Velocity (ft/s)
15
10
5
0
0
6
12
18
24
30
36
42
48
54
60
66
72
Time (hour)

KRONICK MOSKOVITZ TIEDEMANN & GIRARD
A PROFESSIONAL CORPORATION

RECEIVED
APR 6 2004

MEMORANDUM

FILE NO.: 7203.002

TO: Dan Mount
City of West Sacramento

FROM: Janet K. Goldsmith
Andrew P. Tauriainen

CC: Toby Ross
Robert E. Murphy

DATE: December 5, 2003

RE: Update on AB 514, Requiring Central Valley Project Municipal Contractors to Install and Operate Water Meters

---

Governor Davis recently signed Assembly Bill No. 514 ("AB 514"). This law will require urban water suppliers who are Central Valley Project ("CVP") contractors to install water meters on all surface connections to residential and non-agricultural commercial buildings constructed before January 1, 1992, and to operate all water meters for billing purposes no later than the year 2013.[1] The first part of this memorandum will briefly discuss the federal water metering requirements under the Central Valley Project Improvement Act ("CVPIA"). The second part will describe the elements of AB 514. The third part will briefly discuss water metering activities conducted in other municipalities.

I. FEDERAL METERING REQUIREMENTS

According to the legislative findings contained in the bill, AB 514 was enacted in order to prevent the loss of water supplies by municipal CVP contractors that fail to comply with federal water metering requirements. (AB 514, § 1(d)). The CVPIA (P.L. 102-575, 106 Stat. 4706), at section 3405(b), sets forth the federal water metering requirements. This section applies to all districts or agencies that receive CVP water under water service or repayment contracts for agricultural, municipal, or industrial purposes *that are entered into, renewed, or amended under federal reclamation law after October 30, 1992*. Section 3405(b) requires that any CVP contracting district or agency "shall ensure that all surface water delivery systems within its boundaries are equipped with water measuring devices or water measuring methods of

---

[1] Under existing law, all water service connections installed on or after January 1, 2002, must have a water meter. (Cal. Water Code § 110). However, existing law does not require water purveyors to charge customers for water based on the actual volume of deliveries.

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12/5/03 10:11 AM

comparable effectiveness . . . within five years of the date of contract execution, amendment, or renewal. . . ." In addition, any new surface water delivery systems must be so equipped. Section 3405(b) also requires the district or agency to inform the Secretary of the Interior and the State of California, on an annual basis, as to the monthly volume of surface water delivered within its boundaries.

The Bureau of Reclamation has incorporated the requirements of CVPIA section 3405(b) into its current negotiations for CVP contract renewal.[2] However, the City of West Sacramento is not currently renewing its CVP contract, nor has it been requested to do so. The contract term is up for renewal in 2020.

II.
AB 514

Assembly Bill No. 514 (Kehoe, Stats. 2003, ch. 680) was approved by the Legislature on September 2, 2003, and signed by the Governor on October 8. As a non-emergency bill, AB 514 goes into effect on January 1, 2004. A copy of the chaptered bill is attached hereto. AB 514 adds section 111 to the California Water Code, and contains the following provisions:

A. Application

Unlike metering requirements that are triggered only by amendment or renewal of existing CVP contracts, AB 514 applies to any urban water supplier that, on or after January 1, 2004, receives water from the Central Valley Project under a water service contract or subcontract relating to municipal water supply. (Cal. Water Code § 111(a)). AB 514 applies to all counties and cities, including charter counties and cities, and local public agencies that are urban water suppliers. (Cal. Water Code § 111(c)).

Under AB 514, the term "urban water supplier" means a public or private water supplier that provides water for municipal purposes to more than 3,000 customers, or which supply more than 3,000 acre feet of water each year.[3] (Cal. Water Code §§ 111(d), 10617).

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2 / In the "CVP-wide form of contract," which forms the basis for individual contractor negotiations, the Bureau has included a specific term which requires metering of municipal water deliveries. Although the Bureau recognizes that contractors may need to negotiate slightly varying language in each particular circumstance, the CVP-wide form of contract water metering language includes all of the requirements of section 3405(b). For example, all water delivered for municipal and industrial purposes must be measured at each service connection. The contractor must bill water users for water delivered. The Bureau of Reclamation must approve the types of water meters and measuring methods used by the contractor. New surface water delivery systems must comply with the metering requirements. The contractor must inform both the United States and the State of California each year of the monthly volume of surface water delivered within the contractor's service area during the previous year. Finally, the contractor must inform the Bureau of Reclamation each month of the quantity of municipal and irrigation water taken during the preceding month.

West Sacramento is an urban water supplier subject to the metering requirements. "Water meter" is defined to include "any suitable water measuring device or facility which measures or determines the volumetric flow of water." (Cal. Water Code §§ 111(d), 516).

B. <u>Requirements</u>

AB 514 requires urban water suppliers to do both of the following:

(1) install water meters on <u>all</u> service connections to residential and non-agricultural commercial buildings constructed prior to January 1, 1992, **no later than January 1, 2013**; and

(2) begin charging customers for water based on actual volume of deliveries, as measured by a water meter, **commencing March 1, 2013, or according to the terms of the applicable CVP water contract then in operation.**

(Cal. Water Code § 111(a)(1)-(2) (emphasis added)).

C. <u>Recovery of Costs</u>

Urban water suppliers affected by AB 514 may recover the cost of providing services related to the purchase, installation, and operation and maintenance of water meters from rates, fees, or charges. (Water Code § 111(b)).

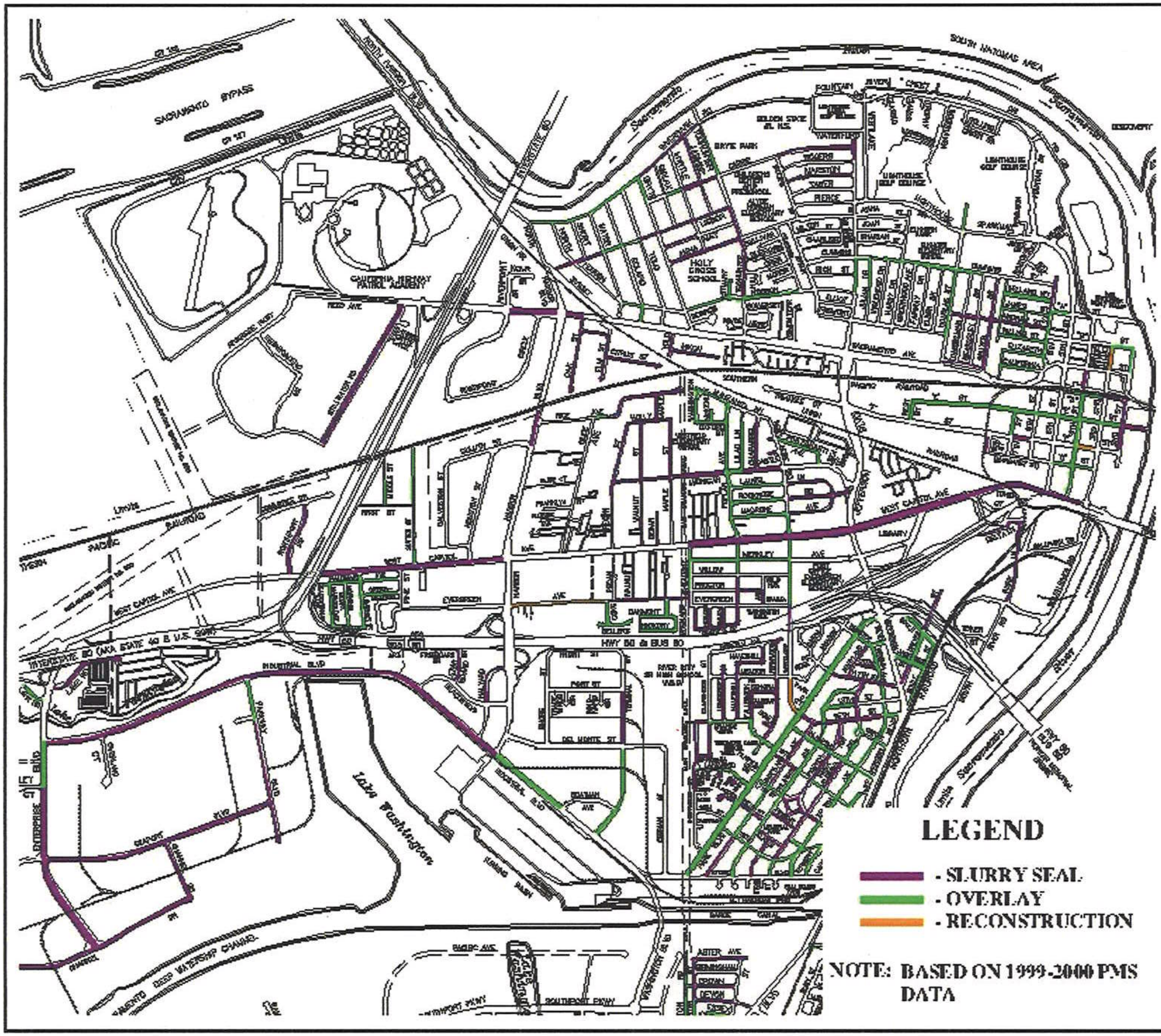
III.
<u>WATER METERING PROGRAMS IN OTHER MUNICIPALITIES</u>

AB 514 applies to all municipalities that receive CVP water pursuant to water service or repayment contracts, including the City of West Sacramento. We are informed, however, that it does not apply to the City of Sacramento, as Sacramento does not receive CVP water. AB 514 applies to the cities of Fresno, Roseville, and Folsom. The City of Fresno opposed AB 514, and does not appear to have a program currently in place to retrofit residential and non-agricultural commercial buildings constructed prior to 1992.

In November 2002, voters in the City of Folsom approved Measure P, which provides that the City of Folsom cannot pay for the cost of retrofitting water meters in homes built prior to 1992. The City of Folsom will instead attempt to collect about half of the money needed to retrofit such homes through developer impact fees, and is exploring other options, including state and federal grants, to obtain the remaining necessary funds. In addition, Folsom has continued to charge all water users a flat rate for water rather than fees based on water usage. Although the City has yet to develop a plan to retrofit all existing homes, Folsom plans to have all homes on metered rates by the year 2011. City of Folsom's website discussing its plans is: http://www.folsom.ca.us/.

CAPITAL IMPROVEMENT PROGRAM

- Street Map of Measure K Streets



THE CITY OF WEST SACRAMENTO

TITLE: STREET REHABILITATION BACKLOG

PROJECT:

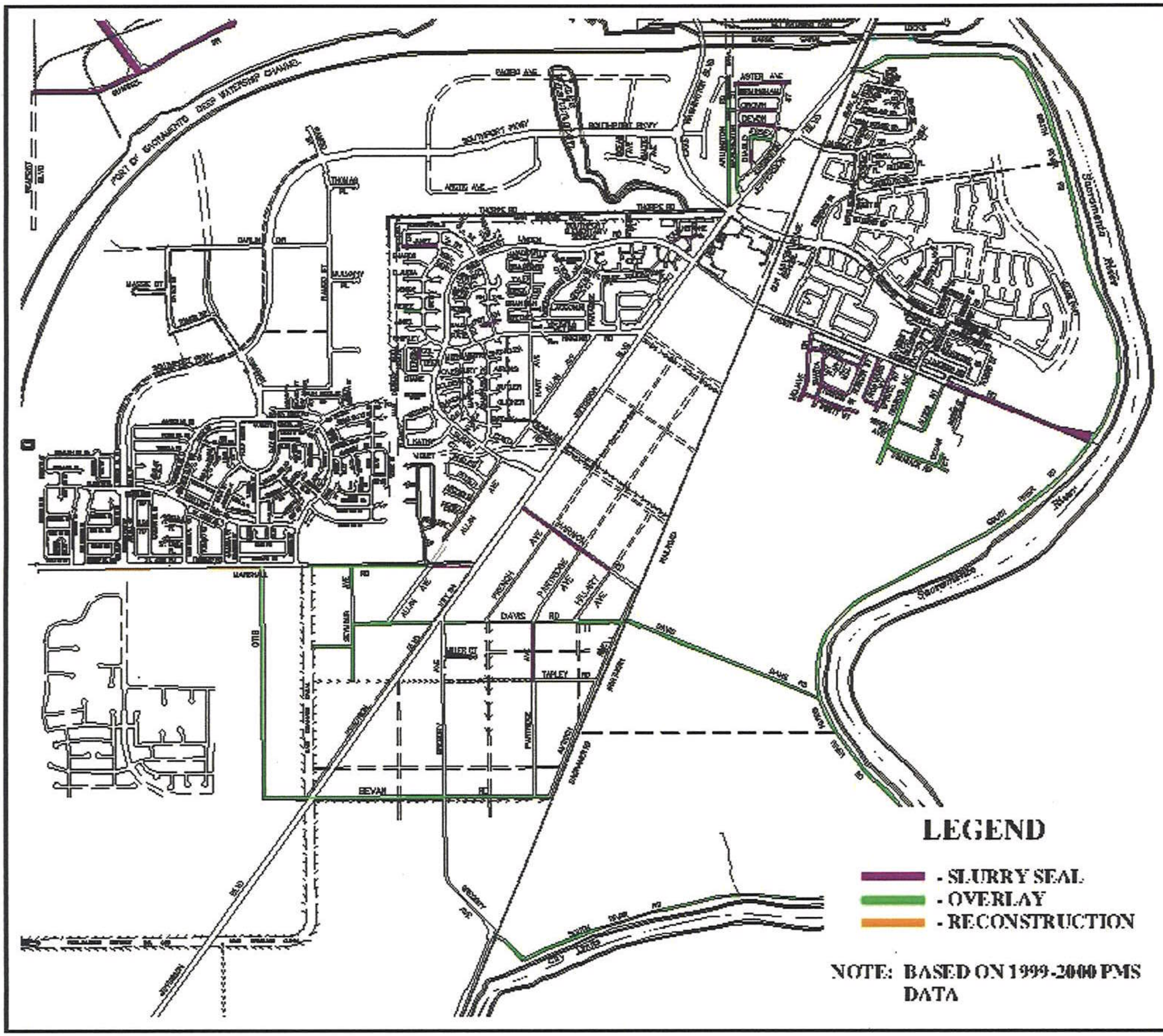
DATE: 06/02/03

SCALE: N.T.S.

DRAWN BY: B. COWARD

CHECKED BY: J. GASKELL

SHEET 1 OF 2



THE CITY OF WEST SACRAMENTO

TITLE:
STREET REHABILITATION BACKLOG

PROJECT:

DATE: 06/02/03

SCALE: N.T.S.

DRAWN BY: B. COWARD

CHECKED BY: J. GASKELL

SHEET 2 OF 2

THE CITY OF WEST SACRAMENTO EST. 1987

CITY OF WEST SACRAMENTO
ENGINEERING DIVISION
1110 W. CAPITOL AVE.
WEST SACRAMENTO, CA 95691

PHONE: (916)617-4645
FAX: (916)371-1516

EMAIL:
comdev@ci.west-sacramento.co.us

TITLE:
STREET REHABILITATION BACKLOG (NORTH)

PROJECT:

DATE: 4-13-04

SCALE: 1" = 2500'

DRAWN BY: B. COWARD

CHECKED BY: J. GASKELL

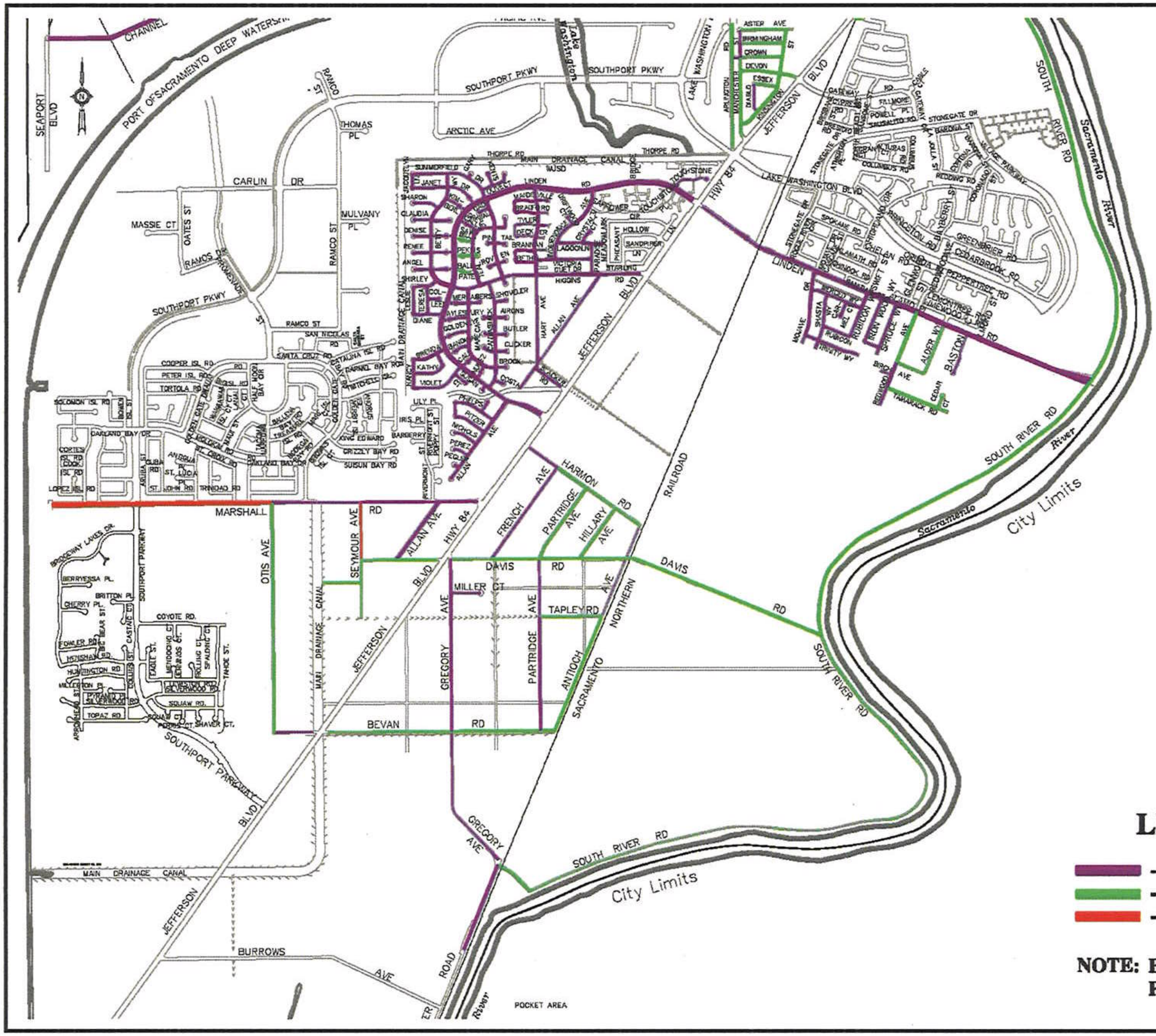
W.O. # :

SHEET 1 OF 1

LEGEND

- SLURRY SEAL
- OVERLAY
- RECONSTRUCTION

NOTE: BASED ON 2002 PMS DATA



CITY OF WEST SACRAMENTO
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1110 W. CAPITOL AVE.
WEST SACRAMENTO, CA 95691

PHONE: (916)617-4645
FAX: (916)371-1516

EMAIL:
comdev@ci.west-sacramento.ca.us

TITLE:
STREET REHABILITATION BACKLOG (SOUTH)

PROJECT:

DATE: 4-13-04

SCALE: 1" = 2500'

DRAWN BY: B. COWARD

CHECKED BY: J. GASKELL

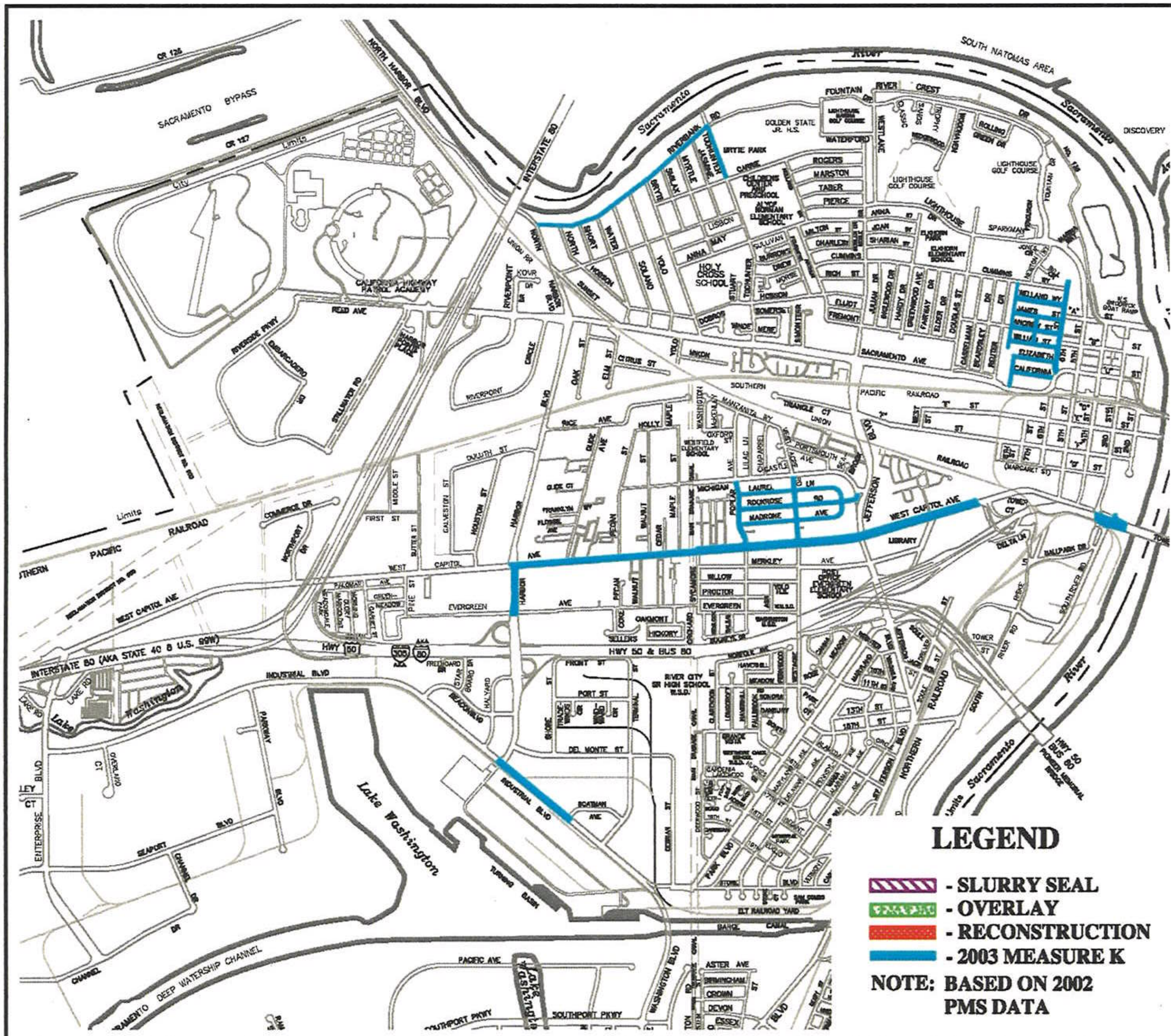
W.O. # :

SHEET 1 OF 1

LEGEND

- SLURRY SEAL
- OVERLAY
- RECONSTRUCTION

NOTE: BASED ON 2002 PMS DATA



THE CITY OF WEST SACRAMENTO EST. 1987

CITY OF WEST SACRAMENTO
ENGINEERING DIVISION
1110 W. CAPITOL AVE.
WEST SACRAMENTO, CA 95916

PHONE: (916)617-4645
FAX: (916)371-1516

EMAIL: comdev@ci.west-sacramento.ca.us

TITLE:
MEASURE 'K'
REHABILITATION
PROGRAM
FY 2003-4

PROJECT:
RIVERBANK RD.,
SIXTH ST.,
W. CAPITOL AVE.,
INDUSTRIAL BLVD.,
WESTFIELD AREA,
AND SR275 REHAB.
PROJECT

DATE: 4-07-04

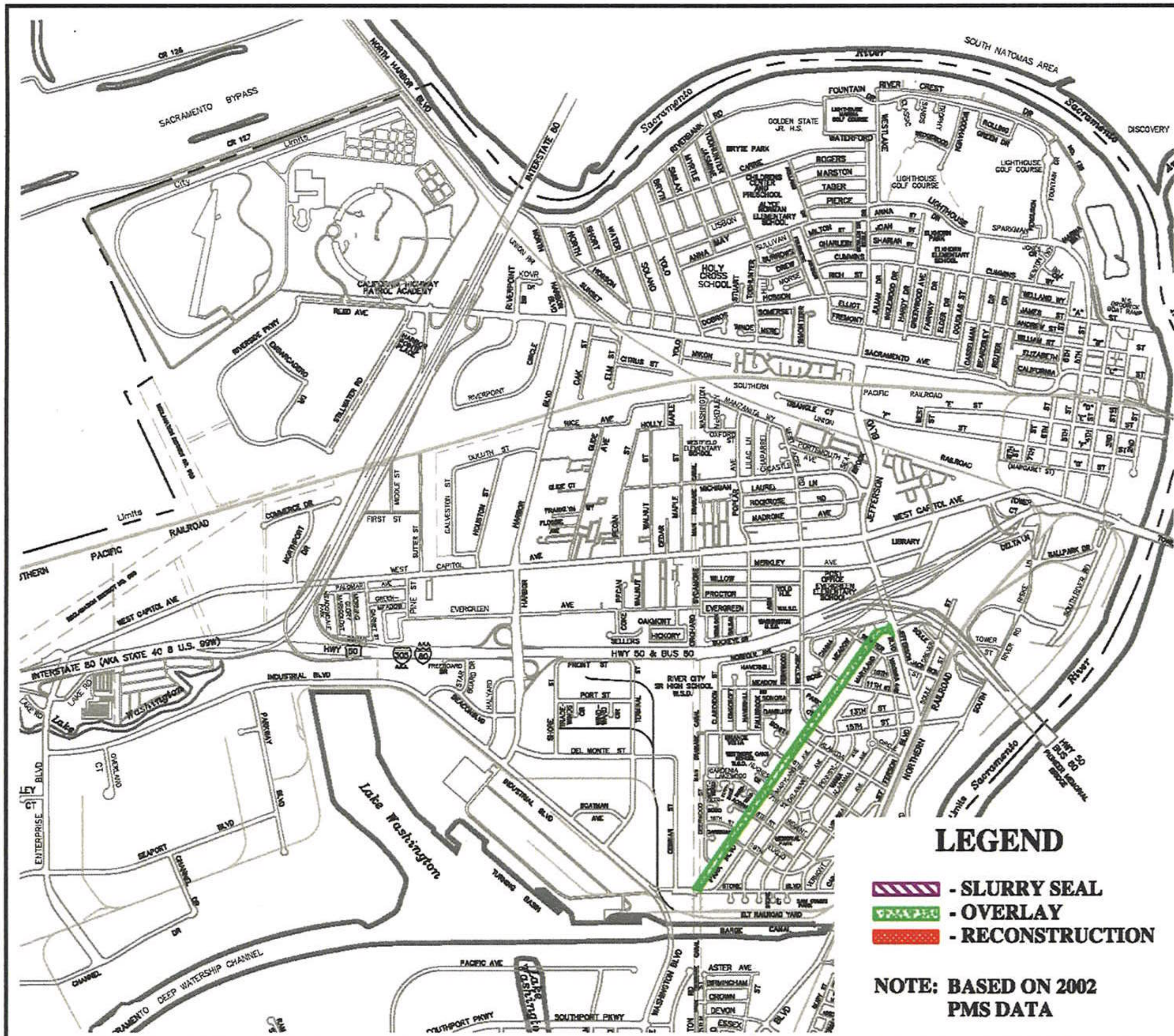
SCALE: 1" = 2500'

DRAWN BY: B. COWARD

CHECKED BY: J. GASKELL

W.O. #:

SHEET 1 OF 1



CITY OF WEST SACRAMENTO
ENGINEERING DIVISION
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WEST SACRAMENTO, CA 95916

PHONE: (916)617-4645
FAX: (916)371-1516

EMAIL: comdev@ci.west-sacramento.ca.us

TITLE:
MEASURE 'K'
REHABILITATION
PROGRAM
FY 2004-5

PROJECT:
PARK BLVD.
PAVEMENT
REHABILITATION
PROJECT

DATE: 4-07-04

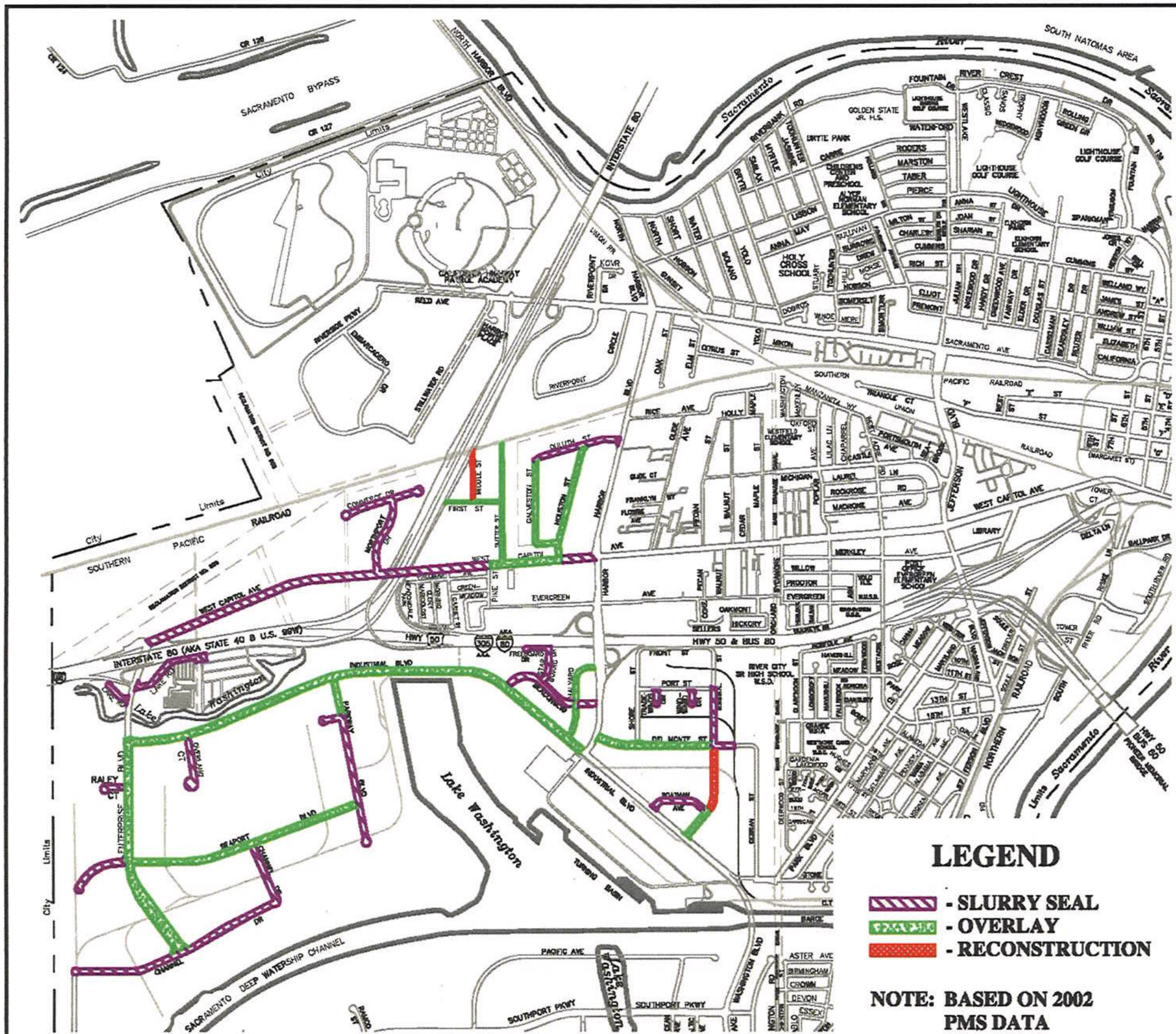
SCALE: 1" = 2500'

DRAWN BY: B. COWARD

CHECKED BY: J. GASKELL

W.O. #:

SHEET 1 OF 1



CITY OF WEST SACRAMENTO
ENGINEERING DIVISION
1110 W. CAPITOL AVE.
WEST SACRAMENTO, CA 95691

PHONE: (916)617-4645
FAX: (916)371-1516

EMAIL: comdev@ci.west-sacramento.ca.us

TITLE:
MEASURE 'K'
REHABILITATION
PROGRAM
FY 2005-6

PROJECT:
ENTERPRISE BLVD./
INDUSTRIAL BLVD./
W. CAPITOL AVE.
EAST
PAVEMENT
REHABILITATION
PROJECT

DATE: 4-13-04

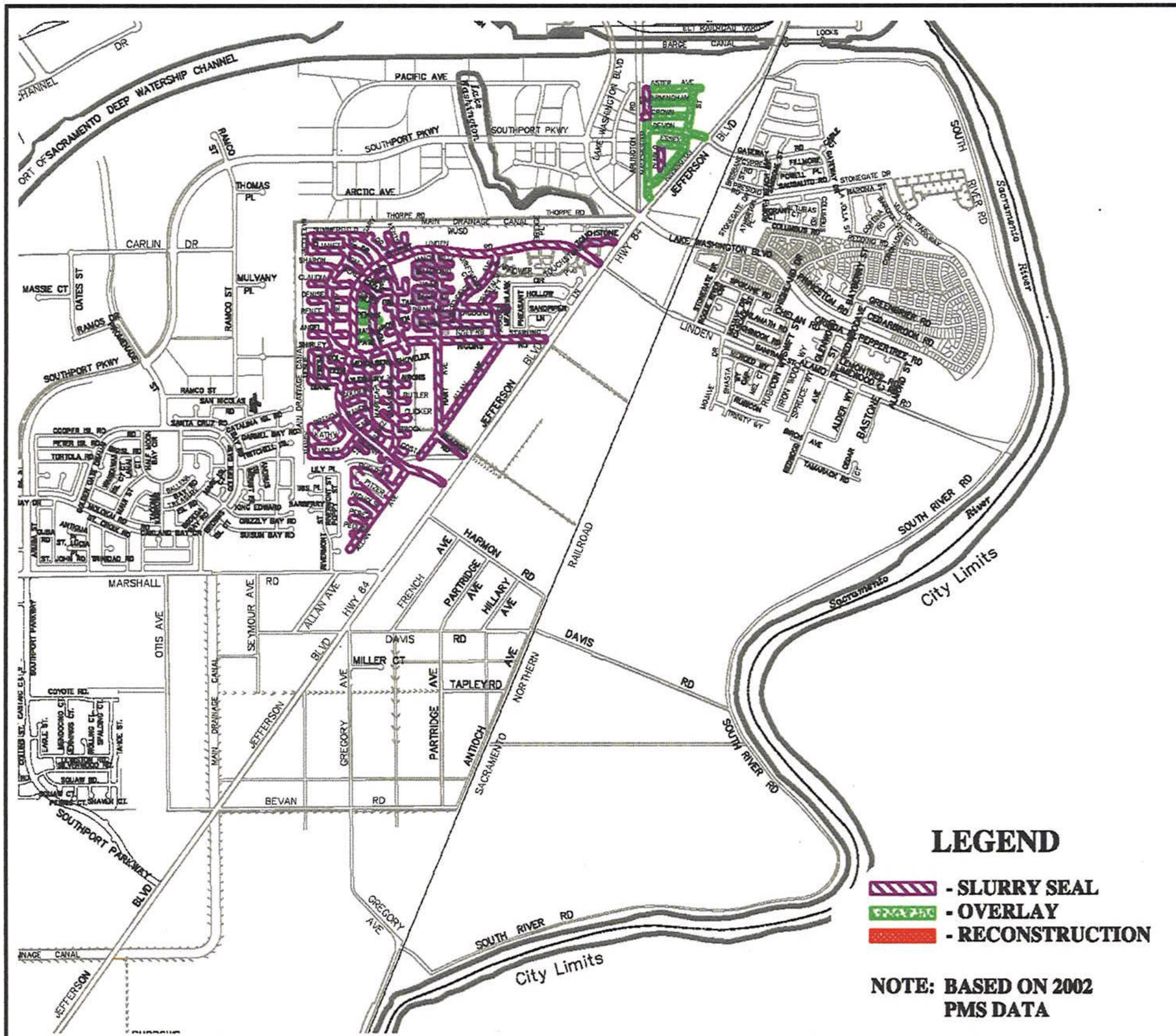
SCALE: 1" = 2500'

DRAWN BY: B. COWARD

CHECKED BY: J. GASKELL

W.O.#:

SHEET 1 OF 1



THE CITY OF WEST SACRAMENTO
EST. 1987

CITY OF WEST SACRAMENTO
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1110 W. CAPITOL AVE.
WEST SACRAMENTO, CA 95691

PHONE: (916)617-4645
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EMAIL: comdev@ci.west-sacramento.ca.us

TITLE:
ACCELERATED MEASURE 'K' REHABILITATION PROGRAM FY (2005 - 06)

PROJECT:
LINDEN RD. WEST AND ARLINGTON OAKS NEIGHBORHOOD

DATE: 4-07-04

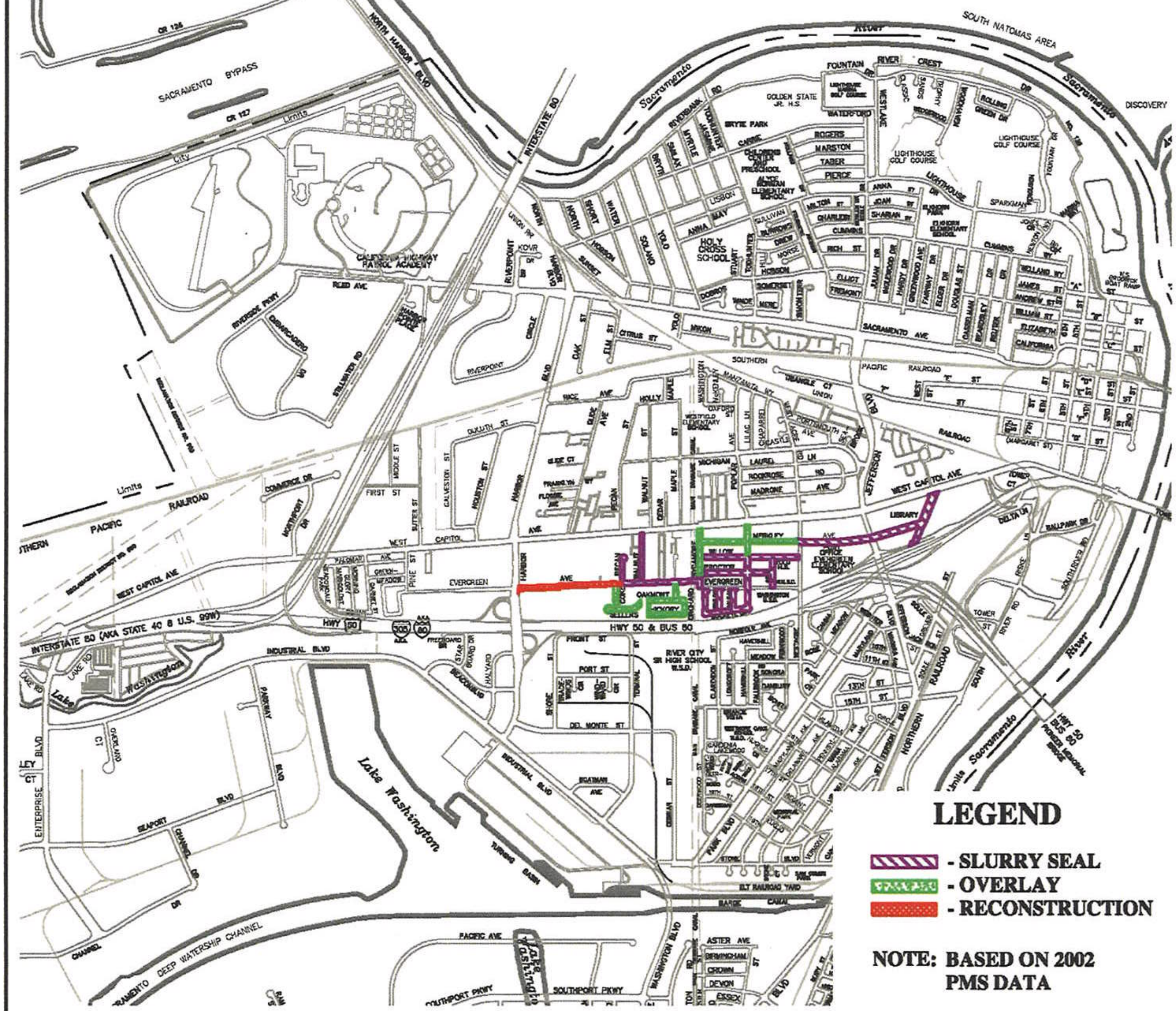
SCALE: 1" = 2500'

DRAWN BY: B. COWARD

CHECKED BY: J. GASKELL

W.O. #:

SHEET 1 OF 1



THE CITY OF WEST SACRAMENTO EST. 1987

CITY OF WEST SACRAMENTO
ENGINEERING DIVISION
1110 W. CAPITOL AVE.
WEST SACRAMENTO, CA 95916

PHONE: (916)617-4645
FAX: (916)371-1516

EMAIL: comdev@ci.west-sacramento.ca.us

TITLE:
MEASURE 'K' REHABILITATION PROGRAM FY 2006-7

PROJECT:
EVERGREEN AVE AND AREA PAVEMENT REHABILITATION PROJECT

DATE: 4-07-04

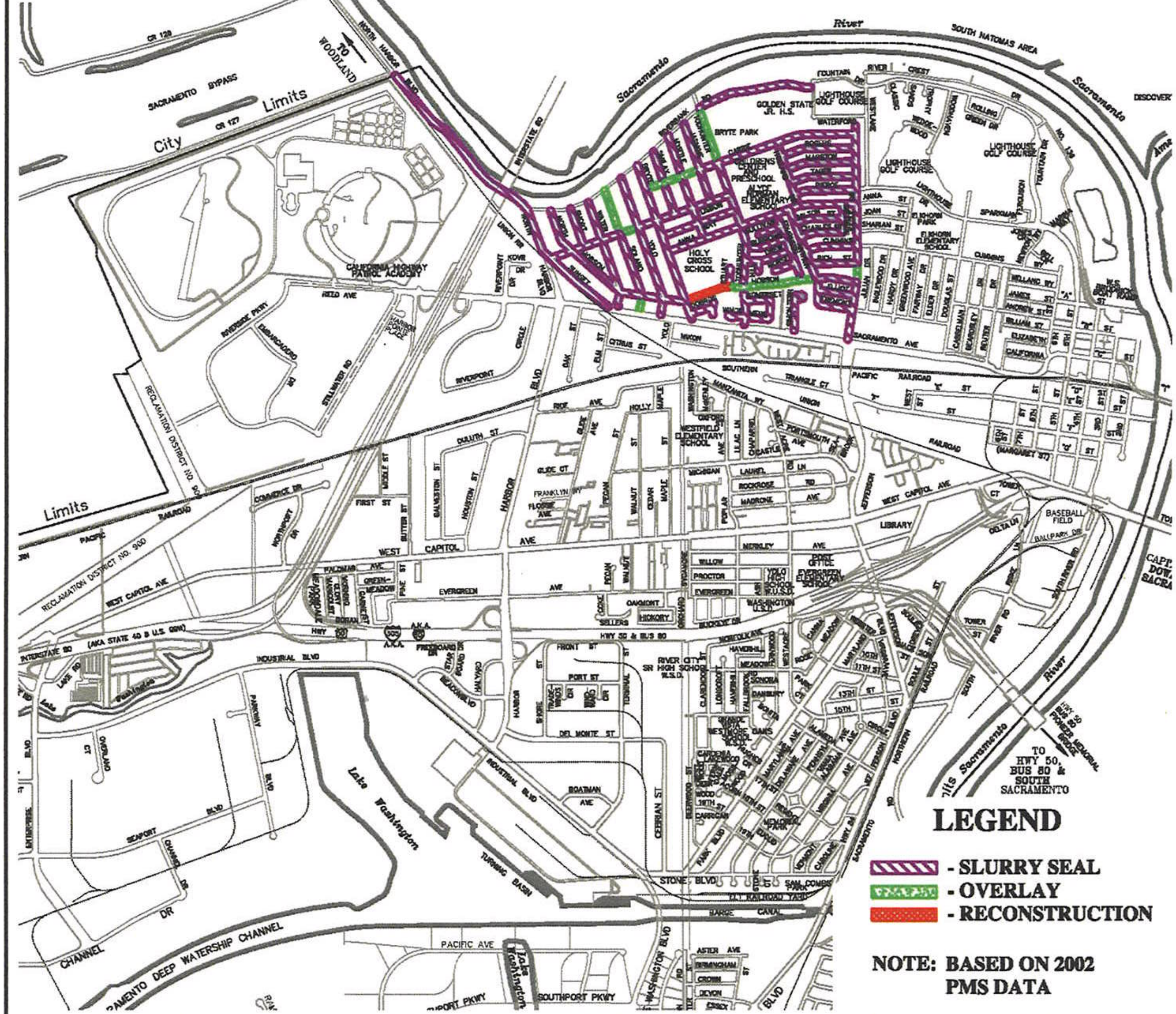
SCALE: 1" = 2500'

DRAWN BY: B. COWARD

CHECKED BY: J. GASKELL

W.O. #:

SHEET 1 OF 1



CITY OF WEST SACRAMENTO
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TITLE:
ACCELERATED MEASURE 'K' REHABILITATION PROGRAM FY (2006-07)

PROJECT:
BRYTE AREA NEIGHBORHOOD

DATE: 4-07-04

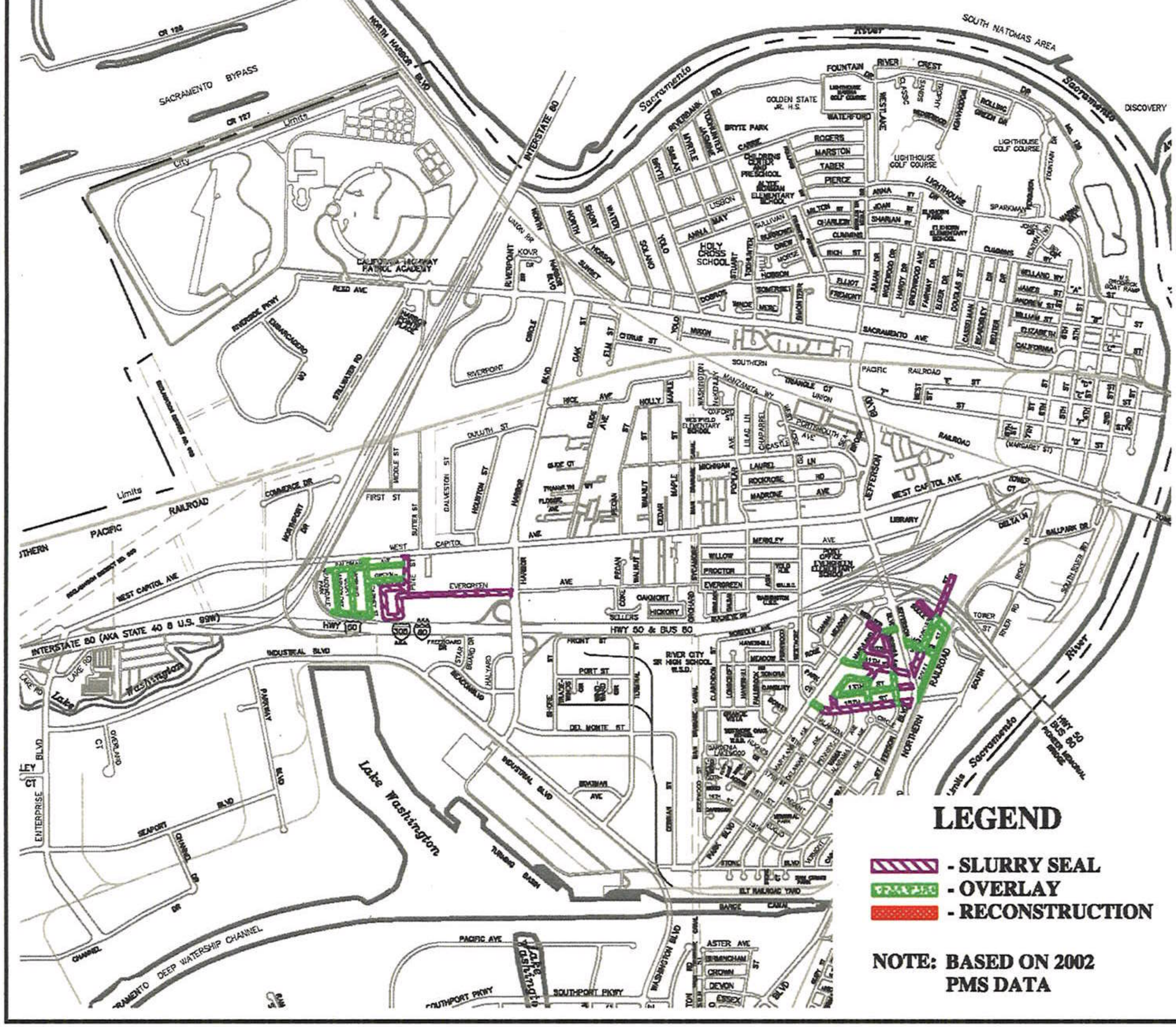
SCALE: 1" = 2500'

DRAWN BY: B. COWARD

CHECKED BY: J. GASKELL

W.O. #:

SHEET 1 OF 1



CITY OF WEST SACRAMENTO
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1110 W. CAPITOL AVE.
WEST SACRAMENTO, CA 95691

PHONE: (916)617-4645
FAX: (916)371-1516

EMAIL: comdev@ci.west-sacramento.ca.us

TITLE:
MEASURE 'K'
REHABILITATION
PROGRAM
FY 2007-8

PROJECT:
MEADOWDALE
NEIGHBORHOOD/
NORTH STATE ST./
DAVIS ROAD
PAVEMENT
REHABILITATION
PROJECT

DATE: 4-09-04

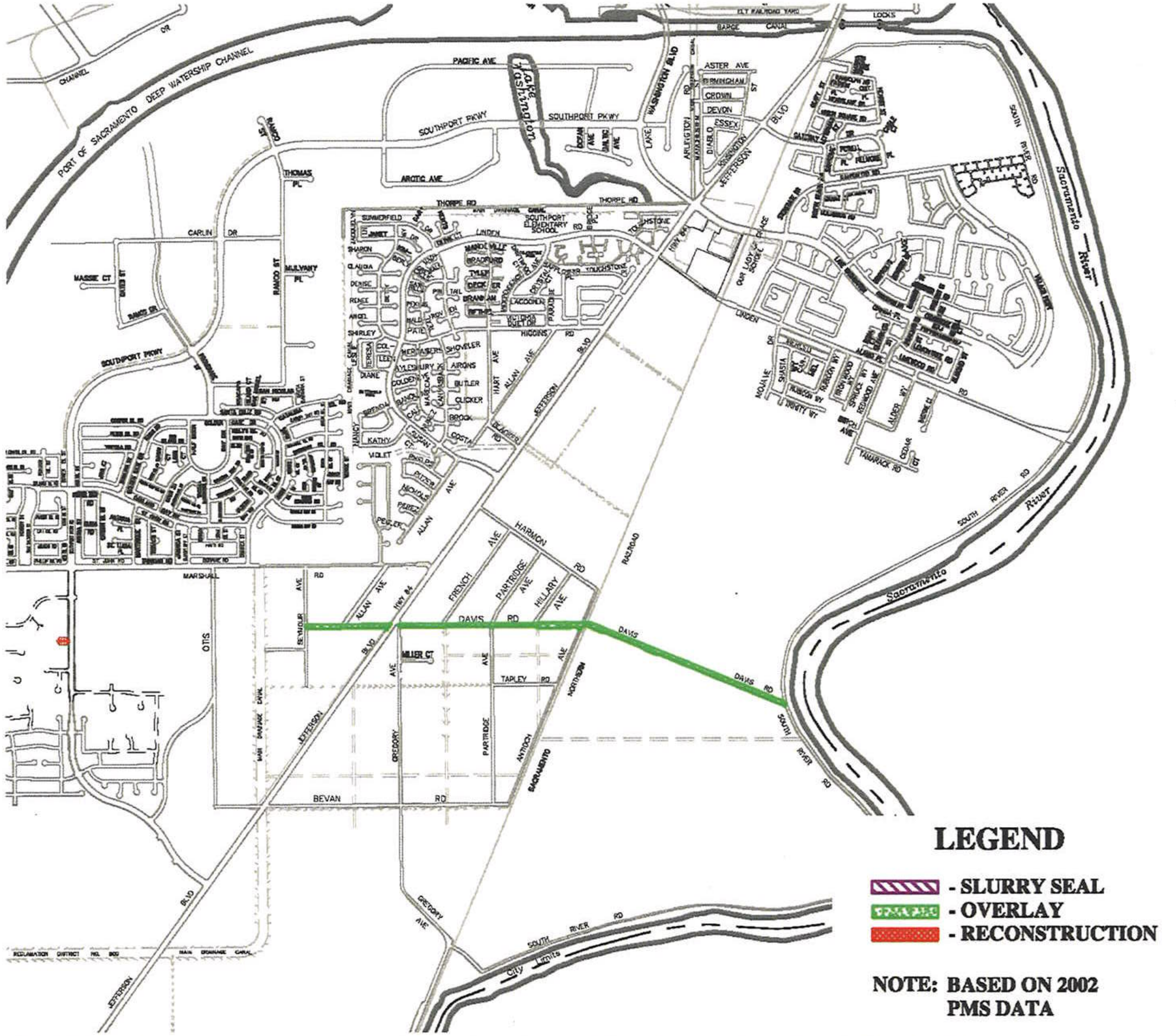
SCALE: 1" = 2500'

DRAWN BY: B. COWARD

CHECKED BY: J. GASKELL

W.O.#:

SHEET 1 OF 2



LEGEND

- SLURRY SEAL
- OVERLAY
- RECONSTRUCTION

NOTE: BASED ON 2002 PMS DATA

THE CITY OF WEST SACRAMENTO EST. 1987

CITY OF WEST SACRAMENTO
ENGINEERING DIVISION
1110 W. CAPITOL AVE.
WEST SACRAMENTO, CA 95916

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EMAIL: comdev@ci.west-sacramento.ca.us

TITLE:
MEASURE 'K' REHABILITATION PROGRAM FY 2007-8

PROJECT:
MEADOWDALE NEIGHBORHOOD/ NORTH STATE ST./ DAVIS ROAD PAVEMENT REHABILITATION PROJECT

DATE: 4-07-04

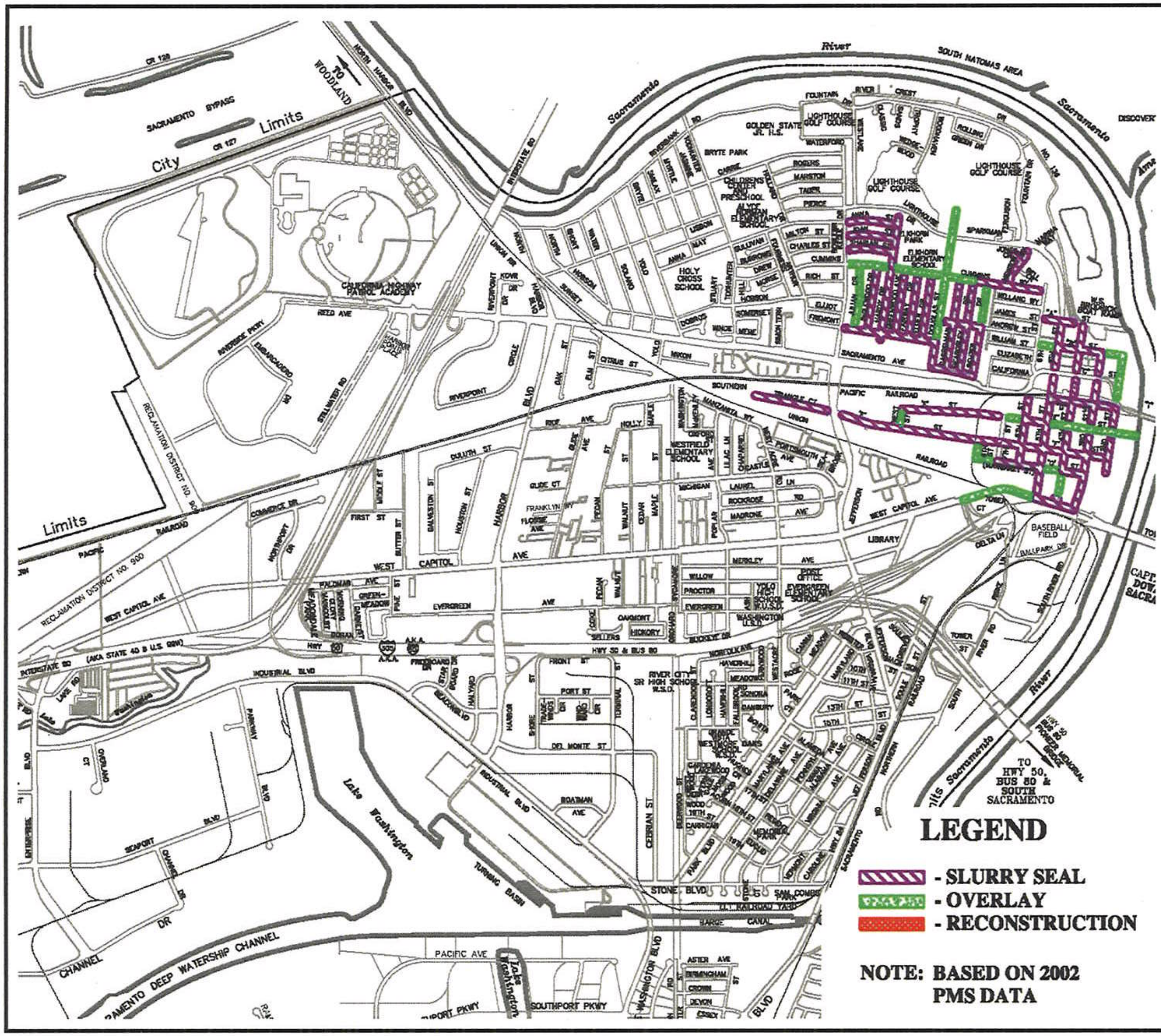
SCALE: 1" = 2500'

DRAWN BY: B. COWARD

CHECKED BY: J. GASKELL

W.O. #:

SHEET 2 OF 2



THE CITY OF WEST SACRAMENTO EST. 1987

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PHONE: (916)617-4645
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TITLE:
ACCELERATED MEASURE 'K' REHABILITATION PROGRAM FY (2007 - 08)

PROJECT:
ELKHORN/ BRODERICK NEIGHBORHOOD

DATE: 4-07-04

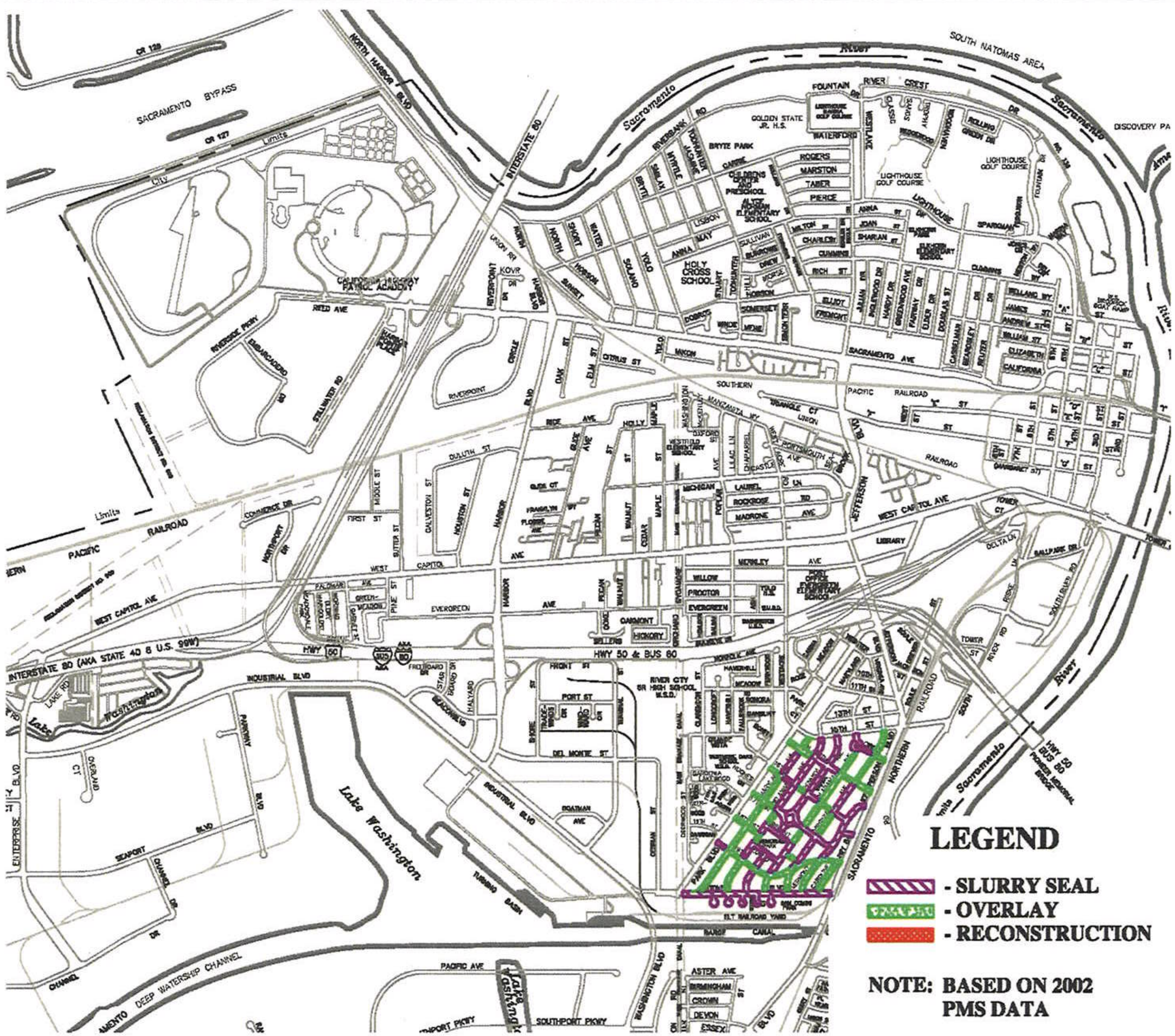
SCALE: 1" = 2500'

DRAWN BY: B. COWARD

CHECKED BY: J. GASKELL

W.O. #:

SHEET 1 OF 1



CITY OF WEST SACRAMENTO
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EMAIL: comdev@ci.west-sacramento.ca.us

TITLE:
MEASURE 'K'
REHABILITATION
PROGRAM
FY 2008-9

PROJECT:
SOUTH STATE
STREET
PAVEMENT
REHABILITATION
PROJECT

DATE: 4-09-04

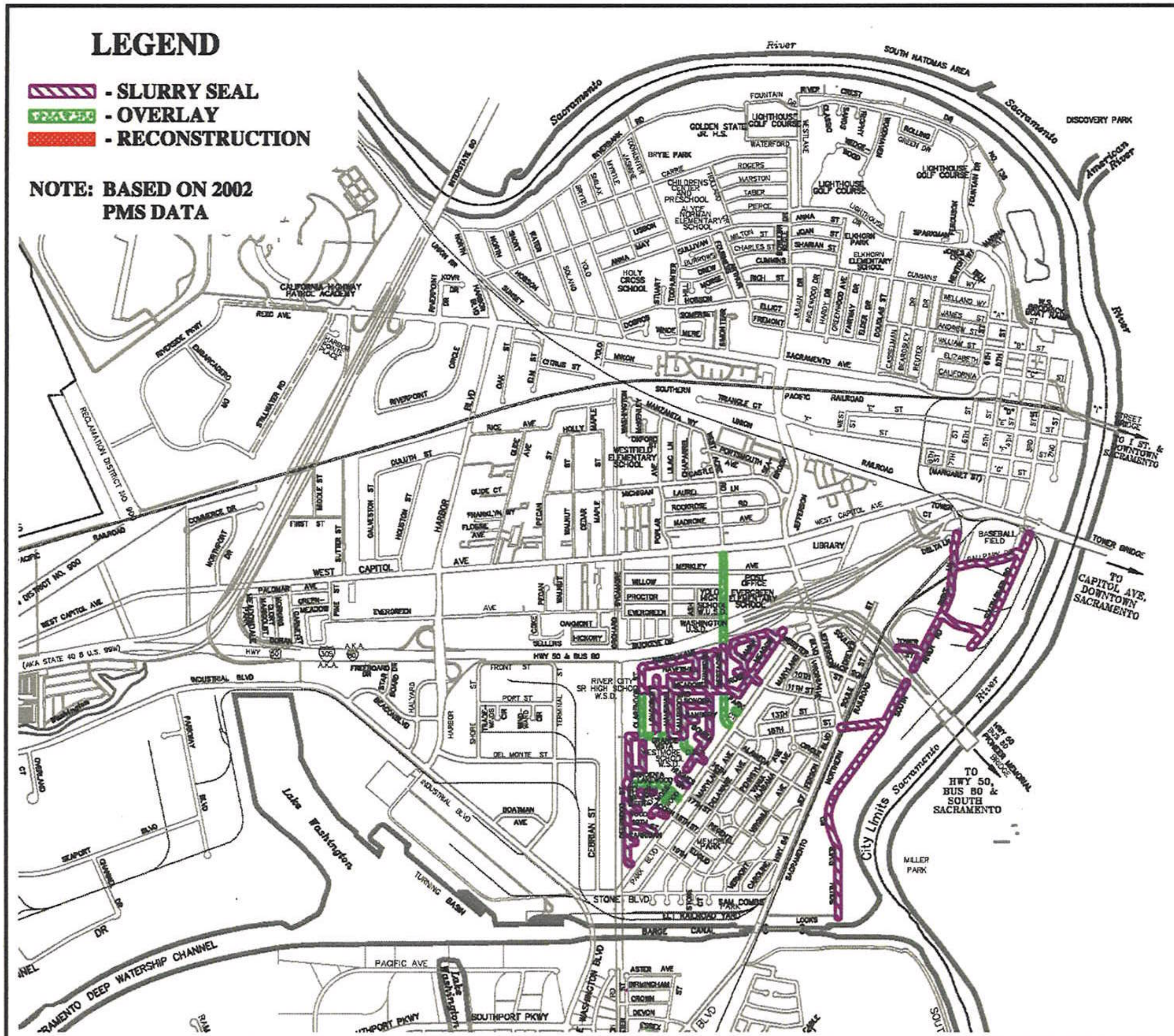
SCALE: 1" = 2500'

DRAWN BY: B. COWARD

CHECKED BY: J. GASKELL

W.O. #:

SHEET 1 OF 1



CITY OF WEST SACRAMENTO
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WEST SACRAMENTO, CA 95691

PHONE: (916)617-4645
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EMAIL: comdev@cityofwestsacramento.org

TITLE:
ACCELERATED MEASURE 'K' REHABILITATION PROGRAM FY (2008 - 09)

PROJECT:
WESTMORE OAKS SCHOOL NEIGHBORHOOD/ SOUTH RIVER RD/ LINDEN RD EAST

DATE: 4-07-04

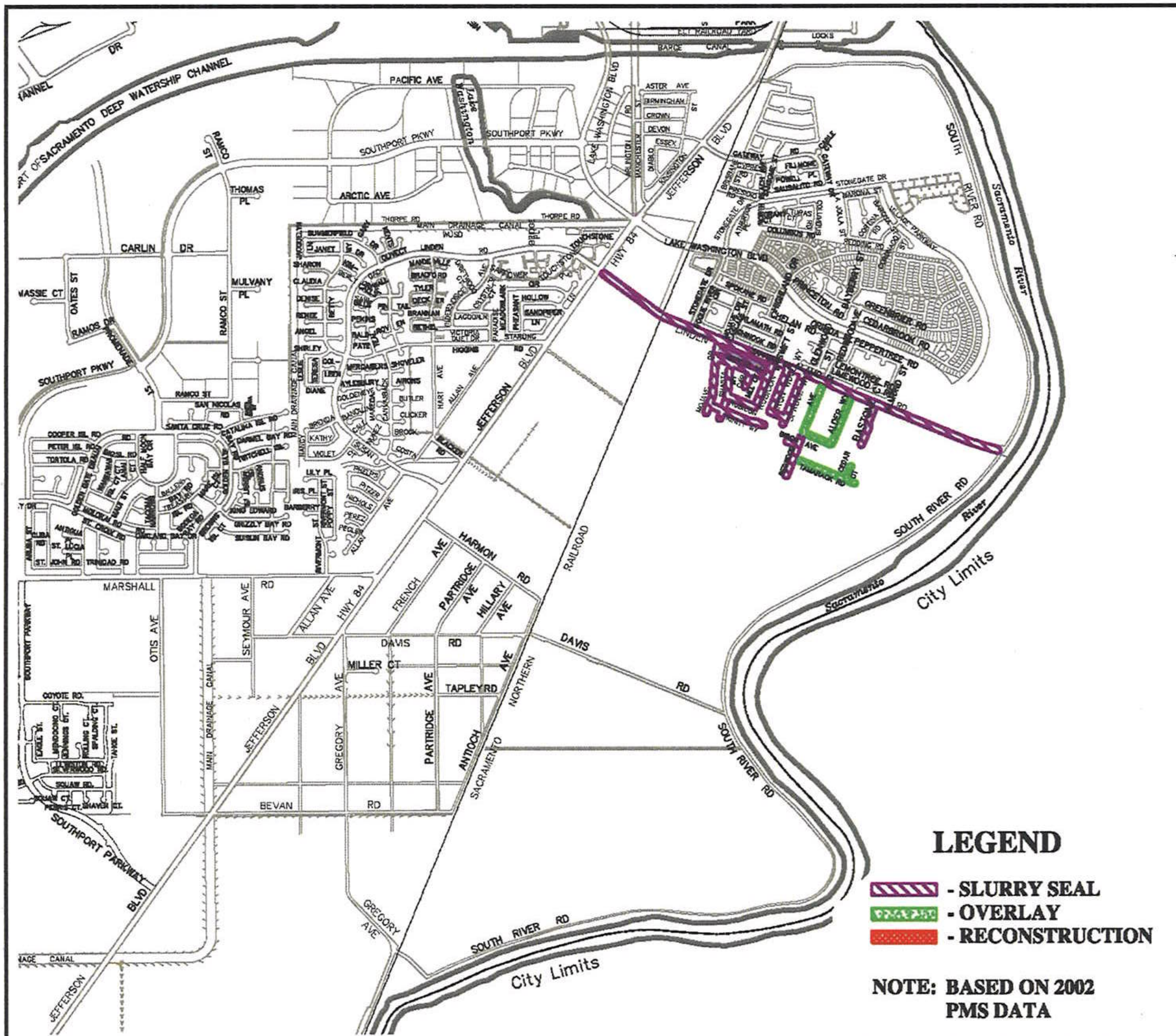
SCALE: 1" = 2500'

DRAWN BY: B. COWARD

CHECKED BY: J. GASKELL

W.O. #:

SHEET 1 OF 2



CITY OF WEST SACRAMENTO
ENGINEERING DIVISION
1110 W. CAPITOL AVE.
WEST SACRAMENTO, CA 95691

PHONE: (916)617-4645
FAX: (916)371-0845

EMAIL: comdev@ci.west-sacramento.ca.us

TITLE:
ACCELERATED MEASURE 'K' REHABILITATION PROGRAM FY (2008 - 09)

PROJECT:
WESTMORE OAKS SCHOOL NEIGHBORHOOD/ SOUTH RIVER RD/ LINDEN RD EAST

DATE: 4-07-04

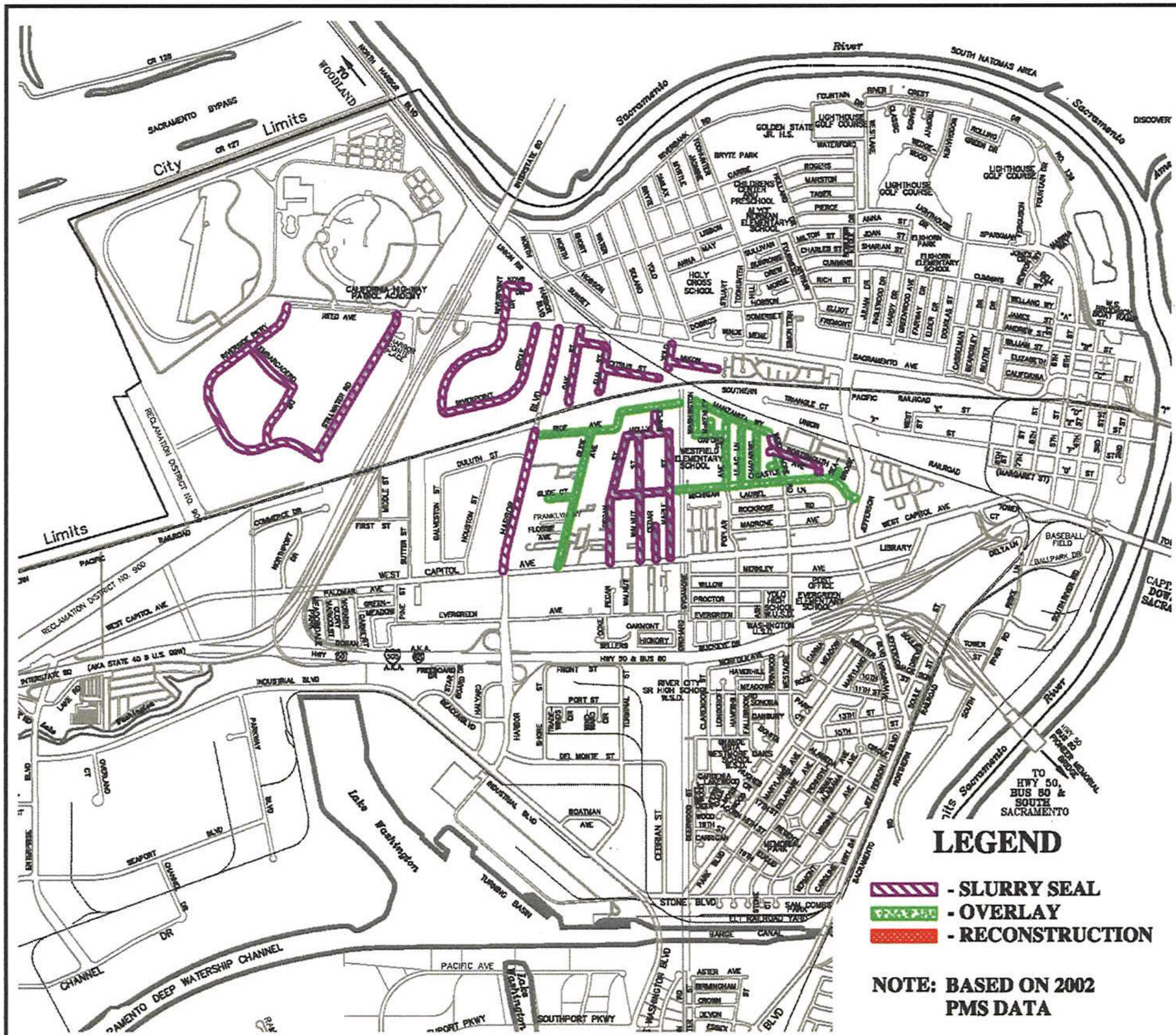
SCALE: 1" = 2500'

DRAWN BY: B. COWARD

CHECKED BY: J. GASKELL

W.O. #:

SHEET 2 OF 2



THE CITY OF WEST SACRAMENTO EST. 1987

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ENGINEERING DIVISION
1110 W. CAPITOL AVE.
WEST SACRAMENTO, CA 95691

PHONE: (916)617-4645
FAX: (916)371-0845

EMAIL: comdev@ci.west-sacramento.ca.us

TITLE:
ACCELERATED MEASURE 'K' REHABILITATION PROGRAM FY (2009 - 10)

PROJECT:
WESTFIELD NEIGHBORHOOD/ RIVERSIDE CENTER/ RIVERPOINT CENTER

DATE: 4-07-04

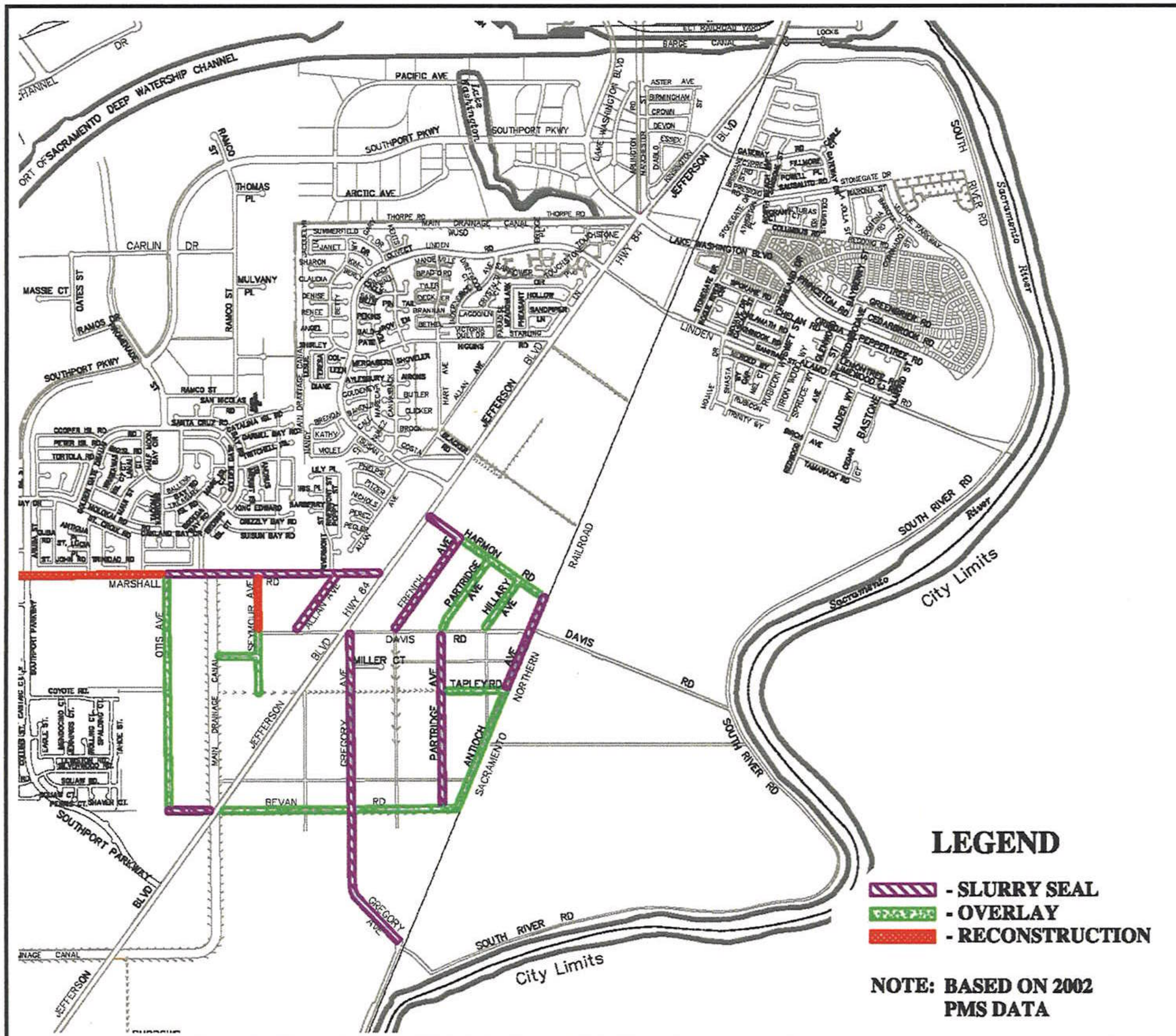
SCALE: 1" = 2500'

DRAWN BY: B. COWARD

CHECKED BY: J. GASKELL

W.O. #:

SHEET 1 **OF** 1



CITY OF WEST SACRAMENTO
ENGINEERING DIVISION
1110 W. CAPITOL AVE.
WEST SACRAMENTO, CA 95691

PHONE: (916)617-4645
FAX: (916)371-0845

EMAIL: comdev@ci.west-sacramento.ca.us

TITLE:
ACCELERATED MEASURE 'K' REHABILITATION PROGRAM FY (2010 - 11)

PROJECT:
MARSHALL RD/ HARMON RD/ BEVAN RD AREAS

DATE: 4-07-04

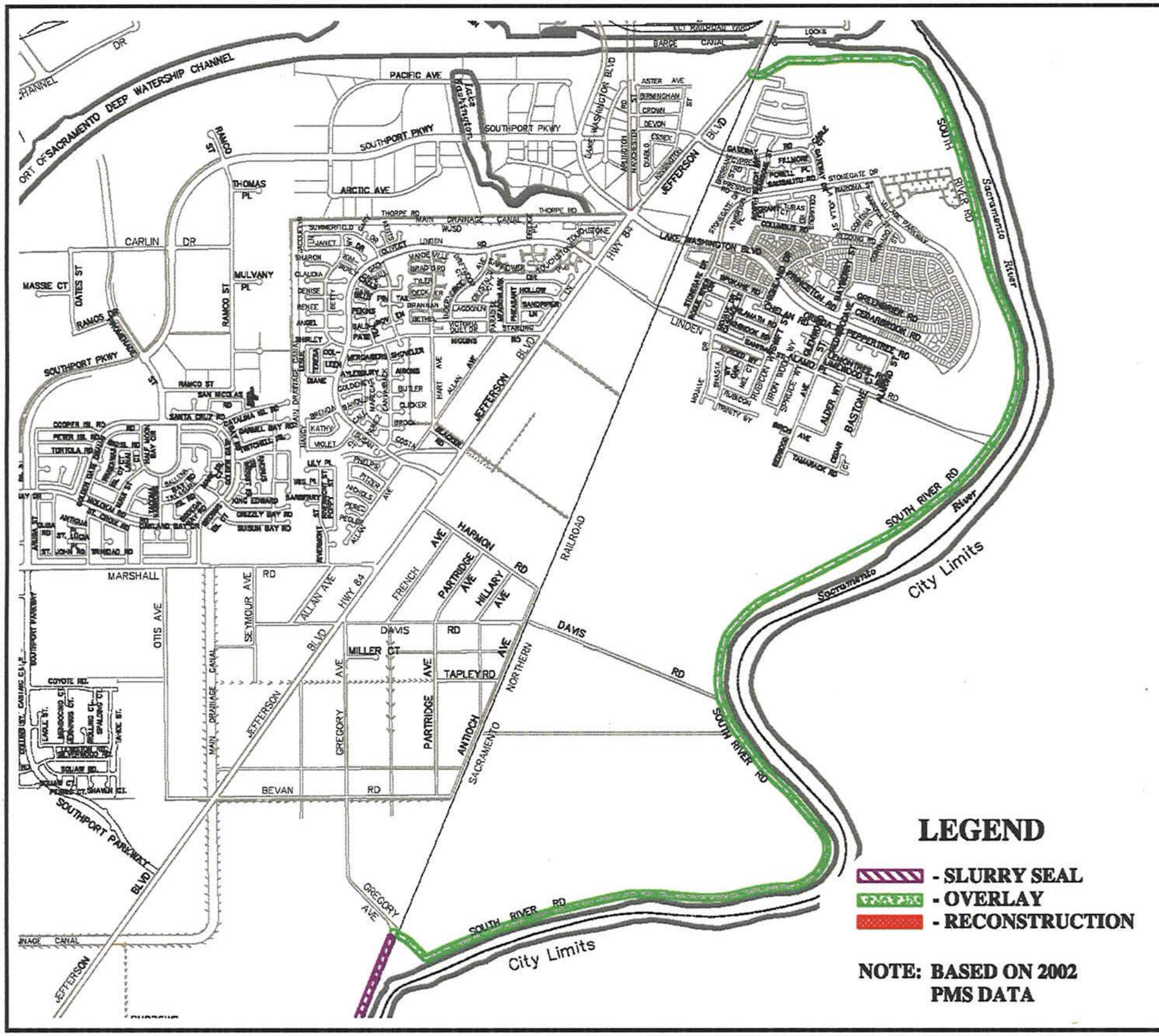
SCALE: 1" = 2500'

DRAWN BY: B. COWARD

CHECKED BY: J. GASKELL

W.O. #:

SHEET 1 OF 1



THE CITY OF WEST SACRAMENTO
EST. 1987

CITY OF WEST SACRAMENTO
ENGINEERING DIVISION
1110 W. CAPITOL AVE.
WEST SACRAMENTO, CA 95691

PHONE: (916)617-4645
FAX: (916)371-0845

EMAIL: comdev@ci.west-sacramento.ca.us

TITLE:
ACCELERATED
MEASURE 'K'
REHABILITATION
PROGRAM
FY (2011 - 12)

PROJECT:
SOUTH RIVER RD
SOUTH OF BARGE
CANAL

DATE: 4-07-04

SCALE: 1" = 2500'

DRAWN BY: B. COWARD

CHECKED BY: J. GASKELL

W.O. #:

SHEET 1 OF 1

Appendix G

FINANCIAL ANALYSIS DETAILS

Table G.1 Water System Financial Plan
Water Master Plan Update
City of West Sacramento

	FY 04-05	FY 05-06	FY 06-07	FY 07-08	FY 08-09	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19	FY 19-20
WATER OPERATIONS FUND																
Beginning-of-Year Balance	7,161,899	3,105,000	2,339,380	1,817,900	1,577,440	1,665,600	1,635,270	1,760,340	1,917,410	2,099,160	2,297,580	2,504,150	2,692,050	2,855,270	2,977,300	3,023,710
Revenues and Transfers In																
Water Rates	7,520,000	8,102,000	8,683,000	9,323,000	10,022,000	10,612,000	11,233,000	11,772,000	12,337,000	12,929,000	13,550,000	14,187,000	14,868,000	15,582,000	16,314,000	17,081,000
Fines & Forfeitures	80,000	82,400	84,900	87,400	90,000	92,700	95,500	98,400	101,400	104,400	107,500	110,700	114,000	117,400	120,900	124,500
Use of Money	56,000	62,100	58,500	54,500	55,200	66,600	65,400	70,400	76,700	84,000	91,900	100,200	107,700	114,200	119,100	120,900
Service Charges	113,220	116,600	120,100	123,700	127,400	131,200	135,100	139,200	143,400	147,700	152,100	156,700	161,400	166,200	171,200	176,300
Other Revenue	35,000	36,100	37,200	38,300	39,400	40,600	41,800	43,100	44,400	45,700	47,100	48,500	50,000	51,500	53,000	54,600
Transfers In - Measure K	780,000	800,000	880,000	968,000	1,064,000	1,147,000	1,214,000	1,272,000	1,333,000	1,397,000	1,464,000	1,533,000	1,607,000	1,684,000	1,763,000	1,846,000
Transfers In - WSIF for DS		2,555,000	2,555,000	2,557,000	2,557,000	2,556,000	2,556,000	2,555,000	2,556,000	2,555,000	2,558,000	2,557,000	2,555,000	2,555,000	2,555,000	2,556,000
Total Revenues & Transfers In	8,584,220	11,754,200	12,418,700	13,151,900	13,955,000	14,646,100	15,340,800	15,950,100	16,591,900	17,262,800	17,970,600	18,693,100	19,463,100	20,270,300	21,096,200	21,959,300
Expenditures and Transfers Out																
Water Treatment																
Personnel Services	1,005,901	1,179,900	1,263,600	1,353,600	1,449,300	1,552,200	1,664,300	1,784,800	1,914,500	2,054,200	2,204,600	2,364,500	2,538,700	2,726,500	2,926,200	3,141,000
Operations & Maintenance	1,277,880	1,377,470	1,486,320	1,603,670	1,728,720	1,863,670	2,011,130	2,170,190	2,341,870	2,526,950	2,726,730	2,939,710	3,172,290	3,423,370	3,690,670	3,978,880
Non-Operating	6,000	6,200	6,400	6,600	6,800	7,000	7,200	7,400	7,600	7,800	8,000	8,200	8,400	8,700	9,000	9,300
Capital Outlay	91,000	94,800	98,700	102,900	107,200	111,700	116,500	121,500	126,800	132,400	138,400	144,700	151,400	158,400	165,700	173,500
Water Distribution																
Personnel Services	446,988	480,060	516,100	554,850	596,300	640,750	689,200	741,450	797,800	858,550	924,210	993,970	1,070,130	1,152,090	1,239,450	1,333,610
Operations & Maintenance	183,438	197,530	213,020	229,720	247,420	266,620	287,420	309,920	334,320	360,620	388,920	419,020	451,920	487,530	525,250	566,180
Capital Outlay	116,000	123,100	130,700	138,900	147,600	156,900	166,900	177,700	189,200	201,600	215,000	229,100	244,400	260,900	278,300	297,000
Water Backflow Prev. Prog.																
Personnel Services	93,345	100,700	108,630	117,260	126,390	136,320	147,050	158,580	171,110	184,640	199,270	214,810	231,850	250,290	269,830	290,970
Operations & Maintenance	45,409	48,720	52,430	56,440	60,650	65,170	70,090	75,410	81,230	87,450	94,180	101,320	109,070	117,520	126,470	136,120
Capital Outlay	16,200	17,440	18,780	20,220	21,760	23,400	25,140	27,080	29,120	31,370	33,820	36,370	39,220	42,270	45,520	48,970
Water Debt Service																
Operations & Maintenance	17,800	18,300	18,800	19,400	20,000	20,600	21,200	21,800	22,500	23,200	23,900	24,600	25,300	26,100	26,900	27,700
2002 Revenue Bonds	1,325,500	1,326,000	1,327,000	1,328,000	1,328,000	1,328,000	1,328,000	1,327,000	1,327,000	1,326,000	1,330,000	1,328,000	1,326,000	1,328,000	1,326,000	1,328,000
2003C Water Revenue Bonds	3,087,968	3,087,000	3,084,000	3,086,000	3,087,000	3,085,000	3,083,000	3,085,000	3,087,000	3,087,000	3,083,000	3,087,000	3,087,000	3,082,000	3,086,000	3,084,000
2009 Interfund Loan		-	-	-	-	308,000	308,000	308,000	308,000	308,000	308,000	308,000	308,000	308,000	308,000	-
Transfers Out																
General Support Services	654,194	673,800	694,000	714,800	736,200	758,300	781,000	804,400	828,500	853,400	879,000	905,400	932,600	960,600	989,400	1,019,100
PW Support Services	360,539	388,800	419,700	453,000	488,500	526,800	568,600	613,800	662,600	715,200	772,000	832,500	898,600	970,000	1,046,100	1,128,100
Capital Repl./Upgr. Reserve	3,912,957	3,400,000	3,502,000	3,607,000	3,715,000	3,826,000	3,941,000	4,059,000	4,181,000	4,306,000	4,435,000	4,568,000	4,705,000	4,846,000	4,991,000	5,141,000
Total Expend. & Transfers Out	12,641,119	12,519,820	12,940,180	13,392,360	13,866,840	14,676,430	15,215,730	15,793,030	16,410,150	17,064,380	17,764,030	18,505,200	19,299,880	20,148,270	21,049,790	21,703,430
End-of-Year Balance	**3,105,000**	**2,339,380**	**1,817,900**	**1,577,440**	**1,665,600**	**1,635,270**	**1,760,340**	**1,917,410**	**2,099,160**	**2,297,580**	**2,504,150**	**2,692,050**	**2,855,270**	**2,977,300**	**3,023,710**	**3,279,580**
Operating Reserve (25%)	1,079,000	1,177,000	1,257,000	1,343,000	1,434,000	1,532,000	1,639,000	1,754,000	1,877,000	2,009,000	2,152,000	2,304,000	2,468,000	2,646,000	2,835,000	3,038,000
Uncommitted Balance	2,026,000	1,162,380	560,900	234,440	231,600	103,270	121,340	163,410	222,160	288,580	352,150	388,050	387,270	331,300	188,710	241,580
Debt Serv. Coverage (115% min.)	136%	220%	238%	257%	275%	294%	314%	334%	355%	376%	400%	422%	450%	480%	509%	544%

Table G.1 Water System Financial Plan
Continued Water Master Plan Update
City of West Sacramento

		FY 05-06	FY 06-07	FY 07-08	FY 08-09	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19	FY 19-20
CAPITAL REPLAC./UPGRADE RESERVE																
Beginning-of-Year Balance	-	-	2,299,000	1,863,500	33,400	1,231,600	265,900	2,822,500	4,902,400	6,402,500	8,151,600	10,201,700	13,537,800	17,293,300	21,533,000	26,258,300
Revenues and Transfers In																
Use of Money	-	-	57,500	55,900	1,200	49,300	10,600	112,900	196,100	256,100	326,100	408,100	541,500	691,700	861,300	1,050,300
Interfund Loan Proceeds					2,500,000											
Transfers In - Buy-In Comp.		1,903,000	2,058,000	2,665,000	2,392,000	2,571,000	2,786,000	3,011,000	3,248,000	3,496,000	3,787,000	4,060,000	4,380,000	4,749,000	5,101,000	5,506,000
Transfers In - Oper. Fund	3,912,957	3,400,000	3,502,000	3,607,000	3,715,000	3,826,000	3,941,000	4,059,000	4,181,000	4,306,000	4,435,000	4,568,000	4,705,000	4,846,000	4,991,000	5,141,000
Total Revs. & Transfers In	3,912,957	5,303,000	5,617,500	6,327,900	8,608,200	6,446,300	6,737,600	7,182,900	7,625,100	8,058,100	8,548,100	9,036,100	9,626,500	10,286,700	10,953,300	11,697,300
Replac./Upgrade Expenditures																
Water Treatment	2,412,147															
Transmission Mains	541,316	-	-	-	125,000	1,586,000	-	-	-	-	-	-	-	-	-	-
Water Pipeline Replacement	331,500	2,203,000	5,245,000	6,360,000	653,000	1,597,000	1,787,000	1,840,000	4,970,000	5,119,000	5,273,000	5,376,000	5,537,000	5,703,000	5,874,000	6,050,000
Metering Implementation		200,000	80,000	83,000	521,000	564,000	1,306,000	2,141,000								
Reservoirs & Pump Stations	398,801	-	-	347,000	4,451,000	616,000	438,000	452,000	465,000	479,000	493,000	-	-	-	-	-
Operational Improvements		601,000	728,000	1,368,000	1,660,000	3,049,000	650,000	670,000	690,000	711,000	732,000	324,000	334,000	344,000	354,000	365,000
Planning Studies	229,193															
Total Replac./Upgr. Expenditures	3,912,957	3,004,000	6,053,000	8,158,000	7,410,000	7,412,000	4,181,000	5,103,000	6,125,000	6,309,000	6,498,000	5,700,000	5,871,000	6,047,000	6,228,000	6,415,000
End-of-Year Balance	**-**	**2,299,000**	**1,863,500**	**33,400**	**1,231,600**	**265,900**	**2,822,500**	**4,902,400**	**6,402,500**	**8,151,600**	**10,201,700**	**13,537,800**	**17,293,300**	**21,533,000**	**26,258,300**	**31,540,600**
WATER SYSTEM IMPACT FEE RESERVE																
Beginning-of-Year Balance	-	-	-	-	-	-	-	88,250	314,600	550,820	802,960	1,093,040	1,562,300	1,895,500	2,275,300	8,164,400
Revenues and Transfers In																
Use of Money	-	-	-	-	-	-	-	1,800	6,300	11,000	16,100	21,900	31,200	37,900	45,500	163,300
Water System Impact Fees	2,500,000	6,015,000	6,505,000	7,020,000	7,559,000	8,124,000	8,803,000	9,516,000	10,263,000	11,048,000	11,967,000	12,831,000	13,840,000	15,007,000	16,120,000	17,401,000
Total Revs. & Transfers In	2,500,000	6,015,000	6,505,000	7,020,000	7,559,000	8,124,000	8,803,000	9,517,800	10,269,300	11,059,000	11,983,100	12,852,900	13,871,200	15,044,900	16,165,500	17,564,300
Expenditures																
Transfer for Debt Service		2,555,000	2,555,000	2,557,000	2,557,000	2,556,000	2,556,000	2,555,000	2,556,000	2,555,000	2,558,000	2,557,000	2,555,000	2,555,000	2,555,000	2,556,000
Expansion Pipeline Projects by City		-	-	142,000	1,015,000	2,394,000	166,000	171,000	176,000	181,000	186,000	-	-	-	-	-
Expan. Reservoir & Pump Sta. Proj. by City		297,000	1,733,000	-	-	-	-	-	-	-	-	-	-	-	-	-
Transfer for Capital Projects		1,903,000	2,058,000	2,665,000	2,392,000	2,571,000	2,786,000	3,011,000	3,248,000	3,496,000	3,787,000	4,060,000	4,380,000	4,749,000	5,101,000	5,506,000
Developer Reimbursements		1,260,000	159,000	1,656,000	1,595,000	603,000	3,206,750	3,554,450	4,053,080	4,574,860	5,162,020	5,766,640	6,603,000	7,361,100	2,620,400	628,000
Total Expenditures	-	6,015,000	6,505,000	7,020,000	7,559,000	8,124,000	8,714,750	9,291,450	10,033,080	10,806,860	11,693,020	12,383,640	13,538,000	14,665,100	10,276,400	8,690,000
End-of-Year Balance	**2,500,000**	**-**	**-**	**-**	**-**	**-**	**88,250**	**314,600**	**550,820**	**802,960**	**1,093,040**	**1,562,300**	**1,895,500**	**2,275,300**	**8,164,400**	**17,038,700**
DEVELOPER CONSTRUCTED EXPANSION PROJECTS																
Beginning-of-Year Balance	-	(1,826,300)	(6,327,300)	(10,098,300)	(9,699,300)	(17,862,300)	(30,459,300)	(29,261,550)	(27,776,100)	(25,854,020)	(23,475,160)	(20,575,140)	(15,382,500)	(9,371,500)	(2,620,400)	(628,000)
Disbursements																
Developer reimbursements	-	1,260,000	159,000	1,656,000	1,595,000	603,000	3,206,750	3,554,450	4,053,080	4,574,860	5,162,020	5,766,640	6,603,000	7,361,100	2,620,400	628,000
Total Revs. & Transfers In	-	1,260,000	159,000	1,656,000	1,595,000	603,000	3,206,750	3,554,450	4,053,080	4,574,860	5,162,020	5,766,640	6,603,000	7,361,100	2,620,400	628,000
Expenditures by Developers																
Past Reimbursable Projects	1,826,300															
Transmission Mains		803,000	40,000	924,000	4,891,000	5,107,000	320,000	329,000	339,000	350,000	360,000	73,000	76,000	78,000	80,000	83,000
Reservoirs & Pump Stations		4,958,000	3,890,000	333,000	4,867,000	8,093,000	1,689,000	1,740,000	1,792,000	1,846,000	1,902,000	501,000	516,000	532,000	548,000	564,000
Total Expenditures	1,826,300	5,761,000	3,930,000	1,257,000	9,758,000	13,200,000	2,009,000	2,069,000	2,131,000	2,196,000	2,262,000	574,000	592,000	610,000	628,000	647,000
End-of-Year Balance	**(1,826,300)**	**(6,327,300)**	**(10,098,300)**	**(9,699,300)**	**(17,862,300)**	**(30,459,300)**	**(29,261,550)**	**(27,776,100)**	**(25,854,020)**	**(23,475,160)**	**(20,575,140)**	**(15,382,500)**	**(9,371,500)**	**(2,620,400)**	**(628,000)**	**(647,000)**

Table G.2 Water Rate Cost Allocation Detail
Water Master Plan Update
City of West Sacramento

	FY 09-10 Revenue Requirement	Alloc. Code	Customer Costs	Capacity Costs	Debt Service Costs	Capital Repl./ Upgr. Costs	Commodity Costs	Shared Costs
EXPENDITURES			1	2	3	4	5	6
Water Treatment -- 506-9610								
Personnel Services								
5111 Salaries & Wages-Permanent	905,100	5	-	-	-	-	905,100	-
5112 Salaries & Wages-Extra Help	38,600	5	-	-	-	-	38,600	-
5113 Salaries & Wages-O/T & Standby	63,900	5	-	-	-	-	63,900	-
5121 Medicare	9,100	5	-	-	-	-	9,100	-
5122 Retirement-PERS	169,400	5	-	-	-	-	169,400	-
5130 Employee Health Insurance	146,000	5	-	-	-	-	146,000	-
5132 Workers Compensation Insur.	101,700	5	-	-	-	-	101,700	-
5133 Deferred Compensation	5,800	6	-	-	-	-	-	5,800
Add metering reading staff/equip.	112,600	1	112,600	-	-	-	-	-
Operations & Maintenance								
5210 Chemicals-Treatment & Oper.	219,600	5	-	-	-	-	219,600	-
5212 Small Tools & Instruments	1,170	2	-	1,170	-	-	-	-
5214 Laboratory & Medical Supplies	14,700	5	-	-	-	-	14,700	-
5215 Safety Clothing & Supplies	-	2	-	-	-	-	-	-
5219 Household Expenses	1,750	5	-	-	-	-	1,750	-
5221 Communications	16,100	5	-	-	-	-	16,100	-
5222 Utilities	1,371,600	5	-	-	-	-	1,371,600	-
5240 Maintenance-Equipment	7,400	5	-	-	-	-	7,400	-
5241 Maintenance-Structures/Growth	106,800	5	-	-	-	-	106,800	-
5245 Rents & Leases-Equipment	1,750	2	-	1,750	-	-	-	-
5251 Office Expense	-	2	-	-	-	-	-	-
5253 Books & Periodicals	600	2	-	600	-	-	-	-
5255 Vehicle Expenses	8,300	5	-	-	-	-	8,300	-
5256 Memberships/Dues/Education	2,100	2	-	2,100	-	-	-	-
5257 Computer Software < $500	-	2	-	-	-	-	-	-
5258 Training, Travel & Meals	8,800	2	-	8,800	-	-	-	-
5259 Special Department Expense	47,500	5	-	-	-	-	47,500	-
5261 Professional Services	55,500	5	-	-	-	-	55,500	-
Non-Operating								
5330 Taxes & Assessments	7,000	2	-	7,000	-	-	-	-
Capital Outlay								
5520 Stuctures & Improvements	68,400	2	-	68,400	-	-	-	-
5572 Equipment-Autos & Trucks	29,300	2	-	29,300	-	-	-	-
5573 Equip.-Shop	14,000	2	-	14,000	-	-	-	-
5574 Equip.-Computers/Software >$500	-	2	-	-	-	-	-	-
5575 Equipment-Other	-	2	-	-	-	-	-	-
Total Water Treatment	**3,534,570**		**112,600**	**133,120**	**-**	**-**	**3,283,050**	**5,800**
Water Distribution -- 506-9611								
Personnel Services								
5111 Salaries & Wages-Permanent	385,500	5	-	-	-	-	385,500	-
5112 Salaries & Wages-Extra Help	14,000	5	-	-	-	-	14,000	-
5113 Salaries & Wages-O/T & Standby	19,700	5	-	-	-	-	19,700	-
5121 Medicare	1,650	5	-	-	-	-	1,650	-
5122 Retirement-PERS	72,300	5	-	-	-	-	72,300	-
5130 Employee Health Insurance	81,200	5	-	-	-	-	81,200	-
5131 Retired Employee Health Insur.	4,200	5	-	-	-	-	4,200	-
5132 Workers Compensation Insur.	54,200	5	-	-	-	-	54,200	-
5133 Deferred Compensation	8,000	6	-	-	-	-	-	8,000
Operations & Maintenance								
5210 Chemicals-Treatment & Oper.	250	5	-	-	-	-	250	-
5212 Small Tools & Instruments	2,900	2	-	2,900	-	-	-	-
5215 Safety Clothing & Supplies	-	2	-	-	-	-	-	-
5219 Household Expenses	250	5	-	-	-	-	250	-
5221 Communications	930	2	-	930	-	-	-	-
5222 Utilities	104,500	5	-	-	-	-	104,500	-
5240 Maintenance-Equipment	2,800	2	-	2,800	-	-	-	-
5241 Maintenance-Structures/Growth	116,300	5	-	-	-	-	116,300	-
5245 Rents & Leases-Equipment	1,700	5	-	-	-	-	1,700	-
5246 Rents & Leases-Structures	410	2	-	410	-	-	-	-
5253 Books & Periodicals	300	2	-	300	-	-	-	-
5255 Vehicle Expenses	24,900	5	-	-	-	-	24,900	-
5256 Memberships/Dues/Education	980	2	-	980	-	-	-	-
5258 Training, Travel & Meals	3,800	2	-	3,800	-	-	-	-
5259 Special Department Expense	3,000	5	-	-	-	-	3,000	-
5261 Professional Services	3,600	5	-	-	-	-	3,600	-

Table G.2 Water Rate Cost Allocation Detail
Water Master Plan Update
City of West Sacramento

	FY 09-10 Revenue Requirement	Alloc. Code	Customer Costs	Capacity Costs	Debt Service	Capital Repl./ Upgr.	Commodity Costs	Shared Costs
Capital Outlay								
5520 Stuctures & Improvements	34,800	2	-	34,800	-	-	-	-
5572 Equipment-Autos & Trucks	108,100	2	-	108,100	-	-	-	-
5574 Equip.-Computers/Software >$500	-	2	-	-	-	-	-	-
5575 Equipment-Other	14,000	2	-	14,000	-	-	-	-
Total Water Distribution	**1,064,270**		**-**	**169,020**	**-**	**-**	**887,250**	**8,000**
Water Backflow Prevention Program -- 506-9612								
Personnel Services								
5111 Salaries & Wages-Permanent	89,000	5	-	-	-	-	89,000	-
5121 Medicare	1,020	5	-	-	-	-	1,020	-
5122 Retirement-PERS	16,700	5	-	-	-	-	16,700	-
5130 Employee Health Insurance	20,300	5	-	-	-	-	20,300	-
5132 Workers Compensation Insur.	9,300	5	-	-	-	-	9,300	-
Operations & Maintenance		5	-	-	-	-	-	-
5212 Small Tools & Instruments	350	2	-	350	-	-	-	-
5221 Communications	1,050	2	-	1,050	-	-	-	-
5240 Maintenance-Equipment	450	2	-	450	-	-	-	-
5241 Maintenance-Structures/Growth	350	2	-	350	-	-	-	-
5253 Books & Periodicals	50	2	-	50	-	-	-	-
5255 Vehicle Expenses	2,800	5	-	-	-	-	2,800	-
5256 Memberships/Dues/Education	250	2	-	250	-	-	-	-
5258 Training, Travel & Meals	1,570	2	-	1,570	-	-	-	-
5261 Professional Services	58,300	5	-	-	-	-	58,300	-
Capital Outlay								
5572 Equipment-Autos & Trucks	22,000	2	-	22,000	-	-	-	-
5574 Equip.-Computers/Software >$500	1,400	2	-	1,400	-	-	-	-
Total Water Backflow Prevention	**224,890**		**-**	**27,470**	**-**	**-**	**197,420**	**-**
Water Debt Service -- 506-9625								
Operations & Maintenance								
5261 Professional Services	20,600	2	-	20,600	-	-	-	-
Debt Service								
5411 2002 Revenue Bonds-Principal	115,000	3	-	-	115,000	-	-	-
5421 2002 Revenue Bonds-Interest	1,213,000	3	-	-	1,213,000	-	-	-
5411 2003C Water Revenue Bonds-Princip	1,235,000	3	-	-	1,235,000	-	-	-
5421 2003C Water Revenue Bonds-Interes	1,849,638	3	-	-	1,849,638	-	-	-
5411 2008 Interfund Loan-Principal	208,227	3	-	-	208,227	-	-	-
5421 2008 Interfund Loan-Interest	100,000	3	-	-	100,000	-	-	-
Total Water Debt Service	**4,741,465**		**-**	**20,600**	**4,720,865**	**-**	**-**	**-**
Total Expenditures	**9,565,195**		**112,600**	**350,210**	**4,720,865**	**-**	**4,367,720**	**13,800**
TRANSFERS AND NON-RATE REVENUES								
Transfers								
To General Support Services Fund	758,300	6	-	-	-	-	-	758,300
To PW Support Services Fund	526,800	6	-	-	-	-	-	526,800
To Capital Replac./Upgr. Reserve	3,826,000	4	-	-	-	3,826,000	-	-
From Measure K	(1,147,000)	2	-	(1,147,000)	-	-	-	-
From WSIF for Debt Service	(2,556,000)	3	-	-	(2,556,000)	-	-	-
Incr./(Decr.) In Oper. Fund Bal.	(30,330)	5	-	-	-	-	(30,330)	-
Total Transfers	**1,377,770**		**-**	**(1,147,000)**	**(2,556,000)**	**3,826,000**	**(30,330)**	**1,285,100**
Non-Rate Operating Revenues								
Fines & Forfeitures	(92,700)	1	(92,700)	-	-	-	-	-
Use of Money	(66,600)	5	-	-	-	-	(66,600)	-
Service Charges	(131,200)	5	-	-	-	-	(131,200)	-
Other Revenue	(40,600)	5	-	-	-	-	(40,600)	-
Total Non-Rate Oper. Revenues	**(331,100)**		**(92,700)**	**-**	**-**	**-**	**(238,400)**	**-**
Net Water Rate Revenue Requirement	**10,611,865**		19,900	(796,790)	2,165,000	3,826,000	4,098,990	1,298,900
			20%	80%				
			259,780	1,039,120				(1,298,900)
			279,680	242,330	2,165,000	3,826,000	4,098,990	-
			3%	2%	20%	36%	39%	

Table G.3 Valuation of Water System Assets for Water System Impact Fee Buy-In Component
Water Master Plan Update
City of West Sacramento

Year	Description (1)	Original Cost	Book Value	Replacement Cost	Replac. Cost Less Deprec.
Land					
1988	Land	$ 1,193,450	$ 1,193,450	$ 1,927,373	$ 1,927,373
	Sub-Total	**$ 1,193,450**	**$ 1,193,450**	**$ 1,927,373**	**$ 1,927,373**
Infrastructure					
1983	W. CAP PIPE/HARBOR REP L	$ 241,460	$ 108,657	$ 433,394	$ 195,027
1983	HARBOR WATER LINES ADJUSTMENT	$ 51,817	$ 46,635	$ 93,006	$ 83,704
1986	BOOSTER @ OAK ST	$ 94,273	$ 2,759	$ 160,187	$ 4,688
1986	MAJOR REPAIR WELL #24	$ 5,350	$ 375	$ 9,091	$ 637
1986	STORAGE TANK/PUMP OAK	$ 647,868	$ 56,696	$ 1,100,848	$ 96,337
1986	MAJOR REPAIR	$ 56,755	$ 8,524	$ 96,437	$ 14,484
1986	BRYTE PLACEMENT LIN	$ 680,174	$ 83,012	$ 1,155,742	$ 141,053
1986	S.R.R. NEW LINES	$ 50,587	$ 5,065	$ 85,957	$ 8,606
1988	NORTHPORT ASSMT DIST	$ 29,090	$ 4,370	$ 46,979	$ 7,057
1988	PIPELINE E	$ 3,031,464	$ 1,985,613	$ 4,895,690	$ 3,206,684
1988	NORTHEAST PUMPS	$ 360,184	$ 235,930	$ 581,682	$ 381,017
1988	NORTHEAST TANKS	$ 329,659	$ 232,126	$ 532,386	$ 374,874
1988	CENTRAL BANK	$ 329,659	$ 232,126	$ 532,386	$ 374,874
1989	PIPELINE A	$ 2,933,756	$ 1,947,053	$ 4,639,339	$ 3,079,002
1992	STONE BLVD REPLACE LIN	$ 289,272	$ 115,713	$ 423,491	$ 169,403
1995	WEST CAPITOL	$ 332,787	$ 282,875	$ 443,919	$ 377,339
1995	MASTER PLAN	$ 301,502	$ 165,826	$ 402,186	$ 221,202
1995	REPLACE 4" W 8" WATER S	$ 50,909	$ 29,487	$ 67,910	$ 39,334
1995	MAIN ON JEFFERSON	$ 49,194	$ 29,931	$ 65,622	$ 39,926
1996	12' MAIN	$ 414,924	$ 240,313	$ 538,811	$ 312,065
1996	HARBOR WATER LINES ADJUSTMENT	$ 956,537	$ 558,374	$ 1,242,136	$ 725,091
1996	16" ENT. TO W. CAP W.O. 21	$ 138,177	$ 89,813	$ 179,433	$ 116,629
1996	CENTRAL PUMPS	$ 407,102	$ 254,440	$ 528,653	$ 330,410
1997	8" MAIN 15TH STREET	$ 521,853	$ 332,684	$ 653,705	$ 416,740
1997	8" MAIN 19TH STREET	$ 355,071	$ 226,358	$ 444,784	$ 283,550
1997	8" MAIN ALABAMA	$ 343,664	$ 219,089	$ 430,495	$ 274,444
1997	WATER MAIN W.O. #2518	$ 669,870	$ 435,412	$ 839,120	$ 545,423
2000	WATERLINES	$ 276,993	$ 249,293	$ 324,947	$ 292,451
2000	WATERLINES	$ 381,084	$ 342,976	$ 447,059	$ 402,353
2000	WATERLINES	$ 349,800	$ 323,565	$ 410,359	$ 379,582
2001	WATERLINES	$ 335,610	$ 310,440	$ 386,688	$ 357,687
2001	WATERLINES	$ 343,650	$ 317,877	$ 395,952	$ 366,256
2001	WATERLINES	$ 486,655	$ 450,157	$ 560,721	$ 518,668
2001	WATERLINES	$ 344,190	$ 318,375	$ 396,574	$ 366,830
2001	WATERLINES	$ 69,960	$ 64,713	$ 80,608	$ 74,562
2001	WATERLINES	$ 519,894	$ 480,903	$ 599,019	$ 554,094
2001	WATERLINES	$ 85,321	$ 78,922	$ 98,306	$ 90,933
2001	WATERLINES	$ 146,354	$ 135,377	$ 168,628	$ 155,981
2001	WATERLINES	$ 593,206	$ 548,716	$ 683,489	$ 632,228
2001	WATERLINES	$ 184,140	$ 170,328	$ 212,165	$ 196,251
2001	WATERLINES	$ 89,906	$ 83,162	$ 103,589	$ 95,819
2001	WATERLINES	$ 315,946	$ 300,148	$ 364,031	$ 345,829
2001	WATERLINES	$ 262,684	$ 249,550	$ 302,663	$ 287,530
2001	WATERLINES	$ 252,596	$ 239,966	$ 291,040	$ 276,488
2001	WATERLINES	$ 54,031	$ 51,329	$ 62,254	$ 59,141
2001	WATERLINES	$ 112,309	$ 106,693	$ 129,402	$ 122,931
2001	WATERLINES	$ 126,639	$ 120,307	$ 145,913	$ 138,617
2002	WATERLINES	$ 217,325	$ 206,459	$ 242,588	$ 230,459
2002	W.O. 25090 REPLACE WATER MA	$ 966,018	$ 869,416	$ 1,078,311	$ 970,480
2002	W.O. 25100 REPLACE WATER MA	$ 815,630	$ 734,068	$ 910,441	$ 819,398
2002	W.O. 25280 REPLACE WATER MA	$ 462,328	$ 416,096	$ 516,071	$ 464,465
2002	W.O. 25270 REPLACE WATER MA	$ 339,382	$ 305,444	$ 378,833	$ 340,950
2002	W.O. 25290 REPLACE WATER MA	$ 8,883	$ 7,995	$ 9,915	$ 8,924
2002	WATERLINES	$ 123,930	$ 117,734	$ 138,336	$ 131,420
2002	WATERLINES	$ 434,049	$ 423,198	$ 484,504	$ 472,392
2002	WATER TANK	$ 1,800,000	$ 1,755,000	$ 2,009,238	$ 1,959,007
2003	WATERLINES	$ 144,331	$ 140,723	$ 157,354	$ 153,420
2003	REPLACE WATER MAIN	$ 889,211	$ 871,427	$ 969,444	$ 950,056
2003	REPLACE WATER MAIN WESTACRE	$ 1,266,823	$ 1,241,487	$ 1,381,128	$ 1,353,506
2004	WATER MSTR PLAN	$ 41,075	$ 41,075	$ 42,132	$ 42,132
2004	REPL WATER MAIN JEFF/15TH	$ 1,165,362	$ 1,165,362	$ 1,195,335	$ 1,195,335
2004	CONT BY DEVELOPER	$ 652,887	$ 652,887	$ 669,679	$ 669,679
2004	CONT BY DEVELOPER	$ 281,289	$ 281,289	$ 288,524	$ 288,524
2004	CONT BY DEVELOPER	$ 237,407	$ 237,407	$ 243,513	$ 243,513
2004	LN3-WATER TREATMENT	$ 5,133	$ 5,133	$ 5,265	$ 5,265
2004	LN9-FLAMMABLE STORAGE	$ 7,890	$ 7,890	$ 8,093	$ 8,093
2004	LN3-WATER LINE REPAIR	$ 8,895	$ 8,895	$ 9,124	$ 9,124
	Sub-Total	**$ 28,871,775**	**$ 22,361,037**	**$ 37,524,624**	**$ 27,849,974**
Capital Improvement Projects (Work in Progress)					
1987	CATHODIC	$ 9,534	$ 9,534	$ 15,792	$ 15,792
2001	INSTALL WATER MAIN W CAP TO JEF	$ 262,476	$ 262,476	$ 302,424	$ 302,424
2003	CARLIN WATER TANK	$ 900,000	$ 900,000	$ 981,207	$ 981,207
2004	2004 WATER MASTER PLAN UPDATE	$ 98,098	$ 98,098	$ 100,621	$ 100,621
2004	OAK STREET PUMP STATION MCC R	$ 140,199	$ 140,199	$ 143,805	$ 143,805
2004	JEFFERSON BLVD - PHASE I	$ 1,465,000	$ 1,465,000	$ 1,502,680	$ 1,502,680
	Sub-Total	**$ 2,875,307**	**$ 2,875,307**	**$ 3,046,529**	**$ 3,046,529**
	Total Depreciated Replacement Cost for Buy-In Component Calculation				**$ 32,823,876**

Notes:
(1) Excludes equipment, short lived assets (< 10 years), water meters, service lines, and water treatment plant costs