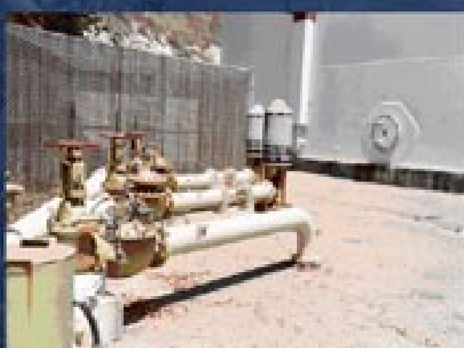
City of Pomona

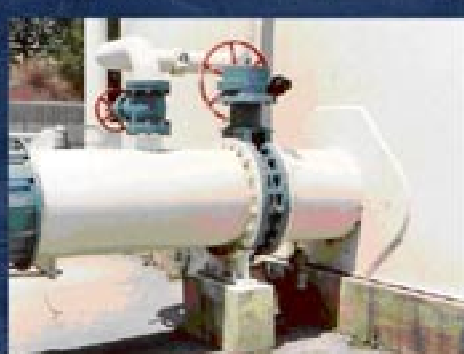
MWH

Water and Recycled Water Master Plan

Final Report

May 2005



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Water and Recycled Water Master Plan

May 2005

MWH

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Water and Recycled Water Master Plan

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Executive Summary

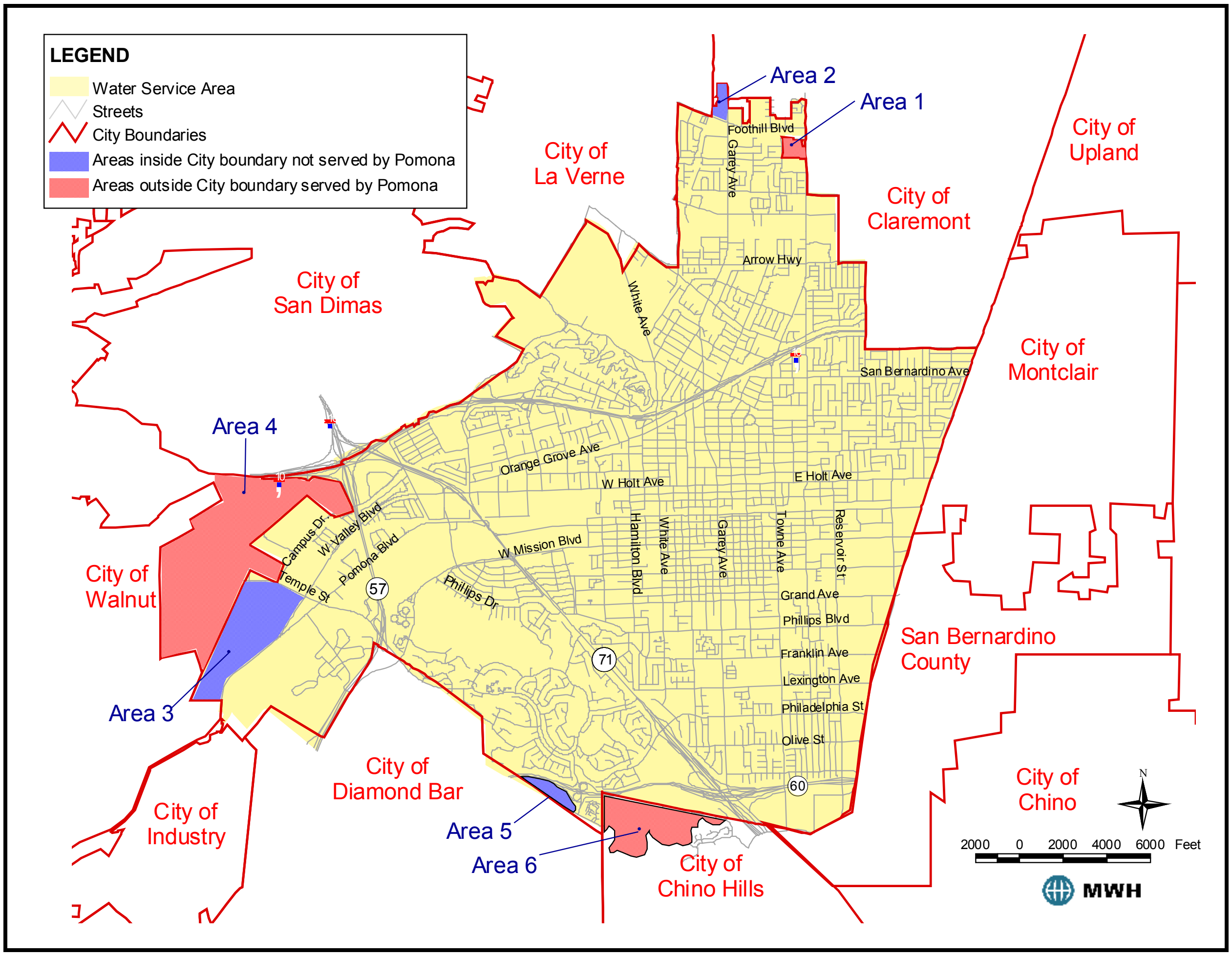
This Water and Recycled Water Master Plan (WMP) provides the City of Pomona (City) with; an evaluation of its existing water and recycled water system, an evaluation of the future system requirements through 2025, and water supply strategies to meet the future system needs.

This WMP recommends system improvements to address existing and future system requirements as well as a phasing and financing plan to address necessary system improvements.

STUDY AREA

The City's service area, as shown in **Figure ES-1**, covers approximately 23 square miles. With a population of approximately 156,500 residents, the City is currently the fifth largest city in Los Angeles County.

Figure ES-1
Pomona Water Service Area



POTABLE WATER SYSTEM

The existing potable water system consists of:

- approximately 421 miles of pipelines
- 22 storage reservoirs
- 15 booster pumping stations
- 41 groundwater wells (38 potable, 3 recycled)
- 4 imported water connections
- 2 inter agency connections
- 5 water treatment plants
- 28 pressure regulating stations
- 6,000 fire hydrants
- 11 pressure zones

Existing and Projected Water Demands

Historical and projected population within the City service area are evaluated and presented in **Section 2**. The population of the City's service area is projected to grow to about 189,700 people over the next 20 years. This growth will increase future water demands.

The future water demands based on population projections are based on a combination of existing water demands, and future water demands associated with the projected residential growth and non-residential growth.

New residential growth is expected to result in an 18 percent increase in water demands, while non-residential growth will increase demands by about 4 percent. The water demand projections in **Table ES-1** identifies the need for up to 34,283 acre-ft/yr of annual supply in 2025 in a normal demand year and approximately 37,200 acre-ft/yr in a hot dry year. The projected maximum day demand in 2025 is 52 million gallons per day (mgd).

Table ES-1
Projected Water Supply Needs

Year	Average Annual Demand (acre-ft/yr)	Dry Year Annual Demand (acre-ft/yr)	Maximum Day Demand (mgd)
2000	30,082	--	43.9
2005	28,414	30,830	43.1
2010	29,882	32,420	45.4
2015	31,181	33,830	47.3
2020	32,715	35,500	49.7
2025	34,283	37,200	52.0

Water Supply

The existing water supply sources consist of:

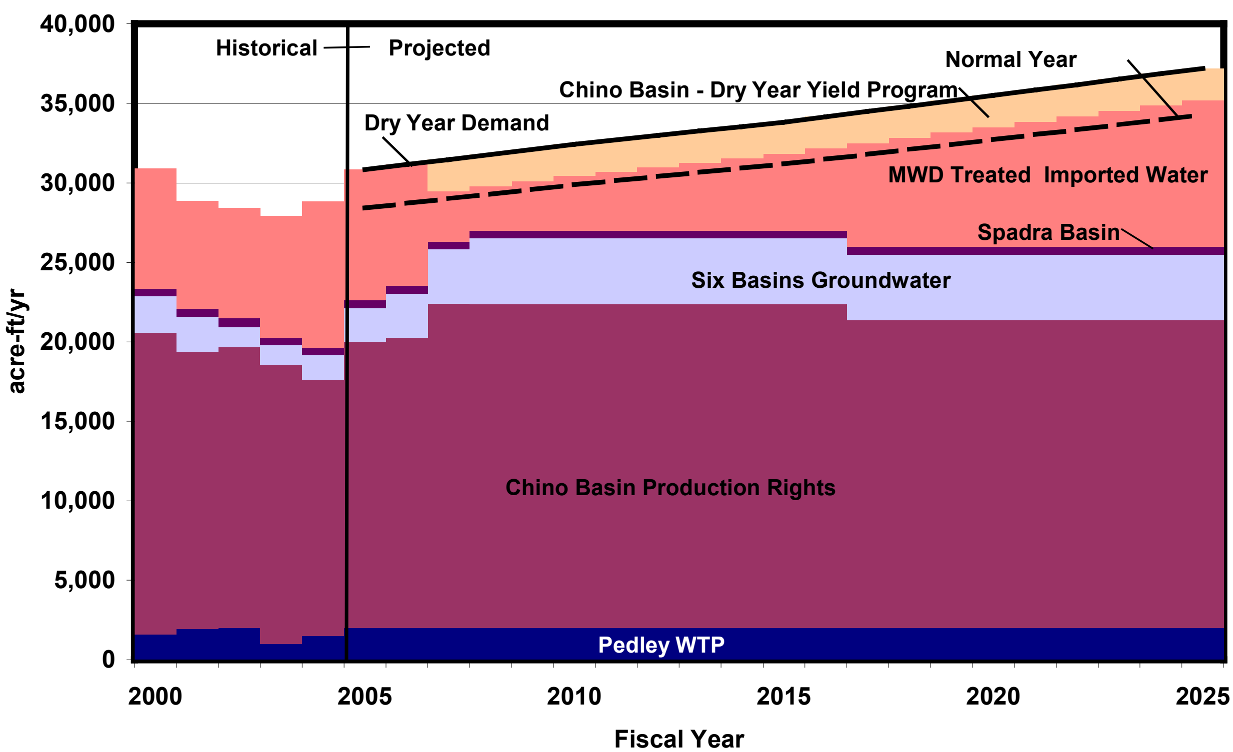
- 70 percent Groundwater: from the Chino Basin, Six Basins, and Spadra Basin
- 23 percent Imported water: from Metropolitan Water District of Southern California (MWD)
- 7 percent Treated surface water: from the Pedley Water Treatment Plant

The recommended water supply plan for the City of Pomona consists of the following elements:

- Maximize the use of surface water rights in San Antonio and Evey Canyons and existing groundwater water rights in the Six Basins and the Chino Basin
- Maximize the use of local groundwater supplies prior to purchasing treated imported water
- Evaluate leasing Chino and Six Basins water rights from other producers in these basins prior to purchasing replenishment water for overproduction.
- Water marketing strategies should only be considered after the City's water supply needs are met.
- Maintain a minimum Chino Basin storage volume of 11,216 acre-ft (one year's operating safe yield) as a dry year reserve
- Reduce or eliminate the sale of water from the Chino Basin storage account.
- Maximize production from good quality wells in the Chino and Six Basins areas as these are the most cost-effective supply sources.
- Investigate and eliminate the precursors for NDMA formation.
- Install treatment facilities for Wells 20, 32, 35 and 37 to meet drinking water standards and increase dependable groundwater production capacity.
- Conduct a study of the ability to treat State Water Project water at the Pedley Plant.
- Continue to maintain and enhance groundwater production capacity.
- Work closely with TVMWD to implement water conservation measures.

For planning purposes, the City should have sufficient water supply to meet the projected annual water demands in a dry year. **Figure ES-2** presents the recommended supply plan for the City.

Figure ES-2
Recommended Water Supply Plan



This plan is based on the strategies discussed above. During dry years, Pomona would be required to pump 2,000 acre-ft/yr under the dry year yield program to offset MWD purchases when required.

Potable Water System Evaluation

The water system is evaluated under existing and future demand conditions using a hydraulic model of the distribution system. The model is used to identify system requirements and to recommend system improvements. The recommended improvements are divided into the following areas:

- Distribution system improvements
- Storage improvements
- Booster station improvements
- Supply improvements
- Other Improvements

These recommendations are summarized in **Table ES-2**. All of the recommended improvements are divided into two categories; 1) existing system improvements addressing existing water system requirements, and 2) future system improvements necessary to meet the projected water demands for year 2025. A more detailed description of these recommendations can be found in **Section 11**.

As shown in **Table ES-2**, a total of 105 miles of pipelines is recommended for replacement, which equates to 5.2 miles per year or approximately 26 miles per period. The phasing of the recommended pipelines is graphically presented on **Figure ES-3**. The location of these pipelines and other system improvements and the phasing of projects are shown on **Figure ES-4**. Detailed descriptions of the recommended improvements, including phasing and project cost are provided in **Section 11**.

Water System CIP

The recommended improvements are phased based on system needs. Projects addressing both existing requirements and future demands are phased over the next 20 years using the following four periods:

- Year 2006 through year 2010
- Year 2011 through year 2015
- Year 2016 through year 2020
- Year 2021 through year 2025

The cost of the potable water CIP is summarized in **Table ES-3**. As shown in this table, the total capital cost is estimated at a total capital cost of $152.0 million. The estimated cost for addressing existing system requirements is $147.2 million while the estimated cost for growth-induced improvements with a planning horizon of year 2025 is $4.8 million. Detailed per project including sizing, phasing, and project cost are included in **Section 11**.

Table ES-2
Summary of Potable Water System Improvements

Type	Category ID	Improvements Description	Quantity	Unit
Existing System Improvements	P	Pipeline Improvements	1	miles
	MP	Pipeline Improvements in major streets	4	miles
	PA	Pipeline Improvements with an age of more than 75 years	28	miles
	MA	Pipeline Improvements in major streets with an age of more than 75 years	15	miles
	FF	Pipeline Improvements for fire flow	32	miles
	MFF	Pipeline Improvements for fire flow in major streets	4	miles
	A	Pipelines with an age of more than 75 years (not included in PA or MA)	21	miles
	Res	Reservoirs Improvements – roof rehabilitation	2	reservoirs
		Reservoirs Improvements – seismic upgrades	3	reservoir
	PS	Pump Stations Improvements – pump replacements	14	stations
		Pump Stations Improvements – rehabilitation	1	station
	S	Water Supply Improvements – abandonment and replacement	7	wells
		Water Supply Improvements – well head treatment	2	wells
		Water Supply Improvements – piping, equipping, treatment	2	wells
		Water Supply Improvements – disinfection	2	wells
		Water Supply Improvements – destruction of abandoned wells	3	wells
	SR	Supply Reliability – new inter-agency connection	1	connections
	Other	Other Improvements – SCADA	1	n/a
		Other Improvements – GIS	1	n/a
		Other Improvements – PEIR	1	n/a
		Meter Replacements (33,600 meters/10 years)	67,200	meters
		Service lateral replacements (in Phillips Ranch Area) + study	500	laterals
		Fire hydrant head replacements (20/year)	400	hydrants
		Pipeline Flow and Coupon Testing	tbd[1]	n/a
		Water System Security Upgrade	1	system
		Corporate Yard Facility (Water System Share)	1	Yard
		Feasibility Study for Pedley WTP	1	Study
Future	F-FF	Pipeline Improvements for fire flow	1	mile
	F-S	Water Supply Improvements – abandonment and replacement	1	wells
		Water Supply Improvements – well head treatment	2	well

1 – tbd = to be determined

Figure ES-3
Pipeline Replacement Rate

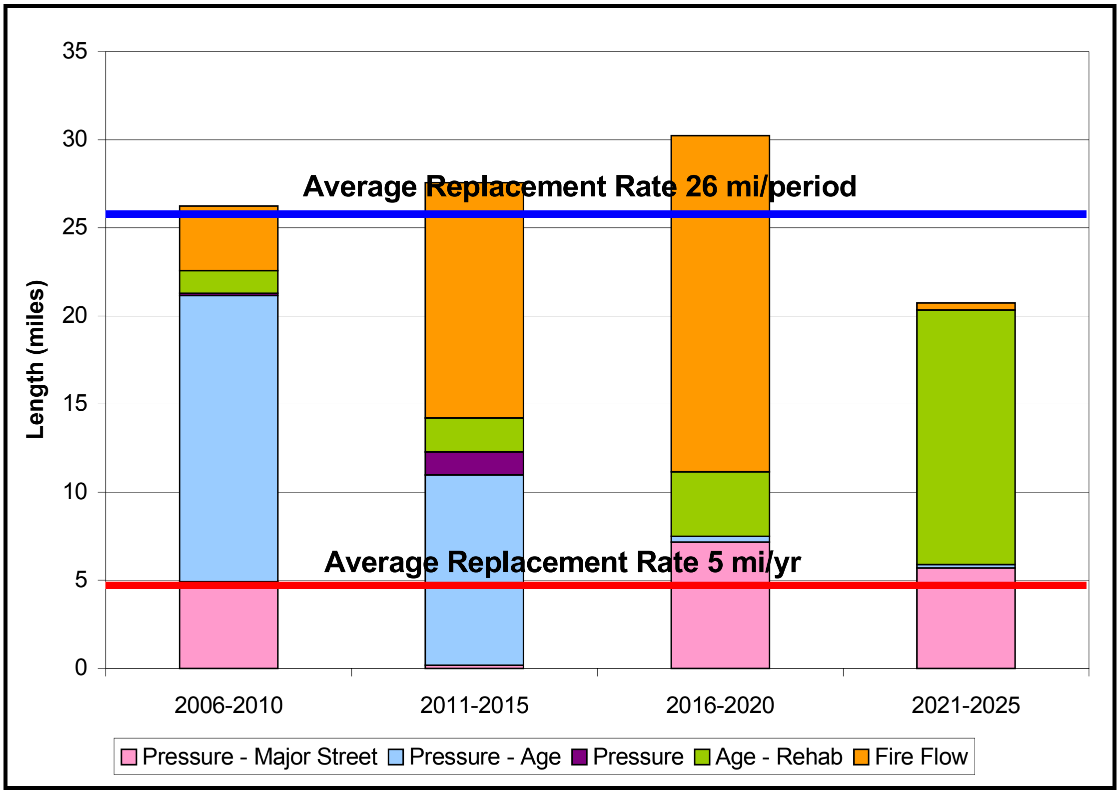
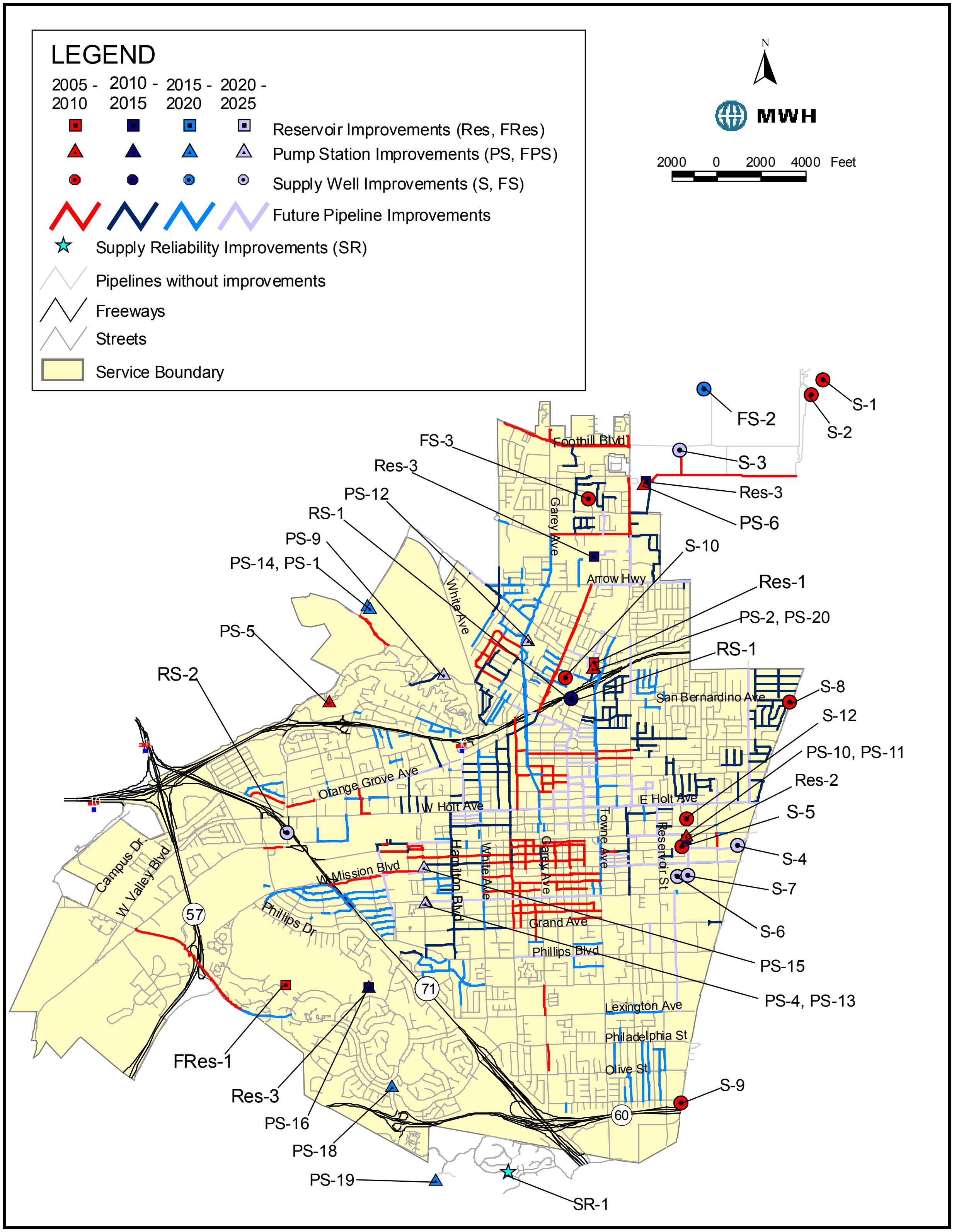


Table ES-3
Summary of Potable Water System Improvements

Improvement Category	Existing System ($ million)	Future System ($ million)	Total ($ million)
Pipeline Improvements (P, MP, PA, MA)	$64.0		$64.0
Fire Flow Improvements (FF, MFF, FFF)	$29.4	$1.2	$30.6
Reservoir Improvements (Res, F-Res)	$4.5		$4.5
Pump Station Improvements (PS)	$4.5		$4.5
Supply Improvements (S, SR, F-S)	$16.3	$3.6	$19.9
Other Improvements	$28.5		$28.5
Total	**$147.2**	**$4.8**	**$152.0**

Figure ES-4
Phasing of Potable Water System Improvements



RECYCLED WATER

The City's recycled water system currently delivers water to seven customers with a combined demand of 5.4 mgd. These demands are served with effluent from the Los Angeles County Sanitation District Pomona Water Reclamation Plant (WRP) and three non-potable water wells. The combined recycled water supply capacity of the Pomona WRP (8 mgd allocated for the City) and the three existing recycled water wells (1.2 mgd) is 9.2 mgd.

This WMP evaluates the feasibility of extending the recycled water system to serve other potential recycled water customers to reduce potable water supply needs. Based on the feasibility analysis presented in **Section 10**, it is determined cost-effective to expand the recycled water system with the addition of 10 new users. The addition of these users would increase the City's recycled water demand from 5,595 acre-ft/yr by 594 acre-ft/yr to 6,189 acre-ft/yr. This is a 10 percent increase compared to the existing recycled water demand. The pipeline additions and other recycled water system improvements are summarized in **Table ES-4**.

Table ES-4
Summary of Recycled Water System Improvements

Category ID	Improvements Description	Quantity	Unit
RS	Recycled Water Supply Improvements - abandonment and replacement	1	well
	Recycled Water Supply Improvements – pump replacement	1	well
F-RS	New Recycled Water Pipelines to serve Segments 1 and 3	1.3	miles
	Recycled Water Fire Hydrants	10	hydrants

Recycled Water System CIP

The cost of the recycled water CIP is estimated at $3.2 million. The estimated cost for addressing existing system requirements is $1.9 million while the estimated cost for growth-induced improvements with a planning horizon of year 2025 is $1.3 million. Detailed per project including sizing, phasing, and project cost are included in **Section 11**.

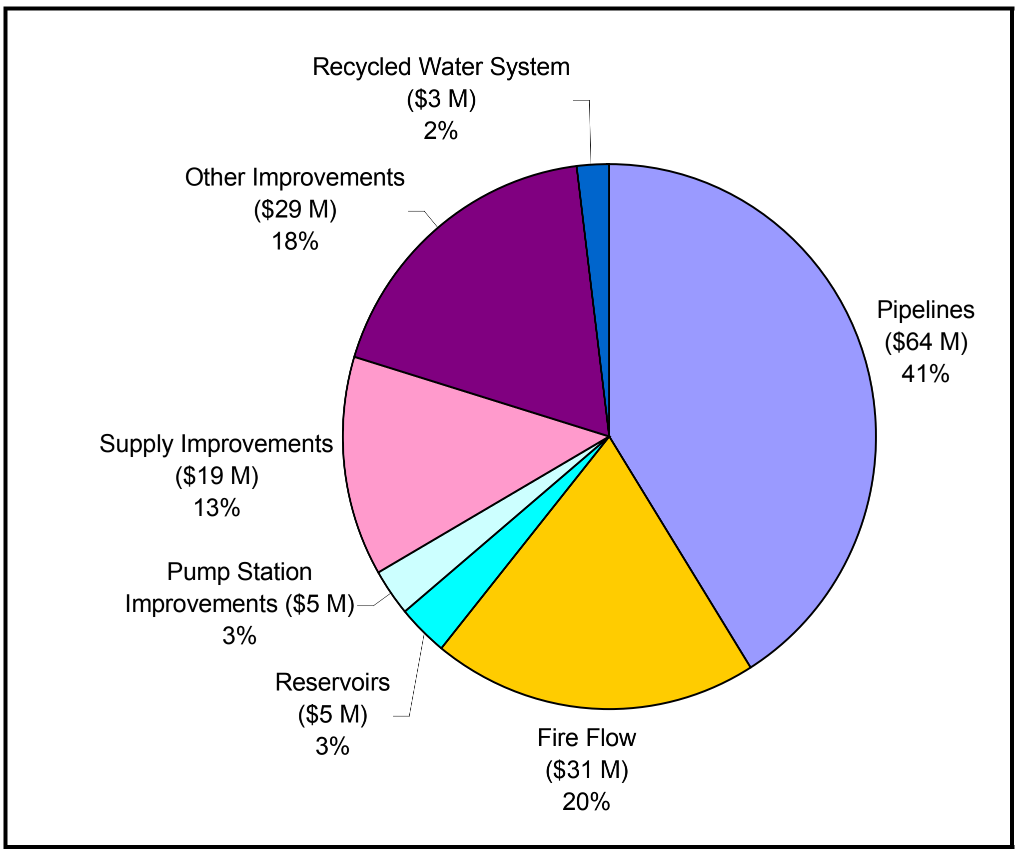
COMBINED CAPITAL IMPROVEMENT PROGRAM

The combined potable and recycled water system CIP for the next 20 years is summarized by improvement category and phase in **Table ES-5**. The distribution of cost by improvement category is graphically presented on **Figure ES-5**.

Table ES-5
Summary of Combined CIP by Improvement Category

Improvement Category	2005-2010	2010-2015	2015-2020	2020-2025	Grand Total
Pipeline Improvements (P, MP, PA, MA)	$20,513,200	$12,520,000	$11,174,000	$19,747,000	$63,954,200
Fire Flow Improvements (FF, MFF, FFF)	$3,736,000	$10,277,000	$15,149,000	$1,485,000	$30,647,000
Reservoir Improvements (Res, F-Res)	$1,278,000	$3,244,000	$0	$0	$4,522,000
Pump Station Improvements (PS)	$1,888,000	$604,000	$684,000	$1,341,000	$4,517,000
Supply Improvements (S, SR, F-S)	$8,978,000	$2,823,000	$0	$8,088,000	$19,889,000
Other Improvements (PEIR, GIS, SCADA, meters)	$11,900,000	$4,250,000	$8,232,000	$4,250,000	$28,632,000
Recycled Water System (RS, F-RS)	$1,093,000	$1,755,000	$0	$160,000	$3,008,000
Total	**$49,386,200**	**$35,473,000**	**$35,239,000**	**$35,071,000**	**$155,169,200**

Figure ES-5
Potable and Recycled Water System CIP



As shown in this figure and table, the combined CIP has the following characteristics:

- The total capital cost is estimated at $155 million
- The average capital cost is $7.8 million per year.
- Potable water system improvements are estimated at $152 million or 98 percent
- Existing system improvements are estimated at $149 million or 96 percent
- Pipeline improvements are estimated at $95 million or 61 percent

FINANCIAL PLAN

A financial plan was prepared to address the capital requirements for funding the CIP (see **Section 12**). The recommended financial plan includes a combination of debt and pay-as-you-go financing. Bond financing would be accomplished biennially over the twenty-year period with a total financing of about $191 million. The financial plan provides a general indication of future water rates over the next twenty years to implement the recommendations of this master plan.

Section 1
Introduction

This section provides an overview of the project and an outline of the master plan. A brief description of the project background, the scope of work, a description of the report sections to follow, and a listing of abbreviations and definitions used in this report are included in this section.

AUTHORIZATION

This Water and Recycled Water Master Plan has been developed in accordance with the agreement for consulting services for the water and sewer master plan between the City of Pomona (City) and MWH Americas, Inc. (MWH) dated September 8, 2003. The findings presented in this report apply to Tasks 1 through 10 and Task 20 only, as Tasks 11 through 19 are presented in a separate document, the Sewer Master Plan.

PROJECT BACKGROUND

Water and recycled water is managed by the City's Utility Services Department (USD). The USD Mission Statement is as follows:

> *The mission of the Pomona Utility Services Department is to provide, plan, develop, operate, and maintain a variety of utility services in a responsive, efficient and cost effective manner. Our services include quality customer care in the areas of water and sewer, trash and recycling collection, and the maintenance of all City equipment.*

The intent of this Water and Recycled Water Master Plan (WMP) is to provide an overall strategy and direction for the management and operation of the City's water system. This WMP is a planning tool with a 20-year planning horizon until year 2025. Based on population projections from Southern California Association of Governments (SCAG), year 2025 is anticipated to be close to the build-out conditions of the City.

WMPs are normally updated periodically to incorporate new data, evaluate impacts of new projects and regulations, and determine the actions or facilities required meeting the needs of the City's customers and maintenance of the water system. The first WMP for the City was prepared by James M. Montgomery, Consulting Engineers, Inc. (JMM) in 1952. Subsequently, the WMP was updated in 1962, 1970, 1976, 1982, and 1992 by JMM. Other planning reports prepared for the City include the Phillips Ranch Master Plan in 1978, Urban Water Management Plans (UWMP) in 1985 and 2000, a water rate study in 1990, and the nitrate feasibility study in 1991. This WMP updates information of these previous reports to reflect the current system conditions, facilities and operations. Some recent events that affect the water and recycled water systems resulting in the need for this WMP update include:

- Development of Downtown Pomona Specific Plan
- Recent population growth projections by the Southern California Association of Governments (SCAG)
- Anion Exchange Plant (AEP) upgrade and expansion
- Adoption of the Chino Basin Peace Agreement and Optimum Basin Management Plan (OBMP)
- Increase of imported water supply cost, requiring an updated water supply strategy
- State regulations promoting the use of recycled water
- Changes in water quality regulations, such as perchlorate.
- Rehabilitation and replacement needs of existing facilities and pipelines

This WMP evaluates the existing and future system conditions and operations of the water system to identify deficiencies and recommends projects to address these deficiencies. In addition, the operation and expansion opportunities of the recycled water system are evaluated. All recommendations are summarized in a Capital Improvement Plan (CIP), which includes the phasing of projects to continue to provide the City's customers with a high quality and reliable water supply at the least cost.

SCOPE OF WORK

The scope of work for the Water and Recycled Water System Master Plan includes the following tasks.

- Project Management
- Data Collection and Review
- Water Demand Projections
- Potable Water Resources, Quality, Marketing, & Supply
- Recycled Water Resources, Supply, and Rates
- Hydraulic Model of the Water System
- Evaluation of Existing and Future Water System
- 20-Year Improvement Program
- Financing Plan
- Water System – Final Report

PROJECT STAFF

The following MWH staff was principally involved in the preparation of this WMP:

Principal-in-Charge:	Roger Austin, Ashok Dhingra, P.E.
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Technical Review: David Bouck, P.E.
Lee Aldridge, P.E.
Eric Mills, P.E.
Matthew Huang, P.E.

DATA SOURCES

Information presented in this report is obtained from a large number of sources. These sources include, but are not limited to:

- Previous Water Master Plan Reports (1982 and 1992)
- Urban Water Management Plan (2000)
- 2001 Engineering Report prepared by the State of California, Department of Health Services (DHS)
- City's GIS data (land use, streets, parcels, topographic data, pipelines, streets)
- General Plans, Land Use and Parcel information for the City
- Hydraulic pump test data conducted by Southern California Edison (SCE) between September 1997 to June 2003
- Historical water production and billing records (2001 to 2003)
- Department of Water Resources Public Water Systems Statistics (2000 to 2003)
- Historical recycled water production records (July 1993 to February 2004)
- Facility design drawings of booster stations, well pumping stations, and storage reservoirs
- Water system schematic including details on water facilities
- Electronic aerial photography coverage within State Plan Coordinate System, in NAD83, California Zone V
- City Water Atlas Maps
- Construction drawings of newly installed pipelines not included on Water Atlas Maps
- Manufacturer's design curves for some of the City's booster pumps and well pumps
- Water level and drawdown elevations at wells
- Inlet/outlet level, high water level, bottom elevations of wells
- Drawings and depth-volume curves of all reservoirs
- Database listing of all pressure regulating stations
- Pump controls and settings of pressure regulating valves
- Well and booster operational controls
- Digital elevation model
- Southern California Association of Governments (SCAG) historical and projected population estimates
- California Department of Finance (DOF) historical population estimates

REPORT OUTLINE

This Water and Recycled Master Plan (WMP) is divided into twelve sections. Section 2 discusses population, land use, existing water demands and the demand projections for year 2020. Section 3 discusses the existing and future water demands. In Section 4, the existing water system is described, and Section 5 summarizes water supply requirements, sources, water quality, and water supply management opportunities. The hydraulic model creation and calibration process are defined in Section 6. Section 7 discusses the water system evaluation criteria. The existing and future system evaluations are discussed in Sections 8 and 9 respectively. Section 10 discusses the existing and future recycled water system. Based on these system evaluations, the CIP was developed, which is discussed in Section 11. Section 12 discusses a financial plan for the implementation of the CIP.

ABBREVIATIONS

To conserve space and improve readability, abbreviations have been used in this report. Each abbreviation has been spelled out in the text the first time it is used. Subsequent usage of the term is usually identified by its abbreviation. The abbreviations used are shown in **Table 1-1**.

Table 1-1
Abbreviations

Abbreviation	Description
A	Age Improvements (pipelines)
AC	asbestos cement
acre-ft/yr	acre-feet per year
acre-ft/mo	acre-feet per month
ADD	average day demand
AEP	Anion Exchange Plant
ANSI/NSF	American National Standards Institute/NSF International
AWWA	American Water Works Association
BMP	Best Management Practice
Cal Poly	California State Polytechnic University
CBWM	Chino Basin Watermaster
CEQA	California Environmental Quality Act
CI	cast iron
CIP	Capital Improvement Plan
City	City of Pomona
CONC	concrete
COPA	City of Pomona Accounts
COPP	copper
CRA	Colorado River Aqueduct
CUWCC	California Urban Water Conservation Council
CWC	Cañon Water Company
CY	calendar year
D&B	Dyett and Bhatia, Urban and Regional Planners
DCE	1,1-Dichloroethylene
D/DBP	Disinfectant/Disinfection By-Product
DHS	State of California, Department of Health Services
DI	ductile iron
DOF	Department of Finance
DSP	Downtown Specific Plan
DYY	Dry Year Yield
EIR	Environmental Impact Report
EPA	United States Environmental Protection Agency`
EPS	Extended Period Simulation

Table 1-1 (Continued)
Abbreviations

Abbreviation	Description
FCC	Federal Communications Commission
FF	Fire Flow or Fire Flow Improvements (pipelines)
F-FF	Future Fire Flow Improvements (pipelines)
ft	foot (feet)
fps	feet per second
F-PS	Future Pump Station Improvements
F-Res	Future Reservoir Improvements
F-RS	Future Recycled Water System Improvements
F-S	Future Supply Improvements (wells)
FY	fiscal year
GAC	granular activated carbon
gal/ft	gallons per foot
GIS	Geographical Information System
gpcd	gallons per capita per day
gpd/ac	gallons per day per acre
gpm	gallons per minute
GWR	Groundwater Rule
HAA	haloacetic acid
HGL	hydraulic grade line
HP	horsepower
IEUA	Inland Empire Utilities Agency
IOC	inorganic compounds
JMM	James M. Montgomery, Consulting Engineers, Inc.
kW	kilowatts
kWh	kilowatt per hour
LACSD	Los Angeles County Sanitation Districts
MA	Age Improvements in Major Arterial Streets (pipelines)
MCL	Maximum Contaminant Level
MDD	maximum day demand
MDR	Medium Density Residential
MFF	Fire Flow Improvements in Major Arterial Streets (pipelines)
MG	million gallons
mgd	million gallons per day
mg/L	milligrams per liter
MHz	megahertz
mi	miles
mi/yr	miles per year
Min	minimum
Max	maximum
MinDD	minimum day demand
MinMD	minimum month demand
MLCS	mortar lined and coated steel
MOU	Memorandum of Understanding
MP	Pressure Improvements in Major Arterial Streets (pipelines)
MTBE	methyl-tertiary-butyl-ether
MWD	Metropolitan Water District of Southern California
MWH	MWH Americas, Inc.
N/A	Not Available

Table 1-1 (Continued)
Abbreviations

Abbreviation	Description
NDEA	n-nitrosodiethyamine
NDMA	n-nitrosodimethylamine
NDPA	n-nitroso-di-n-propylamine
NL	Notification Level
NO_3	nitrate
OBMP	Optimum Basin Management Plan
OEHHA	California Office of Environmental Health and Hazard Assessment
OSY	Operating Safe Yield
P	Pressure Improvements (pipelines)
PA	Pressure and Age Improvements (pipelines)
PCE	tetrachloroethylene
PHD	peak hour demand
PHG	Public Health Goal
PEIR	Program Environmental Impact Report
PLAS	plastic
PRV	pressure regulating valve
PS	Pump Station or Pump Station Improvements
psi	pounds per square inch
PUSD	Pomona Unified School District
PVC	polyvinyl chloride
PVPA	Pomona Valley Protective Association
PWR	Pomona-Walnut-Rowland
PWR-JWL	Pomona-Walnut-Rowland Joint Water Line
PWRR5	Pomona-Walnut-Rowland Joint Water Line Connection at Reservoir 5
PWRR8	Pomona-Walnut-Rowland Joint Water Line Connection at Reservoir 8
Res	Reservoir Improvements
RS	Recycled Water System Improvements
RTU	remote terminal unit
RWD	Rowland Water District
S	Supply Improvements (wells)
SAWC	San Antonio Water Company
SCADA	Supervisory Control and Data Acquisition System
SCAG	Southern California Association of Governments
SCE	Southern California Edison Company
SCWC	Southern California Water Company
SDWA	Safe Drinking Water Act
SFR	Single Family Residential
SOC	synthetic organic compound
sq-ft	square foot (feet)
SR	Supply Reliability Improvements
STL	steel
SWP	State Water Project
SWTR	Surface Water Treatment Rule
TW	Tunnel Wells
TCA	1,1,1–trichloroethane
TCE	trichloroethylene
TDS	total dissolved solids
TIN	Triangular Interpolated Network

Table 1-1 (Continued)
Abbreviations

Abbreviation	Description
TOU	Time of Use
TTHM	total trihalomethanes
TVMWD	Three Valleys Municipal Water District
ULF	ultra low flush
ULFT	ultra low flush toilet
UPC	Uniform Plumbing Code
USD	Utility Services Department
UWMP	Urban Water Management Plan
VOC	volatile organic compound
WMP	Water and Recycled Water Master Plan
WRP	water reclamation plant
WTP	water treatment plant
WDF	water demand factor
WVWD	Walnut Valley Water District
µg/L	micrograms per liter

Definitions:

Calendar Year   January 1 through December 31
Fiscal Year   July 1 through June 30

Section 2
Study Area and Land Use Developments

This section provides an overview of the Master Plan study area and includes a discussion of existing and future population and land uses in the study area.

STUDY AREA

The City is located approximately 35 miles east of downtown Los Angeles. **Figure 2-1** shows the City's borders, the USD service area, and the neighboring cities. **Figure 2-1** also shows that the City is bounded on the east by the City of Montclair, on the south by the cities of Chino and Chino Hills and on the southwest by the City of Diamond Bar. The western boundary is comprised of the cities of Industry, Walnut and San Dimas. On the northern boundary are the cities of La Verne and Claremont. The study area covers approximately 23 square miles. With a population of approximately 156,500 residents, the City of Pomona is currently the fifth largest city in Los Angeles County.

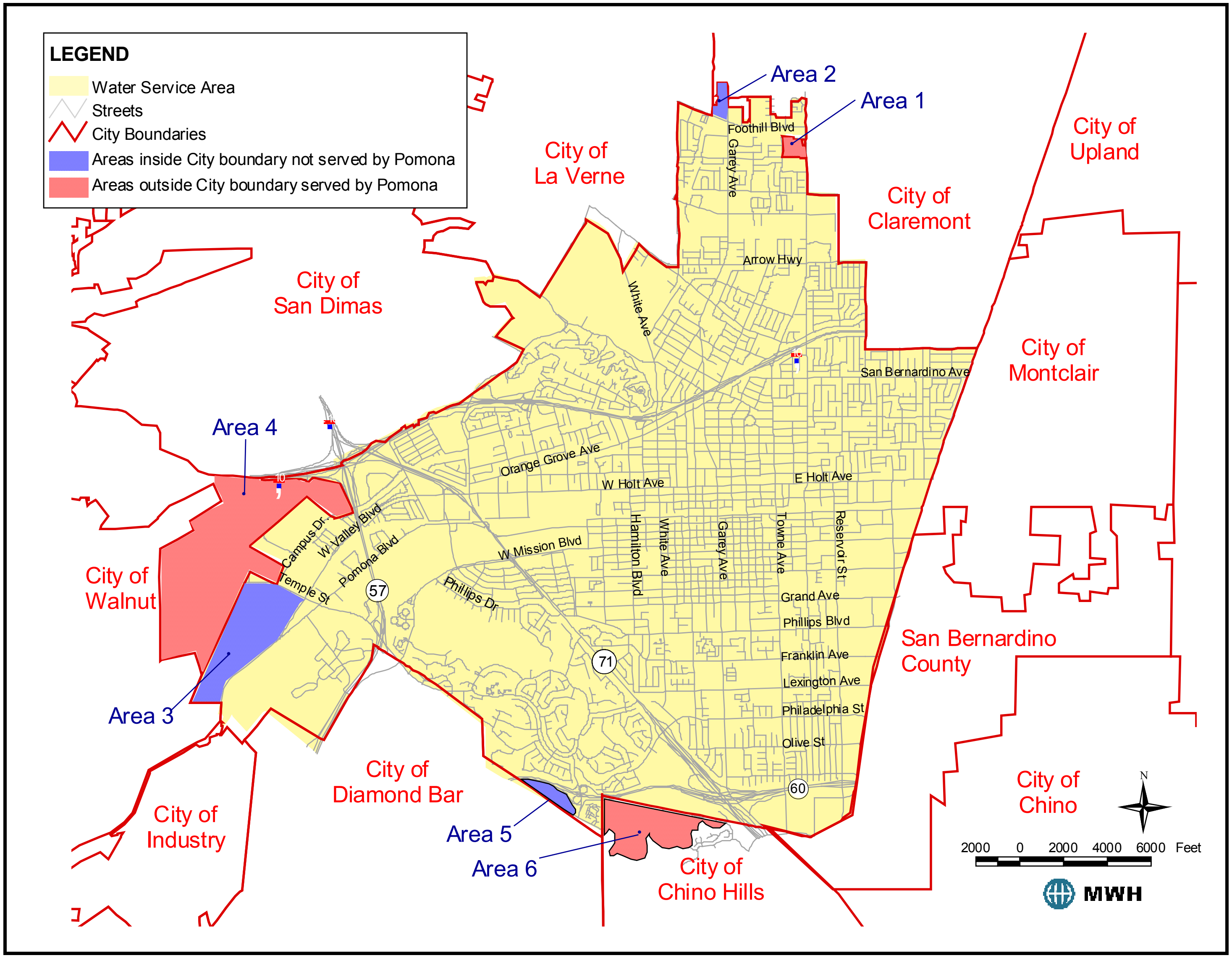
The City was incorporated in January 1888 and became a charter city in March 1911. The City developed as an agricultural base for citrus products in the 1870s and has since developed into a major railway and freeway corridor.

The City's proximity to public transportation facilities has provided convenient access for the City's residents and businesses. Two major east-west freeways pass through the City. The San Bernardino Freeway (Interstate 10) traverses the City's central portion, while the Pomona Freeway (State Route 60) crosses the southern extremity. The Foothill Freeway (Interstate 210) is another major freeway, which runs immediately north of the City. In addition, State Routes 57, 71, and 66 are significant transportation corridors for the City. Union Pacific, Burlington Northern-Santa Fe, Amtrak, and Metrolink provided commercial and passenger/commuter rail services passing through the City.

The water service area includes most of the incorporated area within the City limits with the exception of the following areas:

- a 40-acre area located south of Foothill Boulevard and west of Towne Avenue which is presently served by the Southern California Water Company (SCWC). (indicated as Area 1)
- a 20-acre area located north of Foothill Boulevard and west of Garey Avenue which is presently served by SCWC. (indicated as Area 2)
- a 300-acre area located north of Valley Boulevard and west of Temple Avenue which is served by the Walnut Valley Water District (WVWD). (indicated as Area 3)
- the California State Polytechnic University (Cal Poly) Pomona campus located westerly in an unincorporated area of Los Angeles County. (indicated as Area 4)
- a portion of the Rolling Ridge Estates located south of the Pomona Freeway and west of the Corona Expressway. (indicated as Area 5).

Figure 2-1
Pomona Water Service Area



In addition, the service area includes a 181-acre portion of the Rolling Ridge Estates located south of the Pomona Freeway (State Route 60) and west of State Route 71 in the City of Chino Hills (indicated as Area 6) that is outside the City limits.

HISTORICAL AND PROJECTED POPULATION

The City's historical population estimates are based on California Department of Finance (DOF) and United States Census Bureau data, as listed in **Table 2-1**. Future estimates are obtained from the SCAG 2001 projections, which are presented in **Table 2-2**.

Table 2-1
Historical Population Estimates (1990 to 2003)

Year	Population	Population Increase (percent)	Source
1990	131,723	3.36	California Department of Finance Historical City, County, and State Population Estimates, 1991-2000, with 1990 and 2000 Census Counts (Official State Estimates)
1991	133,200	1.11	
1992	136,600	2.49	
1993	138,000	1.01	
1994	139,300	0.93	
1995	139,400	0.07	
1996	140,000	0.43	
1997	141,200	0.85	
1998	143,200	1.40	
1999	145,400	1.51	
2000	149,473	2.72	
2001	151,600	1.40	California Department of Finance Report E-4 Population Estimates for Cities, Counties and the State, 2001-2003, with 2000 DRU Benchmark
2002	153,800	1.43	
2003	156,500	1.73	

Table 2-2
Projected SCAG 2001 Population Estimates (2005 to 2025)

Year	Population[1]	Annual Increase (percent)
2005	146,447	--
2010	156,484	1.37
2015	165,691	1.18
2020	177,591	1.44
2025	189,687	1.36

1 – Based on SCAG 2001 Population Projections.

As shown in Table 2-2, the SCAG 2001 projections indicate that the City will reach a population of 146,447 in 2005 and the projected population for 2025 is 189,687. It should be noted that the SCAG projection for 2005 (146,447) is about 10,000 people lower than the population estimated by DOF for year 2003 (156,000) as listed in **Table 2-1**. Based on discussions with City Planning Division staff, it was concluded that this variance is likely due to the different data sources used. The DOF estimates are based on a variety of data such as changes in housing stock, birth and death counts, driver's license address changes, school enrollment and other data. The SCAG

1998 and 2001 projections were developed prior to publication of the 2000 census data. **Figure 2-2** shows the difference between the historical data obtained from DOF and the two SCAG projections. Figure 2-2 shows that rapid population growth occurred between after World War II until 1970. Although population decreased in the 1970s, there has been an increasing trend since the 1980s.

Figure 2-2
Historical and Projected Population (1890 to 2025)

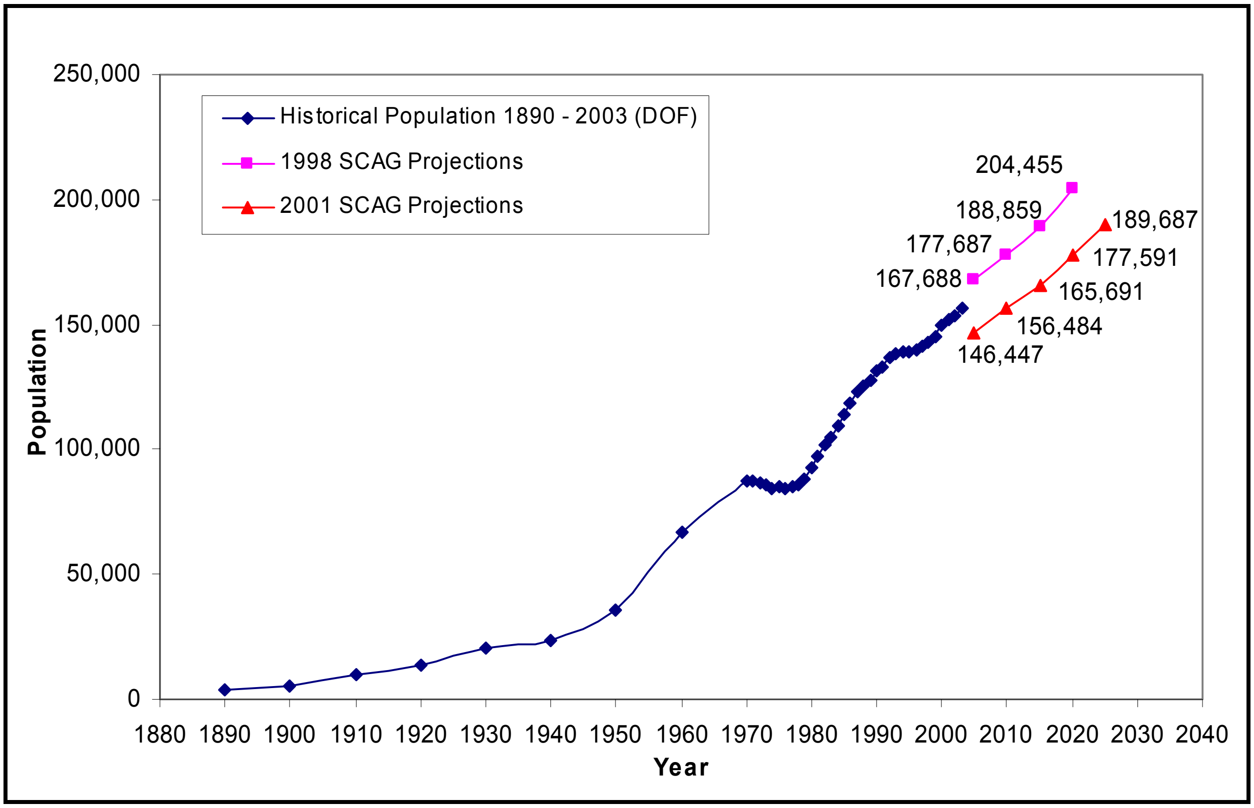


Figure 2-2 also shows the 1998 and 2001 population projections by SCAG. Although the population difference between the two data sources is over 20,000 people for year 2005, the difference in population growth between the two data sources is only 5,600 for the period 2005 through 2020. Based on discussions with City planning staff, it was decided to use the 2001 SCAG projections. The 2001 SCAG projections are more recent and use a more conservative population increase, which in more in-line with the expectations of the City's Planning Division. In addition, the 2001 SCAG projections are also used for the General Plan Update that is currently being prepared.

The planning horizon of this WMP is 2025. This planning horizon is based on discussions with City staff and covers a planning period of 20 years, which is typical for water master plans. In addition, this planning horizon is consistent with the sewer master plan. SCAG has projected the population to increase to 189,687 by 2025 or nearly 27 percent over the year 2000 census population. If the City were to grow as projected by SCAG, the City's population density will increase since the City is currently largely built-out. The projected growth will have to occur either through in-fill developments of currently vacant parcels or re-development of underutilized (not built to current zoning) parcels.

EXISTING LAND USE

Existing land uses by parcel were included in a GIS file provided by the City and are shown in **Figure 2-3.** **Table 2-3** lists the approximate net acreage by land use category (streets and roads have been excluded) and the percent of the total net acreage for each land use category. As seen in **Table 2-3**, Single Family Residential (SFR) comprises a larger area (38 percent) of the City than any other land use, and the area of all residential categories comprises about 46 percent of the City.

Figure 2-3
Existing Land Use

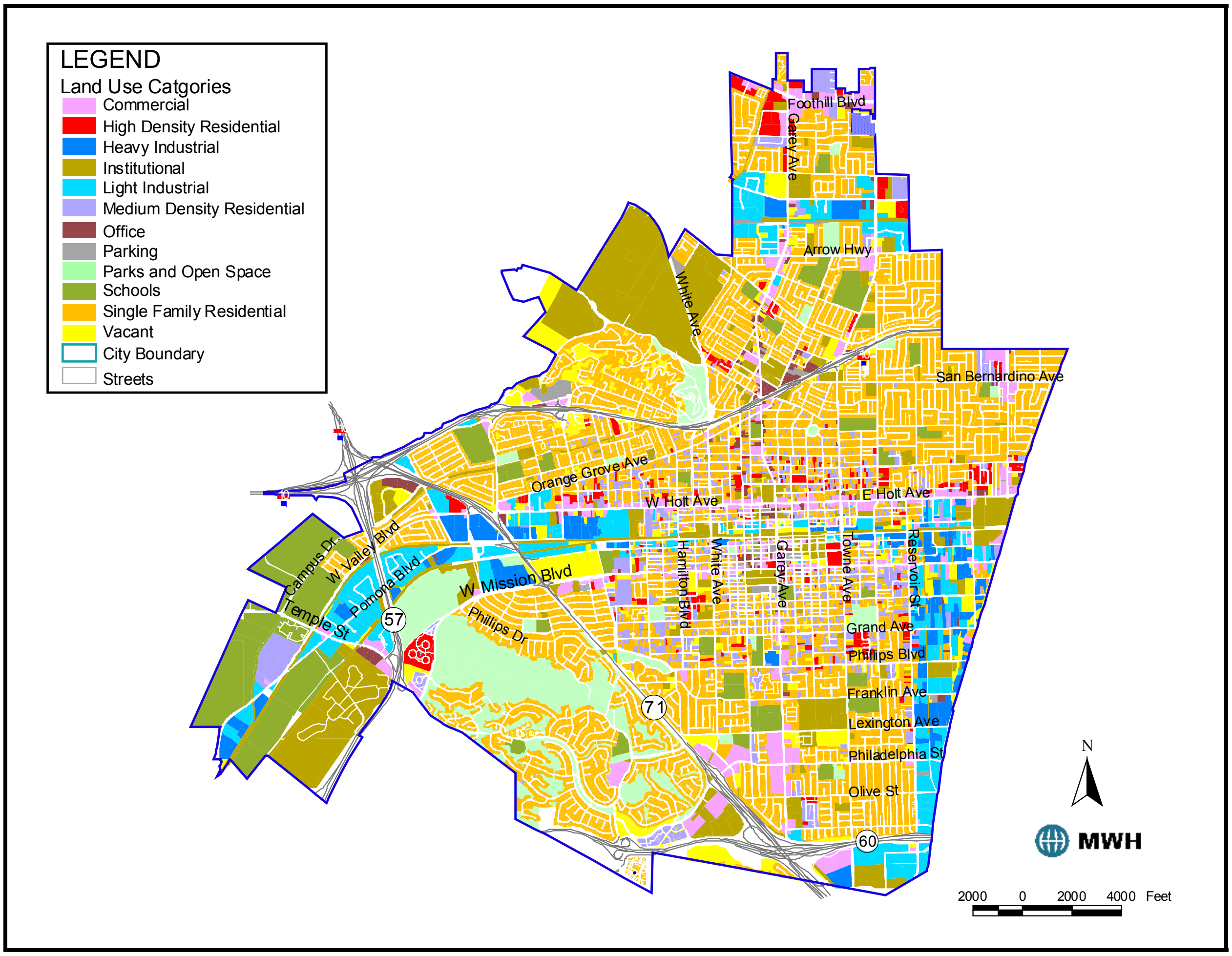


Table 2-3
Summary of Existing Land Use Distribution

Land Use Category	Area (acres)	Area (square miles)	Area (percent)
Single Family Residential	4,594	7.18	31%
Low Density Residential	1,028	1.61	7%
Medium Density Residential	535	0.84	4%
High Density Residential	28	0.04	0%
Administrative Professional	141	0.22	1%
Convenience Commercial	122	0.19	1%
General Commercial	882	1.38	6%
Industrial	2,119	3.31	14%
Institutional	1,835	2.87	12%
Open Space	638	1.00	4%
Specific Plan	2,107	3.29	14%
Blank	675	1.06	5%
Total	**14,704**	**22.97**	**100%**

Source: Existing Land Use shapefile provided by the City

PROJECTED DEVELOPMENTS

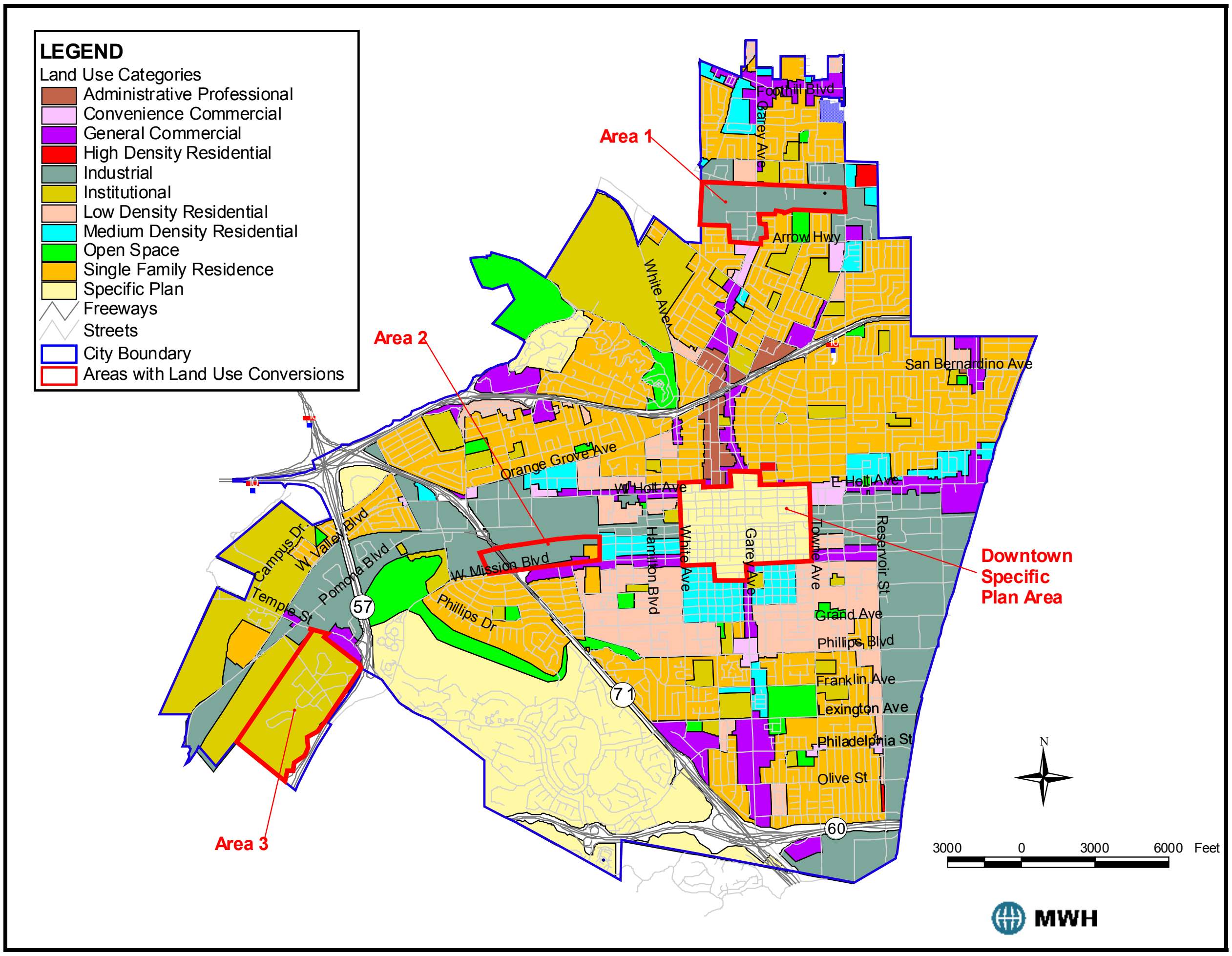
The City's General Plan is currently in the process of being updated from the latest version completed in 1976. The general plan land use is shown on **Figure 2-4,** and the land use distribution is summarized in **Table 2-4**.

Table 2-4
Summary of General Plan Land Use Distribution

Land Use Category	Area (acres)	Area (square miles)	Area (percent)
Single Family Residential	4,311	6.74	29%
Medium Density Residential	591	0.92	4%
High Density Residential	294	0.46	2%
Commercial	536	0.84	4%
Office	115	0.18	1%
Heavy Industrial	418	0.65	3%
Light Industrial	812	1.27	6%
Institutional	1,617	2.53	11%
Schools	959	1.50	7%
Parks and Open Space	864	1.35	6%
Parking	76	0.12	1%
Streets	11	0.02	0%
Vacant	629	0.98	4%
Blank	3,471	5.42	24%
Total	14,704	**22.97**	**100%**

Source: General Plan Land Use shapefile provided by the City.

Figure 2-4
General Plan Land Use



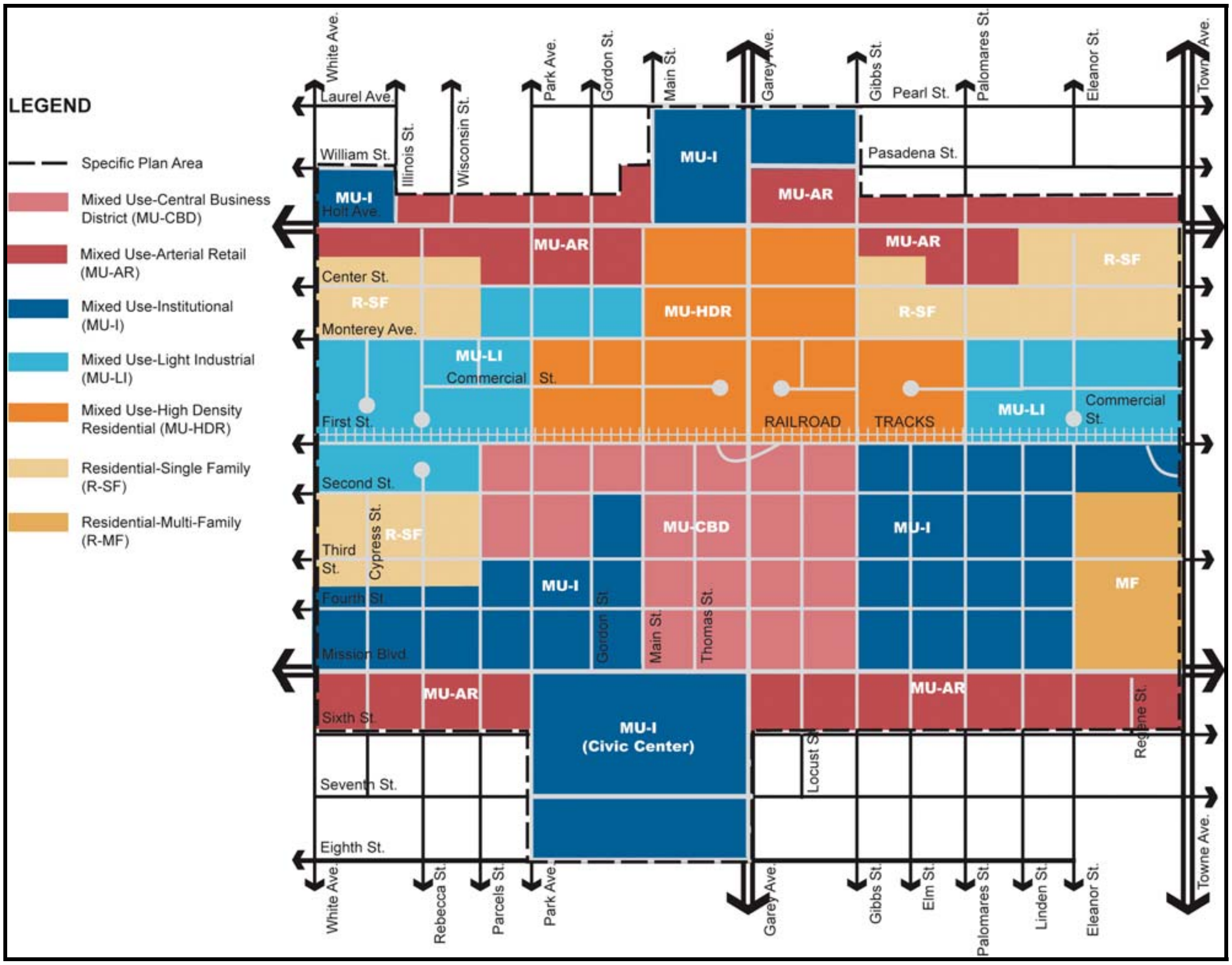
As the General Plan update was not available for the water demand projection in this WMP, meetings were held with the City Planning Division to obtain an understanding of upcoming developments. The Planning Division provided information on specific areas that are expected to change land use significantly or are currently vacant. These areas are listed below:

- Convert industrial area along W. Bonita Avenue to medium density residential (Area 1)
- Convert vacant land between W. Mission Boulevard and W. 2nd Street, just east of the 71 freeway, to half commercial and half medium density residential (Area 2)
- Convert institutional area west of the 57 Freeway to half commercial and half medium density residential. This area is the Lanterman property (Area 3)

Recently, the City has indicated that a portion of the Cal Poly campus known as the Spadra Farm may be developed in the near future. This area is located to northwest of Area 3 on Figure 2-4 and is currently indicated as institutional. In addition to these anticipated developments listed above, the City has developed the Downtown Specific Plan (DSP) to plan for developments in the downtown area. The DSP, shown in **Figure 2-5**, includes several mixed-use land uses, which will contain a mixture of high density residential housing, retail and office space. This specific plan calls for the development of 2,560 dwelling units between years 2005 and 2016; 228,000 square feet of retail space between years 2012 and 2015; and 236,000 square feet of office space between years 2013 and 2016.

Changes in land use between existing and ultimate are used for the projection of water and recycled water demands. The methodology, assumptions, and the projected water and recycled water demands are described in **Section 3**.

Figure 2-5
Downtown Specific Plan



Section 3
Potable Water Demands

This section provides an analysis of the City's water demands from historical and existing conditions. Water-use patterns including annual, monthly, and daily are evaluated and factors are developed for maximum day, minimum day, and peak hour water uses. Projected water demands are presented based on the projected growth trends discussed in **Section 2** of this report.

Water demand refers to the total amount of water used within a distribution system to supply all metered water deliveries and any unaccounted-for water (water losses). Metered water deliveries are also referred to as "water consumption" in this report. Total system-wide water demands equal the total water production for the system from all sources.

HISTORICAL WATER PRODUCTION

In recent years, the City has obtained its water from three sources:

- Groundwater wells located in the Chino, Pomona, Claremont Heights, and Spadra Basins.
- Local surface water from San Antonio and Evey Canyon
- Imported surface water from Three Valleys Municipal Water District (TVMWD) and Metropolitan Water District (MWD) of Southern California.

Over the period Calendar Year (CY) 1999 through CY 2003, approximately 70 percent of the City's water was supplied by groundwater wells, six percent was local surface water treated at the Pedley Water Treatment Plant (WTP), and 24 percent was purchased from TVMWD and MWD. The City's historical water production by source in acre-feet per year (acre-ft/yr) from CY 1999 through CY 2003 is presented in **Table 3-1** and graphically illustrated in **Figure 3-1**. All water supply sources are further discussed in **Section 4**.

Table 3-1
Historical Annual Water Production (FY1999-00 to 2003-04) [1]

Calendar Year	Groundwater (acre-ft/yr)	Surface Water (acre-ft/yr)	Imported Water (acre-ft/yr)	Total Production (acre-ft/yr)
1999	21,466	2,156	5,724	29,346
2000	20,544	1,661	7,877	30,082
2001	20,079	2,350	5,042	27,471
2002	19,602	1,250	8,308	29,161
2003	19,044	1,163	7,939	28,146
Average	**20,147**	**1,716**	**6,978**	**28,841**

1 – Data provided by City staff.

Calendar Years (CY) 1999 through 2003 are used as the basis for detailed water production analyses since this period corresponds with the billing data furnished by the USD. Information is analyzed on an annual, monthly, and daily basis. **Figure 3-2** plots monthly water production in this period. As illustrated in the figure, the average monthly water production is approximately 2,345 acre-feet per month (acre-ft/mo).

Figure 3-1
Historical Water Production

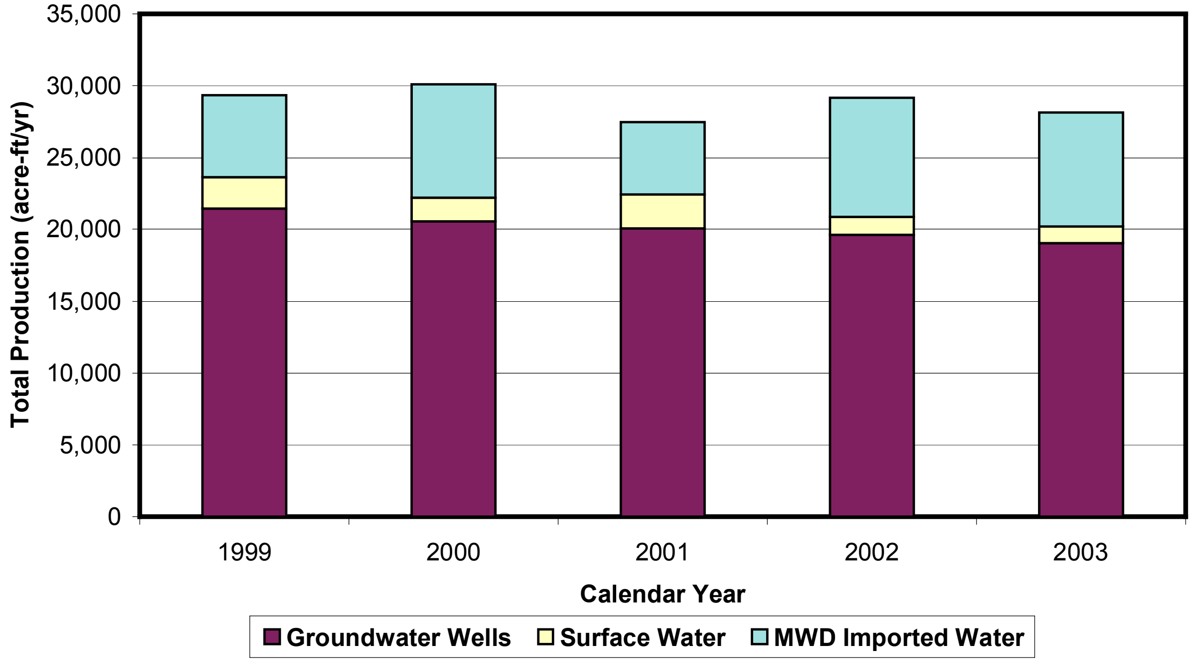
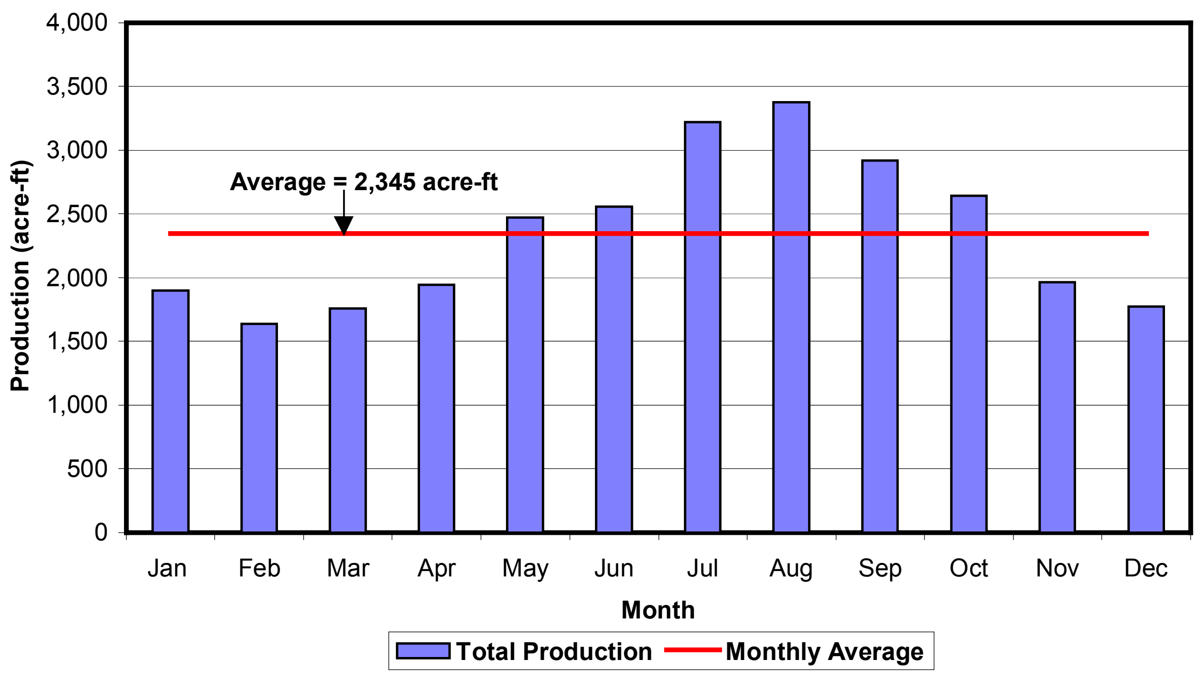


Figure 3-2
Monthly Water Production for CY 2003



Peaking Factors

Water systems must be sized to deliver not only the total annual demand but also the peak demands. The peaking factors derived in this section are used to scale the average demands to represent maximum day and peak hour demands in the hydraulic model. Since maximum day demand (MDD) data available was not readily, the peaking factors are calculated using maximum month demand (MMD) expressed in million gallons per day (mgd). MMD data is available from 1999 to 2003. For conservative results, a 20 percent increase is applied to the MMD to estimate the MDD. This value is based on an analysis of historical daily production data for Pomona during a period of peak water usage in 1985. The available data is summarized in **Table 3-2**. The MDD peaking factors vary historically between 1.55 and 1.69. Based on this information, a conservative MDD peaking factor of 1.7 is used for subsequent water system analyses in this WMP as this represents the highest value in the past five years.

Table 3-2
Historical Production and Peaking Factors

Calendar Year	ADD (acre-ft/yr)	ADD [1] (mgd)	Maximum Month	MMD (mgd)	Estimated MDD [2] (mgd)	MDD Peaking Factor (MDD/ADD)
1999	29,346	26.20	August	35.90	43.08	1.64
2000	30,082	26.86	August	36.62	43.94	1.64
2001	27,471	24.53	August	33.68	40.42	1.65
2002	29,161	26.03	July	33.54	40.25	1.55
2003	28,146	25.13	August	35.49	42.59	1.69

1 – ADD = Average Day Demand
2 – MDD = Maximum Day Demand. MDD is assumed to be 20 greater than the maximum month production in each year

WATER CONSUMPTION

The City's water consumption data is evaluated to assess the seasonal variation in demands, the distribution of water demands by land use category, the location and consumption of large water users, and the amount of indoor and outdoor demands for residential land uses. These analyses are based on data obtained from billing records over the three-year period January 2001 through December 2003.

Historical Water Consumption

The City provided meter-billing information for every service connection from January 2001 to December 2003. The City reads most of its water meters on a bimonthly basis. The consumption data are summarized by month in **Table 3-3** and are graphically illustrated in **Figure 3-3**. Since metering is bimonthly and lags behind actual use of the water, the actual monthly water consumption is estimated by averaging the two subsequent month's billed consumption. This adjusted value can then be compared with the monthly water production.

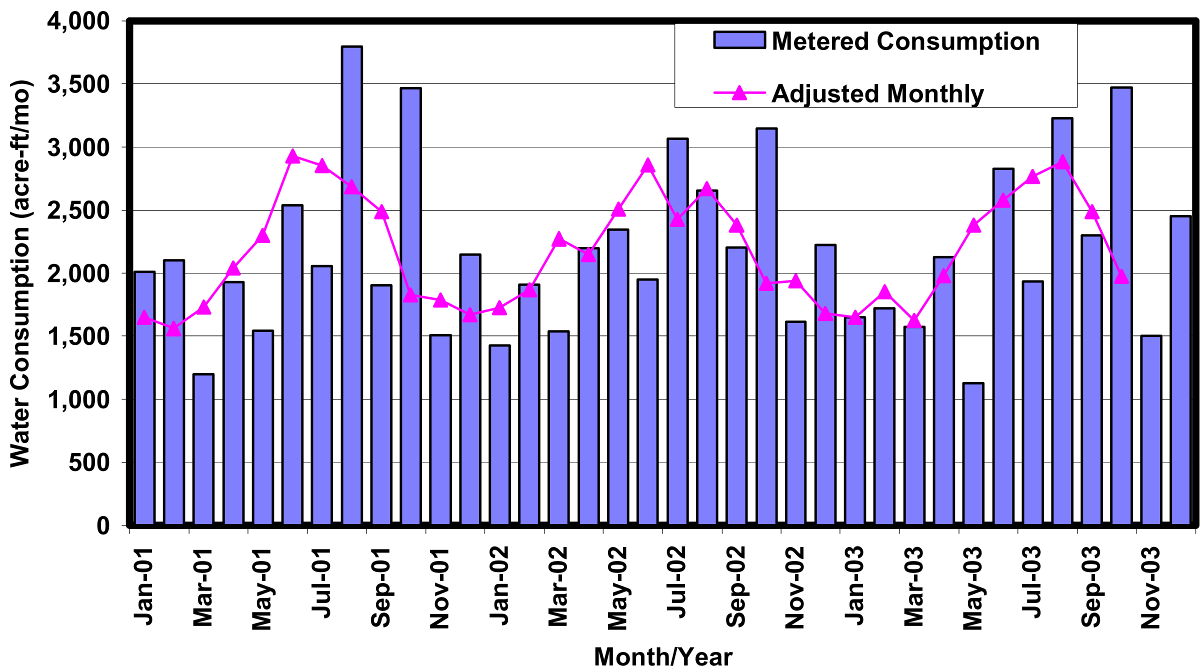
Water consumption increased by approximately 0.2 percent in 2002 and decreased by about 1.4 percent in 2003. Figure 3-3 shows that metered water usage is high from June to October. August is generally the month with the highest water demand and reflects water use patterns from June through August. The large variation in monthly consumption can be explained by variations in weather conditions and the unequal distribution of meter reads per month due to the bi-monthly meter reading. For example, meter readings of 36 of the 40 highest water users (contributing to 13 percent of the total water demand) are all read in the same month, while the remaining four meters are read in the next or previous month. If meter readings would take place monthly, the monthly consumption shown in Figure 3-3 would most likely show a smoother seasonal pattern comparable to the production data.

Table 3-3
Monthly Water Consumption (CY 2001 to CY 2003)

Month	2001 Water Consumption (acre-ft)	2002 Water Consumption (acre-ft)	2003 Water Consumption (acre-ft)
January	2,013	1,425	1,648
February	2,103	1,910	1,719
March	1,197	1,537	1,577
April	1,927	2,196	2,126
May	1,541	2,347	1,128
June	2,539	1,947	2,827
July	2,059	3,065	1,933
August	3,796	2,651	3,226
September	1,905	2,201	2,300
October	3,465	3,143	3,469
November	1,505	1,614	1,504
December	2,148	2,224	2,450
Total Water Usage	**26,198**	**26,262**	**25,906**

Source: Data obtained from 2001 to 2003 Billing Data provided by City staff.

Figure 3-3
Water Consumption (2001 to 2003)



Water Consumption by User Classification

The water consumption by user classification from CY 2001 to CY 2003 is presented in **Table 3-4**. Fifteen water user classifications are used in the City's billing data. This table shows that residential customers, including single-family dwelling, multi-family dwelling and trailer parks, consumed approximately 66.9 percent of the water. Other water user categories include commercial (15.7 percent), industrial (6.0 percent), governmental (6.3 percent), irrigation (4.9 percent), and other categories (0.2 percent). Fire service and sanitation meters show no consumption in the last three years.

Table 3-4
Water Consumption by User Classification (CY 2001 to CY 2003)

User Classification	2001 (acre-ft/yr)	2002 (acre-ft/yr)	2003 (acre-ft/yr)	Average 2001-2003 (acre-ft/yr)	Percent of Total	Percent of Total
Residential Dwelling	12,196	12,720	12,168	12,361	47.3	66.9
Multiple Residential Dwelling	4,691	4,628	4,910	4,743	18.2	
Trailer Park (Residential)	349	348	375	358	1.4	
Commercial	4,117	4,145	4,058	4,106	15.7	15.7
Industrial	1,722	1,393	1,555	1,557	6.0	6.0
Government	1,300	1,075	1,094	1,157	4.4	6.3
City Local Government	47	43	39	43	0.2	
City of Pomona Account	471	482	405	452	1.7	
Irrigation	36	19	22	26	0.1	4.9
Irrigation – Commercial	322	317	306	315	1.2	
Irrigation – City Local Gov.	471	518	436	475	1.8	
Irrigation – Residential Dwelling	444	472	513	476	1.8	
Temporary Service	32	103	23	53	0.2	0.2
Sanitation Only	0	0	0	0	0.0	
Fire Service	0	0	0	0	0.0	
Total Water Consumption	**26,198**	**26,262**	**25,906**	**26,122**	**100.0**	**100.0**

Source: Data obtained from 2001 to 2003 Billing Data provided by City staff.

Indoor and Outdoor Usage

Water demands have base and seasonal components that can be used to estimate the amount of indoor and outdoor water usage. The base component represents non-seasonal consumption and remains relatively constant throughout the year. Much of this base component is indoor water use (i.e., toilet flushing, showers/baths, washing machines, faucets and dishwashers). Because much of the indoor water use ultimately ends up in the sewer system, the estimated indoor usage can be used to estimate the base sewer load for the 2005 Sewer Master Plan. Water usage that varies with weather conditions is known as seasonal consumption and typically includes landscape irrigation, swimming pools, car-washing and cooling. It is assumed that the total consumption during the lowest demand period yields the non-seasonal percentage, while the remaining percentage is seasonal.

Billing data from the City's 2003 billing records is used to analyze the seasonal variation in water demands to estimate the amount of indoor versus outdoor usage. The disaggregation of non-seasonal and seasonal water use is calculated with billing records of single-family and multi-family residential billing classifications. **Table 3-5** summarizes the seasonal disaggregation for single-family and multi-family residential land uses. This table shows the average water consumption during the lowest demand period is about 80 to 83 gallons per capita per day (gpcd). Assuming that no irrigation takes place during the lowest demand period, this amount equals to approximately 79 to 80 percent of the total demand (101 to 104 gpcd). Hence, about 80 percent of water usage may be indoor demand, while 20 percent is identified as outdoor demand.

Table 3-5
Seasonal Disaggregation of Residential Water Use (2003)

Description	Single-Family Residential	Multi-Family Residential
No. of People [1]	104,589	46,612
Lowest Demand Period	Jan - Feb	May – Jun
Water Consumption during Lowest Demand Period (acre-ft/month)	1,575	701
Total Water Consumption in 2003 (acre-ft)	12,168	5,285
Water Consumption/person during Lowest Demand Period (gpcd) [2]	83	80
Total Water Consumption in 2003/person (gpcd)	104	101
Non-seasonal/Base water use or Indoor demand (percent)	80	79
Seasonal/Peak water use or outdoor demand (percent)	20	21

1 – Calculated based on 2003 population estimates for single-family and multi-family residential, density per unit (3.96 people per unit), and vacancy rate (4.4 percent) as reported by the California Department of Finance.
2 – gpcd = gallons per capita per day

With the knowledge that there will always be users that irrigate during the lowest demand period, it is unrealistic to assume that no outdoor demand occurs during the lowest demand period. In addition, the bimonthly billing periods tend to raise the actual minimum month consumption by averaging with an earlier or later month having a higher consumption. However, it is difficult to estimate to how much outdoor usage will take place during low demand periods (wet months). To refine the indoor use estimates, the calculated values presented in Table 3-5 are compared with indoor and outdoor water use estimates published in MWD's 1995 Regional Urban Water Management Plan (UWMP) (MWD, 1995). According to this report, 70 percent of the total residential water usage in MWD's service area is indoor use, which includes toilets, showers/baths, washing machines, faucets, and dishwashers. The other 30 percent is allocated as outdoor use, which includes lawn/garden irrigation, swimming pools, car washing, and air conditioning. Based on MWD's reference values, the indoor and outdoor demand values calculated and presented in Table 3-5, are adjusted to 70 percent indoor use and 30 percent outdoor use to account for outdoor demand that takes place during the lowest demand period.

Table 3-6 presents a revised estimate of indoor use based on the MWD information. With this adjustment, the estimated average indoor use is 73 gpcd (70 percent of 104 gpcd) for single-family residential and 71 gpcd (70 percent of 101 gpcd) for multi-family residential land uses. Hence, the average residential sewer load is estimated to be 72 gpcd. Based on the sewer model calibration, this base load is reduced to 70 gpcd for sewer load projections in the 2005 Sewer Master Plan. These values compare closely to other published information for residential sewage flows.

Table 3-6
Estimate of Indoor Usage or Sewer Load

Description	Single-Family Residential	Multi-Family Residential
Total Water Consumption in 2003 per person	104 gpcd	101 gpcd
Non-seasonal/Base water use/Indoor demand [1]	70%	70%
Seasonal/Peak water use/Outdoor demand [1]	30%	30%
Non-seasonal/Base water use/Indoor demand = Sewer Load calc'd	73 gpcd	71 gpcd
Sewer Load (gpcd)	**72 gpcd**	

1 – Based on 1995 Regional Urban Water Management Plan (MWD, 1995)

These seasonal disaggregations of indoor and outdoor demand for single-family and multi-family residential land use classifications are presented in **Figure 3-4** and **Figure 3-5**. It should be noted that the analyses of other billing classifications do not show clear seasonal trends that could be used to separate the total demand between seasonal and non-seasonal water use.

Large Water Users

The City's major water users have been identified based on the 2003 consumption records to determine high demand locations in the water service area. The top 20 billing accounts are listed in **Table 3-7**. In 2003, the average demands of these users varied between 30 gallons per minute (gpm) (48 acre-ft/yr) and 288 gpm (465 acre-ft/yr). The aggregate demand is approximately 1,654 gpm (2,667 acre-ft/yr), which is approximately 10.3 percent of the total water consumption. Smurfit Newsprint Company is the largest potable water user in the service area, which has two accounts in the top 20 billing account, contributing to 2 percent of the City's total water demand. In addition to potable water, Smurfit is the City's largest recycled water customer.

Diurnal Patterns

A diurnal demand curve is pattern that represents a typical hourly demand variation for one or multiple pressure zones in a water system. These curves are input in hydraulic models to conduct extended period simulations (EPS). Diurnal curve patterns are typically created from Supervisory Control and Data Acquisition (SCADA) data and other hourly flow recordings such as circle charts or strip charts.

During the preparation of this WMP, the City is in the process of upgrading their water SCADA system. As no hourly flow and reservoir level data was available for the maximum day, the diurnal pattern created for the City of Chino is used for the EPS analysis of the City water system. This curve is well suited for the City as both cities have similar land use types and climate conditions. The diurnal curve that reflects the hourly demand variation for the entire City of Chino on September 20, 2000 is shown in **Figure 3-6**. The maximum peaking factor of 1.3 occurs at 7 AM, while the minimum peaking factor of 0.7 occurs at 3 PM. It is recommended that the diurnal curve be computed once the new SCADA is fully operational.

Figure 3-4
Indoor and Outdoor Use for Single-Family Residential (CY 2003)

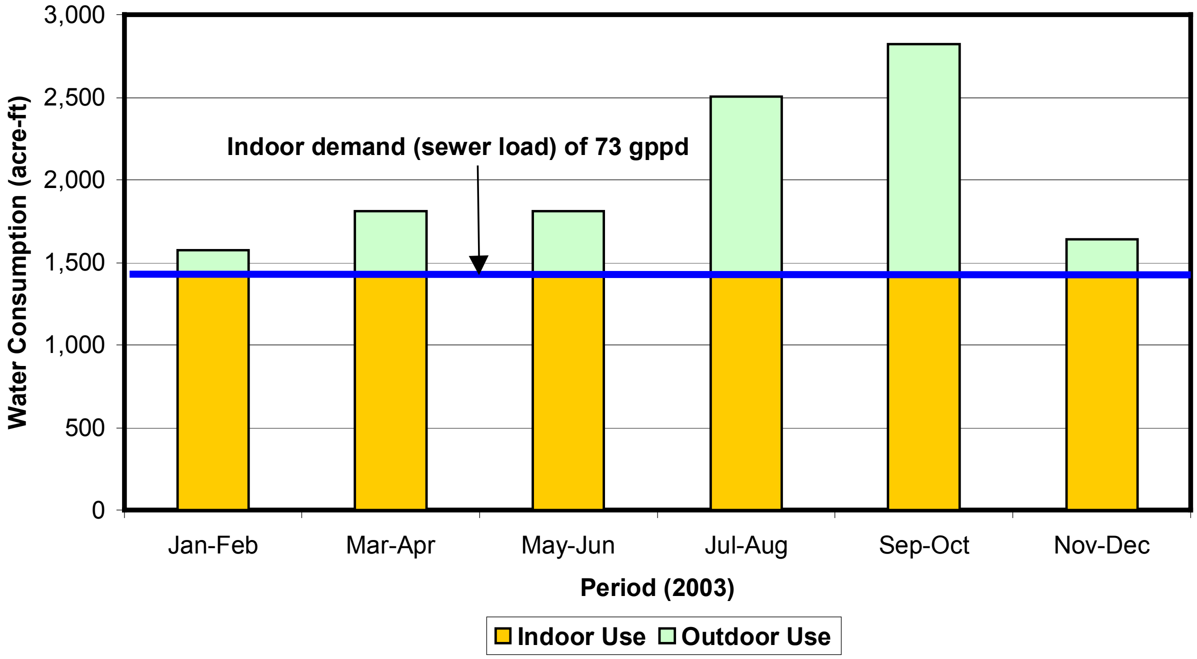


Figure 3-5
Indoor and Outdoor Use for Multi-Family Residential (CY 2003)

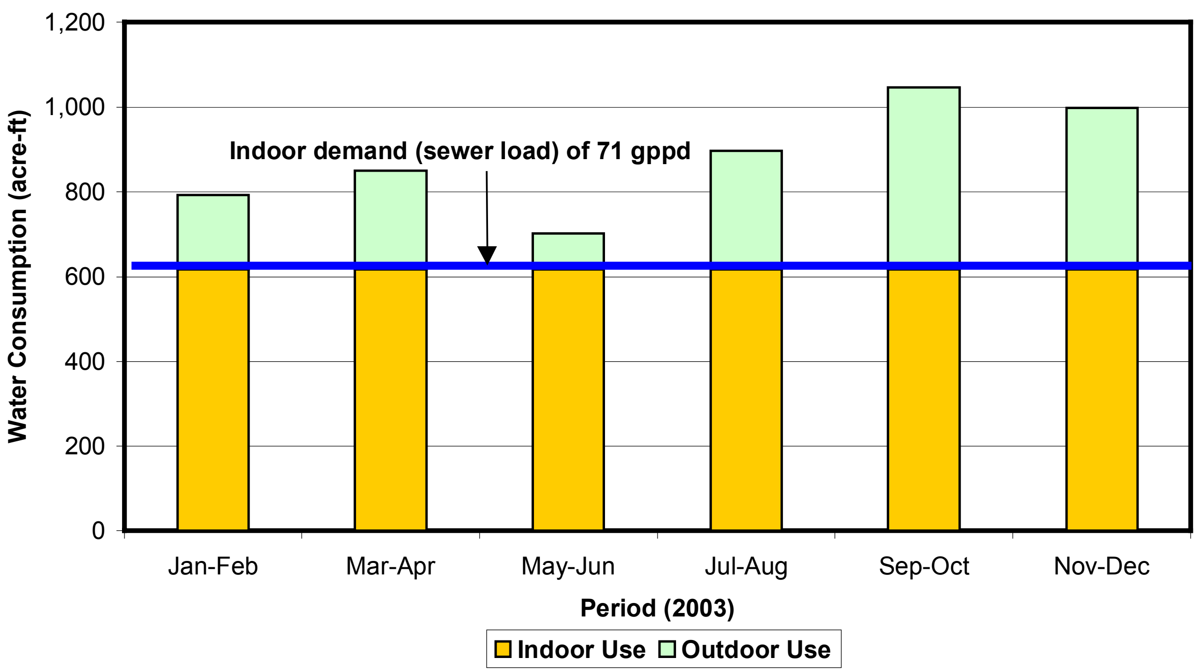
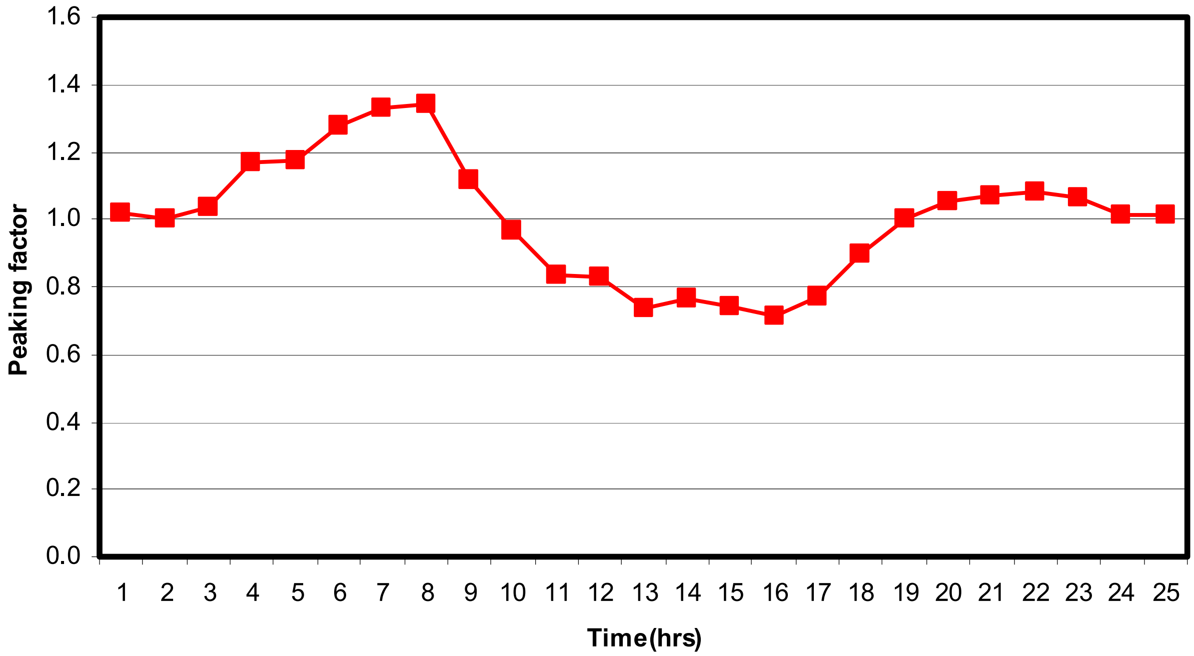


Table 3-7
Major Water Users

Name of Water User	Service Address	Service Type	CY 2003 Consumption (gpm)
Smurfit Newsprint Corp.[1 2]	2200 Mount Vernon Ave	Industrial	288
San Gabriel Cogeneration	102 Erie St	Industrial	232
Lanterman Developmental Center [1]	3530 Pomona Blvd	Government	222
Los Angeles County Fairgrounds [1]	990 Paige Dr	Commercial	121
Allan Company	100 Erie St	Industrial	120
Los Angeles County Fairgrounds	1443 W McKinley Ave	Commercial	93
Westland Estates – Pomona	1460 W Mission Blvd	Trailer Park (Residential)	64
Los Angeles County Fairgrounds	1900 E St	Commercial	54
Smurfit Newsprint Corp.[1 2]	2200 Mount Vernon Ave	Industrial	48
A1 Pomona Laundry/A1 Linen Service	396 La Mesa St	Commercial	47
Wu Shi Wei	635 Delrosa Pl	Multiple Dwelling (Residential)	44
Interstate Brands Corp.	2801 S Towne Ave	Industrial	44
Congregational Homes	900 E Harrison Ave	Commercial	42
Pomona Valley Community Hospital	1798 N Garey Ave	Commercial	40
Hamilton House	980 S Hamilton Blvd	Multiple Dwelling (Residential)	40
Pomona Unified School District (Pomona High School)	475 Bangor St	Government	32
Bigs Mobile Home Park	1461 W Mission Blvd	Trailer Park (Residential)	32
City of Pomona Parks Department (McKinley & Ganesha Park)	550 W McKinley Ave	COPA - City of Pomona Account	30
Pomona Unified School District	725 W Franklin Ave	Government	30
Pomona Unified School District (Ganesha High School)	1201 Fairplex Dr	Government	30
Total Consumption			**1,653**

1 – These users are also recycled water users.
2 – Multiple meters

Figure 3-6
Diurnal Demand Pattern (City of Chino – September 20, 2000)



UNACCOUNTED-FOR WATER

The difference in volumes between water produced and water consumed is defined as "unaccounted-for water", or water losses within a system. Water losses may be attributed to accounting and metering errors, leaking pipes, unmetered water use, water theft or any other event causing water to be withdrawn and not measured, such as reservoir overflows or leakage, and fire fighting. Average percentages of unaccounted-for water per year are shown in **Table 3-8**. Water losses are at about five percent, ten percent, and eight percent of total production in CYs 2001, 2002, and 2003, respectively. The average water loss based on available data is approximately 7.6 percent annually. This value falls within a typical water loss range for water systems, which typically range from 5 to 10 percent. The City should conduct annual audits of its unaccounted water to determine the basis for the unaccounted water and identify methods to further reduce this percentage.

Table 3-8
Unaccounted-For Water (2001 to 2003)

Calendar Year	Total Production (acre-ft)	Total Consumption (acre-ft)	Water Loss (percent)
2001	27,471	26,198	4.6
2002	29,161	26,262	9.9
2003	28,146	25,906	8.0
Average	**28,259**	**26,122**	**7.6**

FUTURE WATER DEMANDS

This section summarizes future water demands through year 2025 and build-out. Future water demands are determined based on land use (using vacant parcels) and population (using SCAG projections). Vacant lots (empty parcels) are identified based on City Planning Division information. Water demand factors by land use type are applied to the vacant land to develop the demand projections. These future demands are then compared to the projections using the population methodology.

Water Demand Factors

Water demand factors (WDF) for the different land use categories are developed to evaluate future demands in the water system. A WDF is the average daily water use in gallons per day per acre (gpd/ac) of a given land use type. WDFs are calculated for 11 land use types using the City's land use data and geocoded (spatially referenced) billing records. For each land use type, multiple sample areas are selected to calculate the WDF for each sample area by dividing the total water demand by the sample acreage. Only those accounts are used that have a billing classification that matches the selected land use type. These calculated values are compared with WDFs calculated and used in other WMPs, such as the 1992 City of Pomona WMP, the 2002 City of Pasadena WMP, and the 2004 City of Chino WMP. Based on the calculated and reference values, WDFs for each of the 11 land use types are established in discussion with City staff. These values are presented in **Table 3-9.** The WDFs used in this WMP are presented in the last column of this table and are based on the concurrence of City USD staff. WDFs used in the 1992 WMP are typically increased to a value that is closer to the values calculated with billing data and land use information.

Table 3-9
Water Demand Factors for the City of Pomona

Land Use Category	Water Demand Factors (gpd/ac)				
	Used in 1992 Pomona WMP	Used in 2004 Chino WMP	Used in 2002 Pasadena WMP	Calculated with 2003 Pomona Data[4]	Used in 2004 Pomona WMP
Single Family Residential	3,125	1,300-3,600	1,800-2,500	2,824	2,600
Medium Density Residential	3,571	4,600	2,280-3,040	6,554	6,000
High Density Residential	3,571	7,600	6,080-9,100	9,974	9,200
Commercial[1]	1,786	3,000-3,500	2,000	2,539	2,400
Offices[2]	1,786	1,750	N/A	2,793	2,600
Institutional	1,786	2,500	N/A	768	1,000
Light Industrial	1,786	1,250	600	2,047	2,000
Heavy Industrial	1,786	1,750	600	2,117	2,000
Schools	N/A	2,400	N/A	1,494	1,500
Parks and Open Space	0	2,400-2,900	3,000[3]	1,054	3,000

1 – Retail Commercial, Shopping Centers, Visitor Commercial, General Commercial
2 – Includes mixed use
3 – Listed as recreational
4 – Calculated by dividing the total consumption for a given area with that land use type by the area in acres. This value is divided by 92.4 percent to convert from consumption (excluding water loss) to production data (including water loss).

Water Demand Projections by Land Use

Future water demands are calculated based on land use methodology. This methodology includes identifying the land use type of future developments and empty lots (vacant parcels) in the water service area. Empty lots are identified using the City aerial photographs and are then verified by a consultant (Dyett and Bhatia Urban and Regional Planners – D&B) for the City Planning Division. D&B is currently updating the General Plan. D&B also provided a list of future developments in the City and an updated parcel shapefile that contains future land use types. The land use classifications reflect the currently adopted General Plan as shown on Table 2-4.

According to the Planning Department, build-out conditions are expected to happen beyond the planning horizon of this Master Plan, which is year 2025. Water demand factors presented in Table 3-9 are used to calculate future water demands. Demand projections for build-out based on land use are shown in **Table 3-10**.

Table 3-10
Future Water Demands Based on Land Use

Land Use Category	Area (acres)	Water Duty Factor (gpd/ac)	Water Demand (acre-ft/yr)	ADD [1] (mgd)	MDD [2] (mgd)
Single Family Residential	4,311	2,600	12,558	11.21	19.06
Medium Density Residential	591	6,000	3,977	3.55	6.04
High Density Residential	294	9,200	3,025	2.70	4.59
Commercial	536	2,400	1,445	1.29	2.19
Office	115	2,600	336	0.30	0.51
Heavy Industrial	418	2,000	941	0.84	1.43
Light Industrial	812	2,000	1,815	1.62	2.75
Institutional	1,617	1,000	1,815	1.62	2.75
Schools	959	1,500	1,613	1.44	2.45
Parks and Open Space	864	3,000	2,901	2.59	4.40
Parking, Streets, Vacant	4,187	0	0	0.00	0.00
Total Consumption	**14,704**		**30,426**	**27.16**	**46.17**
Total Demand[3]			**32,929**	**29.39**	**49.97**

1 – Values rounded to 0.01 mgd.
2 – Based on a MDD/ADD peaking factor of 1.70
3 - Total demand includes 7.6 percent unaccounted water.

As shown in Table 3-10, the projected future water demand based on land use is 29.39 mgd and 49.96 mgd for ADD and MDD conditions, respectively, or 32,909 acre-ft per year. This corresponds with a 17 percent increase compared to 2003.

As the General Plan is currently being updated and phasing information on near-future developments is limited to the Downtown Specific Plan, more accurate demand projections and phasing for intermediate years can be obtained using population projections.

Water Demand Projections by Population

Water demand projections can also be based on historical and projected population estimates. Future population projections are compared with historical population estimates by census tract to determine the geographical distribution of population growth within the City. Year 2000 census data are used in combination with the 2001 projections for population and employment obtained from the SCAG, existing City land uses by parcel, and knowledge of future developments in a few specific areas. Different procedures are applied to estimate and geographically distribute residential and non-residential populations. These procedures are described below.

Residential Population

Residential population is estimated for each parcel in the City. The population distribution to parcels within a census block is based on land use as determined from the City's GIS as discussed in **Section 2**. Different procedures are used to estimate the average residential population per parcel for existing and future population estimates. Details of the procedures used are described below.

The existing population per parcel is estimated using the Year 2000 census block population. The population by census block is distributed to each parcel with a residential land use within a given census block, based on parcel area and land use. High density and medium density residential land uses received proportionately more population than single family residential areas. If a census block contained no residential parcels, population is distributed evenly over the census block. Census block data provides very good resolution for existing population distribution, as the median size of a census block is less than six acres.

The future population per parcel is estimated using the SCAG 2001 estimates (based on 1990 census tract boundaries), the City's Downtown Specific Plan, and other specific major developments anticipated by the City's Planning Division, as discussed in **Section 2**. Residential population growth is distributed to residential and mixed-use parcels only. Population growth is allocated proportionately to the area of each parcel.

SCAG 2001 projections by census tract include population estimates for every five years from 2000 through 2025. As recommended by the City's Planning Division, SCAG's projected 2025 population is considered the build-out population, rather than a population based on the projected percentage increase. Several adjustments are made to the intermediate year SCAG projections to account for differences between the existing population estimated by SCAG and the population counted by the census. Adjustments are also made to the distribution of population growth projected by SCAG to account for particular developments anticipated by the City's Planning Division that may not have been considered in the SCAG distribution. These developments and the key assumptions used for the adjustments are summarized in **Table 3-11**.

Other adjustments and assumptions made are:

- The City-wide growth is based on the difference between the 2025 SCAG projections and the 2000 census count, rather than the difference between the 2025 and 2000 SCAG projections, because the actual population count from the census for year 2000 differs from the population projected by SCAG.

- Intermediate-year growth (2005, 2010, 2015, 2020) is determined based on percentage of total growth occurring within each intermediate period and the revised growth to build-out. For example, if SCAG predicted 10,000 new people between 2000 and 2025, with 5,000 new people between 2005 and 2010, but the revised total growth (from 2000 census to 2025 SCAG) is only 8,000 people, the 2005 to 2010 growth is assumed to be 4,000 people.
- The total growth for the areas not listed in **Table 3-11** is reduced to match the 2025 SCAG projection, as the population projected for developments listed in **Table 3-11** exceed the SCAG projection for these areas.

Table 3-11
Adjustments to SCAG Residential Growth Distribution

Area	1990 Census Tract	Description and Key Assumptions
Lanterman Property	403200	Development of half of this property as Medium Density Residential (MDR) housing. Assumes a MDR density of 46.8 persons/acre and steady growth from 2004 through 2025. Assumes this property accounts for all growth within this tract.
Bonita St	401702	Re-development of industrial parcels along this street to MDR. Assumes a MDR density of 46.8 persons/acre and steady conversion from 2004 through 2025. Assumes this redevelopment accounts for all growth within this tract.
Mission Blvd	402402	Development of half of a large vacant parcel as MDR. Assumed a MDR density of 46.8 persons/acre. This development accounts for approximately 90 percent of the growth projected by SCAG in this tract. SCAG projections are not adjusted.
Downtown Specific Plan	408800	Growth according to DSP land uses, with all growth occurring before 2020, according to most recent schedule provided by city planners. The DSP specifies the number of new housing units developed within each land use type. Per recommendation by city planners, assumes 3 persons per household. Assumes DSP accounts for all growth within this tract.
Phillips Ranch	403311	No development or densification is expected (zero growth)
Hillside Area	402200	No development or densification expected in Hillside area. Growth projected for this tract is applied to areas outside of Hillside.

The existing and future population estimates by census tract are summarized in **Table 3-12**. This table shows that the population is estimated to increase from 149,258 people in year 2000 to 189,661 people in year 2025, which corresponds with a 27 percent increase. Census Tract 408800 has the greatest population growth between 2000 and 2025 accounting for 19 percent of the total population growth.

Table 3-12
Residential Growth Distribution by Census Tract

Census Tract	Population					
	2000	2005	2010	2015	2020	2025
401701	1,175	1,187	1,198	1,226	1,307	1,390
401702	8,586	8,889	10,405	11,920	13,435	14,951
402101	4,773	4,813	4,848	4,937	5,194	5,456
402102	4,775	4,812	4,856	4,943	5,190	5,435
402200	7,540	7,623	7,668	7,866	8,394	8,940
402301	5,256	5,302	5,320	5,436	5,753	6,102
402302	8,131	8,198	8,341	8,548	9,010	9,490
402401	7,769	7,828	7,871	8,014	8,418	8,836
402402	7,519	7,598	8,013	8,300	8,688	9,074
402403	6,506	6,548	6,575	6,676	6,945	7,234
402404	0	5	7	19	51	78
402501	5,176	5,215	5,263	5,393	5,741	6,117
402502	6,916	6,975	7,038	7,240	7,774	8,358
402600	7,355	7,411	7,531	7,702	8,137	8,571
402701	11,928	12,014	12,111	12,287	12,802	13,301
402702	6,581	6,617	6,645	6,764	7,086	7,441
402800	12,737	12,828	12,948	13,259	14,091	14,982
402901	7,745	7,807	7,859	7,986	8,351	8,716
402902	6,343	6,407	6,418	6,614	7,125	7,718
403000	6,935	7,006	7,041	7,165	7,510	7,860
403200	0	311	1,868	3,424	4,980	6,537
403311	11,427	11,427	11,427	11,427	11,427	11,427
403313	514	517	520	529	554	586
408800	3,571	4,302	8,691	10,885	11,061	11,061
Total	**149,258**	**151,640**	**160,462**	**168,560**	**179,024**	**189,661**

Non-Residential

Existing developed square footage is available for non-residential parcels in the City's GIS. This existing square footage is increased for future years based on the percent employment growth projected by SCAG. Similar to the residential increases, the SCAG projections were adjusted to account for particular developments anticipated by the City Planning Division, as detailed in **Table 3-13**. Projected SCAG growth in the remaining tracts was adjusted to account for these areas to maintain the city-wide growth percentage projected by SCAG.

The existing and future non-residential growth estimates by census tract are summarized in **Table 3-14**. This table shows that non-residential areas are estimated to increase from 35,200,478 square feet (sq-ft) in year 2000 to 40,345,032 sq-ft in year 2025, a 15 percent increase. The majority of growth is estimated to occur in Census Tract 403200, which contributes to 47 percent of the total non-residential building growth.

Table 3-13
Adjustments to SCAG Non-Residential Growth Distribution

Area	1990 Census Tract	Description and Key Assumptions
Lanterman Property	403200	Development of half of this property as a commercial area. The city-wide average commercial floor area ratio (FAR) is 0.4. The property accounts for all non-residential growth within this tract.
Bonita St	401702	Re-development of Industrial parcels along this street to MDR. Assumes a steady conversion from 2004 through 2025, with zero non-residential square footage by 2025.
Mission Blvd	402402	Development of half of a large vacant parcel as commercial property. Assumes the city-wide average commercial FAR of 0.4. This development accounts for a portion of the total growth projected by SCAG for this tract.
Downtown Specific Plan	408800	Office and retail space growth projected by the DSP is applied to DSP land uses, with growth occurring after 2010, per the schedule provided by City planners. Uses SCAG percent increase within this tract for 2005 and 2010.

Table 3-14
Non-Residential Growth by Census Tract

Census Tract	Building Area (sq-ft)					
	2000	2005	2010	2015	2020	2025
401701	415,839	478,672	529,489	548,863	595,232	631,786
401702	2,913,436	2,837,984	2,445,062	2,027,565	1,592,691	1,157,803
402101	391,934	494,621	579,750	609,774	665,621	715,713
402102	1,177,896	1,221,125	1,270,243	1,291,800	1,307,351	1,331,025
402200	916,367	975,933	1,046,495	1,075,265	1,108,163	1,145,096
402301	33,156	47,061	61,247	66,126	73,500	81,381
402302	996,008	1,030,070	1,065,329	1,113,821	1,135,162	1,149,503
402401	592,664	673,441	748,241	777,104	819,121	863,986
402402	9,857,819	10,067,289	10,315,158	10,475,309	10,600,945	10,726,585
402403	1,376,893	1,436,099	1,491,725	1,525,461	1,548,316	1,585,630
402404	640,311	640,311	640,311	640,311	640,311	640,311
402501	319,033	352,719	382,077	392,213	410,119	425,179
402502	175,645	224,931	273,494	291,063	317,934	345,935
402600	1,044,107	1,070,005	1,107,901	1,136,191	1,133,631	1,148,245
402701	400,858	432,283	465,797	480,631	491,815	509,250
402702	1,395,998	1,395,998	1,395,998	1,395,998	1,395,998	1,395,998
402800	3,026,399	3,026,399	3,026,399	3,031,210	3,031,210	3,031,210
402901	3,837,291	3,862,625	3,914,422	3,941,280	3,939,364	3,962,776
402902	794,143	874,827	958,134	989,583	1,031,911	1,076,066
403000	1,295,106	1,468,393	1,617,718	1,676,644	1,779,476	1,869,225
403200	0	115,892	695,325	1,274,784	1,854,219	2,433,678
403311	365,189	411,569	428,477	438,591	452,178	468,649
408800	3,234,386	3,248,943	3,268,669	3,603,953	3,650,002	3,650,002
Total	**35,200,478**	**36,387,190**	**37,727,461**	**38,803,540**	**39,574,270**	**40,345,032**

Future Water Demands

The future water demands based on population projections are based on a combination of:

- Existing water demands (geocoded billing records for 2003)
- Water demands associated with the projected residential growth
- Water demands associated with the projected non-residential growth

The summation of the existing and growth-related demands are added to determine the future water demands by population. As shown in Table 3-8, the 2003 water consumption was 25,906 acre-ft/yr, which corresponds with 28,146 acre-ft/yr or 25.1 mgd when scaled to production.

Residential demands are based on a water usage of 106 gpcd, which is calculated with the City's population of 150,278 people for 2003 (Pomona, 2004d) and the average residential water demand for 2003 of 11,138 gpm obtained from the billing records for service types R, M, NR, and T. As shown in Table 3-12, the City's population is projected to increase to 189,661 people, which, corresponds to an increase of 39,383 people compared to the City's population in 2003. Hence, the residential water demand is estimated to increase about 4.17 mgd (106 gpcd times 39,383 people). Scaling this value up to production results in a residential production increase of 4.52 mgd.

The non-residential demands are based on a water usage of 0.20 gpd/sq-ft. This is calculated with estimated non-residential building space in 2003 (35,912,504 sq-ft, obtained per linear interpolation of year 2000 and 2005 data) and the average non-residential water demand for 2003 of 4,923 gpm obtained from the billing records of service types C, I, G, L, P, NC, and NL. As shown in Table 3-14, the City's non-residential area is projected to increase to 40,345,032 sq-ft, which, corresponds to an increase of 4,432,528 sq-ft compared to the City's building area in 2003. Hence, the non-residential water demand is estimated to increase about 0.89 mgd (0.20 gpd/sq-ft times 4,432,528 sq-ft). Scaling up this value to water production results in a non-residential production increase of 0.96 mgd.

The estimated future water demands based on population projections and using these assumptions are summarized in **Table 3-15**. This table shows that the projected water demands based on population growth is about 30.6 mgd and 52.1 mgd for ADD and MDD conditions, respectively, or 34,283 acre-ft per year. This corresponds with an 18 percent increase compared to 2003 (28,146 acre-ft/yr).

Table 3-15
Future Water Demands Based on Population

Category	Annual Demand (acre-ft/yr)	Average Day Demand (mgd)	Maximum Day Demand[1] (mgd)
Existing Production (2003)	28,146	25.13	42.72
Residential Growth (2003-2025)	5,062	4.52	7.68
Non-Residential Growth (2003- 2025)	1,075	0.96	1.63
Total Demand Year 2025	**34,283**	**30.61**	**52.03**

1 – Based on a MDD/ADD peaking factor of 1.70

In comparison, the projected future water demand based on land use is about 29.4 mgd and 50.0 mgd for ADD and MDD conditions, respectively, or 32,909 acre-ft per year. The land use-based projection is about 4 percent less than the population-based projection.

Based on discussions with City staff, it is decided that the demand projections using population information are preferred as it provides a more conservative estimate for future facility planning, and the population estimates provide more detailed phasing information for the period between 2003 and 2025. Hence, the demand projections based on population are input in the hydraulic model. The model database field "Demand1" reflects the existing water demands scaled to production based on the geocoded water billing data, while the model database field "Demand2" reflects the growth related demands based on the distribution of residential and non-residential growth according to SCAG.

The future demand distribution per pressure zone is presented in **Table 3-16**. This table shows that the ADD and MDD for year 2025 will be 30.6 mgd and 52.0 mgd, respectively. Pressure Zone 5 has the largest water demand, contributing to about 37 percent of the future water demand in the City.

Table 3-16
Future Water Demands (Year 2025) by Pressure Zone

Pressure Zone	Average Day Demand (gpm)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Year 2025 Demand (percent)
Zone 2	3,403	4.90	8.33	16%
Zone 4	432	0.62	1.05	2%
Zone 5	7,767	11.18	19.01	37%
Zone 6	1,024	1.47	2.50	5%
Zone 7	1,990	2.87	4.88	9%
Zone 8	715	1.03	1.75	3%
Zone 8R	2,571	3.70	6.29	12%
Zone 9	1,783	2.57	4.37	8%
Zone 11	1,482	2.13	3.62	7%
Zone 11H	85	0.12	0.20	0%
Zone 12H	22	0.03	0.05	0%
Grand Total	**21,274**	**30.62**	**52.05**	**100%**

Note: Differences between the totals shown in Table 3-15 and Table 3-16 are due to rounding.

Section 4
Existing Water System

This section describes the City's existing potable water system and provides an understanding of its facilities and operations. The existing potable water system consists of eleven pressure zones and has 22 storage reservoirs, 15 active booster pumping stations, 41 groundwater wells, four imported water connections, two inter agency connections, five water treatment plants, and 28 pressure regulating stations. The potable water distribution system has about 6,000 fire hydrants and approximately 421 miles of pipelines. The existing system characteristics are summarized in **Table 4-1**, while the physical locations of the water system facilities and pressure zones are shown on **Figure 4-1**.

Table 4-1
Summary of Existing Water System

Facility Type	Number
Booster Pumping Stations	15
Groundwater Wells – Total	41
Potable Wells - Active	*29*
Potable Wells - Inactive	*9*
Recycled Water Wells	3
Inter-Agency Connections	6
Imported Water Connections	4
Emergency Connections	2
Pressure Regulating Stations	28
Storage Reservoirs (Potable Water)	22
Water Treatment Plants	5
Transmission and Water Distribution Pipelines (miles)	421
Fire Hydrants	$\geq$ 6,000
Potable Water Service Connections	≈ 30,300

PRESSURE ZONES AND HYDRAULIC PROFILE

The City's service area is divided into eleven pressure zones, including two hydro zones and one pressure reduced zone. These pressure zones with their respective hydraulic grade lines (HGLs) and ground elevation ranges are listed in **Table 4-2**. The HGLs of the eight primary pressure zones are determined by the high water level of the reservoir(s) feeding that zone, while the HGLs of the two hydro zones (Sub-zones 11 Hydro and 12 Hydro) are determined by pump lift of the hydro-pneumatic pumps that pump into these zones. The HGL of the reduced pressure zone (Sub-zone 8R) is determined by the ground elevation at the regulating station located at Bellevue Avenue and Mt. Vernon Avenue and a pressure setting of 60 pounds per square inch (psi) for the lead pressure regulating valve (PRV) and 54 psi for the lag PRV.

Table 4-2
Pressure Zone Summary

Pressure Zone	HGL[1] (feet)	Average Day Water Demand (mgd)[4]	Min & Max Ground Elevation (feet)[5]	Min & Max Static Pressure (psi)[1]
Zone 9	1,308	1.6	910 – 1,120	36 – 107
Zone 11	1,243	2.1	880 – 1,140	45 – 157
Sub-zone 11 Hydro	1,368 [2]		1,140 – 1,226	61 – 99
Sub-zone 12 Hydro	1,383 [2]		1,139 – 1,226	68 – 106
Zone 2	1,202	3.8	910 – 1,120	35 – 126
Zone 4	1,192	0.9	900 – 1,100	40 – 126
Zone 7	1,107	2.3	840 – 950	68 – 116
Zone 8	1,015	3.3	790 – 880	58 – 97
Sub-zone 8R	936 [3]		880 – 1,140	60 – 117
Zone 5	984	7.7	780 – 900	36 – 88
Zone 6	894	1.2	740 – 800	41 – 67
Total		**23.1**		

1 – Calculated based on the high water level of the storage reservoir feeding the zone.
2 – Calculated based on the pressure settings of the hydro-pneumatic pump systems.
3 – Calculated based on a pressure setting of 65 psi and ground elevation of 786-feet MSL (ground elevation of the PRV station Bellevue and Mt. Vernon).
4 – Based on geocoded water billing data of calendar year 2003.
5 – Based on the Engineering Report for consideration of Permit Applications from the City Water Department (Dec. 11, 2001).

A hydraulic schematic of the existing facilities is presented in **Figure 4-2**. The pressure zones, which are shown on **Figure 4-1**, are separated by closed gate valves, check valves, pressure regulating valves, and booster stations. According to the Uniform Plumbing Code (UPC), water service connections located in areas having pressures exceeding 80 psi are required to have individual pressure reducing valves installed. The delineation of the pressure zone boundaries is obtained from the City's geographical information system (GIS).

The City's largest pressure zone is Zone 5 and it is located in the middle portion of the service area. This zone encompasses approximately 32 percent of the water service area and contributes to about 38 percent of the existing water demand. It is currently served by four groundwater wells and an imported water connection; it has a combined storage capacity of 30.6 million gallons (MG).

WATER TREATMENT PLANTS

The City currently has the following five water treatment plants (WTPs):

- Frank G. Pedley Memorial Filtration Plant (Pedley) WTP
- Anion Exchange Plant (AEP)
- 10 and Towne Groundwater Treatment Plant (air stripping facility for volatile organic chemical (VOC) removal)
- Air stripping facility for VOC removal at the Well 3 site.
- Well 29 Ion Exchange Plant

Figure 4-1
Water System Facilities and Pressure Zones

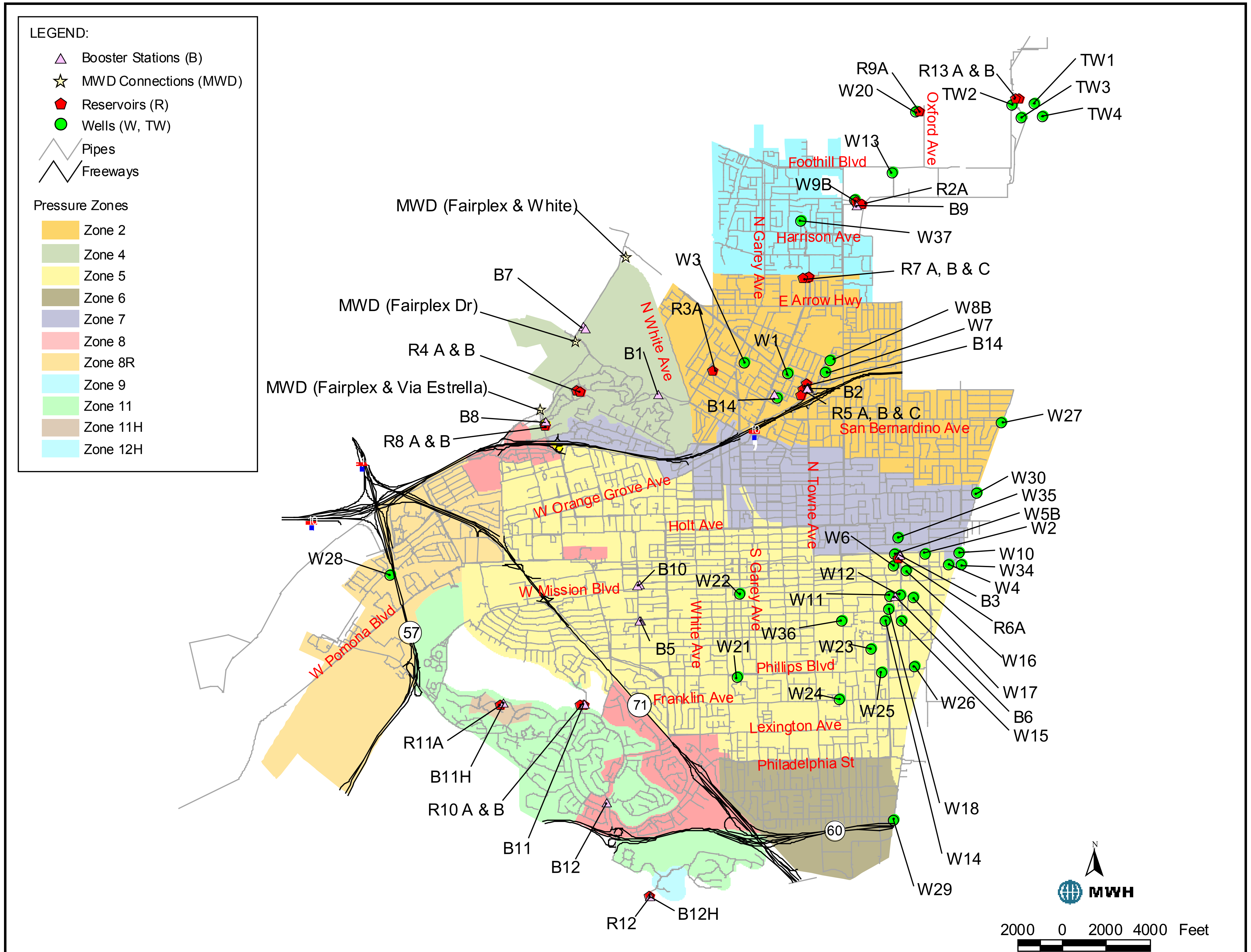
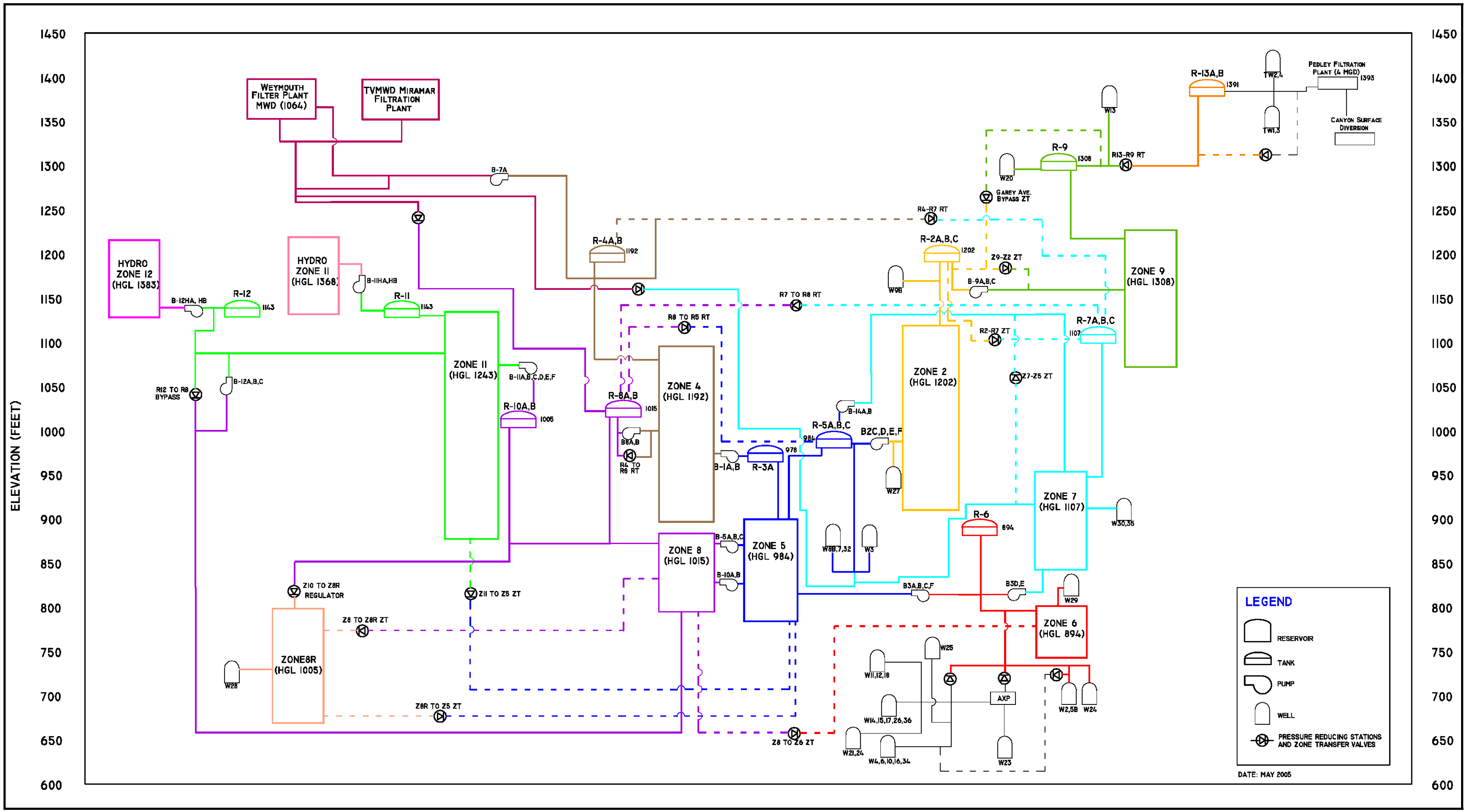


Figure 4-2
Hydraulic Schematic



The details of all five plants are discussed below.

Pedley Surface Water Treatment Plant

The Pedley WTP is located in the City of Claremont west of Mills Avenue and south of Baseline Road. The plant's current maximum capacity is 4 mgd, which equals 2,778 gpm or 5,041 acre-ft/yr if continuously operated. It should be noted that the actual operating capacity fluctuates throughout the year as the plant treats local runoff, whose quantities vary greatly during the year. Especially in dry or drought conditions, the treatment capacity far exceeds the available surface water runoff. The treatment process at the Pedley WTP includes coagulation, clarification, disinfection, and filtration. Magnetic flow meters are installed in the inlet metering structure and in a metering vault downstream of the filter building to measure plant influent and effluent flow rates. Additional meters are installed at the plant outlet downstream of the clearwells to measure the plant effluent including the production from the four tunnel wells, which is added downstream of the clearwells. Plant modifications were made in 1997 to comply with the Surface Water Treatment Rule (SWTR) requirements. Modifications to the plant were made to improve the chlorine contact time, by increasing the time and concentration that the chlorine was in contact with the treated water. In addition, changes were made in the operation of the moving filter bed to perform sampling of water after backwash to determine if additional backwashing was necessary. These modifications reduced the treatment capacity of the filter plant from 5 mgd to 4 mgd.

Surface water from the San Gabriel Mountains accounts for approximately four percent of the City's water supplies. The water flows down San Antonio Canyon into the San Antonio Creek and is diverted at three intake structures, two of which are maintained by the Southern California Edison Company (SCE). The upper and middle intakes are used by SCE to run three hydroelectric generating stations. The creek flow then combines with water from a third intake at a weir structure to distribute the water between San Antonio Water Company (SAWC) and the City. The water is then transported through a pipeline to the Pedley WTP. Prior to entering the plant, surface flow from Evey Canyon is collected and fed into the main pipe to combine with the San Antonio Creek flow. The water is filtered, treated, and chlorinated at the water treatment plant prior to entering the City's distribution system.

The Pedley WTP production is dependent on the climate for its operations. In cases when production is low, more treated imported water supplies are needed for the distribution system to meet water demands. When the Pedley WTP is offline for maintenance or when the surface water runoff either exceeds the treatment capacity or exceeds the turbidity limits of the plant, the City can divert the surface water into a groundwater spreading facility on the Pedley WTP site to recharge the groundwater supply. The City receives credit in its Six Basins production rights for water spread at the Pomona spreading grounds.

Anion Exchange Plant

The AEP was built in 1992 to remove nitrate from the City's groundwater supplies. The plant utilizes ion exchange technology to remove nitrate from the groundwater. The ion exchange resin is regenerated periodically using a brine solution. The AEP has a treatment capacity of 9.0 mgd and is designed to produce 15.0 mgd of blended product water having a nitrate concentration of less than 35 milligrams per liter (mg/L). Groundwater pumped from 14 of the City wells (Wells 4, 6, 10, 11, 12, 14, 15, 16, 17, 18, 21, 23, 25, 26, and 34) are currently being combined and diverted to the AEP for treatment, blending, and disinfection, as presented in **Table 4-3**. Wells 24 and 36 will pump to the AEP when the current expansion is completed. It should be noted that Wells 24 and 36 are currently inactive due to high nitrate and VOCs. Approximately 50 percent of the water is treated at the AEP, while the other 50 percent is bypassed and blended with the treated AEP effluent. The final effluent is delivered to Reservoir 6, where additional blending occurs with water from Wells 2 and 5B. The blended water is pumped into the distribution system of Pressure Zones 5, 6, and 7.

Air Stripping Plants (VOC Removal)

The City has a 1-mgd air stripper and blending facility that primarily removes VOCs from Well 3 water at the Well 3 site. Air stripping reduces the 1,1-dichloroethylene (DCE) concentration from 200 micrograms per liter (µg/L) to 3 µg/L at 700 gpm and also reduces the trichloroethylene (TCE) and 1,1,1-trichloroethane (1,1,1-TCA) concentrations from the well water. However, the effluent from the air stripping plant exceeds the maximum contaminant level (MCL) for nitrate (see **Section 5**). To reduce the nitrate concentration, water is delivered to the Reservoir 5 site and is blended in accordance with the City's DHS-approved blending plan. Off-gas from the air stripping facility is treated using a vapor phase granular activated carbon (GAC) unit to adsorb the VOCs removed from the water at the 10 and Towne Groundwater Treatment Plant.

The City also completed an air stripper unit at the 10 and Towne Groundwater Treatment Plant, with a capacity of 2.3-mgd, to treat Wells 7 and 8B for VOCs in an effort to increase groundwater production in the Six Basins. Specifically, TCE and DCE were detected in these wells in excess of California's MCLs. Nitrate (NO_3) levels in the water also exceed the nitrate MCL. With the new system piping, the City will utilize the air stripper units at the Reservoir 5 site to place Wells 7 and 8B back into service with blending to reduce nitrate concentrations.

Well 29 Ion Exchange Treatment Plant

In 2005, the City relocated a portable water treatment module leased from Basin Water Inc., to address high nitrate levels at Well 29. The well had been a reliable 400 gpm Chino Basin "system pumper" but had fluctuating levels of nitrates over the last several years which caused operational problems and resulted in the well being out of service for long periods of time. Over 0.5 mgd of treated groundwater is now serving Zone 6 as a result of this installation.

GROUNDWATER WELLS

The water service area is served by 41 groundwater wells, 38 potable water wells and three wells that supply the recycled water system. **Figure 4-1** shows the physical locations of these wells and **Table 4-3** summarizes each well's physical and operational data. Currently, 29 of the 38 potable water wells are active, 8 are inactive, and one well is in standby mode. Four of the active potable wells are the tunnel wells located near the Pedley WTP. The inactive wells are out of service primarily due to water quality problems, such as high concentrations of nitrate,

Table 4-3
Summary of Groundwater Wells

Well No.	Groundwater Basin	Status	Discharge To[1, 2]	Year Drilled [2,3]	Motor (hp)[4]	Depth (ft)[3]	Static (ft)[4]	Pumping Head (ft)[4]	Draw-down (ft)[4]	SCE Test Head (ft)[4]	SCE Test Flow (gpm)[4]	Capacity (gpm)[2]	Water Quality Comments[2]
T-1[1]	Claremont	Active	Reservoir 13	1904	30	300	145	170	26	212	314	255	None
T-2[1]	Claremont	Active	Reservoir 13	1985	30	363	147	160	13	170	235	480	None
T-3[1]	Claremont	Active	Reservoir 13	1926	30	309	198	225	28	236	331	340	None
T-4[1]	Claremont	Active	Reservoir 13	1990	25	401	163	182	19	194	240	260	None
1	Pomona	Inactive	N/A	1990	25	540	20	93	73	123	259	No data	The City has no plans to reactivate well into the system
2	Chino	Active	Reservoir 6	1967	200	803	360	379	20	437	1,103	1,200	Blended at Reservoir 6 with AEP effluent
3	Pomona	Active	Air Stripper, then to Reservoir 5	1954	75	800	128	176	47	246	596	650	VOC removal by air stripping and blended for nitrates at Reservoir 5
4	Chino	InActive	AEP	1940	125	520	349	380	31	460	523	1,100	Treated at AEP
5B	Chino	Active	Reservoir 6	1991	125	885	354	385	30	440	801	1,000	Blended at Reservoir 6 with AEP effluent
6	Chino	Active	AEP	1933	150	541	341	361	20	387	990	950	Treated at AEP
7	Pomona	Active	Air Stripper, then to Reservoir 5	1957	75	1,000	33	144	110	166	688	600	VOC removal by air stripping and blended for nitrates at Reservoir 5
8B	Pomona	Active	Air Stripper, then to Reservoir 5	1993	100	1,030	48	73	25	126	1,089	1,200	VOC removal by air stripping and blended for nitrates at Reservoir 5
9B	Pomona	Active	Blended at Reservoir 2	1991	50	606	234	246	13	396	269	350	Blended with Zone 9 at Reservoir 2
10	Chino	Active	AEP	1965	125	800	347	368	21	386	860	900	Treated at AEP
11	Chino	Active	AEP	1947	150	550	322	347	25	465	443	655	Treated at AEP
12	Chino	Active	AEP	1947	150	560	322	333	10	388	597	900	Treated at AEP
13	Pomona	Active	Blended at Reservoir 2	No data	30	542	121	160	39	269	258	220	Blended with Zone 9 at Reservoir 2
14	Chino	Active	AEP	1951	75	560	314	324	10	376	511	650	Treated at AEP
15	Chino	Active	AEP	1951	100	560	317	344	27	394	480	650	Treated at AEP
16	Chino	Active	AEP	1953	125	560	340	353	13	376	771	850	Treated at AEP
17	Chino	Active	AEP	1953	100	637	330	349	20	400	515	700	Treated at AEP
18	Chino	Active	AEP	1954	125	677	312	377	65	482	628	850	Treated at AEP
19	Spadra	Active	Recycled Water System	1951	No data	287	No data	No data	No data	No data	No data	400	Non-potable
20[5]	Claremont	Inactive	Reservoir 9	1927	60	432	68	83	15	158	543	No data	Exceeds nitrate MCL. Potential future wellhead treatment
21	Chino	Active	AEP	1926	75	266	129	136	7	277	841	615	Recently piped to be treated at AEP
22	Chino	Inactive[6]	N/A	1962	No data	478	No data	No data	No data	No data	No data	No data	Inactive for several years and no plans to reactivate well into the system
23	Chino	Active	AEP	1964	125	750	288	305	17	397	803	893	Treated at AEP
24	Chino	Inactive	AEP	1927	75	431	236	268	33	440	352	834	Exceeds PCE MCL. To be treated at AEP
25	Chino	Active	AEP	1968	200	808	284	310	27	411	1,029	900	Treated at AEP
26	Chino	Active	AEP	1971	100	800	277	320	43	413	573	975	Treated at AEP
27	Chino	Active	Zone 2	1973	250	903	478	525	47	716	807	850	None
28	Spadra	Active	Zone 8R	1973	40	370	105	118	14	306	321	435	None
29	Chino	Active	Zone 6	1975	75	539	183	198	15	394	359	495	Equipped with on-line nitrate analyzer, shuts down at 36 mg/L. To be equipped with wellhead treatment.
30	Chino	Inactive	Zone 7	1977	75	907	366	435	69	719	226	340	None
31	Spadra	Active	Recycled Water System	1956	25	250	128	133	5	253	240	240	Non-potable
32	Pomona	Inactive	VOC Plant, then to Reservoir 5	1996	No data	No data	79	No data	186	No data	No data	No data	
33	Pomona	Active	Recycled Water System	1936	15	884	98	155	57	60	178	No data	Exceeds 1,1-DCE and nitrate MCLs

Table 4-3 (Continued)
Summary of Groundwater Wells

Well No.	Groundwater Basin	Status	Discharge To[1, 2]	Year Drilled [2,3]	Motor (hp)[4]	Depth (ft)[3]	Static (ft)[4]	Pumping Head (ft)[4]	Draw-down (ft)[4]	SCE Test Head (ft)[4]	SCE Test Flow (gpm)[4]	Capacity (gpm)[2]	Water Quality Comments[2]
34	Chino	Active	AEP	1993	150	1,120	344	361	16	378	1,041	1,244	Treated at AEP
35	Chino	Active	Zone 7	1993	150	1,135	386	421	36	641	628	725	None
36	Chino	Inactive[8]	AEP	1996	N/A	1,000	269	No data	102	No data	No data	No data	Inactive due to high nitrates and VOCs. To be treated at AEP
37	Pomona	Inactive[8]	N/A	1997	N/A	701	183	No data	17	No data	No data	No data	Inactive due to high nitrates and VOCs. Planned to be equipped with wellhead treatment

Notes:
1 – T = tunnel well, AEP = Anion Exchange Plant
2 – Data obtained from DHS Engineering Report (December 11, 2001).
3 – Data obtained from City of Pomona Water Master Plan (MWH, formerly James M. Montgomery, Consulting Engineers, Inc., 1992).
4 – Data obtained from SCE Hydraulic Tests (conducted between September 1997 to June 2003).
5 – Based on the 2001 DHS Engineering Report, unacceptable blending plan for this well was submitted in 1997. It was denied due to inadequate controls, common inlet/outlet design, and potential for this blending operation to affect the quality at Reservoir 2, which is where Wells 9 and 12 are blended for nitrates.
6 – Well 22 has been inactive for over ten years. The City has no plans to reactivate this well into the system.
7 – Well 33 was converted to a recycled water well in 2002. The well now serves the Pomona Paper Company.
8 – Information for Wells 36 and 37 are obtained from Driller's Logs. Based on the 2001 Engineering Report, these wells were drilled in 1996 and 1997, but were never put into service due to high nitrate and VOC concentrations.

perchlorate, tetrachloroethylene (PCE), DCE or other VOCs. The total active potable water wells' capacity is approximately 21,300 gpm or 30.7 mgd.

Groundwater is produced from four aquifers: 1) Chino Basin, 2) Pomona Basin, 3) Spadra Basin, and 4) Claremont Heights Basin. The largest groundwater supply source is the Chino Basin where 24 of the City wells are located. The rest of the wells are spread throughout the City, with some located in the City of Claremont (Well 20, Well 13, Well 9B, and all four tunnel wells).

Seventeen of the thirty potable groundwater wells are treated, 14 wells at the AEP, and three at the VOC treatment plant. After completion of the AEP expansion, three additional wells will be treated. More details on water quality and proposed treatment are discussed in **Section 5**.

INTER-AGENCY CONNECTIONS

The City has four imported water connections and two emergency connections. The locations of these connections are shown in **Figure 4-1**.

Imported Water Connections

The City obtains its imported water supplies from the TVMWD, a member agency of MWD. The City has four connections which can utilize treated imported water, providing a blend of MWD treated northern California and Colorado River water from the Weymouth Plant. The two major connections are located on the Pomona-Walnut-Rowland (PWR) Joint Water Line. The connection at E Street and Arrow Highway provides water through a 36-inch and 30-inch pipeline to Reservoir 5 and has a capacity of 25 mgd. The connection at Reservoir No. 8 has a capacity of 20 mgd. There is a third imported water connection that supplies Booster Pumping Station No. 7. This connection is limited to 1.8 mgd, the booster capacity of Booster Pumping Station No. 7.

The capacity of the connection to the Orange County Feeder (PM-11) is rated at 6.5 mgd. Its delivery rate is limited to 1.8 mgd by the capacity of Booster Pumping Station No. 7. It provides treated MWD water from the Weymouth WTP.

Emergency Connections

The City currently has two emergency connections with the Walnut Valley Water District (WVWD) as shown in **Table 4-4**. One connection is a 12-inch intertie located at the corner of Valley Boulevard and Temple Avenue. Its production capacity varies from 400 to 550 gpm (0.6 to 0.8 mgd). This connection, because of pressures, can provide water from the City to WVWD. Another connection is a 6-inch intertie located near the intersection of Temple Avenue and Rancho Novato Drive. The capacity of this second connection also varies from 400 to 550 gpm (0.6 to 0.8 mgd) and it interconnects the Phillips Ranch and Diamond Bar areas. This connection, because of pressure, can provide water from WVWD to the City.

The 1992 Water Master Plan reports that additional inter agency connections were being planned by the City. These connections were to be developed with the City of La Verne, Monte Vista Water District, Southern California Water Company, and Chino Hills. None of these connections have been implemented to date; however, discussions with the cities of Chino and La Verne have taken place. There is discussion of future interconnection in **Section 8**.

Table 4-4
Summary of Emergency Connections

Connection Agency	Source Water	Transmission	Connection Location	Status	Connection Capacity
WVWD to Pomona	Blend of WVWD Water Sources	12” Tie-In	Valley Blvd. At Temple Ave.	Emergency (Standby)	0.8 mgd 550 gpm
Pomona to WVWD	Blend of Pomona Water Sources	6” Tie-In	Temple and Rancho Novato	Emergency (Standby)	0.8 mgd 550 gpm

BOOSTER PUMPING STATIONS

The City currently operates 15 booster pumping stations, including two hydro-pneumatic booster stations. The number of booster pump units at each station ranges from one to six, which vary in capacity and motor capacity from 245 gpm to 4,115 gpm and from 7.5 hp to 200 hp, respectively. **Table 4-5** summarizes the booster pumping stations’ physical and operational data, including capacities, hydraulic test results, water supply sources, and discharge information. **Figure 4-1** shows the locations of individual stations while **Figure 4-2** shows their relationship in the hydraulic schematic.

Three types of pumps are used in the booster pumping stations, namely turbine, centrifugal, and submersible pumps. Twenty-six of the units have vertical turbine pumps and 16 units have centrifugal pumps including all four hydro-pneumatic units. Only Booster Station No. 4 has submersible vertical turbine pumps. Each booster pumping station operates based on the water level in the storage reservoir from which it is pumping.

STORAGE RESERVOIRS

The City’s water system contains 22 potable water storage reservoirs ranging in storage capacity from 0.5 MG to 10.5 MG. The total storage capacity is approximately 87.7 MG. **The City** has DHS-approved nitrate blending plans for Reservoirs 2 (A, B, C) and 5 (A, B, C). The Reservoir 5 site also contains an air stripper that reduces VOC concentrations from Wells 7 & 8B. There is also an air stripper and static mixer at the Well 3 site. A discussion of these facilities is provided in the groundwater wells section.

Table 4-6 summarizes each reservoir’s information including physical location, year and type of construction, capacity, and pressure zone served. Information listed is obtained from the City’s water storage data sheets and the 2001 Engineering Report. The reservoirs’ locations are shown in **Figure 4-1** and are schematically represented in **Figure 4-2**. **Table 4-3** and **Table 4-5** identify the groundwater wells and booster pump stations that discharge to reservoirs. **The City** has DHS-approved nitrate blending plans for Reservoirs 2 (A, B, C) and 5 (A, B, C). The Reservoir 5 site also contains an air stripper that reduces VOC concentrations from Wells 7 & 8B. There is also an air stripper and static mixer at the Well 3 site. A discussion of these facilities is provided in the groundwater wells section.

Table 4-6 also specifies the reservoirs that are used as water supply sources for some booster stations.

As shown in **The City** has DHS-approved nitrate blending plans for Reservoirs 2 (A, B, C) and 5 (A, B, C). The Reservoir 5 site also contains an air stripper that reduces VOC concentrations from Wells 7 & 8B. There is also an air stripper and static mixer at the Well 3 site. A discussion of these facilities is provided in the groundwater wells section.

Table 4-6, 50 percent of the City's reservoirs are made of concrete and the remaining 50 percent are made of steel. Most of the reservoirs are circular, with the exception of four that are rectangular and two that are oval shaped. The reservoirs are equipped with overflow pipes, which are air-gapped and covered for protective purposes. In addition, each pipe is installed with flapper valves on the discharge outlet to prevent animal entry.

Table 4-5
Summary of Booster Pumping Stations

Booster Station	Unit No.	Source [1]	Year Constructed	Discharge To [1]	Motor (hp) [2]	Capacity (gpm) [1]	SCE Test Flow [2] (gpm)	SCE Test Head [2] (ft)	Discharge Pressure [2] (psi)
Booster Station 1	A	Zone 5	1989	Zone 4	75	810	864	218	107
	B	Zone 5	1996	Zone 4	125	1,625	1,787	232	110
Booster Station 2	A	Reservoir 5	1965	Zone 7 & Reservoir 7	40	945	1,009	118	56
	B	Reservoir 5	1965	Zone 7 & Reservoir 7	40	930	1,131	93	44
	C	Reservoir 5	1965	Zone 2 & Reservoir 2	100	1,865	1,474	219	100
	D	Reservoir 5	1965	Zone 2 & Reservoir 2	50	625	758	211	97
	E	Reservoir 5	1965	Zone 2 & Reservoir 2	125	1,585	1,527	220	99
	F	Reservoir 5	1965	Zone 2 & Reservoir 2	150	1,680	1,921	223	100
	G	No data	See Note 3	Zone 2	150	No data	No data	No data	No data
Booster Station 3	A	Reservoir 6	1971	Zone 5 & Reservoir 5	100	2,730	2,436	110	54
	B	Reservoir 6	1971	Zone 5 & Reservoir 5	100	No data	2,171	82	44
	C	Reservoir 6	1971	Zone 5 & Reservoir 5	125	3,400	3,693	101	48
	D	Reservoir 6	1971	Zone 5 & Reservoir 5	100	1,040	743	213	98
	E	Reservoir 6	1994	Zone 7 & Reservoir 7	200	2,635	2,571	241	102
	F	Reservoir 6	1994	Zone 7 & Reservoir 7	200	4,115	5,024	100	41
	G	No data	See Note 3	Zone 5	150	No data	No data	No data	No data
Booster Station 4	A	Well 3 Air Stripping Plant	1992	See Note 4	30	700	617	99	40
	B	Well 3 Air Stripping Plant	1992	See Note 4	30	700	577	97	40
Booster Station 5	A	Zone 5	1964	Zone 8, Reservoir 8 & Reservoir 10	50	2,012	1,885	50	86
	B	Zone 5	1995	Zone 8, Reservoir 8 & Reservoir 10	50	2,400	2,518	45	86
	C	Zone 5	1996	Zone 8, Reservoir 8 & Reservoir 10	60	2,400	2,328	53	87
Booster Station 7	A	PWR-JWL	1988	Zone 4 & Reservoir 4	60	1,250	1,307	151	93
Booster Station 8	A	Reservoir 8A & Reservoir 8B	1959	Zone 4, Reservoir 4A & Reservoir 4B	40	745	729	196	93
	B	Reservoir 8A & Reservoir 8B	1959	Zone 4, Reservoir 4A & Reservoir 4B	40	725	758	190	90
Booster Station 9	A	Reservoir 2	1957	Zone 9 & Reservoir 9	20	500	352	123	62
	B	Reservoir 2	1957	Zone 9 & Reservoir 9	60	1,100	1,333	135	67
	C	Reservoir 2	1957	Zone 9 & Reservoir 9	60	1,100	1,264	135	67

Table 4-5 (Continued)
Summary of Booster Pumping Stations

Booster Station	Unit No.	Source [1]	Year Constructed	Discharge To [1]	Motor (hp) [2]	Capacity (gpm) [1]	SCE Test Flow [2] (gpm)	SCE Test Head [2] (ft)	Discharge Pressure [2] (psi)
Booster Station 10	A	Zone 5	1969	Zone 8, Reservoir 8 & Reservoir 10	40	2,100	2,104	58	82
	B	Zone 5	1988	Zone 8, Reservoir 8 & Reservoir 10	40	2,100	2,058	58	82
Booster Station 11	A	Reservoir 10	1978	Zone 11 & Reservoir 11	60	650	740	252	116
	B	Reservoir 10	1978	Zone 11 & Reservoir 11	60	650	711	257	118
	C	Reservoir 10	1978	Zone 11 & Reservoir 11	60	650	724	258	119
	D	Reservoir 10	1978	Zone 11 & Reservoir 11	60	650	735	259	119
	E	Reservoir 10	1989	Zone 11 & Reservoir 11	100	1,150	1,172	263	122
	F	Reservoir 10	1989	Zone 11 & Reservoir 11	100	1,150	1,187	262	121
Hydro-pneumatic 11	A	Reservoir 11	1981	Sub-zone Hydro 11	10	245	259	112	55
	B	Reservoir 11	1981	Sub-zone Hydro 11	10	265	252	113	55
Booster Station 12	A	Zone 8	1981	Zone 12 & Reservoir 12	75	750	779	245	168
	B	Zone 8	1981	Zone 12 & Reservoir 12	75	750	645	241	167
	C	Zone 8	1981	Zone 12 and Reservoir 12	75	750	681	253	172
Hydro-pneumatic 12	A	Reservoir 12	1981	Sub-zone Hydro 12	7.5	260	108	100	50
	B	Reservoir 12	1981	Sub-zone Hydro 12	7.5	260	114	103	51
Booster Station 14 [5]	A	Reservoir 5	Under Construction	Zone 7	50	750	No data	No data	No data
	B	Reservoir 5	Under Construction	Zone 7	50	750	No data	No data	No data
Booster Station 15 [6]	A	currently under construction (Zone 5)							
	B	currently under construction (Zone 5)							

Notes:
1 – Data obtained from Engineering Report for Consideration of the Permit Application from the Pomona-City, Water Department (December 11, 2001).
2 – Data obtained from SCE Hydraulic Tests (conducted between October 1996 to June 2003).
3 – Booster Pumps 2G and 3G are currently under construction. The completion will be determined in a later date.
4 – Booster Station 4 does not serve any particular pressure zone. This station is for transferring water from Well 3 to Reservoir 5 for nitrate blending.
5 – Booster Station 14 is currently being upgraded. Thus, data from old SCE tests were not included in the table.
6 – Booster Station 15 is currently in design. The completion of this booster pump has not yet been determined.

The City has DHS-approved nitrate blending plans for Reservoirs 2 (A, B, C) and 5 (A, B, C). The Reservoir 5 site also contains an air stripper that reduces VOC concentrations from Wells 7 & 8B. There is also an air stripper and static mixer at the Well 3 site. A discussion of these facilities is provided in the groundwater wells section.

Table 4-6
Summary of Storage Reservoirs

Res. No	Year Constructed[1]	Material [2]	Zone Served[2]	Diameter (ft)[2]	Height (ft)[2]	Capacity (MG)[2]
2A	1993	Concrete	Zone 2	142	31	3.67
2B	1957	Steel	Zone 2	127	31	2.93
2C	1964	Steel	Zone 2	127	31	2.93
3A	1998	Concrete	Zone 5	170 ft x 100 ft Rectangle	24	5.66
4A	1984	Concrete	Zone 4	128	26	2.50
4B	1964	Concrete	Zone 4	97	18	1.00
5A	1928	Concrete	Zone 5	162 ft x 303 ft Oval Tank	16	4.90
5B	1968	Concrete	Zone 5	190 ft x 400 ft Rectangle	16	9.55
5C	2004	Concrete	Zone 5	207 ft x 305 ft Rectangle	23	10.5
6A	1934	Concrete	Zone 6	162 ft x 303 ft Oval Tank	16	4.90
7A	1941	Steel	Zone 7	71.5	31	0.93
7B	1957	Steel	Zone 7	127	31	2.93
7C	1966	Steel	Zone 7	127	31	2.93
8A	1957	Steel	Zone 8	127	31	2.93
8B	1964	Steel	Zone 8	127	31	2.93
9A	1969	Concrete	Zone 9	137 ft x 300 ft Rectangle	18	5.30
10A	1977	Steel	Zone 8	167	24	3.75
10B	1989	Steel	Zone 8	200	24	5.63
11A	1981	Steel	Zone 11	165	24	3.65
12A	1981	Steel	Zone 12	60	24	0.50
13A	1997	Concrete	Zone 9	168	23	3.83
13B	2002	Concrete	Zone 9	168	23	3.83
Total Reservoir Capacity (MG)						**87.68**

1 - Data obtained from Engineering Report (December 11, 2001).
2 - Data obtained from City of Pomona Water Storage Information Sheets.

PRESSURE REGULATING STATIONS

The City's water system contains 28 pressure-regulating stations, which are presented in **Table 4-7**. Most of the stations (26) have one pressure regulating valve (PRV), with the exception of the stations located on 3101 Temple Boulevard, and 131 N. Bellevue, which have two PRVs each. The PRVs vary in diameter from 4 inches to 14 inches.

As shown in **Table 4-7**, the majority (14) of the PRV stations feed into the largest pressure zone, Zone 5, from Zones 7, 8 and 11. And Zone 8R is supplied through four PRV stations from Zones 5, 8 and 11.

Table 4-7
Summary of Pressure Regulating Stations

Location	PRV Diameter (in)	Pressure Setting (psi)	From Zone	To Zone	Hydraulic Grade (ft)
2701 North Garey Ave. at Santa Fe	6	N/A	Zone 9	Zone 2	1202
805 Towne Ctr. Dr. at Towne Ave.	8	N/A	Zone 9	Zone 2	1202
Towne Center at Arrow Hwy.	8	N/A	Zone 9	Zone 2	1202
Joshua Lane at Lincoln Ave.	8	45	Zone 2	Zone 7	1107
900 Loma Vista at Cleveland	6	45	Zone 4	Zone 7	1107
Val Vista at Vallecito	8	60	Zone 4	Zone 7	1107
Rustic Glen Dr. N/O Falcon	8	55	Zone 11	Zone 8	1107
Phillips at Southview	12	60	Zone 11	Zone 5	984
Sage Canyon at No. Ranch Rd.	10	50	Zone 11	Zone 5	984
200 South East End	8	45	Zone 7	Zone 5	984
Cleveland St. and Murchison	4	42	Zone 7	Zone 5	984
1300 Bellview at Glenpark	8	60	Zone 8	Zone 5	984
1544 West Mission Blvd.	8	60	Zone 8	Zone 5	984
1600 West Second St.	8	55	Zone 8	Zone 5	984
220 Las Brisas	6	60	Zone 8	Zone 5	984
Arroyo East of Fairplex Dr.	8	60	Zone 8	Zone 5	984
Buena Vista at Philips	6	80	Zone 8	Zone 5	984
East of 1547 Club Dr.	8	40	Zone 8	Zone 5	984
Lexington at White Ave.	8	50	Zone 8	Zone 5	984
Storrs Pl. East of Redview Dr.	6	30	Zone 8	Zone 5	984
West 1410 Glen Ave. at Debby	8	60	Zone 8	Zone 5	984
400 Olive St. at Mills Ave.	8	50	Zone 5	Zone 6	894
Rio Rancho Rd. at Gambier	10	40	Zone 5	Zone 6	894
3101 Temple Blvd.	12	120	Zone 11	Zone 8R	936
	12	40	Zone 11	Zone 8R	936
2330 Pomona Blvd. At Humane Way	8	45	Zone 5	Zone 8R	936
1000 Avalon at Fairplex Dr.	6	57	Zone 8	Zone 8R	936
131 N. Bellevue	12	60	Zone 8	Zone 8R	936
	14	54	Zone 8	Zone 8R	936
Fairplex at Arroyo on Fairplex Dr.	6	55	Zone 8	Zone 8R	936

Source: Data obtained from City of Pomona, Utility Services Department Water/Wastewater Operations Division
Cla-Valve bi-monthly Pressure Readings provided by City staff.

DISTRIBUTION SYSTEM

Information presented herein is based on the City's Geographic Information System database. The distribution system, including service connections, is comprised of approximately 421 miles of potable water pipelines with diameters that vary from 1-inch to 36-inches. This does not include the length of City laterals, which connect pipelines in the streets with the individual meter connections. A summary of the total lengths of pipelines by diameter is listed in **Table 4-8**. The pipelines are colored by diameter in **Figure 4-3**.

Table 4-8
Pipelines Summary by Diameter

Diameter (in)	Total Length (ft)	Total Length (miles)	Percent of Total Length (rounded)
1	600	0.1	0.0%
1 ¼	100	0.0	0.0%
1 ½	600	0.1	0.0%
2	16,900	3.2	0.8%
4	263,821	50.0	11.9%
5	484	0.1	0.0%
6	513,784	97.3	23.1%
8	751,198	142.3	33.8%
10	181,536	34.4	8.2%
12	202,329	38.3	9.1%
14	22,765	4.3	1.0%
16	136,687	25.9	6.2%
18	27,126	5.1	1.2%
20	19,564	3.7	0.9%
24	64,353	12.2	2.9%
30	19,190	3.6	0.9%
36	1,127	0.2	0.0%
Total	**2,222,164**	**420.8**	**100.0%**

1 – Data obtained from the City's GIS database.

Approximately 67 percent of the pipelines are between 4 and 8-inches in diameter, 24 percent are between 10 and 16-inches and about five percent are between 18 and 24-inches. Only about 2 percent have pipeline diameters that are greater than 24-inches.

A summary of pipeline age is presented in **Table 4-9**. Pipeline age often reflects the development of the City. The City was incorporated in 1888, with most of the development occurring from the 1950s to the 1960s. As shown in **Table 4-9,** approximately 28 percent of the City's pipelines were installed during this period. Common pipeline materials in the 1950s and 1960s were asbestos cement (AC) and steel (STL) pipes. Thus, most of the distribution pipelines are made of AC (55 percent) and STL (18 percent). Newer pipelines are made of concrete (CONC), ductile iron (DI), or cast iron (CI). Approximately 8.6 percent of the pipes are constructed of concrete material, 9.6 percent are ductile iron, and about 6.9 percent are cast iron pipes. Other water pipe materials, which are less than two percent of the total pipe length, include copper and plastic pipes (e.g. polyvinyl chloride or PVC).

Table 4-10 lists the total lengths of pipelines in the City by pipe material. The pipelines are colored by material in **Figure 4-4**.

Table 4-9
Pipeline by Installation Period Summary

Installation Period (years)	Total Length (ft)	Total Length (miles)	Percentage of Total Length (percent)
1885-1924	26,100	4.9	1.4
1925-1949	359,400	68.1	15.8
1950-1960	603,400	114.3	27.6
1961-1970	365,800	69.3	17.1
1971-1980	229,800	43.5	10.3
1981-1990	346,000	65.5	15.1
1991-2003	291,500	55.2	12.7
Total	**2,222,100**	**420.8**	**100.0**

Table 4-10
Pipeline by Material Summary

Material	Total Length (ft)	Total Length (miles)	Percentage of Total Length (percent)
Asbestos Cement	1,231,700	233.3	55.4
Plastic (PVC)	27,900	5.3	1.3
Cast Iron	153,900	29.1	6.9
Steel	397,100	75.2	17.9
Copper	8,600	1.6	0.4
Concrete	190,600	36.1	8.6
Ductile Iron	212,300	40.2	9.6
Total	2,222,100	**420.8**	100.0

The soils in the vicinity of the City are generally non-aggressive and exterior corrosion of ferrous pipes is minimal except in the Phillips Ranch area. Most of the cast iron and steel pipes installed since 1930 have been “asphalt dipped,” wrapped with asbestos-felt and coated with asphaltic material, or cement mortar coated. Certain steel pipelines constructed prior to year 1930, or which have been acquired by the City from private irrigation companies, are not coated (City of Pomona Engineering Report, 2001).

Figure 4-3
City of Pomona Pipelines by Diameter

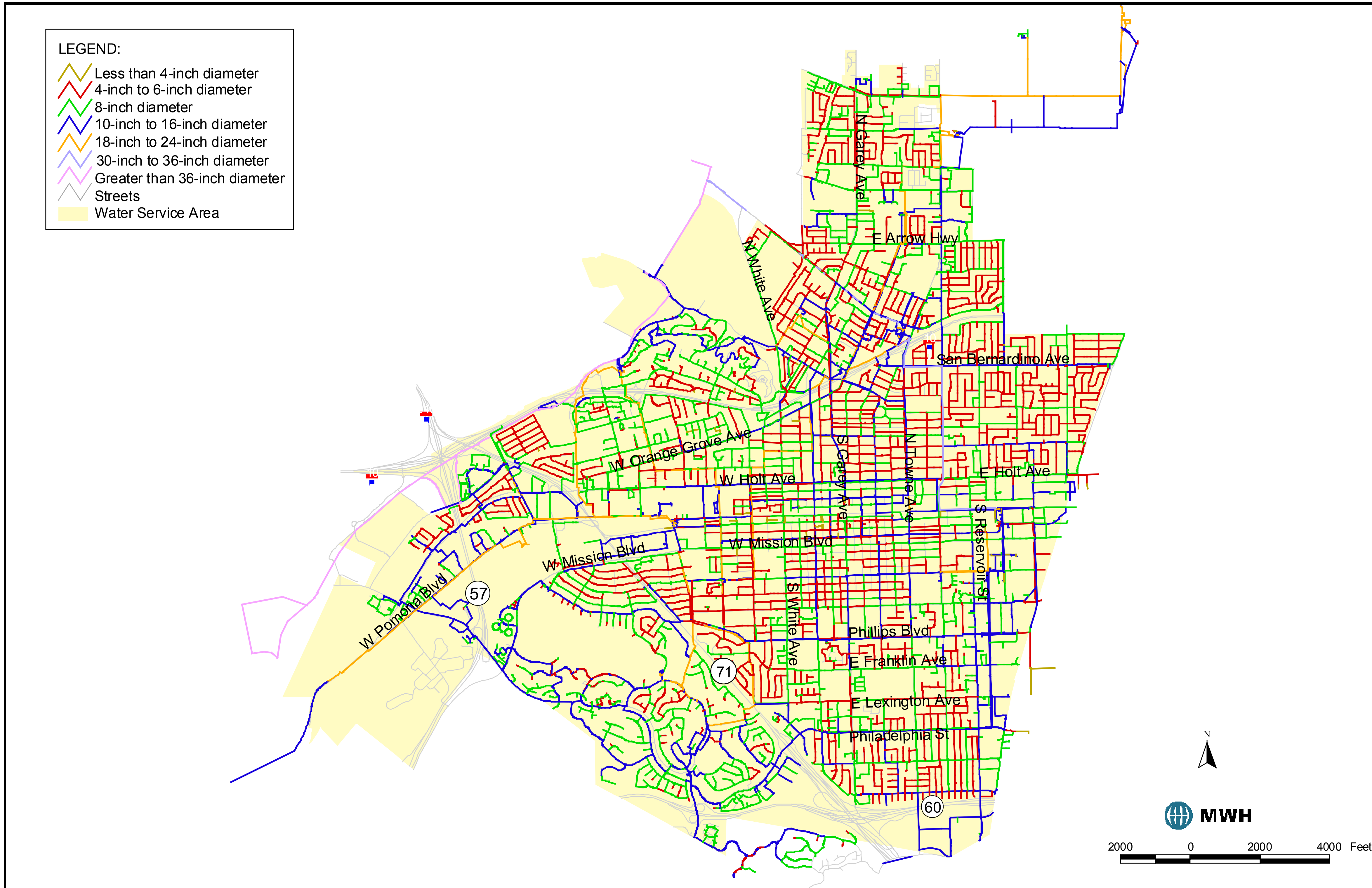
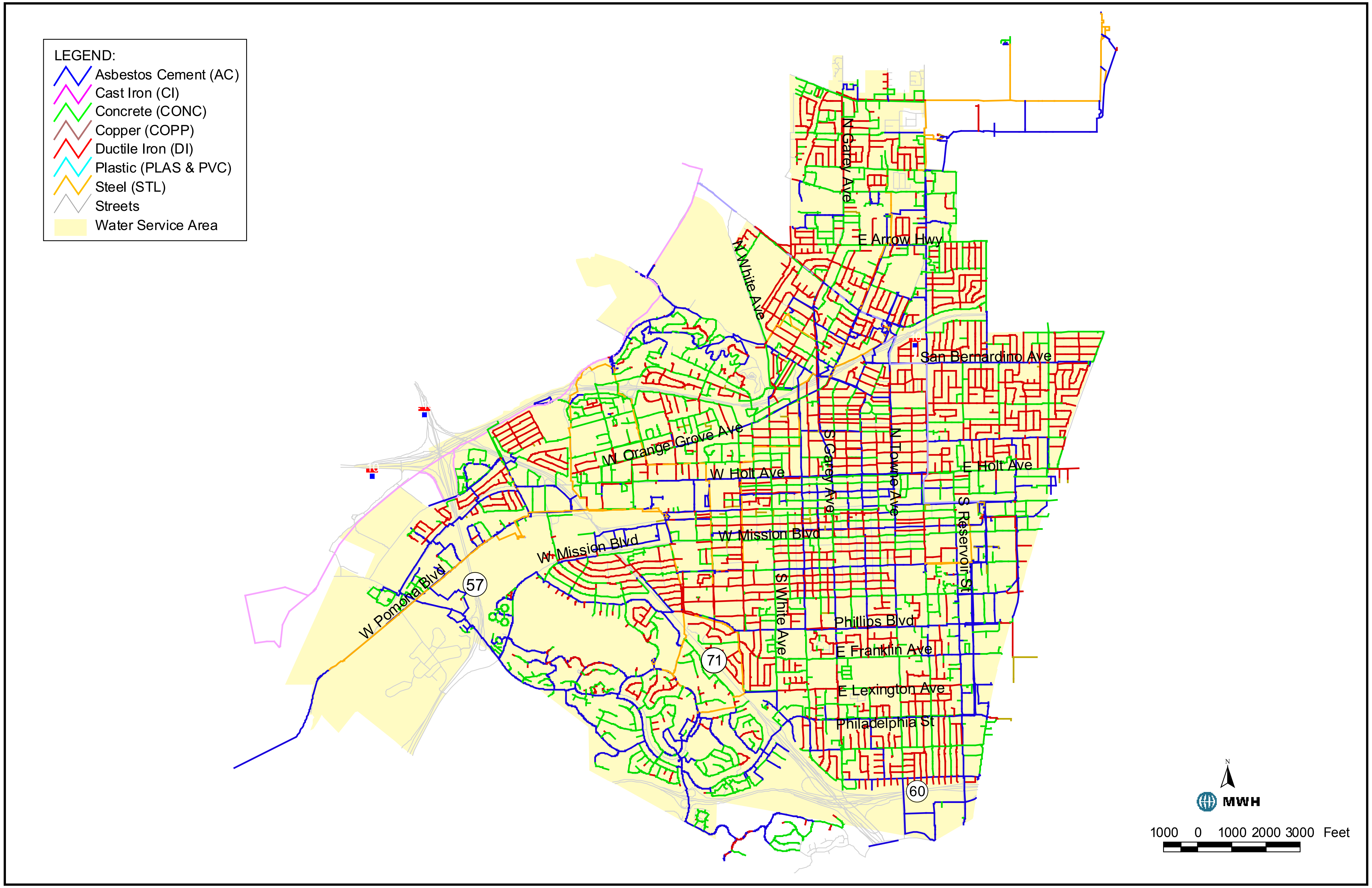


Figure 4-4
City of Pomona Pipelines by Material



AUTOMATIC CONTROL AND TELEMETERING SYSTEM

The City currently controls and monitors its water system facilities by using a Supervisory Control and Data Acquisition System (SCADA) telemetry system that includes field sensors, remote telemetry units, a radio telemetry system. The original SCADA system was implemented in 1986. This SCADA system is currently being upgraded by Northern Digital Inc. and is anticipated to be operational in July 2005.

This new SCADA system is based on InTouch application software running on Windows 2000. It includes, but is not limited to, the recording, storage, and compilation of data that produce the following reports:

- Daily usage report by pressure zone (today, this day last year, yesterday, YTD, last YTD)
- Daily production reports (wells, reservoirs, MWD, AEP, transfers and reclaimed water)
- Daily reservoir levels per reservoir (high, low, average, change)
- Daily runtimes per booster pump (today, yesterday, month to date)
- Daily runtimes per groundwater well (today, yesterday, month to date)
- Hourly flows of the AEP (bypass, treated, waste, brine and dilution flows)
- Hourly flows of the Pedley WTP (canyon flow, influent flow, effluent flow)
- Hourly influent turbidity and peak flows of the Pedley WTP
- Fifteen-minute effluent turbidity at Pedley WTP
- Hourly flows per booster pump
- Hourly flows per groundwater well
- Hourly flows into the reclaimed water system (boosters A/B, boosters C/D/E/F, reclaimed water, Parks Booster, Bonelli Park Booster, Bonelli Park make-up)
- Hourly transfer valve reports per valve
- Hourly reservoir levels
- Hourly nitrate concentrations at all blending locations (AEP at B3 and RP Gravity, VOC at Reservoir 5A East, 5A West, 5B and 5C, Effluent of P19 and P29)
- Monthly runtimes and maintenance records (Class A/B/C) per booster pump
- Monthly runtimes and maintenance records (Class A/B/C) per groundwater well

Data communication between the remote sites and the central headquarters uses a Federal Communications Commission (FCC) licensed 900 MHz radio frequency. Data transmitted between the new central control computer and the backup control system uses an ethernet-type radio.

Section 5
Potable Water Supply

This section discusses the City's existing and future water supply sources. In addition, water conservation and water quality regulations are discussed. The water supply assessment consists of a description of the supply capacities and needs, water quality constraints, and an assessment of the water supply facilities. This section is concluded with a recommended water supply plan. This section is limited to the discussion of potable water supplies and needs. Recycled water capacities and demands are discussed in **Section 10**.

SUPPLY PLANNING CRITERIA

Criteria for potable water supply planning falls into two principal categories: water supply needs and water quality regulations. Each of these is discussed below.

Water Supply Needs

The water demand projections in **Section 3** identify the need for up to 34,283 acre-ft/yr of annual supply in 2025 in a normal demand year. The projected water supply requirements are shown in **Table 5-1**. A review of historical water production indicates that annual production can be 8.5 percent above the average production in a dry year due to increased demand. This variation in demand is primarily due to weather conditions. For planning purposes, the City should have sufficient water supply to meet the projected annual water demands in a dry year. For 2025, this amount is approximately 37,200 acre-ft/yr (8.5 percent increase over 34,283 acre-ft/yr.).

Table 5-1
City of Pomona Projected Water Supply Needs

Year	Average Annual Demand (acre-ft/yr)	Dry Year Annual Demand (acre-ft/yr)
2000	30,082	--
2005	28,414	30,830
2010	29,882	32,420
2015	31,181	33,830
2020	32,715	35,500
2025	34,283	37,200

EXISTING POTABLE WATER SUPPLY SOURCES

The existing water supply sources consist of:

- Groundwater
- Treated surface water
- Imported water
- Water conservation

Historically, groundwater has been the primary source of water supply for the City, contributing about 70 percent of the total water supply during the five fiscal years (FY) 1998-99 through 2002-03, as shown in **Table 5-2**. Imported water from the Metropolitan Water District of Southern California (MWD) via Three Valleys Municipal Water District (TVMWD) is the second largest source of supply, contributing about 23 percent of the potable water demands. Treated surface water from the Pedley WTP contributed, on the average, only seven percent of the total water supply, ranging from four to 12 percent depending on the available amount of runoff water. Fluctuations in treated surface water supply are offset by adjusting the amount of imported water, while groundwater supply provides a relatively constant contribution to the water supply mix, ranging from 69 percent to 72 percent.

Table 5-2
Summary of Historic Water Supply per Source

Supply Source	FY 98-99 (acre-ft/yr)	FY 99-00 (acre-ft/yr)	FY 00-01 (acre-ft/yr)	FY 01-02 (acre-ft/yr)	FY 02-03 (acre-ft/yr)	Average (acre-ft/yr)	Average (%)
Groundwater	19,829	21,712	20,707	20,639	19,304	20,438	70%
Treated Surface Water	3,368	1,598	1,918	2,011	991	1,977	7%
Imported Water	4,195	7,557	6,763	6,923	7,659	6,619	23%
Total	**27,392**	**30,867**	**29,388**	**29,574**	**27,954**	**29,035**	**100%**

This chapter presents a general discussion of each water source, with special emphasis on recent production, water rights and water quality. The water supply facilities are discussed in detail in **Section 4**.

Groundwater

The City overlies and produces groundwater from four different groundwater basins, as shown in **Figure 5-1**. These four basins are:

- Chino Basin
- Pomona Basin
- Claremont Heights Basin
- Spadra Basin

The Chino Basin, Pomona Basin and Claremont Heights Basin are adjudicated and managed by watermasters. Pomona Basin and Claremont Heights Basin are part of the Six Basin Adjudication Agreement (December 1998), which covers the Two Basins and Four Basins areas. The Two Basins area includes the Live Oak and Ganesha Basins, while the Four Basins area includes Canyon, Upper Claremont Heights Basin, Lower Claremont Heights Basin, and Pomona Basin. The Spadra Basin is neither adjudicated nor formally managed, however discussions are ongoing to establish some form of basin management.

Table 5-3 shows that the City has a total of 38 potable groundwater wells and three recycled water wells. Chino Basin provides the largest source of groundwater supply with 19 of the City's 29 active potable groundwater wells, contributing about 76 percent of the active well capacity.

The Claremont Heights Basin contains four active potable groundwater wells that contribute about 6 percent of the total active potable well capacity. The Pomona Basin contains five active potable groundwater wells that contribute about 16 percent of the total active potable well capacity. Spadra Basin has one active potable water well and contributes about 2 percent of the City's groundwater supply. The City also has three non-potable wells that supply the recycled water system, one well in the Pomona Basin and two in the Spadra Basin.

Table 5-3
Summary of Groundwater Well Capacities

Basin	Number of Wells				Well Capacity (gpm)		
	Active	Inactive	Recycled Water	Total	Active Wells	Recycled Water	All Wells
Chino Basin	19	5		24	13,780		14,881
Claremont Heights Basin	4	1		5	1,120		1,663
Pomona Basin	5	3	1	9	2,900	178	3,337
Spadra Basin	1		2	3	321	640	961
Total	**29**	**9**	**3**	**41**	18,121	818	20,842

Note: Well status and capacity reflects operation as of April 30, 2005 and SCE test data presented in **Table 4-3**.

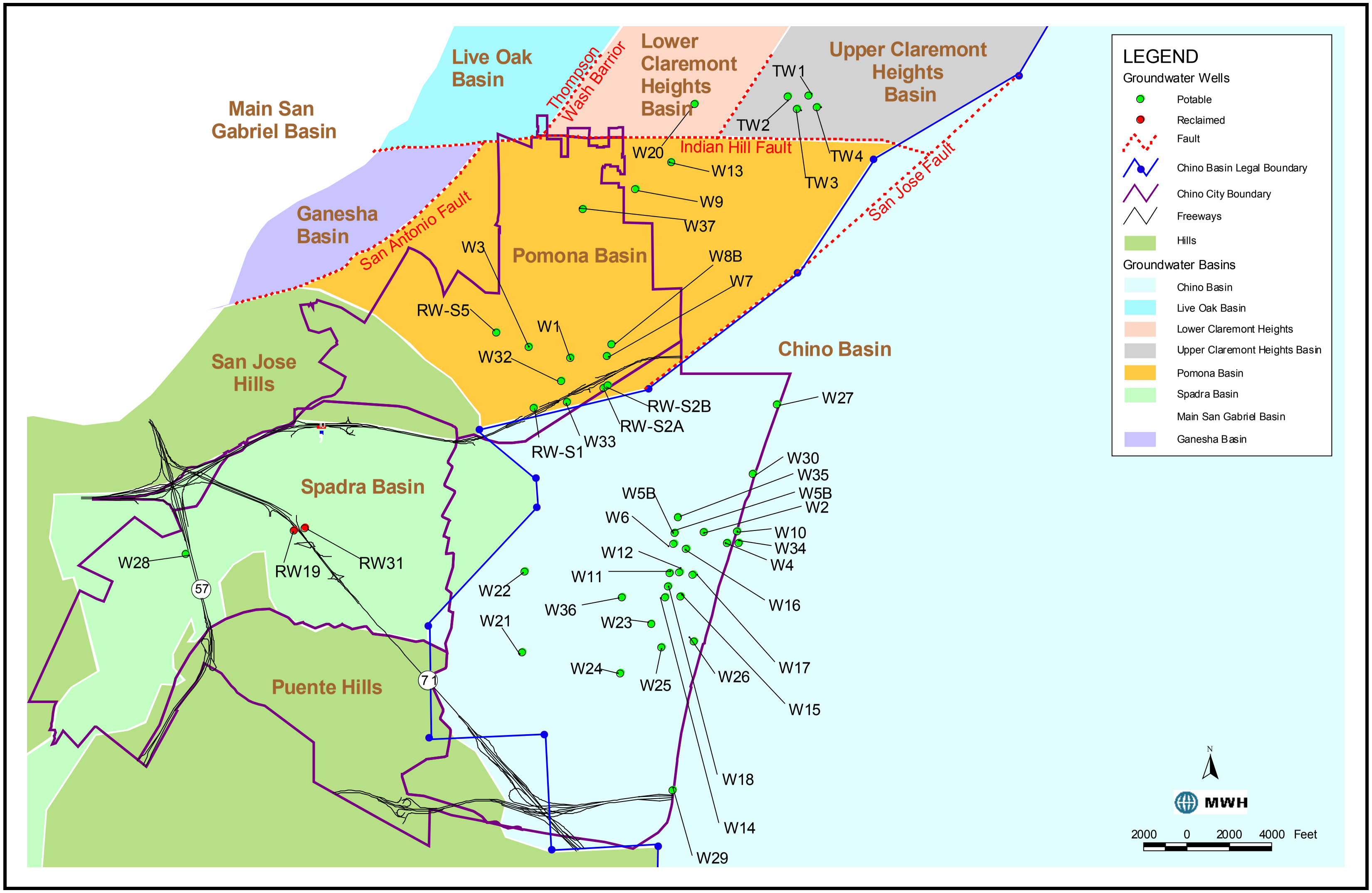
As shown in **Table 5-4**, Chino Basin was the largest source of groundwater supply over the past five years, contributing 86 percent of the total groundwater production and 61 percent of the total water supply over the period FY 1998-99 through FY 2002-03. The Claremont Heights Basin contributed seven percent of the total water supply over this period. Although Spadra Basin has one only active potable water well, it contributed four percent of the City's groundwater supply, compared to three percent for the Pomona Basin with its four active groundwater wells. The City also produces groundwater from two non-potable wells in the Spadra Basin for its recycled water system. In addition to these wells, the City also acquired several wells when it purchased the assets of the Orange Grove Tract Water Company and the Pomona (formerly Simpson) Paper Company. These wells are not operable and were never connected to the water system.

Table 5-4
Summary of Historic Groundwater Supply per Basin

Groundwater Basin	FY 98-99 (acre-ft/yr)	FY 99-00 (acre-ft/yr)	FY 00-01 (acre-ft/yr)	FY 01-02 (acre-ft/yr)	FY 02-03 (acre-ft/yr)	FY 03-04 (acre-ft/yr)	Average (acre-ft/yr)
Chino Basin	16,524	18,972	17,453	17,667	17,574	16,256	17,408
Pomona Basin	557	552	1,041	870	138	438	599
Claremont Heights	2,365	1,722	1,129	1,001	795	1,116	1,355
Spadra Basin	383	466	1,085	1,101	797	956	798
Total	**19,829**	**21,712**	**20,707**	**20,639**	**19,304**	**18,766**	**20,160**

In addition to the groundwater wells located within the City's boundaries, the City has historically received occasional deliveries of groundwater from the City of La Verne's Old Baldy Well, which was delivered via the Pomona-Walnut-Rowland (PWR) Joint Water Line. Groundwater pumped from this well has high nitrate concentrations. Because of water quality

Figure 5-1
Groundwater Basins and Water Supply Facilities



issues, Wells 3, 7, 8B, and in the future Well 32 use the PWRR5 Arrow and "E" connection for blending purposes at the Reservoir 5 site. When those wells were in operation and the PWRR5 connection must have low nitrates for blending, the Old Baldy Well would not be allowed to operate. The operation of the Old Baldy Well has not occurred the last several years due to Pomona's operation of Well 3. The California Department of Health Services (DHS) determined that the addition of other high nitrate wells to the PWR Joint Water Line would make the it subject to reclassification as a community water system requiring a separate water supply permit from DHS.

Chino Basin

The Chino Basin encompasses a total area of about 235 square miles, of which the western portion overlies the City's service area. The basin contains about 5 million acre-ft of water in storage and has an unused storage capacity of about 1 million acre-ft. The western portion of the basin within the City's boundary is about 9 square miles or 5,900 acres. Total annual groundwater production from the basin was about 182,000 acre-ft/yr during FY 2003-04.

The Chino Basin is the largest groundwater basin in the Upper Santa Ana River watershed. The basin is bounded on the north by the Red Hill fault and Cucamonga fault zone, on the northwest by the San Jose fault, on the southwest by the Chino Hills, on the northeast by the Rialto-Colton fault, on the east by the Jurupa and Pedley Hills and on the south by the Santa Ana River. The basin is an alluvial valley that was formed when eroded sediments from the surrounding San Gabriel Mountains, the Chino Hills, the Puente Hills and the San Bernardino Mountains filled a geological depression. The water bearing sediments consist of older Pleistocene alluvium that is overlain by younger Holocene alluvial deposits. The younger alluvium varies in thickness from over 100 ft near the mountain front to a few feet south of Interstate 10. The younger alluvium is not saturated and does not yield water to wells; however, it readily transmits recharged water to the deeper aquifers. The older alluvium varies in thickness from about 200 feet near Prado Dam to over 1,100 feet near Fontana. A review of lithologic and geophysical logs indicated the presence of three main water-bearing units in the basin (JMM, 1992).

In FY 2003-04, the City pumped a total of 16,256 acre-ft from the Chino Basin. This was about 93 percent of the average production over the past six fiscal years. The 19 active wells in the basin have a combined capacity of 16,500 gpm or 26,600 acre-ft/yr if all wells were pumped continuously.

Pomona Basin

The Pomona Basin occupies about nine square miles between the cities of La Verne, Claremont, and Pomona. The basin is bounded on the north by the Indian Hill fault, on the south and east by the San Jose fault and on the southwest by the San Jose Hills. The basin is partially divided by the "Intermediate" fault, which acts as a barrier to groundwater flow from the east to the west. The estimated groundwater storage capacity of the Pomona Basin is about 320,000 acre-ft based on an average saturated thickness of 700 feet and a specific yield of 0.081. The operating storage of the Pomona Basin may be low as the basin is partially confined.

The Pomona Basin is naturally recharged by subsurface inflow across the western end of the Indian Hill fault from the Live Oak and Claremont Heights Basins during high level conditions. During years of below average rainfall, little recharge occurs in the Pomona Basin. Outflow from the basin only occurs at the edges of the San Jose fault.

In FY 2003-04, the City pumped a total of 438 acre-ft from the Pomona Basin. This was about 73 percent of the average production over the past six fiscal years due to water quality problems. The five active wells in the basin have a combined capacity of 3,020 gpm or 4,870 acre-ft/yr if all wells were pumped continuously.

Claremont Heights Basin

The Claremont Heights Basin occupies about seven square miles. The basin is bounded on the north by the Cucamonga fault, on the east by the San Jose fault, on the south by the Indian Hill fault, and on the west by the Thompson Wash where it borders with the Live Oak Basin. The Claremont Heights Basin is separated into the Upper Claremont Heights and the Lower Claremont Heights Basins by the Claremont Heights Barrier, which extends from the Indian Hill fault north along the northwest side of the Indian Hill and along a line directed toward Gail Canyon. The Upper Claremont Heights Basin is located on the eastern side of this barrier, while the Lower Claremont Heights Basin is located on the western side of this barrier.

The Upper Claremont Heights Basin has an estimated storage capacity of 150,000 acre-ft, assuming an average saturated thickness of 500 feet and a specific yield of 0.102. The basin is naturally recharge by subsurface inflow from the San Antonio Canyon Basin, deep percolation of precipitation and applied water, and percolation from spreading grounds operated by the Pomona Valley Protective Association (PVPA), a non-profit corporation made up of the groundwater producers. Subsurface outflow occurs through or over the Claremont Heights Barrier, the Indian Hill fault, and the San Jose fault in a minor degree.

The Lower Claremont Heights Basin has an estimated storage capacity of 50,000 acre-ft, assuming an average saturated thickness of 400 feet and a specific yield of 0.092. The basin is naturally recharged by subsurface inflow from the San Antonio Canyon Basin and the Upper Claremont Heights Basin and from deep percolation of precipitation and applied water. Subsurface outflow occurs through or over the Indian Hill fault to the Pomona Basin and the San Gabriel Valley portion of the Live Oak Basin.

In FY 2003-04, the City pumped a total of 1,116 acre-ft from the Claremont Heights Basin. This was much lower (about half) of the average production over the past five fiscal years due to declining groundwater levels. The four active wells in the basin have a combined capacity of 1,335 gpm or 2,150 acre-ft/yr.

Spadra Basin

The Spadra Basin occupies about 6.5 square miles and is bounded on the north by the San Jose Hills and the San Jose fault, on the west by subsurface constriction called the Spadra Narrows, on the south by Puente Hills, and on the east by a groundwater flow divide with the Chino Basin. The Spadra Basin in naturally recharged by subsurface flow from the Chino and Pomona Basins during high-water level conditions, surface inflow and direct precipitation. Groundwater outflow from the basin occurs through the Spadra Narrows to the Puente Basin.

In FY 2003-04, the City pumped a total of 956 acre-ft from the Spadra Basin. This was about 20 percent higher than the average production over the past six fiscal years. Of this total, 470 acre-ft/yr of Spadra Basin groundwater was delivered to Pomona's recycled water system. The sole active potable well in the basin has a capacity of 435 gpm or 700 acre-ft/yr if pumped continuously.

The Spadra Basin is neither adjudicated nor formally managed. Historically, the basin had numerous pumping entities including the City, California State Polytechnic University at Pomona (Cal Poly), Pomona Paper, and a mobile home park. Due to poor water quality, the mobile home park's well was shut down. The Pomona (Simpson) Paper Plant has gone out of business leading to the closure of their single well. Hence, the only remaining pumpers in the basin are the City, Cal Poly Pomona and Walnut Valley Water District (WVWD). The WVWD has a well operating for non-potable purposes at the western boundary of the Spadra Basin near the Spadra Narrows where the Spadra Basin flows to the Puente Basin in Pomona at the City of Industry border.

Water Rights

In some California groundwater basins, the amount of water that different parties can pump from a basin are defined in an agreement that has been approved by the courts. These basins are referred to as adjudicated basins. The primary reasons for adjudication of a groundwater basin are to formalize an entity's annual right to a portion of the groundwater and to protect the basin from overpumpage. In adjudicated basins, the court appoints a watermaster to oversee the court judgment. In most basins, the judgments limit the amount of groundwater that can be extracted by all parties. The City pumps water from two adjudicated groundwater basins, the Chino Basin and the Six Basins. The Chino Basin adjudication was originally filed as a stipulated decree on January 27, 1978. This judgment was revised with the adoption of the *Chino Basin Peace Agreement* on June 29, 2000. The adjudication of the Six Basins, which covers both the Upper and Lower Claremont Heights Basins and the Pomona Basin as well as three other adjacent groundwater basins, was established on December 18, 1998 and is referred to as the *Six Basin **Judgment.*** Spadra Basin is the only basin that is used by the city for groundwater pumping that is not adjudicated. The adjudication and water rights allocation of the Chino Basin and Six Basins are discussed below.

Chino Basin Judgment

Groundwater rights are defined by the 1978 judgment in the case *Chino Basin MWD v. City of Chino, et al.* The judgment is administered by a watermaster and is subject to the on-going court jurisdiction. The original watermaster, the Chino Basin Municipal Water District, was replaced in 1998 by a nine-member board made up of representatives of the basin pumpers, designated the Chino Basin Watermaster (CBWM). The judgment defined the safe yield of the basin to be 140,000 acre-ft/yr. Water rights are divided between three pools:

- Overlying (Agricultural) Pool – 82,800 acre-ft/yr
- Overlying (Non-agricultural) Pool – 7,366 acre-ft/yr
- Appropriative Pool – 49,834 acre-ft/yr.

The rights of the Overlying (Non-agricultural) Pool and the Appropriative Pool parties are explicitly defined in the judgment; whereas, Overlying (Agricultural) Pool parties have common rights. The judgment includes a physical solution that defines the Operating Safe Yield (OSY) for the Appropriative Pool as 54,834 acre-ft/yr. This includes an allowed overdraft of 5,000 acre-ft/yr up to a total of 200,000 acre-ft/yr. This allowed overdraft is expected to end in FY 2017 after which the Operating Safe Yield will return to 49,834 acre-ft/yr. The OSY is divided among the Appropriative Pool parties according to their assigned shares of the OSY. The judgment provides that the Safe Yield may need to be adjusted periodically based on more accurate and updated data and on evidence of increased capture of native water and increased return flow from the use of replenishment or stored water. New yield will be allocated to the Appropriative Pool.

Production in excess of the pumper's defined rights must be replaced with replenishment water. The CBWM purchases imported untreated water for replenishment from the Inland Empire Utilities Agency (IEUA). In the future, supplemental replenishment water is expected to include recycled water. The cost of replenishment water required to replace overpumping by pumpers in the IEUA and Western Municipal Water District (except Norco) service areas is subject to the "85-15 Formula" where 85 percent of the replenishment water cost is paid by the responsible party and the remaining 15 percent is paid by all of the "85-15" pumpers as an assessment on total pumping. Pumpers in the TVMWD and the San Bernardino Valley Municipal Water District service areas pay for replenishment water only if they overpump. Pumpers can avoid incurring a replenishment assessment by leasing or purchasing water rights from other pumpers who do not use their entire allocation. Appropriative Pool pumpers can carry over unpumped water rights to the following year up to their share of the OSY. Any carryover water beyond one year's amount must be retained through a written storage agreement with the Watermaster.

Water rights are transferred from the Overlying (Agricultural) Pool to the Appropriative Pool on a permanent or a temporary basis. Permanent transfers are accomplished through the permanent conversion of agricultural land to urban uses. In the past, conversions were based on 2.6 acre-ft/yr/acre with one-half going to appropriator who undertook service of the converted land and the remaining half going to all parties in the Appropriative Pool. Temporary conversions occur annually when the Overlying (Agricultural) Pool produces less water than its rights during the prior year. Previously, unpumped Overlying (Agricultural) Pool water was transferred to the Appropriative Pool in the following year. The mechanism for both permanent and temporary transfers have changed as a result of the *Peace Agreement* signed in June 2000 to implement Optimum Basin Management Plan (OBMP).

Optimum Basin Management Program

In 1998, the Superior Court appointed a nine-member board as Interim Watermaster and directed the Watermaster to prepare an OBMP by September 30, 1999. The OBMP is intended to formulate and implement a groundwater management plan having the goal of preserving and enhancing the safe yield and water quality of the basin. Development of the OBMP involved two phases. Phase I consisted of defining the current state of the Basin, establishing goals associated with the major issues facing the stakeholders, and developing a management plan to achieve the goals. Phase II of the OBMP involves the development of specific implementation plans that will allow the physical construction, operation, management and monitoring of OBMP facilities. This phase includes development of a series of agreements, technical memoranda, facilities reports, policy documents and plans to implement the OBMP.

Phase I of the OBMP included a detailed assessment of the conditions of the Basin including groundwater levels and storage, groundwater production, historical and current groundwater quality, safe yield, water demands and agency supply plans, wastewater flows, treatment and disposal plans (CBWM, 1999). During Phase I, the stakeholders developed a mission statement goals and potential management actions to achieve these goals. The Phase I Report was submitted to the Court in September 1999.

A major accomplishment of Phase II of the OBMP was the signing of the Chino Basin *Peace Agreement* on June 29, 2000. The purpose of this agreement is to facilitate implementation of the OBMP and to resolve many of the significant outstanding basin management issues. The agreement has a 30-year term and may be extended for an additional 30 years. Key elements of the Peace Agreement include:

- Watermaster Performance – administration of basin recharge and replenishment activities, regulation of storage capacity and groundwater recovery, management of water transfers and leases between judgment parties, computation of assessments and salt credits, and management of well metering
- Early Transfer Water – The reallocation of safe yield not produced by the Agricultural Pool to the Appropriative Pool on an annual basis. The Early Transfer shall be the greater of 32,800 acre-ft /yr or 32,800 acre-ft/yr plus the actual quantity of water not produced by the Agricultural Pool after all land use conversions are satisfied. Early Transfer water is allocated among the Appropriative Pool members according to their pro-rata share of the Initial OSY.
- Land Use Conversions – The amount of water rights converted for agricultural land to urban use is changed from 2.6 acre-ft/yr per acre split between the appropriator providing water service and all Appropriative Pool members to 2.0 acre-ft/yr per acre to the appropriator providing water service. The purveyor is required to pledge the use of the converted water to serve the converted land.
- Assignment of Overlying Rights – Overlying rights may be assigned by agreement to an appropriator to the extent necessary to provide water service to the overlying agricultural lands.
- OBMP Credits and Reimbursement – Watermaster is required to adopt procedures to evaluate requests for credits against future OBMP assessments or reimbursement of producer expenses incurred to implement any program or project that carries out the purposes of the OBMP including facilities related to subsidence prevention.

- Covenants by Agricultural Pool Members – support for storage and recovery projects, agreement of good faith and fair dealing relative to storage and recovery projects, and waiver of compensation from a storage and recovery project
- Desalters – conditions regarding the ownership, funding, design, construction, operation, replenishment water and sale of water for existing and new desalters
- Conflicts – remedies for default by parties to the agreement and dispute resolution procedures
- Replenishment by Watermaster – as part of its recharge and replenishment activities, Watermaster is required to purchase and recharge 6,500 acre-ft/yr of imported water in Management Zone 1 over a five-year period (total of 32,500 acre-ft). The cost of recharged water and rights to pump this water is allocated the Appropriative Pool according to each member's share of the Initial OSY. Watermaster has assigned this water to each Appropriative Pool member's local storage account. The Watermaster will evaluate the need for continued recharge after FY 2004-05.
- New Yield – The Watermaster is developing a program to enhance replenishment of stormwater in the basin. This program is initially estimated to develop an average yield of 12,000 acre-ft/yr. This new yield is being distributed among the Appropriative Pool parties according to their share of the OSY.

For management purposes, the Chino Basin has been divided into five management zones. These zones are depicted in **Figure 5-2**. These zones are based on the observation of five distinct groundwater flow systems having similar hydrogeological characteristics. Water management activities occurring in one zone have little or no impact on the other zones. Hence, recharge and pumping activities in Management Zone 1 (MZ-1) have little effect on the adjacent MZ-2, and vice versa. The City of Pomona falls within MZ-1.

Chino Basin Water Rights

The City of Pomona has water rights which are based on 20.454 percent of the Initial OSY of the Chino Basin, temporary transfers of unpumped water from the Appropriative Pool, and the safe yield reallocation of the Agricultural Pool. The City does not own any water rights in the Non-Agricultural Pool.

For FY 2003-04, the City had a total right to pump 18,258 acre-ft. This amount consists of 11,216 acre-ft of the Initial OSY, 446 acre-ft from agricultural pool transfers (unpumped water), and 5,903 acre-ft of reallocation of the Agricultural Pool. Details of the water right allocation are presented in **Table 5-5.** As shown in Table 5-5, the OSY of Chino Basin is 54,834 acre-ft. Hence, the City's share of the OSY at 20.545 percent is 11,215.746 acre-feet. The City transferred 2,595 acre-ft from its storage account to its active rights and leased 3,000 acre-ft of this amount to the Monte Vista Water District and Fontana Water Company. In FY 2003-04, the CBWM commenced an enhanced stormwater recharge program that is estimated to increase the operating safe yield by 12,000 acre-ft/yr. Pomona's share of this new yield is 2,454 acre-ft/yr, resulting in a total water transaction water activity of 2,049 acre-ft. The FY 2003-04 agricultural pool safe yield transfers of 4,768 acre-ft consist of an early transfer of 6,709 acre-ft/yr from the Overlying Agricultural Pool (20.545 percent of 32,800 acre-ft/yr as defined in the Peace

Figure 5-2
Chino Basin Management Zones

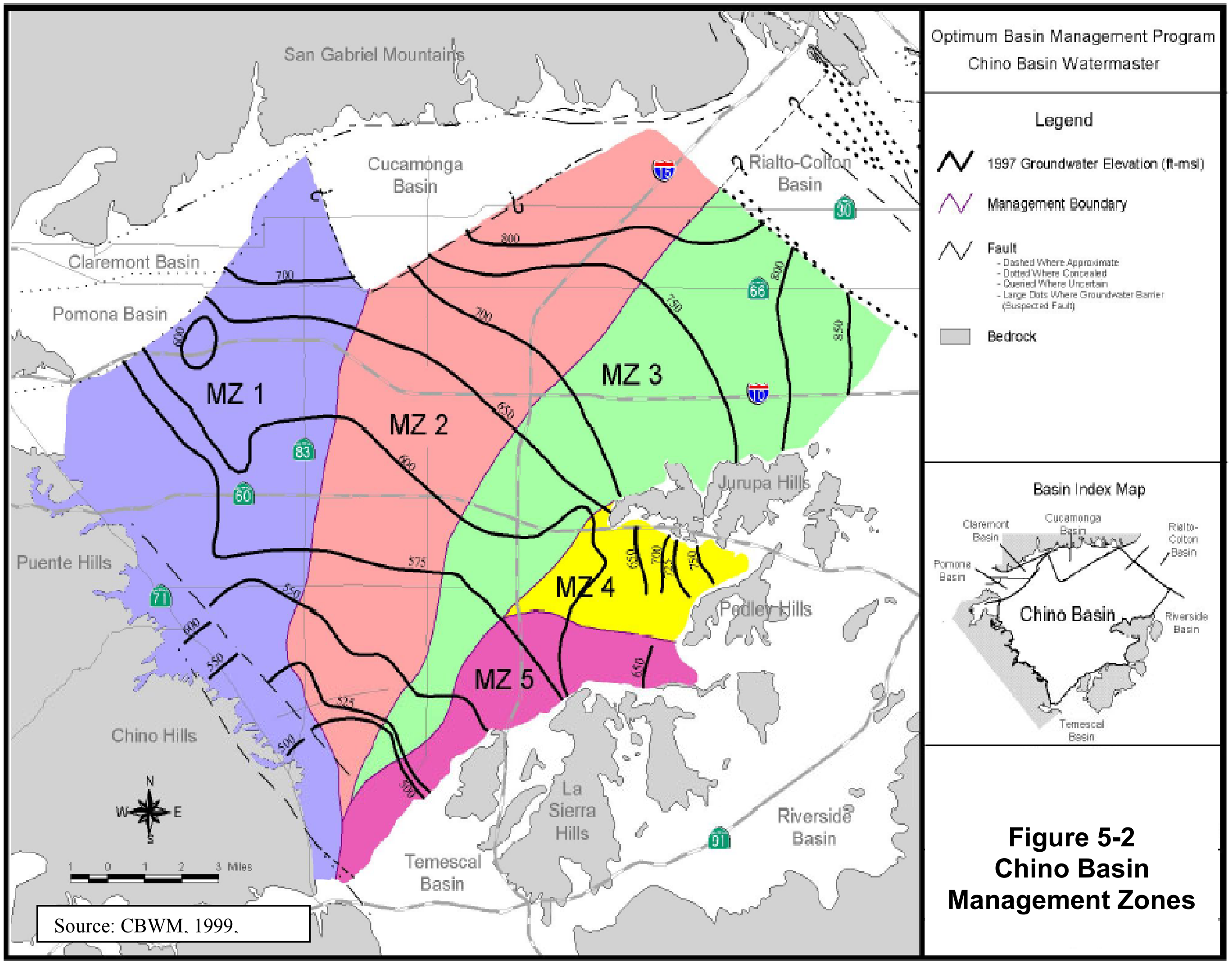


Figure 5-2
Chino Basin
Management Zones

Table 5-5
Chino Basin Water Rights Allocation FY 2003-04

Description	Appropriative Pool (acre-ft)	Pomona's Share (acre-ft)
Operating Safe Yield	54,834.000	11,215.746
Carry-over from FY 2002-03	18,656.476	0
Prior Year Storage Account Adjustments	0.000	225.413
Appropriative Pool - Water Transaction Activity		
Leases and Transfers - to/(from)	0.000	(3,000.000)
Supplemental Water	48.400	0
Transfer from storage	19,207.658	2,594.765
New Yield – Stormwater Recharge	12,000.000	2,454.480
Total	31,256.058	2,049.245
Agricultural Pool – Operating Safe Yield Reallocation		
Early transfers	32,800.000	6,708.912
Land use conversions	17,510.388	0
Net Agricultural Pool Overproduction FY 2003-04	-9,488.570	-1,940.792
Total available Agricultural Pool Reallocation	40,821.818	4,768.120
Annual Production Right	**145,568.352**	**18,258.524**

Agreement) less a 1,941 acre-ft/yr adjustment based on actual agricultural pool overproduction during FY 2003-04 (20.545 percent of 9,489 acre-ft). The Watermaster also increased Pomona's water rights with a one-time adjustment to storage accounts of 225 acre-ft in FY 2003-04. Based on these transactions, Pomona had rights to produce 18,259 acre-ft in FY 2003-04. Since actual production in FY 2003-04 was 16,110,509 acre-ft, Pomona carried over 2,148.015 acre-ft to FY 2004-05.

The City's available Chino Basin storage at the end of FY 2003-04 was 13,555 acre-ft. This storage amount is based on the initial storage at the beginning of FY 2003-04 of 15,422 acre-feet, a 728 acre-ft credit to its local storage account based on water recharged in Management Zone 1, and a transfer of 2,595 acre-ft of stored groundwater. Over the past five years, Pomona has reduced its storage account by 10,114 acre-ft. Pomona has leased this stored water plus an additional 14,286 acre-ft of annual production rights to other Chino Basin producers in the past five years. These water transactions generated about $5 million in revenue for the City.

A discussion of the City's projected Chino Basin rights is discussed later in this Section under **Future Water Supply Sources**.

In addition to the allocated water production right, the City is participating in the Chino Basin Dry Year Yield (DYY) Storage Program. The objective of this program is to improve the reliability of imported water supplies during dry periods. The program is intended to store up to 100,000 acre-ft in the Basin and generate 33,000 acre-ft/yr of dry year yield for MWD. During wet periods, MWD would deliver SWP water to program participants in-lieu of Chino Basin groundwater production. In these years, the unpumped water would be credited to the DYY storage account. When imported water supplies are inadequate to meet MWD's requirements, the stored water would be pumped out by the participating agencies and used locally instead of taking imported water deliveries from the MWD system. Pomona has committed to developing 2,000 acre-ft/yr of DYY yield by reactivating three Chino Basin wells and expanding the capacity of the Anion Exchange Plant (AEP) by at least 1.8 mgd. The City can use these wells in normal years to meet its demands but must reduce its imported water use in dry years when production from the DYY is required.

Six Basins Judgment

Groundwater rights are defined by the 1998 judgment in the case *Southern California Water Company v. City of La Verne, City of Claremont, City of Upland, Pomona College, Pomona Valley Protective Association, San Antonio Water Company, Simpson Paper Company, Three Valleys Municipal Water District, West End Consolidated Water Company, et al.* The judgment is administered by a watermaster, which is the committee with the powers and duties defined in Article V of the Judgment.

The judgment defined the safe yield of the basin to be 19,300 acre-ft/yr. The Six Basins are divided into two areas, the Two Basins (Live Oak and Ganesha Basins) and the Four Basins (Canyon, Upper Claremont Heights, Lower Claremont Heights, and Pomona Basins). The Judgment defines the following, but is not limited to:

- The rights of the parties to produce groundwater in the Two Basins
- The rights of the parties to produce groundwater in the Four Basins
- The rights of the parties to store groundwater in the Two Basins
- Responsibilities of the PVPA regarding spreading

The Base Annual Production Rights of the Party's within the Two Basins and Four Basins areas are described in the next subsection. The Watermaster may enter a Storage and Recovery agreement with any party holding a Base Annual Production Right or TVMWD as long as the storage and recovery of groundwater will not cause an unreasonably high groundwater table and physical damage.

Groundwater extracted from the Six Basins area will be replenished by PVPA pursuant to Exhibit E of the Judgment, or under any other replenishment program or activity. Exhibit E of the Judgment outlines four spreading programs at the San Antonio Spreading Grounds, Thompson Creek Spreading Grounds, Pomona Spreading Grounds, and Live Oak Spreading Grounds. The Pomona Spreading Grounds are owned and operated by the City of Pomona and comprise eight acres of spreading grounds adjacent to the Pedley WTP, where surface water from the San Antonio Creek and Evey Canyon is spread, along with some local runoff. The City is not obligated to spread these surface waters and these diversions are excluded from the operation of the Judgment.

Six Basins Water Rights

The Watermaster will annually (before September 15) establish the OSY for the following year, taking into consideration the amount of water in storage and the need to control water table elevations. The conditions of the basin will be reviewed at least quarterly and the Watermaster may make appropriate adjustments of the OSY.

The Judgment allows the carryover of rights from one year to the following year, as well as transfer of rights among parties, as long as these transfers are in compliance with the limitations set forth in the Judgment. Transfers of rights among Parties are limited to rights within the Four Basin Area or within the Two Basin area. A party's right to produce, store, or recover groundwater accruing under the Judgment may not be transferred between the Four Basin Area and the Two Basin Area, and vice versa.

The City of Pomona has a base annual right to produce 4,014 acre-ft/yr from the Six Basins, which is 20.798 percent of the OSY of 19,300 acre-ft/yr. This amount includes 691 acre-ft/yr of water rights the City acquired from Pomona (Simpson) Paper Company. In addition, the City has the right to produce an additional 109 acre-ft/yr subject to provisions defined under items a, b, and c of Exhibit D of the Judgment. The water rights are divided over the Upper Claremont Heights, Lower Claremont Heights, and the Pomona Basins as summarized in **Table 5-6**. The Operating Safe Yield is adjusted annually by the Six Basin Watermaster based on water levels in the basin. For 2005, the OSY is 16,500 acre-ft/yr.

Table 5-6
Six Basins Water Rights Summary

Groundwater Basin	Six Basin Annual Water Right (acre-ft/yr)	Pomona's Base Water Right (acre-ft/yr)	Pomona's 2005 Annual Water Rights (acre-ft/yr)
Canyon Basin	464	0	0
Upper Claremont Heights Basin	10,542	1,234	1,055
Lower Claremont Heights Basin	1,068	961	822
Pomona Basin	7,226	1,819	1,555
Total	**19,300**	**4,014**	**3,432**

Source: Exhibit D from the Six Basin Judgment (December 1998) and Table 4 of Preliminary Determination of Operating Safe Yield for Calendar Year 2005.

The City has pumped an average of 2,034 acre-ft/yr from the Six Basins over the period 1998 through 2004, which is lower than the allocated water rights. It should be noted that reports demonstrate that the cumulative groundwater production of the parties of the Six Basins has been greater than 20,000 acre-ft in each of the five years immediately preceding the filing of the Judgment, exceeding the available safe yield. According to the Judgment, the native safe yield had been continuously exceeded for at least two decades.

Treated Surface Water

The City's surface water supplies are obtained from San Antonio Canyon and Evey Canyon. These supplies have produced as much as 4,140 acre-ft/yr of water in the past twelve years. The average yield over the past twelve years is about 2,500 acre-ft/yr or 2.25 mgd. During summer months (June through September), the average flow has ranged from 4 mgd (the plant capacity) to a low of 0.5 mgd. Prior to the plant rehabilitation, the peak summer flow was 4.5 mgd.

San Antonio Canyon drains one of the largest watersheds of the San Gabriel Mountains and is located north of the City of Upland. The perennial flow has been divided between the San Antonio Water Company (SAWC) in Upland and the Cañon Water Company (CWC). The City's water rights from San Antonio Canyon are based on its ownership of 94 percent of CWC stock. The division of flow between CWC and SAWC was established through the California Supreme Court decree of 1915. The division of flow is regulated by a diversion box structure on San Antonio Creek as follows:

- When the flow is 15.47 cubic feet per second (cfs) or less:
  - 17 percent of the flow shall go to SAWC, prior to any diversion
  - 0.36 cfs of the flow shall go to SAWC under the Gird Right
  - 50 percent of the balance shall go to CWC
  - 50 percent of the balance shall go to SAWC
- W hen the flow exceeds 15.47 cfs:
  - SAWC can take up to 19.3 cfs between April 1 and December 31
  - SAWC can take up to 14.8 cfs between January1 and March 31
  - CWC can take up to 6.24 cfs

Surface water flow from Evey Canyon is diverted by a submerged dam near the canyon mouth and collected with the City's collection facilities. The City owns rights to all of the water from Evey Canyon. The available flow from Evey Canyon is heavily dependent upon climatic conditions. During the heavy storms of 2005, the Evey Canyon collection system was buried with more than 20 ft of new sediment. This has significantly reduced the yield from this source.

Surface water from San Antonio and Evey Canyons is treated at the Pedley WTP, which has a capacity of 4 mgd. During periods of high runoff, the water is too turbid to filter and runoff bypasses the Pedley WTP to be spread in the gravel pit adjacent to the WTP or to the San Antonio Spreading Groundwater where Pomona also receives a spreading credit.. During dry periods, when no runoff is available, the Pedley WTP is shut down.

Since the plant was upgraded in 1998, it has produced an average of 1,894 acre-ft/yr. This reduced flow was influenced by five years of drought from 2000 through 2004.

Imported Water

The City obtains imported water from the TVMWD, a member agency of MWD. The primary source of imported water supply is MWD's Weymouth Filtration Plant in La Verne. The Weymouth plant currently produces a 65/35 blend of State Water Project (SWP) and Colorado River Aqueduct (CRA) water. During 2003, this blend ranged from 100 percent SWP water to a 52/48 percent blend of SWP and CRA water. Imported water is conveyed to the City through MWD's Orange County Feeder and the PWR Joint Water Line. Pomona has one connection to the Orange County Feeder near McKinley Avenue and Fairplex Drive. This water from this

10 cfs connection is pumped to the water system through Booster Station 7. Pomona has two connections to the PWR line, with capacities of 30 cfs and 40 cfs. However, the meters are rated at 30 cfs each, limiting the available imported water supply

Water Conservation

The City of Pomona has specifically implemented the following conservation or water use efficiency measures or programs:

School Education Program

The City provides water conservation education to school age children via tours of water facilities and speakers on a request-only basis.

Public Education Program

The City's public education program includes water use efficiency and conservation literature that consists of pamphlets, which are mailed out with customer water bills or made available at the City's public counter. The City periodically includes bill inserts with its water bills, which encourage water conservation, and also includes information flyers on water reclamation, water rates, and how to read a meter.

Ultra Low Flow Toilet (ULF) Ordinance for All New Construction and ULF Fixture Replacement in Existing Residences

The City distributes Water Conservation Equipment and Kits in conjunction with MWD. The water conservation kits include a shower flow restrictor, toilet tank displacement bag, low-flow showerhead, ULF toilet, and a brochure on conservation tips.

Metering

The City has an on-going large meter testing program involving approximately 110 meters that are 3" and larger. The American Water Works Association (AWWA) recommends that small meters be replaced on a 10-year cycle. Plans were made to replace the small meters in the Phillips Ranch area that have been in use for at least 30 years. Other priorities have delayed this program which has been estimated at $500,000 for metering that will include automated meter reading technology. This project will be identified in the Capital Improvement Plan (CIP) list developed by this WMP.

The City's entire service area is metered and read on a bi-monthly basis with certain large customer's meters read monthly. The City also requires that all water used for construction, street sweeping, and sewer flushing is metered and billed. The City maintains water use records on all active accounts and, according to the analysis in **Section 3**; the unaccounted-for water loss averaged 7.6 percent per year for calendar years 2001 through 2003.

Rates

The City has a water rate schedule, which was developed to encourage water conservation. The rate schedule consists of front-end charges based on water meter size and capacity, with no allowance for water usage, and a commodity rate, which consists of an increasing block structure. The initial block or lifeline rate is based solely on water production costs and all users are charged this rate for the first 1,200 cubic feet of water usage every two months. The regular commodity rate is based upon all other operating expenses less the revenue received from lifeline rates.

Large Landscape Water Audits and Incentives

The City encourages customers to participate in MWD's Protector del Agua Program through TVMWD.

Landscape Water Conservation Requirements for New and Existing Commercial, Industrial, Governmental, and Multi-family Developments

The City has developed irrigation regulations in accordance with the requirements of the Water Conservation Landscaping Act of 1991. The City currently requires all new construction to include landscaping, and the City's Parks Division is currently using soil moisture sensors, provided by the City's Utility Services Department (USD), to control the frequency of watering in the street medians and City parks.

Xeriscape

The City has retrofitted public landscape to include xeriscape plants requiring little or no water. In year 2000, there were approximately 3 miles of street medians paved, not requiring water; approximately 2 miles of street medians required low water use; and approximately 8,500 lineal feet of streets with two sides were irrigated with recycled water. The City continues to incorporate xeriscape into new planning and development.

Water Waste Prohibition

The City has prohibited water wasting since 1954, including unlawful use of fire hydrant water.

Water Conservation Coordinator

The City has assigned water conservation duties to an individual on the USD Business Services Division staff.

Water Conservation Ordinance

The City adopted a Water Conservation Ordinance in 1990. The City's plan is structured in phases and allows the City Council to impose the phase necessary, according to the level of anticipated water shortage. The following phases will take effect upon adoption of a resolution by the City Council declaring an emergency.

- **Phase 1– Voluntary Compliance- Water Watch**: Phase 1 shall apply during periods when the possibility exists that the City will not be able to meet all of the reasonably beneficial demands of its customers or when the regional water supplier requests water conservation measures throughout its service area.

- **Phase 2– Mandatory Compliance - Water Alert**: Phase 2 shall apply during the same periods as for Phase 1: However, the compliance shall be mandatory.

- **Phase 3 – Mandatory Compliance - Water Warning**: Phase 3 shall apply during periods when the City will not be able to meet all of the water demands of its customers. During a Phase 3 shortage, the water use restrictions listed under Phase 2 shall be in effect. In addition, agricultural users, commercial nurseries, golf courses, and other water dependent industries shall be prohibited from watering laws, landscaping, and other turf areas during the hours stated, with no restriction on watering with recycled water.

- **Phase 4 – Mandatory Compliance – Water Emergency Plan**: Phase 4 shall apply when a major failure of any supply or distribution facility, whether temporary or permanent, occurs in the water distribution system of the SWP, MWD, or the City water facilities.

There shall be no restriction on watering with recycled water. The use of water from fire hydrants will be strictly limited to use for fire fighting and related activities. Other uses of water for municipal purposes shall be limited to activities necessary to maintain the public health, safety, and welfare.

Penalties are imposed for violations of prohibited activities as follows:

- **Phase 1 Violation** – Educational letter notice and request to comply with its requirements.

- **Phase 2 Violation** – First violation will receive an educational letter notice and request to comply with its requirements. Second and subsequent violations will be fined $50.

- **Phase 3 Violation** – First violation will receive an educational letter notice and request to comply with its requirements. Second and subsequent violations will be fined $100.

- **Phase 4 Violation** – First violation will receive an educational letter notice and request to comply with its requirements. Second and subsequent violations will be fined $100 and violators will have their flow restricted or their service will be discontinued.

FUTURE WATER SUPPLY SOURCES

This section describes anticipated future changes that are expected to occur with Pomona's water supplies. This section also includes discussions of potential water marketing opportunities and water conservation activities that could be implemented by the City.

Groundwater

Chino Basin

The Chino Basin Peace Agreement addresses the future administration of water rights in the Chino Basin for the next 30 years (60 years if renewed). This includes, among other items, the method for handling Agricultural Pool transfers, development of New Yield, and the administration of storage accounts.

Since Pomona has no agricultural land within the Chino Basin, it will not experience any increased water rights due to land conversion to urban use as will such cities as Chino and Ontario. However, Pomona's Chino Basin water rights are expected to increase in FY 2006-07 due to a anticipated change in the method that unused Agricultural Pool water rights are allocated to the Appropriative Pool. Currently, the Watermaster allocates any difference between Agricultural Pool water rights (82,800 acre-ft/yr) and the combination of actual Agricultural Pool production (currently 41,978 acre-ft/yr, Early Transfers (32,800 acre-ft/yr) and land use conversions (currently 17,510 acre-ft/yr) among the Appropriative Pool members according to their share of the Initial OSY. In FY 2003-04, the total production and transfers exceeded water rights by 9,489 acre-ft/yr and reduced Pomona's water rights by about 1,941 acre-ft/yr. This adjustment is believed to be done *in lieu* of the Appropriative Pool purchasing replenishment water. Beginning in FY 2006-07 (or sooner if the difference between total production and water rights exceeds 10,000 acre-ft/yr), the Appropriative Pool is required to reconsider its method for apportioning replenishment water costs, if any.

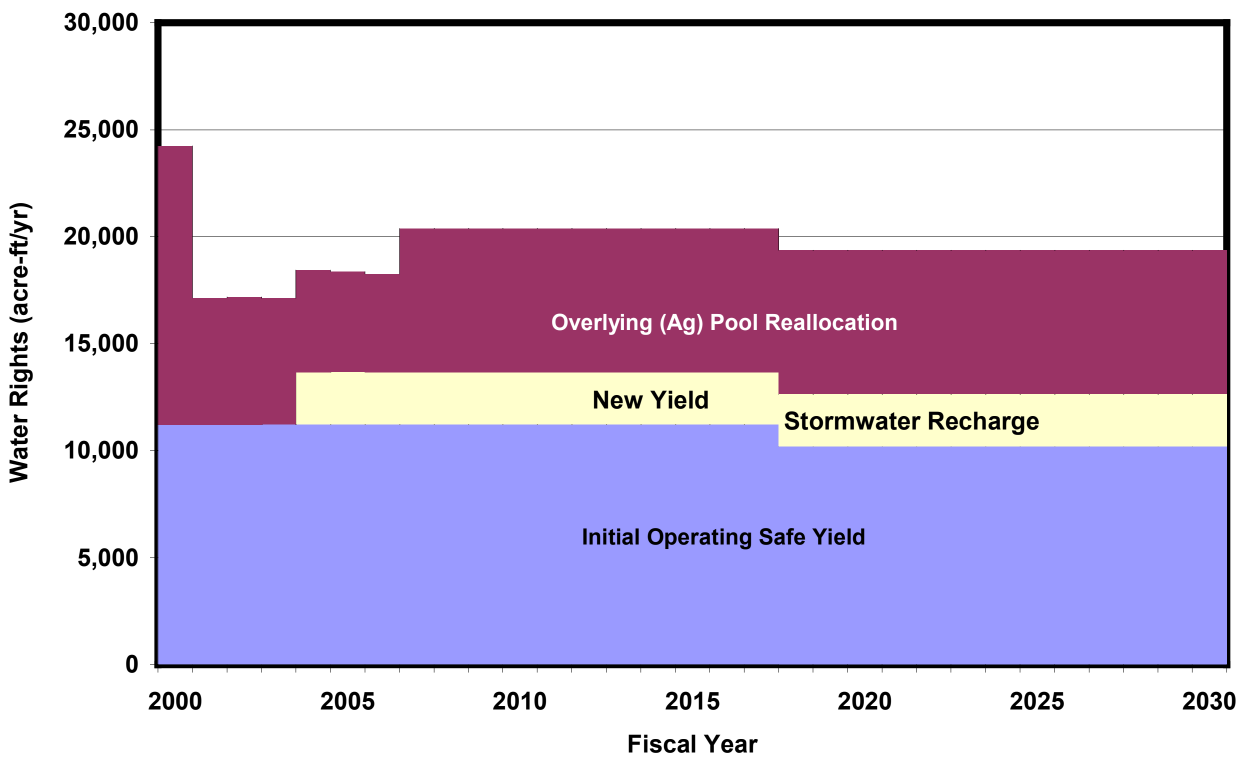
For this evaluation, Pomona's future water rights are estimated based on a review of the Judgment and the Peace Agreement. The Peace Agreement states that the Early Transfer amount shall be no less than 32,800 acre-ft/yr. Under the terms of the Judgment as amended in 1995, if the unallocated Agricultural Pool water is insufficient to satisfy all outstanding conversion claims, the Watermaster is required to prorate the available unallocated water based on the acres of converted land. This allocation method differs from the current method, which apportions any shortfalls to all members of the Appropriative Pool. This results in Pomona's Early Transfer remaining at 6,709 acre-ft/yr for the duration of the Peace Agreement. In addition, Pomona is assumed to continue receiving its share of the 12,000 acre-ft/yr of New Yield (2,454 acre-ft/yr). Pomona's share of the OSY would reduce from 11,216 acre-ft/yr to 10,193 acre-ft/yr on July 1, 2017 when the 200,000 acre-ft controlled overdraft authorized by the Judgment expires.

It is assumed that all potential agricultural water rights will be transferred to Appropriative Pool pumpers through land use conversions by 2030. Based on Appendix 1 to the 1995 Judgment Amendment, the total acreage of agricultural land eligible for conversion in FY 1994-95 is 32,343 acres. Since that time, about 11,000 acres of land have been converted. The remaining acreage is expected to convert by 2030. It should be noted that the actual transfer of Overlying (Agricultural) Pool water will depend on the rate of development of the Agricultural Preserve area. Based on this conversion, it is estimated that the Early Transfer plus the land conversions will exceed the total Agricultural Pool rights of 82,800 acre-ft/yr. Since the Judgment requires that any shortage be prorated based on acres converted, there would be no effect on Pomona's water rights.

Figure 5-3 shows the City's projected Chino Basin water rights through FY 2024-25. This figures shows that Pomona's rights would be 20,279 acre-ft/yr for FY 2006-07 through FY 2016-17. For FY 2017-18 and after, Pomona's rights would be 19,356 acre-ft/yr. If it is cost-effective, the City could produce water in excess of its Chino Basin water rights by either leasing rights from other producers or by paying the replenishment assessment. The cost-effectiveness of over-production should consider the energy required to pump Chino Basin water to Zone 5 in comparison to purchasing treated imported water from MWD.

Pomona currently accrues about 1,300 acre-ft/yr of water to its Chino Basin storage account as a result of the Management Zone 1 recharge program. This program is scheduled to be terminated once 32,500 acre-ft has been recharged (estimated to occur in 2006) unless continued by the Watermaster. This would affect Pomona's storage account. Beginning in 2005, the annual loss rate for storage accounts will be set at 2 percent until recalculated based on best available scientific information (Peace Agreement, 2000). Based on its current storage volume, Pomona would lose approximately 271 acre-ft/yr from its storage account.

Figure 5-3
City of Pomona Projected Chino Basin Water Rights



Six Basins

In the Six Basins area, Pomona has consistently under-produced its water rights due to poor water quality and now has about 4,200 acre-ft of water in storage, in addition to its base rights. Pomona is also limited to a 25 percent annual carryover of its water rights in a given year. Since

Six Basins water is relatively high in the system, it is more economical to produce than Chino Basin groundwater. Consequently, it is in Pomona's interest to maximize production from the Six Basins area.

Additional treatment facilities are planned in the future to improve water quality in the City's water supplies. A nitrate blending plan for Wells 7 and 8B was completed in 2004. These wells were previously inactive due to high nitrate concentrations and VOC concentrations. Since blending the poor quality water with uncontaminated water from wells or imported sources has been successful in reducing nitrate levels, the City plans to use similar treatment process for these wells. In addition to nitrate, TCE and 1,1-DCE are also contaminants of concern in Wells 7 and 8B. The City provides VOC removal treatment for these two wells and for Well 32 at the I-10 and Towne Groundwater Treatment Plant at the Reservoir 5 site. There is also VOC removal treatment for Well 3 at the Well 3 site. Returning Wells 7 and 8B to active production status will allow Pomona to pump a significant portion of its Six Basins rights. Other planned projects including nitrate treatment facilities for Well 20 and Well 37 (Harrison Well) will add to the City's Six Basin production. The City should also consider locations for new wells in the Pomona Basin. Proper location of wells could be beneficial for controlling shallow groundwater in the old Palomares Cienega area and creating a pumping depression to control the migration of poor quality water across the San Jose fault.

Spadra Basin

The City could also consider construction of new wells in the Spadra Basin to maximize the yield of this basin. Although investigation of this basin is beyond the scope of this master plan, the City should identify potential well sites that may have good quality water.

Surface Water

The City's rights to San Antonio Canyon water are fixed by judicial decree and could only be increased by purchasing water rights from SAWC. This is unlikely. However, as mentioned previously, storm damage in early 2005 has adversely affected the yield from Evey Canyon. Absent any action on Pomona's part, the yield from Evey Canyon could be reduced to about one-third of its historical production.

Imported Water Supplies

City could purchase additional imported water in the future. Costs of imported water are expected to increase, as more costly supplies are developed to meet future demands in Southern California.

City has constructed a connection to TVMWD's Miramar Treatment plant to supplement surface water supplies during dry years. This project is partially completed and requires a relatively small capital expenditure for pipeline, metering and flow control facilities to Reservoir 13 to complete the project. Since Pomona did not participate in the development of this plant, this water would probably be available only when other project participants are not using the water. This reduces the reliability of this source.

Water Marketing

Water marketing, for the purpose of the following discussion, is the sale of the City's water, or groundwater rights, to another entity for the purpose of generating revenue. When applied to groundwater rights, the sale of water is actually a temporary transfer, or lease, of water production to another agency during a specific year. Groundwater rights can only be sold, or leased, in the Chino Basin. In the sales of groundwater rights in the Chino Basin from one agency to another, no actual water is transferred between agencies. The groundwater rights are sold to another agency, then that agency must produce (extract) the groundwater from the basin. This transaction does not require the City to produce any of the groundwater sold. The City can also sell water. In this case, the sale of water to another agency refers to the physical extraction and treatment of groundwater by the City and the subsequent sale of the water to another agency.

The City has groundwater rights (annual and storage combined) which currently exceed the groundwater production capacity. Every year the City must supplement its water supply needs through the purchase of expensive imported water and then sell, at more than half the cost of the imported water cost, the unused groundwater rights. The City typically sells groundwater rights from a storage account in the Chino Basin; however, this storage account will eventually be depleted and will no longer be available as a revenue source, or for drought protection.

The City should consider using the revenue generated from the sale of unused, or stored, groundwater rights to construct new groundwater production facilities that will help meet the City's long-term water supply needs.

With the long-term goal of increasing the City's groundwater production/treatment capacity, the City may consider investigating and developing projects for the following water marketing concepts. There are nine different water-marketing concepts discussed below. Other water market concepts exist, but they generally fall into one of the categories below.

Concept No. 1 - Production and Exportation of Available Groundwater Rights

In this concept, available (unused or stored) groundwater rights would be pumped, treated, and then sold/delivered to an adjacent city/water district. The City could deliver a portion of their current water supply to one of the following agencies through existing interconnection, or, in the case of Walnut Valley Water District (WVWD) and Rowland Water District (RWD), the City could deliver the water through the PWR Joint Water Line (PWR-JWL). This concept has several challenges.

- The interconnections to the WVWD system is limited in capacity and would require a small booster pumping station because WVWD's pressure exceeds that of the City's water system. Limited capacity, pumping and production/treatment costs decrease the revenue potential of this concept.
- The City has no connection to RWD, and delivery of water could only be possible through the PWR-JWL. To deliver water to RWD, the City would have to deliver treated groundwater to the PWR-JWL. DHS would have to approve of the delivery of treated groundwater to the PWR-JWL and would likely reclassify the pipeline as a community water

system. The cost associated with reclassification and maintenance of the water permit, would add to the operational cost of delivering the water and reduce the revenue potential.

- It is likely that the groundwater produced from one of the City's groundwater basins will require treatment, which will increase the cost of the water. Additional treatment capacity could be met through the construction of wellhead treatment, the leasing of wellhead treatment units, or though the construction of additional treatment capacity at the existing AEP. The capital cost of wellhead treatment or the leasing of wellhead treatment units, would increase the cost of the groundwater. In addition, groundwater treated at the AEP would require boosting (lifting) of the water to all adjacent agencies and to the PWR-JWL. This additional treatment/deliver cost would also increase the production cost to the PWR-JWL.
- The biggest challenge is that the City does not have annual excess production capacity to produce the groundwater for sale. If the City were to sell water to an adjacent city or water agency without having excess water, then the City would need to replenish their supply needs through the purchase of imported water. Alternately, the City would need to build new production facilities to produce excess water.

Concept No. 2 – Relocation of PM-11

In this concept, one of the City's imported water connections (PM-11), which is connected to the Orange County Feeder, would be relocated north, near the connection of the City's main imported water connection from the PWR-JWL, in the vicinity of the intersection of Arrow Highway and E Street. The City uses the existing PWR-JWL connection to delivery high quality treated water to the Reservoir 5 site for blending purposes. This concept considers replacing their PWR-JWL treated water connection at Arrow Highway and E Street with a new connection to the relocated PM-11 turnout. The City would then use exclusively the PM-11 connection to provide blend water to the Reservoir 5 site. The agencies in the northern part of the Six Basins area could then deliver groundwater from impaired (poor water quality) wells into the PWR-JWL for sale at some fraction of the imported water cost. The PWR-JWL would be utilized as a blending conduit for the impaired groundwater wells that currently have high concentrations of nitrates. This concept has several challenges.

- The City's current connection capacity at the PWR-JWL is 40 cfs. The relocated PM-11 connection would be rated at 10 cfs. In this scenario, the City could not take water from the Arrow Highway and E Street connection to the PWR-JWL for blending purposes because the PWR-JWL pipeline would now contain a higher concentration of nitrates and would not be suitable for blending purposes. Therefore, the City's connection capacity would essentially be reduced by 30 cfs, which is not sufficient to meet the City's water supply needs.
- Groundwater production capacity from the upper portions of the Six Basins area is limited and highly dependent on the groundwater levels. These groundwater levels fluctuate sharply with dry and wet years. Therefore this option would not be a consistent revenue generator.
- This option would likely have the same DHS regulatory issues as Concept No. 1 with the potential reclassification of the PWR line as a community water system.
- There would be several entities involved in the production, delivery, and purchase of this blended well water, and would have limited revenue potential. In addition, the relocation of the PM-11 connection is costly (roughly $1 million) and would also require a pipeline from

PM-11 to Arrow Highway and E Street. This capital cost would further reduce the revenue potential.

Concept No. 3 – Construct and Impaired Groundwater Pipeline

This concept is a slight variation on Concept No. 2. In this concept, impaired groundwater wells in the upper areas of Six Basins, that are currently offline for water quality reasons, would be connected through a new pipeline. This impaired groundwater pipeline would then connect to the PWR-JWL pipeline, downstream of the City's connection at Arrow Highway and E Street. A backflow structure would have to be constructed on the PWR-JWL to prevent impaired water from entering the City's turnout so that the City could still use its 40 cfs connection for blending purposes. This concept would also allow the City to connect Well 37 to the impaired groundwater pipeline. This concept has several challenges.

- Groundwater production capacity from the upper portions of the Six Basins area is limited and highly dependent on the groundwater levels. These groundwater levels fluctuate sharply with dry and wet years.
- The construction of a backflow structure on the PWR-JWL pipeline would be costly, and may present operational problems. The construction of the impaired water pipeline and the backflow structure results in very high capital costs. In combination with the inconsistent water supply, this would result in a low revenue potential.

Concept No. 4 – Increase the Groundwater Production to the Recycled Water System

The City owns four groundwater wells within the Six Basins that were acquired from the Pomona (Simpson) Paper Company. These groundwater wells have relatively small production capacity, but are in a good location of the Pomona Basin to withdraw groundwater. The City could expand its recycled water system by rehabilitating these wells and connecting them to the recycled water system. Potential recycled water users are identified in **Section 10**. The additional non-potable water supply could offset potable imported water production needs. This concept has a couple of challenges.

- Roughly 10,000-ft of pipelines (Black and Veatch, Evaluation of Water Marketing Strategies, 1999) would need to be constructed to connect all of the wells to the recycled water system.
- All of the Pomona (Simpson) Paper wells require some sort of rehabilitation to make them reliable production wells. These wells were originally agricultural wells and are not suitable for potable use. They are in poor repair and have not been operated in a number of years.
- Although the City does not currently utilize all of its rights in Six Basins, if additional groundwater production is added to fully utilize water rights in Six Basins, the water rights may be better utilized for producing potable water to offset any imported water purchase requirements. An economic evaluation of refitting these wells for non-potable use and construction/rehabilitation of conveyance facilities should be performed to determine whether non-potable use of these wells is more appropriate than potable production elsewhere in the basin.

Concept No. 5 – Increase Spadra Basin Production

The Spadra Basin is currently not adjudicated and, therefore, production from the basin is limited only by groundwater well capacities and the basin characteristics. This concept would require the installation of additional wells within Spadra Basin. It is likely that new groundwater wells in the Spadra Basin will encounter groundwater with quality issues. However, if the wells encountered poor quality groundwater, then the new wells could be connected to the recycled water system, essentially offsetting the potable water requirements. This concept has several challenges.

- New wells would need to be constructed. WVWD recently drilled a groundwater well (the Valley Well) within the Spadra Basin and found it have a very low production capacity. The City runs the risk of drilling a new well also with very low production capacity. A low production capacity would decrease the economic viability of the project.
- The City has two recycled and one potable groundwater wells in the Spadra Basin. Two of the three wells are recycled groundwater wells because of water quality issues. A new well most likely have similar water quality issues and therefore would be used as a recycled groundwater well.
- The recycled water system in this area has no storage and operation of the well would be subject to demands.

Concept No. 6 – Sell Groundwater Rights from Chino Basin Storage Account

This concept has been utilized by the City of many years. The City currently has roughly 15,000 acre-feet (acre-ft) of water in their Chino Basin storage account. Over the past 5 years, the City has sold, or transferred, almost 24,000 acre-ft of water from their storage account to other Chino Basin entities. This concept does not require the City to produce any groundwater and therefore is currently the only concept that can be implemented without adding new production facilities.

Although this concept is the only currently viable water marketing concept, the eventual depletion of the City's Chino Basin storage account would reduce the City's drought protection. MWH recommends that the Chino Basin storage account be maintained at a minimum of the City's current base share of the OSY or 11,216 acre-ft. The storage account in Six Basins should be maintain at a minimum of 2,100 acre-ft (about six months of water rights). This storage amount represents about 90 percent of the City's imported water (firm plus replenishment) needs in 2025. This would allow the City to sustain a 50 percent interruption of imported water during a three-year drought. The City could continue to sell groundwater rights, above the 13,316 acre-ft threshold to generate revenue to construct new groundwater production and treatment facilities that reduce dependence on imported water.

Concept No. 7 – Increase Participation in a Dry Year Yield Program

The City is currently participating in a DYY Program, led by the IEUA/TVMWD in combination with Chino Basin groundwater pumpers. In this program, MWD can store, through in-lieu water deliveries, water in the Chino Basin during "wet" years, or when MWD has surplus water. During dry years, MWD would reduce their imported water deliveries to the City by 2,000 acre-ft per year (with a maximum of 6,000 acre-ft in a three-year period). The City would replace the undelivered imported water delivery with groundwater production from the Chino Basin, using the groundwater stored by MWD. MWD has provided funding to construct additional treatment capacity at the AEP to treat the additional 2,000 acre-ft/year.

The City could look for other storage programs to receive additional funding for new facilities. However, the Chino Basin is the only basin in which storage is an option and typical sponsors of similar programs, like MWD, look for regional participation that would provide a significant local supply in dry years. In this case, the City most likely will not receive funding without the participation from other Chino Basin entities. In addition, the storage of groundwater in the Chino Basin would have to be approved by the CBWM and the other members of the Chino Basin.

This concept does provide revenue that could be used to fund projects that would increase both production and treatment capacity. However, this additional production and treatment capacity can only be used while the sponsoring agency (i.e. MWD) is not using the facility. Consequently, in dry years, this additional capacity (production and treatment) does not provide the City a consistent long-term available water supply resource.

Concept No. 8– Increase Surface Water Production at the Pedley Filtration Plant

The Pedley Filtration Plant has been deemed as having alternate technology pursuant to an evaluation of the DHS. Because of this classification, the plant's original production was at 5 mgd but was eventually reduced to 4 mgd. In this case, the City could create an untreated water connection from the Rialto Feeder to the Pedley untreated water pipeline. This would allow the City to purchase untreated water from MWD, and maintain the Pedley Plant at its capacity. Currently the surface water deliveries to the Pedley Plant have steadily declined over the past few years, due to drought conditions. This untreated water connection would allow the City keep the Pedley Plant running at capacity. Untreated water could also be diverted from the treatment plant to the spreading grounds at the Pedley site, but based on the cost of untreated water, this alternative would not be cost effective.

Based on cursory review of the treatment technology used at the Pedley Filtration Plant, the untreated water from the Rialto Feeder (SWP water) could be treated at the plant. However, the availability of water from the Pedley Plant is subject to the overall demand of existing customers and MWD's untreated water supply. The City may have low priority in drought years and potentially could not supplement deliveries to the Pedley Plant.

Concept No. 9 – Increase Size of Existing Spreading Basin at the Pedley WTP

The City has a spreading basin at the Pedley treatment site. During the construction of Reservoir 13A & 13B, excess soil was dumped into this spreading basin, decreasing the overall capacity of the basin. Although some of the soil was re-used to fill in around the reservoirs, much of it still occupies the spreading basin.

When surface water arrives at the Pedley Plant with high turbidity, the City diverts the flows into this spreading basin. On average, the basin is able to spread about 1,500 to 2,000 acre-feet of water. The City not only receives basin credits in the form of additional water rights when water is spread in the basin, but the production of nearby tunnel wells is increased significantly. By having the additional spreading capacity, the City could capture more of this high turbidity water, which correlated in additional water capacity and water production from the nearby tunnel wells.

MWH recommends that the City investigate the economic viability of Concepts No. 5, 8, and 9, which would have the most direct impact on the City's long-term water supply.

Water Pricing

When an agency looks to purchase additional water, they may choose to do one of the following:

- Purchase imported treated water from MWD
- Produce additional groundwater from their basin, and pay to have the basin replenished (recharged) with imported untreated water.
- Purchase additional water rights from another basin agency with excess groundwater rights, and produce that water using their own facilities.

The agency that buys, or could buy, water from the City would compare the City's price of water (or water rights) to the price of imported treated and untreated water from MWD. That price varies between the local MWD member agencies – TVMWD and IEUA. Currently the IEUA imported water costs is $335/acre-ft (Tier 1) and $416/acre-ft (Tier 2) for treated water and $238/acre-ft for untreated replenishment water and the TVMWD rate for imported treated water is $481/acre-ft (2005 melded rate).

In addition, those agencies that extract groundwater from the Chino Basin above their annual groundwater rights allocation must pay $250/acre-ft for replenishment water ($238/acre-ft + IEUA and CBWM surcharge). Those agencies that extract groundwater from the Six Basins above their annual groundwater rights allocation must pay $265/acre-ft for replenishment water. These two replenishment rates essentially create a ceiling for the sale of Pomona's water and water rights. The ceiling is actually lower for Chino Basin agencies because they actually pay 85 percent of the replenishment rate and the other 15 percent of the costs is distributed to Appropriative Pool members within the IEUA and Western Municipal Water District service areas further reducing the ceiling to $212.50/acre-ft.

Over the last five years, the City has sold over 23,900 acre-ft of water rights at roughly $200/acre-ft, which is just over $4.8 million (just under $1 million each year). Over the last 10 years, the City's storage account in Chino Basin has dropped from 56,705 acre-ft to 15,422 acre-ft (through June of 2004), or just over 41,200 acre-ft. At roughly 4,000 acre-ft water sold each year, the City's storage account will be depleted by the end of June 2008.

The price that City's could sell their water rights for is limited in both price and availability. However, if the City were able to produce and treat the water, and sell it to an agency, which has limited groundwater capacity (WVWD or RWD), then the artificial ceilings in the Chino Basin and Six Basins would no longer exist. The water price for those agencies would then be comparable to the imported treated water price from TVMWD, or $481/acre-ft.

If the City were to augment their production and treatment facilities to meet their long-term needs, or short-term water marketing needs, they could generate revenue from the sale of water to other adjacent water cities/districts at a higher margin than the sale of water, or water rights, to Chino Basin or Six Basins entities. Based on conversations with the City staff, the City's current production and treatment cost of water is roughly $200/acre-ft. The City could then set their price for water between $400/acre-ft ($200/acre-ft production/treatment plus $200/acre-ft typical price of water right sold in Chino Basin) and $481/acre-ft (TVMWD imported treated water price).

Water Conservation

Per State law, the City is required to adopt an urban water management plan (UWMP) and submit the plan to DWR every five years, (California Water Code, Sections 10610-10656). As part of its 2005 plan update, the City must conduct an evaluation of the feasibility of the various water conservation measures and establish a budget for water conservation activities. The UWMP will identify specific programs for meeting the urban water conservation goals established in the Water Management Plan.

State law establishes a number of policies regarding water conservation and the use of recycled water. It mandates several water conservation techniques, which have been implemented in the Chino Basin. For example, California plumbing codes have required the installation of ultra-low-flush toilets (1.6 gallons/flush) and low-flow showerheads (2.5-gpm maximum) on all new construction since 1992. The Federal Energy Policy Act of 1992 mandated these same standards nationwide on all plumbing fixtures manufactured since January 1994. The *Water Conservation in Landscaping Act* (California Government Code, Sections 65591-65600) required each city and county to adopt a water efficiency ordinance for landscaping or enforce the Department of Water Resources' model ordinance by January 1, 1993. State law also includes the *Water Recycling in Landscaping Act* (California Government Code, Sections 65601-65607) which requires recycled water producers to notify local agencies of the availability of recycled water and requires local agencies to adopt and enforce a recycled water ordinance within 180 days of be notified.

In addition to state law, water agencies and public interest groups developed the *Memorandum of Understanding Regarding Urban Water Conservation* (MOU), first adopted December 11, 1991 (as amended March 10, 2004) (CUWCC, 2004). The MOU asks that participating water agencies commit to make a "good faith effort" to: 1) develop comprehensive conservation Best Management Practices (BMPs) programs using sound economic criteria and 2) consider water conservation on an equal basis with other water management options.

The MOU has identified a list of BMPs for urban water conservation that are generally recognized as producing more efficient water usage and are technically and economically feasible. The list of BMPs was updated in September 1997 to include the following:

1. BMP 1 - Water Survey Programs for Single-Family Residential and Multi-Family Residential Customers
2. Residential Plumbing Retrofit

3. System Water Audits, Leak Detection and Repair
4. Metering with Commodity Rates for all New Connections and Retrofit of Existing Connections
5. Large Landscape Conservation Programs and Incentives
6. High-Efficiency Washing Machine Rebate Programs (new)
7. Public Information Programs
8. School Education Programs
9. Conservation Programs for Commercial, Industrial, and Institutional Accounts
10. Wholesale Agency Assistance Programs (new)
11. Conservation Pricing
12. Conservation Coordinator
13. Water Waste Prohibition
14. Residential Ultra Low Flush Toilet (ULFT) Replacement Programs

Pomona's 2000 Urban Water Management Plan projected a 5 percent water conservation savings. This value will be updated in 2005 when the City revises its plan. Consequently, the 5 percent value will be used in this master plan. The funding of water conservation at City Parks could be explored. City Parks are City of Pomona accounts (COPA) and therefore are not charged for water use. This practice may not encourage water conservation on COPA accounts.

WATER QUALITY EVALUATION

Water Quality Regulations

This subsection discusses existing water quality regulations and how they impact the City's sources of supply.

Current Regulations

The Safe Drinking Water Act (SDWA, Public Law 99-339), originally enacted in 1974, gave the federal government, through the Environmental Protection Agency (EPA), the authority to set standards for drinking water quality in water delivered by community (public) water suppliers. In 1986 and 1996, Congress passed major amendments to the SDWA.

The California Safe Drinking Water Act is contained in Health and Safety Code Sections 4010 through 4037.5. The primacy agency for California is the DHS. California drinking water regulations are contained in Code of California Regulations Title 22, Chapters 15 through 17, "Domestic Water Quality and Monitoring Regulations" Sections 64400 through 64692. As a primacy state, California drinking water regulations must be at least as stringent as federal regulations. State regulations can be more stringent than federal requirements.

The EPA has established new maximum contaminant levels (MCLs) and monitoring requirements for many additional contaminants pursuant to the federal Safe Drinking Water Act Amendments of 1986 and 1996. As primacy agency in California, the DHS has adopted more stringent standards for a number of inorganic compounds (IOCs), volatile organic compounds (VOCs) and synthetic organic compounds (SOCs).

Increase in Number of Regulated Constituents. Since the last City Master Plan was prepared in 1992, EPA has promulgated standards for 60 contaminants in the Phase II and Phase V regulations published in 1991 and 1992, respectively. Most of these contaminants were previously regulated in California. No significant impact is foreseen concerning water quality compliance for these contaminants.

MTBE. Methyl-tertiary-butyl-ether (MTBE) is a gasoline additive that has contaminated ground water and surface water. DHS published a primary MCL for MTBE of 0.013 mg/L effective May 2000. The secondary MCL for MTBE of 0.005 mg/L, effective January 1999, is based on taste and odor concerns. The City should ensure that it is routinely monitoring for MTBE as part of its source monitoring program. The concentration of MTBE in City wells is less than the MCL.

Fluoridation. In 1993, the State of California passed a law requiring any public water system with 10,000 service connections or more that does not have a fluoridation system to install a fluoridation system if DHS identifies a source of sufficient funds to cover capital and any associated costs necessary to install such a system. Installation shall be completed within two years of the date the funds are received by the water system. Due to its size, the City is affected by this requirement. The City of Pomona is ranked 37th on the state's priority list. The complexity of the City's water system with multiple supplies would make implementation difficult and costly.

Stage 1 Disinfectants/Disinfection By-Product Rule. The EPA published the Stage 1 Disinfectant/Disinfection By-Product (D/DBP) Rule in December 1998. This new rule:

- reduced the existing MCL for total trihalomethanes (TTHM) from 0.10 mg/L to 0.080 mg/L
- established new MCLs for haloacetic acids (HAAs or HAA5) at 0.060 mg/L, bromate at 0.010 mg/L and chlorite at 1.0 mg/L
- established Maximum Residual Disinfectant Levels for chlorine (4 mg/L), chloramines (4 mg/L), and chlorine dioxide (0.8 mg/L) within the distribution system
- established enhanced coagulation requirements for the reduction of DBP precursors (using total organic carbon as a surrogate for DBP precursors) for surface water systems using conventional treatment.

Since the City serves more than 10,000 people, it must comply with this rule beginning January 2002. Systems using only groundwater were required to comply beginning January 2004. As of April 2005, DHS has not yet adopted the Stage 1 DBP Regulation, but issued draft regulations in March 2005. However, compliance with the federal regulation is still required. Compliance with the revised THM standard and the new HAA standard can be first demonstrated after four quarters of distribution system monitoring data are collected. The City has been collecting and analyzing quarterly distribution monitoring data for determining compliance.

Interim Enhanced Surface Water Treatment Rule. In December 1998, the EPA published the final Interim Enhanced Surface Water Treatment Rule (IESWTR). This rule:

- Established a requirement to achieve a 2-log reduction in *Cryptosporidium* for surface water systems that filter;
- Lowered the existing turbidity performance standards from 0.5 nephelometric turbidity units (NTU) in 95 percent of the monthly measurements not to exceed 5 NTU, to 0.3 NTU in 95 percent of the monthly measurements not to exceed 1 NTU;
- Credits public water systems meeting the new turbidity performance standards with the required 2-log reduction in *Cryptosporidium*;
- Established requirements for continuous monitoring of individual filter effluents;
- Required filing an exceptions report with the State if individual filters are not performing adequately (as defined) and may require a comprehensive performance evaluation;
- Established requirements for covers on new finished water reservoirs;
- Required states to conduct periodic sanitary surveys (every three years);
- Required certain systems to compile a disinfection profile and prepare a disinfection benchmark;
- Mandated HAA monitoring within three months of publication of the final rule (quarterly monitoring of four distribution system samples for HAAs for one year) to determine if systems serving greater than 10,000 people must compile a disinfection profile and prepare a disinfection benchmark. TTHM and HAA monitoring to determine if a disinfection profile and a disinfection benchmark are required must occur in the same year. Information Collection Rule data can be used for public water systems serving over 100,000 people.

The IESWTR applies to systems utilizing surface water or groundwater under the direct influence of surface water and serving more than 10,000 people. These systems were required to begin compliance starting January 2002. DHS prepared draft regulations to implement the IESWTR in March 2003 that are in review. The City is affected by the IESWTR since it operates the Pedley Water Treatment Plant.

California Notification Levels. Notification levels (NLs) are health-based advisory levels established by DHS for chemicals in drinking water that lack MCLs. When chemicals are found at concentrations greater than their notification levels, certain requirements and recommendations apply. Since the early 1980s, DHS has established NLs (referred to as “action levels” through 2004) as needed for 89 unregulated chemicals. Of these, 38 chemicals now have established MCLs and 51 have current NLs of which 25 have archived advisory levels. Most of the archived NLs are for pesticides that have not been detected in drinking water but are of concern in the Central Valley. DHS recommends that water systems provide public notification if NLs are exceeded, unless the sources are taken out of service. Water systems are required to notify local governing agencies within 30 days whenever an NL is exceeded. DHS recommends that sources be removed from service if analysis results are ten times the NL for non-carcinogens and 100 times the NL if the NL is based on cancer risk and established at the 10^{-6} risk level (except for n-nitrosodiethyamine (NDEA), n-nitrosodimethylamine (NDMA) and n-nitroso-di-n-propylamine (NDPA), which are 10, 20 and 50 times the NL, respectively) (DHS, 2005). NDMA and NDPA are discussed later in this section under **Groundwater Quality**.

California Public Health Goals. Under California law, the State Office of Environmental Health and Hazard Assessment (OEHHA) establishes public health goals (PHGs) for contaminants that represent the allowable level of contaminants in drinking water that are protective of public health. PHGs are not enforceable limits, but instead are used in the development of MCLs. Once a PHG is finalized, DHS will set an enforceable MCL as close as feasible to the PHG taking costs and technology into consideration.

Nitrate. Nitrates and nitrites are nitrogen-oxygen compounds that combine with various organic and inorganic compounds. The greatest use of nitrates is as a fertilizer. Once taken into the body, nitrates are converted into nitrites. Both EPA and DHS established the MCL for nitrate at 10 mg/L as nitrogen and for nitrite at 1 mg/L as nitrogen. Infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome. Many Pomona wells are affected by high nitrate concentrations that are a legacy of historical agricultural land use. Pomona complies with the MCL through blending of high and low nitrate waters where practical and, in 1992, constructed the AEP to remove nitrate from its Chino Basin wells.

Perchlorate. Perchlorate is used in the solid propellant of rockets, missiles and fireworks, as well as a variety of other industrial uses and appears to be associated with certain types of fertilizers. Perchlorate interferes with the thyroid gland's uptake of iodine to produce thyroid hormones. Although there is no MCL for perchlorate, DHS has had a NL for perchlorate of 18 μg/L since 1997. In January 2002, DHS lowered the NL for perchlorate from 18 μg/L to 4 μg/L based on an EPA draft toxicity assessment for perchlorate, which suggests that the risks from exposure to perchlorate in drinking water may be greater than previously thought. In March 2004, OEHHA published a final perchlorate PHG of 6 μg/L. DHS subsequently revised its perchlorate NL to 6 μg/L. DHS anticipates proposing a perchlorate MCL in 2005. The MCL will be set as close as technically and economically feasible to the PHG).

When an NL is exceeded, water systems are required to notify local government agencies (e.g., County Board of Supervisors or the City Council). DHS recommends notification of consumers when an action level is exceeded. DHS also recommends removal of a source when results are 10 times the NL (60 μg/L for perchlorate). The lower Action Level for perchlorate has caused a number of water agencies to remove groundwater sources from service.

The City has 19 wells that have detectable perchlorate concentrations and 14 wells that are over the current 6 μg/L PHG and NL. Until the MCL is in place, DHS will continue to use 6 μg/L as a notification level to advise water systems and others. Perchlorate findings above that level prompt new requirements, pursuant to a new state law as discussed below, as well as recommendations for consumer notification and, at higher levels, source removal. Treatment at the AEP effectively removes perchlorate from the water.

Arsenic. Arsenic is a naturally occurring inorganic contaminant found in some groundwater and surface water supplies and is considered a known human carcinogen. In its March 1999 report, the National Research Council stated that "the current MCL of 0.05 mg/L does not achieve the EPA's goal for public-health protection and, therefore, requires downward revision as promptly as possible." In June 2000, the EPA proposed a revised MCL for arsenic of 0.005 mg/L, and requested public comment on alternate MCLs at 0.003 mg/L, 0.01 mg/L and 0.02 mg/L. The EPA established the final MCL for arsenic at 0.01 mg/L in January 2001. In March 2001, the EPA proposed to withdraw the new arsenic MCL pending independent review of the standard. On October 31, 2001, the EPA Administrator announced that the final MCL for arsenic would remain 0.010 mg/L. In December 2001, the Natural Resources Defense Council petitioned the US Court of Appeals for a review of the final arsenic MCL. The effective date for the arsenic rule is February 22, 2002 and the compliance date for the regulation is January 23, 2006. All surface water systems must complete initial monitoring by December 31, 2006 while groundwater systems must complete initial monitoring by December 31, 2007. The concentration of arsenic in City wells is less than the current MCL, except for Well 35 that had an arsenic level of 18 μg/L in May 2005. The USD has budgeted for arsenic removal treatment for this well to be completed in FY 2006-07.

Public Notification. Health and Safety Code Section 116455 establishes new public notification requirements effective January 1, 2005. A public water system must comply with these requirements within 30 days after it is first informed of a confirmed detection of a contaminant found in drinking water delivered by the public water system for human consumption that is in excess of a MCL, a NL, or a response level established by DHS. If the public water system is a retail water system, then the person operating the retail water system shall notify the retail water system's governing body and the governing body of any local agency whose jurisdiction includes areas supplied with drinking water by the retail water system. The notification shall identify the drinking water source, the origin of the contaminant, if known, the MCL, response level, or NL, as appropriate, the concentration of the detected contaminant, and the operational status of the drinking water source, and shall provide a brief and plainly worded statement of health concerns.

Future Regulations

Several regulations are under development at the federal and state levels that could affect water utilities using, or planning to use, groundwater to augment their supplies. Six pending regulations could be significant for local groundwater supplies: arsenic, chromium 6, radon, sulfate, groundwater treatment rule and the Stage 2 DBP Rule.

Arsenic. Health and Safety Code Section 116361 required DHS to adopt a new arsenic MCL by June 30, 2004. DHS was unable to meet the June 2004 requirement because at that time there was no PHG for arsenic. In April 2004, the OEHHA established the arsenic PHG at 0.004 μg/L, based on risks associated with cancers of the lung and urinary bladder. DHS is now proceeding with the MCL process for arsenic; however, no timeline was provided on the DHS website as of April 2005.

Chromium 6. Hexavalent chromium (chromium 6) is known to cause cancer when it is inhaled; however, the evidence for its carcinogenicity when ingested is not compelling. California regulates chromium 6 in drinking water by a total chromium MCL. Total chromium consists of both the chromium 6 and a less-toxic form of the metal, trivalent chromium (chromium 3). The California MCL for total chromium is 0.05 mg/L (the federal MCL for total chromium is 0.1 mg/L). The OEHHA adopted a PHG for total chromium of 0.0025 mg/L in February 1999. In November 2001, OEHHA withdrew its PHG for total chromium in drinking water. OEHHA is developing a new chromium 6 PHG that will replace the withdrawn PHG for total chromium. DHS will use the new PHG to develop a chromium 6 drinking water standard as required by state law. As of April 2005, there is no schedule for adopting the new PHG or the MCL. Analyses for chromium 6 in City wells ranged from 0.6 to 51 μg/L with only one well (Well 11) exceeding 10 μg/L.

Radionuclides. DHS issued a notice of proposed rulemaking to adopt updated drinking water regulations for radionuclides (radium-226, radium-228, gross alpha particle activity, uranium, beta/photon emitters, strontium-90 and tritium). This proposed regulation will incorporate all of the federal regulations except for uranium which will be kept at the more stringent state MCL of 20 picocuries per liter. Comments on the proposed regulations are due June 13, 2005. These regulations could be adopted in late 2005. The regulations are expected to have minimal effect on the water system operation as the numerical limits will not change; however, some of the monitoring requirements may be reduced.

Radon. Radon is a naturally occurring gas that is a radioactive decay product in certain rock formations. Under the 1996 amendments to the SDWA, the EPA published for public comments a health risk reduction and cost analysis for a potential radon standard on February 5, 1999. The EPA was required to propose a radon regulation in August 1999 and to publish a final regulation in August 2000. On November 2, 1999, the EPA published for public comment the proposed MCL for radon of 300 picocuries per liter (pCi/L) for groundwater systems serving 10,000 or more people. However, the 1996 SDWA amendments require the EPA to establish an alternate MCL (AMCL) for radon if the contribution of radon from water to radon in indoor air is less than background levels in outdoor air. This AMCL is proposed to be 4,000 pCi/L. Under the proposed regulations, the City could comply with the AMCL, if an EPA- or State-approved multi-media mitigation (MMM) program is in place. A MMM is “a State or community water system program plan of goals and strategies developed with public participation to promote indoor radon risk reduction.”

A Final Radon Rule was sent to the Office of Management and Budget (OMB) on January 19, 2001, and had not gone through OMB review by the time the new Bush Administration came into office. The Radon Rule has been sent back to EPA for review under the Bush Administration. After that review is completed, it will go back to OMB for their review (OMB is allowed up to 90 days for its review). The schedule for promulgation of a radon MCL is uncertain as of April 2005.

Sulfate. Currently, the EPA and the DHS have secondary standards for sulfate of 250 mg/L with the DHS having an “upper limit” of 500 mg/L based on aesthetic (taste and odor) effects. The EPA proposed a MCL for sulfate of 500 mg/L in 1994. However, the sulfate standard was never finalized. The EPA is authorized (but not required) to establish a regulation for sulfate in the 1996 SDWA Amendments. The EPA was required to consider the regulation of sulfate by August 2001 as part of the Candidate Contaminant Listing process and review. In July 2003, the EPA made a determination not to establish a primary drinking water regulation for sulfate because it would not present a meaningful opportunity for health risk reduction for persons served by public water systems. Sulfate concentrations in all City wells are significantly less than the current secondary standard.

Groundwater Rule. The EPA is developing a groundwater rule (GWR) to assure public health protection from bacterial and viral pathogens or fecal contamination indicators in groundwater. The proposed GWR will specify appropriate use of disinfection and encourage the use of alternative approaches, including management practices and control of contamination at its source. During 1998, the EPA held three stakeholder meetings around the country to provide an update on the status of development of the GWR and to indicate possible regulatory directions.

On May 10, 2000, EPA published the proposed GWR. The public comment period closed on August 9, 2000. In January 2005, EPA sent the final GWR to the Office of Management and Budget for a 90-day review and anticipates that the final GWR will be published in May 2005.

The major components of the GWR as proposed included the following:

1. Sanitary surveys are to be conducted by the State (every three years for community water systems) to identify significant deficiencies.
2. Significant deficiencies were proposed to include: defect in design, operation, or maintenance, or a failure or malfunction of the source, treatment, storage, or distribution system that the State determines to be causing, or has potential for causing the introduction of contamination into the water delivered to consumers.
3. States would assess the hydrogeologic sensitivity of a given groundwater (the proposed regulation defined groundwater from karst, gravel, or fractured bedrock aquifer as being hydrogeologically sensitive unless protected by a hydrogeologic barrier (physical, chemical or biological barriers)).
4. Groundwater systems that do not disinfect or otherwise treat to provide a 4-log reduction of viruses and draw from hydrogeologically sensitive aquifers would be required to conduct monthly source water microbial monitoring (either *E. coli*, enterococci, or coliphage monitoring as specified by the State). The State could waive the source water monitoring requirement after 12 months (based on no detects of fecal indicators and the State determined that fecal contamination of the well is “highly” unlikely based on sampling history, land use pattern, disposal practices in the recharge area, and proximity of septic tanks and other fecal contamination sources).
5. Groundwater systems that do not provide 4-log reduction in viruses that detect a total coliform positive in the distribution system (under the Total Coliform Rule) would be required to collect a source water sample within 24 hours of notification of the distribution system positive.

6. If any source water sample is positive for one of the microbial indicators, the water utility would be required to notify the State by the end of the next day after the water utility learns of the positive result.
7. Any system identified with a significant deficiency (or positive microbial samples indicating fecal contamination of the source water) would be required to implement corrective action (eliminate the source of contamination, correct the significant deficiency, provide an alternate source water, or provide 4-log reduction of viruses) within 90 days.
8. If the system was unable to address the source water contamination within 90 days, then the system would have to submit a proposed plan and schedule for addressing the deficiency for State approval within the 90 day period.
9. Systems that disinfect to achieve the 4-log virus inactivation would be required to conduct compliance monitoring.

Should these regulations be finalized as indicated, the City may need to modify the microbial monitoring of its wells. None of the City's wells are "hydrogeologically sensitive" due the nature of the alluvial sediments in the Chino Basin and no significant deficiencies exist that could cause introduction of contamination. At this time, no significant compliance issues are anticipated.

Stage 2 DBP Rule. EPA released a draft of the Stage 2 DBP Rule in August 2003. The draft rule includes the following anticipated requirements:

1. Initial Distribution System Evaluation (IDSE) – Surface water systems and ground water systems will have to conduct one year of monitoring at sample locations that are separate from the current DBP compliance sample locations. The sample locations will be determined based on the type of distribution system residual maintained by the system. EPA issued a IDSE Guidance Manual to provide guidance on the conduct of the IDSE including selection of monitoring sites, alternatives to monitoring, waivers, development of monitoring schedules, and preparation of the IDSE report
2. The results of the IDSE will be used to determine four new DBP compliance locations per plant. The new DBP compliance locations will be as follows: one representative average from the Stage 1 DBP Rule sample locations, one sample representative of highest HAA5 concentrations from the IDSE and two samples from locations representative of highest concentrations of THMs from the IDSE.
3. Compliance with the Stage 2 DBP Rule will be determined using a Locational Running Annual Average (LRAA) instead of a distribution system wide running annual average.
4. For compliance purposes, groundwater systems serving greater than 10,000 people will monitor quarterly at the highest THM location and the highest HAA5 location.
5. EPA has developed a guidance manual "Significant Excursions Guidance Manual" to assist utilities with identification, evaluation and prevention of significant excursions.
6. The bromate MCL will remain at 0.010 mg/L. The MCL will be reviewed as part of a six-year review (to determine whether the MCL should stay at 0.010 mg/L or whether it should be lowered to 0.005 mg/L).

The following is the anticipated schedule for the promulgation of the final Stage 2 DBPR and when utilities must be in compliance.

1. EPA is required to promulgate Stage 2 DBPR within 18 months after promulgating the Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR). EPA will finalize the LT2ESWTR concurrently with the Stage 2 DBPR to ensure simultaneous protection from microbial and DBP risks.
2. Current information from EPA indicates their intention to publish a final regulation by mid-2005.
3. Within two years of the final rule, systems serving over 10,000 people will have completed and submitted reports on the IDSE and the Cryptosporidium monitoring to the State primacy agency.
4. Within three years of the final rule being published systems will have to comply with MCLs of 0.120 mg/L for THMs and 0.10 mg/L for HAA5 using the LRAA approach but using the Stage 1 DBP Rule sample locations (i.e., not the new locations as will be determined by the IDSE) as well as continue to demonstrate compliance with the Stage 1 MCLs of 0.080 mg/L for THMs and 0.060 mg/L for HAA5 with compliance based on the use of a running annual average (distribution system wide average). Two year extensions for capital projects will be available.
5. Within six years of the final rule systems will need to be in compliance with the MCLs of 0.080 mg/L for THMs and 0.060 mg/L for HAA5 using the new sample locations (identified per the IDSE) and using the Locational Running Annual Average for compliance determination. Two year extensions for capital projects will be available.

The Stage 2 DBP Rule will require a change in the way the City monitors DBPs in its distribution system. The change to a LRAA may result in compliance issues; however, the extent is unknown at this time.

Long Term 2 Enhanced Surface Water Treatment Rule. EPA is proposing the LT2ESWTR to reduce disease incidence associated with Cryptosporidium and other pathogenic microorganisms in drinking water. The LT2ESWTR will supplement existing regulations by targeting additional Cryptosporidium treatment requirements to higher risk systems. This proposed regulation also contains provisions to mitigate risks from uncovered finished water storage facilities and to ensure that systems maintain microbial protection as they take steps to reduce the formation of disinfection byproducts. The LT2ESWTR will apply to all systems that use surface water or ground water under the direct influence of surface water. Proposed regulations were published in August 2003. Key provisions of the LT2ESWTR include:

- Source water monitoring for *Cryptosporidium*, with reduced monitoring requirements for small systems.
- Additional *Cryptosporidium* treatment techniques for filtered systems based on source water *Cryptosporidium* concentrations.
- Inactivation of *Cryptosporidium* for all unfiltered systems.
- Disinfection profiling and benchmarking to assure continued levels of microbial protection while PWSs take the necessary steps to comply with new DBP standards.

- Covering, treating, or implementing a risk management plan for uncovered finished water reservoirs.

Total Coliform Rule

EPA published the Total Coliform Rule (TCR) on June 29, 1989. The TCR requires all public water systems to monitor for the presence of coliforms in their distribution systems, as measured by "total coliforms." The 1996 amendments to the Safe Drinking Water Act require the EPA to review and revise, as appropriate, each national primary drinking water regulation not less often than every six years. In July 2003, as part of its National Primary Drinking Water Regulation Review, EPA published its decision to revise the TCR.

The TCR requires systems to monitor for total coliforms at a frequency proportional to the number of people served. If any sample tests positive for total coliforms, the system must perform the following additional tests:

- Further test that culture for the presence of either fecal coliforms or Escherichia coli;
- Take one set of 3-4 repeat samples at sites located within 5 or fewer sampling sites adjacent to the location of the routine positive sample within 24 hours; and
- Take at least 5 routine samples the next month of operation.

As part of the TCR rulemaking, EPA plans to assess the effectiveness of the current TCR in reducing public health risk, and what technically supportable alternative/additional monitoring strategies are available that would decrease economic burden while maintaining or improving public health protection. EPA, along with distribution system experts external to EPA, have developed a series of "white papers". The objective of the "white papers" is to review the available data, information and research regarding the potential public health risks associated with the distribution system issues, and where relevant, identify areas in which additional research may be warranted. In addition, EPA, along with AWWA, is preparing a series of ten TCR issue papers presenting available information related to topics for potential TCR revision. EPA will use the papers as information sources for discussions of TCR issues with the drinking water community, experts and stakeholders (USEPA, 2005).

Surface Water Quality

The quality of water from San Antonio and Evey Canyons are generally excellent with total dissolved solids (TDS) of 220 mg/L. This source has relatively low hardness of 170 mg/L as $CaCO_3$. The only routine problem is occasional high turbidity following storms. This problem is exacerbated following wildfires in the watershed. During these periods of high turbidity, the canyon supply is diverted into Pomona's recharge basin located adjacent to the treatment plant. However, since this surface water source is derived from a watershed that is subject to intensive recreational activities, the City should keep its watershed sanitary survey up to date and work with the U.S. Forest Service to correct any deficiencies. **Table 5-7** summarizes available quality data for the Pedley Plant.

Table 5-7
Summary of Groundwater Quality Data

Chemical	Unit	MCL[1]	DLR[2]	Pedley WTP	MWD Weymouth	Claremont Heights				Pomona				Chino Basin - untreated						Chino Basin – Anion Exchange Plant															Spadra	
						T1	T2	T3	T4	3	9B	13	37	2	5B	27	29	30	35	4	6	10	11	12	14	15	16	17	18	21	23	25	26	34	19	28
Total Hardness as $CaCO_3$	mg/L		2	170	164	160	160	140	120	NR	310	220	NR	220	200	150	250	NR	92	NR	280	220	280	330	260	200	280	200	250	NR	280	210	220	250	440	520
Calcium	mg/L		1	49	37	49	49	46	36	NR	95	56	NR	69	65	50	76	NR	32	NR	86	68	87	100	81	61	87	61	74	NR	87	68	67	77	130	150
Magnesium	mg/L		1	11	17.5	8.3	10	6.2	6.1	NR	17	20	NR	13	10	6.2	15	NR	2.9	NR	15	13	16	18	14	11	16	11	15	NR	14	11	12	14	28	34
Sodium	mg/L		1	4.9	69	15	9.3	16	30	NR	15	19	NR	11	18	24	14	NR	34	NR	15	11	16	14	16	15	13	15	14	NR	18	17	13	11	29	39
Potassium	mg/L		1	2.2	3.2	1.9	2.4	1.9	1.8	NR	3.5	2.6	NR	2.5	2.9	1.6	2.2	NR	1.2	NR	3.4	2.1	2.8	3.1	2.7	2.6	2.9	2.6	2.2	NR	2.1	2	1.8	1.7	3	3.8
Total Alkalinity as $CaCO_3$	mg/L		1	148	92	150	150	140	140	NR	180	210	NR	130	130	120	180	NR	98	NR	160	140	170	180	170	150	170	140	170	NR	170	160	150	15	280	310
Bicarbonate	mg/L		1			180	190	170	170	NR	220	260	NR	150	160	140	220	NR	120	NR	190	170	210	220	210	180	200	180	200	NR	210	200	180	180	340	380
Sulfate	mg/L	250-500-600[1]	0.5	25	111	29	27	28	29	NR	80	76	NR	47	48	37	74	NR	33	NR	60	41	54	57	56	180	54	29	52	NR	69	50	25	43	140	220
Chloride	mg/L	250-500-600[1]	1	1.8	79	8.2	6.6	7.1	6	NR	33	39	NR	35	31	30	20	NR	18	NR	28	35	22	29	19	15	29	14	22	NR	21	15	20	25	47	55
Nitrate as NO_3	mg/L	45	2	ND	0.5	10	9.8	9.8	9.7	**76**	**56**	40	**61**	32	35	15	35	NR	15	**56**	**65**	44	**76**	**67**	**56**	**57**	**74**	**61**	**72**	NR	**55**	34	**63**	**70**	NR	27
Fluoride	mg/L	1.4-2.4	0.1	0.37	0.15	0.39	0.29	0.34	0.62	NR	0.28	0.21	NR	0.23	0.2	0.18	0.27	NR	0.29	NR	0.23	0.23	0.23	0.23	0.25	0.21	0.23	0.2	0.25	NR	0.25	0.22	0.26	0.23	0.35	0.32
pH	units			8.3	8.15	7.48	7.61	7.59	7.67	NR	7.45	7.06	NR	7.54	7.59	7.66	7.7	NR	7.78	NR	7.46	7.43	7.49	7.45	7.56	7.62	7.55	7.62	7.39	NR	7.55	7.65	7.63	7.57	7.34	7.06
Specific Conductance	µS	900-1600-2200[1]	10	340	679	390	380	380	370	NR	660	710	NR	520	510	420	610	NR	360	NR	650	530	640	720	580	480	640	480	610	NR	620	500	500	560	990	1100
Total Dissolved Solids	mg/L	500-100-1500[1]	1	220	387	230	230	230	220	NR	420	440	NR	340	320	270	390	NR	220	NR	440	360	420	490	380	310	430	320	400	NR	420	330	330	380	670	770
Color, Apparent	units		3	7.5	1	0	0	0	0	NR	3	3	NR	0	0	0	0	NR	0	NR	0	0	0	0	0	0	0	0	0	NR	0	0	0	0	NA	0
Odor Threshold	TON		1	<1	-	1	1	1	1	NR	1	1	NR	1	1	1	1	NR	1	NR	1	1	1	1	1	1	1	1	1	NR	1	1	1	1	NA	1
Turbidity	NTU		0.1	0.04	0.06	0.14	0.13	0.15	0.17	NR	2	3.3	NR	ND	0.13	0.1	0.15	NR	0.17	NR	0.21	0	0	0	0.12	0	0.1	0.11	0.14	NR	0	0.1	0.1	0	NA	0.32
Copper	µg/L	1000	50	ND		ND	ND	ND	ND	NR	ND	ND	NR	ND	ND	ND	ND	NR	ND	NR	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	ND	ND	ND	ND	ND	ND
Iron	µg/L	300	100			ND	ND	ND	ND	NR	**950**	**380**	NR	2	ND	ND	ND	NR	ND	NR	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	ND	ND	ND	ND	ND	ND
Manganese	µg/L	50 500 (NL)	20	11	17.5	ND	ND	ND	ND	NR	ND	27	NR	ND	ND	ND	ND	NR	ND	NR	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	ND	ND	ND	ND	ND	ND
Zinc	µg/L	5000	50			ND	ND	ND	ND	NR	ND	ND	NR	ND	ND	ND	ND	NR	ND	NR	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	ND	ND	ND	ND	ND	ND
Total Chromium	µg/L	50	10	ND		ND	ND	ND	ND	NR	1	1.7	NR	4.4	ND	3.9	10	9.6	7.1	NR	ND	ND	**51**	24	4.4	ND	ND	ND	12	8.3	ND	7.3	7	ND	ND	6
Chromium VI	µg/L		5	ND		0.96	0.58	0.59	0.8	NR	1.2	1.8	NR	4.6	NA	4	0.96	10	7	NR	NA	NA	51	NA	4.6	NA	NA	NA	NA	10	NA	7.4	7.2	NA	3.3	6.8
Arsenic[3]	µg/L	50 (10)	2	ND		ND	ND	ND	ND	NR	ND	3.1	NR	ND	ND	ND	ND	NR	**18**	NR	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	ND	ND	ND	ND	ND	ND
Vanadium	µg/L		3	ND		NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Cyanide	µg/L	200	4			NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Perchlorate	µg/L	6 (NL)	4	ND		ND	ND	ND	ND	NR	**6.9**	4.2	NR	4.3	5.5	ND	ND	NR	ND	**11**	**12**	**6.7**	**11**	**12**	**8.1**	**8.2**	**12**	**12**	**11**	NR	**7.8**	3.3	**6.1**	**14**	NR	3.1

1 - Recommended, upper and short-term maximum concentrations per California Drinking Water Standards. NL – Notification Level
2 - DLR- Detection limit for reporting.
3 - MCL for arsenic will be 10 µg/L effective January 23, 2006. Arsenic data for Well 35 based on May 2005 data.
Source: Water Quality Reports provided by City of Pomona, 2003
Values in **boldface** exceed the MCL or NL. ND – not detected. NR – not reported

To provide a back-up water source for the plant, the City should conduct a study to determine the ability of and the required modifications to the Pedley Plant to treat SWP water from MWD's Rialto Pipeline in Claremont.

Imported Water Quality

Imported water from MWD's Weymouth Filtration Plant is a blend of SWP and CRA water. The TDS of this supply ranges from about 370 mg/L to over 500 mg/L depending on the supply mix. MWD's water supply complies with all established MCLs. However, its CRA source contains detectable levels of perchlorate that have exceeded the current PHG of 6 μg/L. Since this water is blend with SWP water, the delivered perchlorate concentration is less than the PHG. The City has and will continue to use its imported water supply to blend down local wells having high nitrate concentrations. Table 5-7 summarizes available water quality data for the Weymouth Plant.

Groundwater Quality

The groundwater produced by the City's wells is of good quality with the exception of high levels of nitrate, perchlorate, total chromium, and iron. In addition, arsenic exceeds the new federal MCL in one well (Well 35) that will require treatment. The water quality characteristics are summarized in Table 5-7.

As shown in this table, 15 wells pump groundwater with nitrate levels exceeding the MCL of 45 μg/L. However, only two of these wells (Wells 9B and 37) are not treated at the AEP. In addition, Wells 20 and 37 in the Claremont Heights Basin are currently off-line due to high nitrate concentrations that cannot be adequately blended with low nitrate water. Installation of package nitrate treatment systems at each of these wells would allow their return to production. The USD has budgeted for the treatment of Well 37 with completion anticipated in FY 2006-07. Treatment of Well 20 should be budgeted in the CIP.

The notification level for perchlorate of 6 μg/L is exceeded in 14 groundwater wells, with concentrations ranging from 6.1 to 14 μg/L. Currently, there is no MCL for perchlorate; however, DHS requires notification of the local governing body (i.e., City Council) if a NL is exceeded. Perchlorate is effectively removed by the AEP.

In addition, the MCL of 300 μg/L for iron is exceeded in Wells 9B and 13 with concentrations of 950 and 3800 μg/L, respectively. All remaining wells have iron levels below the detection limit. The MCL of 50 μg/L for total chromium is exceeded in Well 11 with a concentration of 51 μg/L. This water is treated at the AEP and is blended with other Chino Basin groundwater prior to distribution.

Pomona also has a number of groundwater wells contaminated with volatile organics. Wells 7 and 8B have been off-line due to VOC contamination (principally trichloroethylene (TCE), tetrachloroethylene (PCE) and 1,1-dichloroethylene (DCE)) in the Pomona Basin. These wells were recently returned to service with air stripper treatment. Well 3 has been treated for VOCs using air stripping for over thirteen years. Wells 11, 12, 14, 23 and 25 in the Chino Basin also have detectable VOC concentrations. Water from these wells is treated for nitrates and blended at the AEP with other groundwater prior to distribution. Well 32 also has VOCs and is budgeted for treatment in FY 2005-06. Well 19 in the Spadra Basin also has VOC contamination; however, this well is currently used for the recycled water supply.

Well 35 has had arsenic levels in the range of 6 to 18 µg/L since 1995. All but two of the measurements exceeded the new arsenic MCL of 10 µg/L that will be effective on January 23, 2006. Since this well pumps into the distribution system, either blending or treatment to achieve a level of less than 8 µg/L will be required. For budgetary purposes, the City has included arsenic treatment using ion exchange in its capital budget. Arsenic treatment is anticipated to be on line in FY 2006-07.

N-nitrosodimethylamine (NDMA) causes cancer in laboratory animals and is classified as a probable human carcinogen. DHS established a NL for NDMA of 0.01 µg/L in 2002. NDMA has been detected in the effluent of the AEP. In 2002, Pomona retained McGuire Environmental, Inc. to investigate the source of the NDMA. This study was unable to determine the source of this chemical. The report recommended that further investigation focus on individual wells to identify possible precursor compounds for NDMA formation. The current expansion of the AEP Plant includes a plan for ultimately adding on an ultraviolet destruction process that would remove NDMA from the AEP effluent in the event that it is not possible to isolate and remove NDMA precursors from the source water. In May 2005, DHS established a NL for NDPA at 0.01 µg/L. Analytical results were not available at the time this WMP was published. However, like NDMA, NDPA may be may be a by-product of ion-exchange treatment. The City should analyze the plant effluent and blended water for NDPA and NDEA to determine if it is within the DHS NLs for these compounds. If these compounds are detected, the source and potential methods for removal should be investigated.

Well Destruction

In its engineering report for the City's domestic water supply permit, the DHS recommended the destruction of several abandoned and inactive wells to protect the groundwater supply from contamination. Destruction must be performed in accordance with DWR Bulletins 74-81 and 74-90. The City has budgeted for the destruction of Well 1, Well 6 (Orange Grove Tract) and Well 22.

ESTIMATED WATER PRODUCTION COSTS

Table 5-8 presents the unit costs per acre-ft for the existing sources and proposed supply improvements identified in this Section. The sources are generally listed in the order of increasing cost. Production costs are based on current well pumping costs and estimated water treatment costs. The CBWM Assessment is based on the FY 2004-05 assessments on gross pumpage. Treatment costs are based on estimates from City-furnished information. (The City should modify its cost accounting to allow derivation of actual treatment costs for each treatment facility.) Water purchases are payments for imported water. The replenishment assessment is based on 100 percent of the FY 2004-05 CBWM replenishment water cost. Where shown, a MWD credit is applied for water conservation measures. This table indicates that production from existing wells without treatment is the least costly source for the City. The City should implement sources in the order of increasing costs to minimize future supply costs. These costs

Table 5-8
Unit Costs of Existing Sources and Proposed Improvements

Source	Production Cost[1]	Watermaster Assessment[2]	Treatment[3]	Water Purchases	Lease/ Replenish-ment	MWD Rebate	Total
Pedley Treatment Plant	$25		$25				$50
Claremont Heights Basin	$66						$66
Claremont Heights Basin - Treated – nitrate	$66		$90				$156
Pomona Basin	$65						$65
Pomona Basin – Treated – VOC	$65		$25				$90
Pomona Basin – Treated - VOC + nitrate	$65		$115				$180
Spadra Basin	$88						$88
Spadra Basin – Treated – VOC	$88		$90				$178
Water Conservation w/ MWD Credit	$310					-$154	$156
Chino Basin	$124	$25					$149
Chino Basin w/ leased rights	$124	$25			$212		$361
Chino Basin w/ replenishment	$124	$25			$250		$399
Chino Basin – Anion Exchange Plant	$124	$25	$90				$239
Chino Basin – Arsenic Treatment	$124	$25	$200				$350
Chino Basin – Anion Exchange Plant w/ leased rights	$124	$25	$90		$212		$451
Chino Basin – Anion Exchange Plant w/ replenishment	$124	$25	$90		$250		$489
Water Conservation w/o MWD Credit	$310						$310
Chino Basin – Anion Exchange Plant – DYY				$481			$481
MWD Treated melded rate				$481			$481
Chino Basin – Lease revenue					-$210		-$210

Notes:
1 – Production cost is estimated based on recent SCE pump tests and energy rates.
2 – Watermaster Assessment is applied to all Chino Basin pumping and is based on the CBWM FY 2004-05 Assessment Package.
3 – Water treatment costs are estimated based on typical costs for similar processes.
4 – Purchased water cost is based on the current TVMWD melded rate for treated non-interruptible water.
5 – Chino Basin replenishment cost is based on the average price for leased water rights or the net replenishment assessment (where applicable).

are used in combination with other considerations in this section to develop a recommended potable water supply strategy.

RECOMMENDED POTABLE WATER SUPPLY STRATEGY

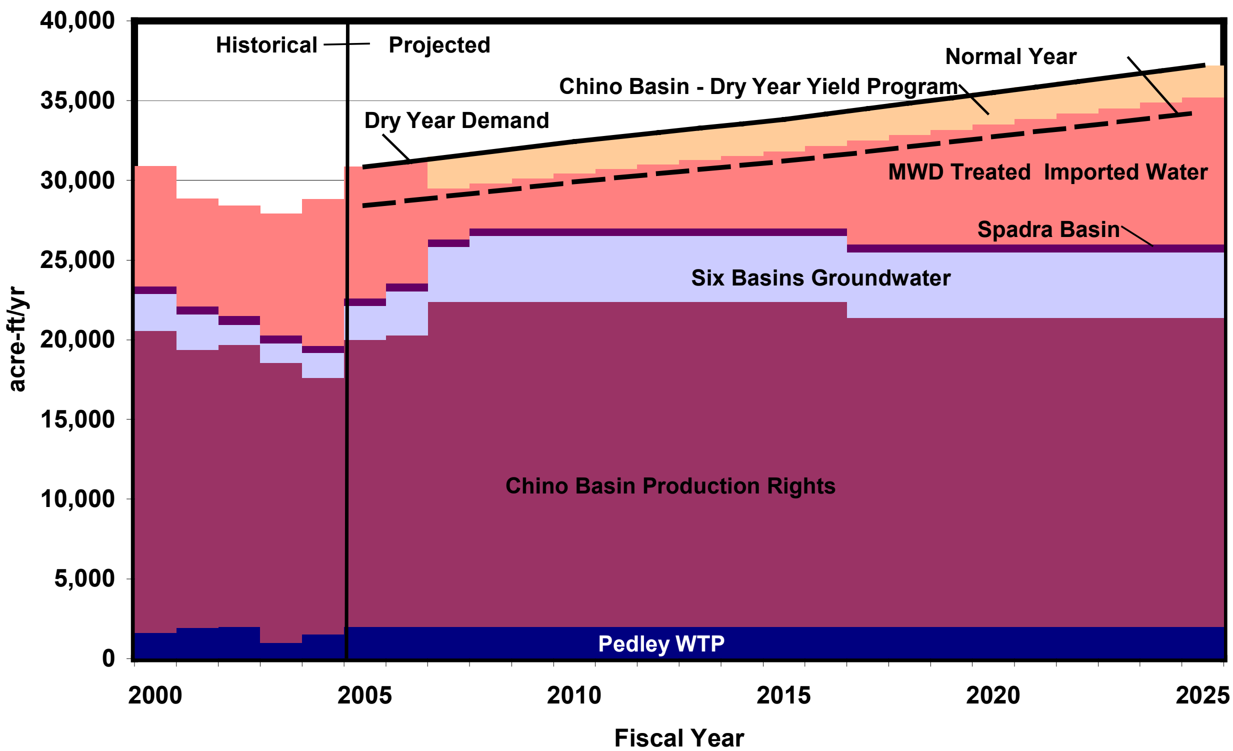
The recommended water supply plan for the City of Pomona consists of the following elements:

- The use of surface water rights in San Antonio and Evey Canyons should be maximized. The City may need to modify the Evey Canyon collection system as a result of storm damage in 2005.The use of existing water rights in the Six Basins area should be maximized to offset purchase of more costly treated imported water.
- The use of existing water rights in the Chino Basin should be maximized to offset purchase of more costly treated imported water.
- The use of Spadra Basin groundwater should be maintained at current levels unless it can be demonstrated that the basin can provide additional supplies.
- The City should maximize its use of its local supplies including purchasing replenishment water in the Chino Basin prior to purchasing treated imported water to minimize supply costs. At current costs, this could save the City about $60/acre-ft of additional water pumped compared to purchasing treated imported water.
- The City should evaluate leasing Chino and Six Basins water rights from other producers in these basins prior to purchasing replenishment water for overproduction. Typically, the cost of leased water rights is as much as $50 acre-ft less than paying a replenishment surcharge. Alternatively, the City could use a portion of its stored water to offset replenishment water purchases.
- Water marketing strategies should only be considered after the City's water supply needs are met. The funds generated from any water marketing activities should be applied to water system improvements to reduce or stabilize the financial impact on water ratepayers.
- Reduce or eliminate the sale of water from the Chino Basin storage account. This water should be retained for possible use in dry years, to meet DYY programs, or other periods of supply deficiency.
- Maximize production from good quality wells in the Chino and Six Basins areas as these are the most cost-effective supply sources.
- Investigate and eliminate the precursors for NDMA formation. In addition, the City should monitor for other nitrosamines (NDEA and NDPA) in AEP effluent to determine whether it is within the new DHS NLs for these compounds. This would allow the City to treat additional Chino Basin water at the AEP and reduce current limitations on AEP operations.
- Install treatment facilities for Wells 20, 32, 35 and 37. Wells 20 and 37 should be treated for nitrates. Well 32 should be treated for VOCs and blended at the Reservoir 5 site. Well 35 should be treated for arsenic removal to comply with the new arsenic MCL. These facilities will allow the City to return these wells to active status and increase the available production capacity.

- Conduct a study to evaluate the ability of the Pedley Plant to treat SWP water as a back-up water source.
- Continue to maintain and enhance groundwater production capacity.
- The City should track all charges associated with production and treatment of water including the AEP so that future planning activities have a solid basis for economic evaluations.
- Work closely with TVMWD to implement water conservation measures.

Figure 5-4 presents the recommended annual supply plan for the City. This plan is based on the strategies discussed above. Pumping in excess of rights in the Chino and Six Basins areas is not shown, but could be implemented if adequate groundwater production capacity is available to offset purchase of treated imported water. During dry years, Pomona would be required to pump 2,000 acre-ft/yr under the DYY program. As shown on the figure, this would offset MWD purchases when required.

Figure 5-4
Recommended Supply Plan



Water conservation consistent with the TVMWD goals is also an important element of the plan. As new growth occurs in the system, those homes and businesses will comply with current plumbing codes, resulting in lower water usage rates. Therefore, the water conservation efforts should focus on the older homes, businesses, and COPA accounts.

Section 6
Model Development and Calibration

The methods used to develop the City's water system hydraulic model are described in this section. The model was used to identify deficiencies within the existing and the future system in meeting water demand conditions. These deficiencies are used to develop a Capital Improvement Program (CIP) for the existing and future conditions.

MODEL DEVELOPMENT METHODOLOGY

The hydraulic model is developed using *H_2OMAP Water*, a stand-alone hydraulic modeling software by MWH Soft. The software is capable of transferring data to and from the City's water system GIS, which is reviewed and updated using *ArcView GIS* as part of this Water Master Plan. The model includes all water pipelines 4-inches in diameter and greater, groundwater wells, storage reservoirs, booster stations, imported water connections, pressure regulating valves, and other water distribution facilities within the system. Additional pipe segments with diameters smaller than 4 inches are also included to complete loops within certain areas of the distribution system. Water pipelines and their parameters (e.g. diameter, year of installation, material, etc.) are imported from the City's GIS into *H_2OMAP Water* to form the initial pipe network. Spatial data analysis is also performed to allocate ground elevations, water demands and other necessary modeling data using *ArcView GIS*. These data is then imported to the *H_2OMAP Water* database as part of the model development process.

Data Sources

The City provided detailed information that was required for the development of the hydraulic model for this master planning effort. Key information included:

- Previous Master Plan Reports (1982 and 1992)
- Urban Water Management Plan (2000)
- DHS Engineering Report (2001)
- GIS files
- General Plans, Land Use and Parcel information for the City
- Historical water production and billing records (2001 to 2003)
- Facility design drawings of booster stations, well pumping stations, and storage reservoirs
- Water system schematic including details of water facilities
- Electronic aerial orthophotography coverage
- City Water Atlas Maps
- Drawings of newly installed pipelines not included on Water Atlas Maps
- Pump curves and performance test for some pumps
- Water level and drawdown elevations at wells
- Inlet/outlet level, high water level, bottom elevations of wells
- Drawings and depth-volume curves of all reservoirs
- Database listing of all pressure regulating stations

- Pump controls and settings of pressure regulating valves
- Well and booster operational controls
- Digital elevation model

Additional data are gathered over the course of the project with the assistance of City staff and the Planning Division. These data include summaries of projects currently under consideration for development/construction, fire hydrant test data used for model calibration, and historical and projected population estimates from Department of Finance (DOF) and Southern California Association of Governments (SCAG).

Integration of GIS

The initial pipe network is created by importing network data from the City's GIS to *H_2OMAP Water*. The network is reviewed and updated for completeness and correctness prior to adding facilities and controls in the model. The review tasks include checking of pipeline information (e.g. location, year of installation, material and diameter) with the Water Atlas Maps, and fixing of pipeline connectivity errors. Pipelines not found on the Water Atlas Maps (mostly for newly installed pipelines) are also added based on information provided by City staff.

Developed from the City's GIS data, the model is projected to the same coordinate system (NAD 83, California State Plane Zone V) as the City's GIS. GIS layers from the City and those created by the model can be viewed together.

MODEL CONSTRUCTION

The following is a chronological order of steps taken to create the model from the City's updated GIS:

- The pipeline shapefile from the City's GIS containing only the potable water mains and their attribute information, including diameter, year of installation, lining, and the roughness coefficient C, are imported into *H_2OMAP Water* to form the initial pipe network.
- Junctions are added at both ends of pipelines by the "Convert Polyline" feature of *H_2OMAP Water*. Overlapped junctions and/or those within a five feet radius are merged into a single junction.
- All dead-end pipelines with length less than 100 feet are deleted from the model.
- All pipelines with "0-inch" diameter are investigated individually, and the correct diameter is updated in the model accordingly.
- *H_2OMAP Skeletonizer* is used to reduce the number of pipes from 20,000 to 8,000 using the following parameters: diameter, material, year of installation, lining, and zone. *Skeletonizer* combines pipe segments in series and with the same parameters to become a single pipe.
- Pipeline connectivity at junctions is verified by checking with the City's Water Atlas Maps.
- Overlapped pipelines are determined and thus, are deleted from the model.
- Missing pipelines are added based on information provided by City staff.
- The pipelines and nodes in the model are assigned to the pressure zones they serve.
- Other facilities (wells, booster pumps, valves, and reservoirs) are digitized in *H_2OMAP Water* based on the data collected from City staff.

Distribution System

As previously discussed, the City's distribution system network is created using the City's GIS converted into an *H_2OMAP Water* network. The updated distribution network contains a total of 7,734 pipe segments, totaling approximately 420 miles. The hydraulic model includes all potable water mains 4-inches in diameter and greater. Additional pipe segments with diameters smaller than 4-inches are also included to complete loops within certain areas of the distribution system. **Table 6-1** presents the total length of pipes by diameter.

Table 6-1
Modeled Water Distribution Network

Diameter (in)	Length (miles)
4	50.0
5	0.1
6	97.3
8	142.3
10	34.4
12	38.3
14	4.3
16	25.9
18	5.1
20	3.7
24	12.2
30	3.6
36	0.2
Total	**417.4**

The transmission pipelines in the model are identified based on information obtained from the water system hydraulic schematic, facility design drawings, Water Atlas Maps, and through discussions with City staff. Most of these pipelines have diameters that vary from 12-inches to 30-inches. In addition, pipes with closed isolation valves in the distribution system are identified in the model using the Water Atlas Maps. Some of these pipes with closed isolation valves are also assumed based on zoning boundaries and have been verified by City staff.

Water Facilities

The City's existing water system contains 22 storage reservoirs, 15 booster pumping stations, 41 active and inactive groundwater wells, and 28 pressure regulating stations. These water facilities are modeled based on the hydraulic schematic and information provided by the City staff during field visits to the facilities sites. Information gathered include piping schematics, the location and settings of valves, outlet elevations of reservoirs, and the operational controls for booster stations and wells. A detailed description of the modeled facilities is described below.

Wells

The City has 41 groundwater wells, including 3 recycled water wells. The City's 38 potable water wells are included in the hydraulic model. Each well is represented as a tank and a flow control valve. The tanks represent the groundwater aquifer and are modeled as fixed grade reservoirs with an initial water level equal to the pumping groundwater level. These pumping levels are obtained from the most recent SCE pump tests, which range from September 1997 to June 2003. Elevations for each tank are obtained from the water system's hydraulic schematic. The flow control valves are modeled with settings that are based on the well capacities, which are obtained from the most recent SCE test flows to simulate the current operating conditions.

Booster Pumping Stations

All 15 of the booster pumping stations, as listed in **Section 4**, are included in the hydraulic model database. The database information for each booster pumping station includes head-capacity curve information for each pump that is developed from the actual pump manufacturer's curve data (if available), or from the SCE pumping test results. The SCE pump test results are also used to update the pump curve data to account for the decrease in mechanical performance associated with age. The pump controls have been added to the hydraulic model database, based on information provided by the City.

Reservoirs

All the reservoirs listed in **Section 4** are included in the hydraulic model. Initially, the model parameters of each reservoir are obtained from the previous water master plans, the 2001 Engineering Report, and data provided by the City. These parameters are then verified by City staff and by field inspection. The reservoirs are modeled as cylindrical tanks. Since not all of the City's reservoirs are cylindrical, the diameters of the modeled reservoirs are adjusted such that their areas are equivalent to the areas of non-cylindrical reservoirs.

Pressure Regulating Stations and Transfer Valves

All pressure regulating stations and zone transfer valves within the City's distribution system are included in the hydraulic model. Adjustments are made to the location of the stations so that they are consistent with the pressure zone boundaries. The PRV and transfer valve settings and initial status (open/closed) are included in the model database.

Pressure Zones

There are eight pressure zones, two hydro pneumatic zones, and one pressure reduced zone within the City's water distribution system. A GIS shapefile from the City is used to delineate the pressure zone boundaries in between the pipelines. Pressure zone designations are assigned to all modeled pipelines and nodes. Pipes connecting two pressure zones are closed at locations of closed valves. The pressure zone boundaries were discussed with City staff, and adjustments were made accordingly.

Elevation Allocation

The elevations of all nodes in the model are established from the City's 2-foot elevation contours available in GIS shapefile format. The contours are converted into a Digital Elevation Model (DEM) with the *3D Analyst* extension of *ArcView GIS*. The model nodes are overlaid with the DEM to determine ground elevation for each junction. The elevations are then imported to

H2OMAP Water. The elevations in the hydraulic model range from 692 feet in Zone 8R to 1,400 foot in Zone 9.

Ground elevations and water levels (static, pumping etc.) at wells are obtained from data provided by the City (hydraulic schematic and table listing well information).

Demand Allocation

The existing water demands in the hydraulic model are allocated using actual water usage information obtained from the City's 2003 customer billing records. The future water demands are allocated using the year 2025 demand projections determined based on land use and population growth as discussed in **Section 3**. The allocation of both existing and future water demands to model nodes is described below.

Allocation of Existing Demands

The water demands for existing conditions are based on actual customer usage information (billing data) provided by the City. The billing data covers the water usage of 30,786 accounts for the year 2003. The average water usage for each account for the calendar year is calculated and scaled to the water production of the same year to include unaccounted for water in the model. Each billing record is geographically located in GIS by comparing its address to the address ranges of streets in Pomona. With the process called "geocoding", points for each of the 30,786 billing records containing the average demand of the account scaled to production and their geographical locations are created. The points are located along the street centerlines.

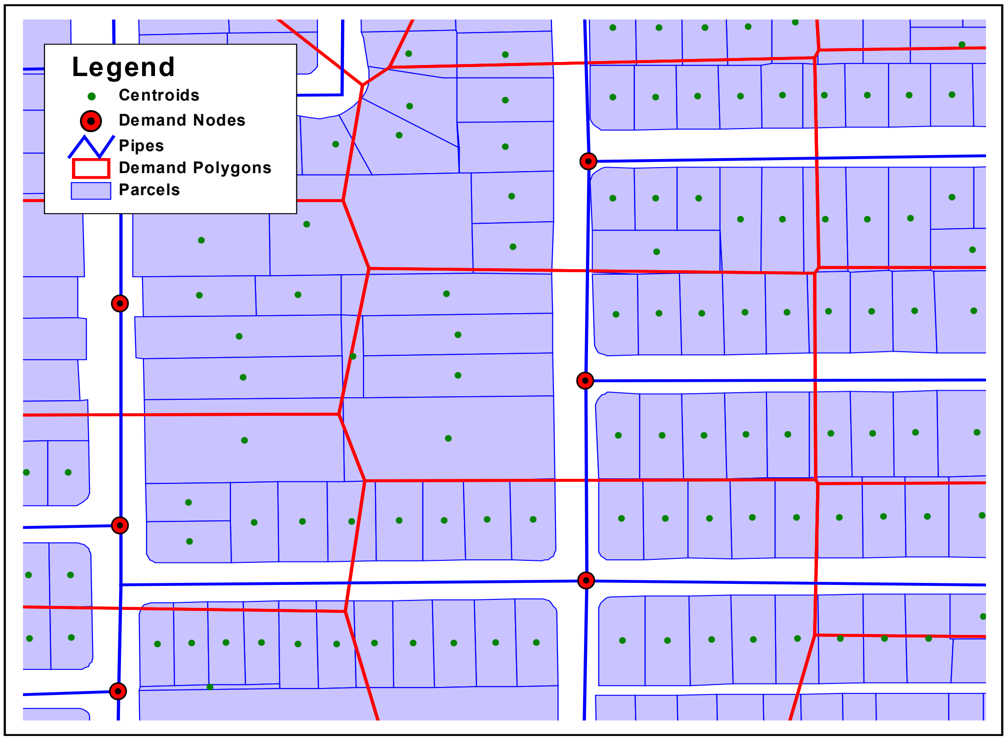
To allocate the demands of all these records in the hydraulic model, demand nodes are selected that represent a small area of multiple accounts. For the selection of demand nodes, all junctions connected to water facilities or transmission pipes are excluded. After the selection of 5,773 demand nodes, demand polygons are created for each demand node, using the Thiessen's polygon routine in *ArcView*. Finally, the demands of all centroids (billing accounts) that are located within each demand polygon are totaled and allocated to the demand node accordingly. The process of demand allocation is graphically presented in **Figure 6-1**. This is the most accurate method available to allocate existing water demands, because the distribution of demands is maintained. However, this distribution of demands is based on average annual water usage and does not include seasonal variations in demand distribution.

The large demand customers are individually checked to verify that these large demands are assigned to the correct location. Large demand customers are defined as all customers with an average water demand of 7 gpm or more. This procedure is used to verify the spatial accuracy of the demand allocation, since these customers sometimes have different billing addresses than their physical locations. Adjustments are made when the meter and billing addresses did not correspond.

Allocation of Future Demands

For the allocation of future demands, the projected water demand as described in **Section 3** is input in the hydraulic model. For the future demand allocation, the same 5,773 demand nodes and demand polygons used for the existing demand allocation are used. New centroids are created for the areas identified for demand growth. Again, the future demands of all centroids that are located within each demand polygon are totaled and allocated to the demand node accordingly.

Figure 6-1
Demand Allocation Process



Diurnal Demand Curve

The demand curve determined in **Section 3** is input in the model to simulate demand variations over a 24-hour period. As shown in Figure 3-6, the maximum peaking factor of 1.3 occurs at 7 AM, while the minimum peaking factor of 0.7 occurs at 3 PM

MODEL CALIBRATION

Due to the inability to retrieve historical information from the existing SCADA system, the model is not calibrated against SCADA data. However, a series of verification runs are performed to verify that the model produces a reasonable representation of existing system hydraulics. Model runs performed include:

- Steady state runs with existing average and maximum day conditions with existing demands.
- EPS runs for average day and maximum day conditions with existing demands.

All runs have produced reasonable results with existing system controls. The results of those have been reviewed with City operations staff. Adjustments in the model have also been made to better represent the actual distribution system conditions.

The C-factors used in the model are based on a combination of year of installation, pipeline diameter, and the distribution of materials over time. **Table 6-2** presents the C-factors used in the model by diameter and year of installation. C-factors typically decrease when pipes are older. In addition, the pipeline material and lining affects C-factors. Asbestos Cement (AC) pipelines and lined pipes were mostly installed in the mid 1950s and beyond, resulting in higher C-factors, as shown in **Table 6-2**. It is recommended that C-factor tests be conducted in the future to verify assumptions made and make additional adjustments in the model when necessary. The model results and database can be used to identify pipelines with low C factors and high headlosses. These pipelines are ideal candidates for further field checks (pipeline diameter, age, and materials) and future C-factor tests.

Table 6-2
C-Factors Used in Hydraulic Model

Diameter	Before 1900	1900-1920	1920-1930	1930-1938	1938-1960	1960-1975	1975-1995	After 1995
≤ 5-inch	15	25	35	45	80	100	120	130
6-inch	25	35	45	55	90	110	130	130
8 to 10-inch	35	45	55	65	95	110	130	130
12 to 16-inch	50	55	65	75	100	120	130	140
18 to 20-inch	55	65	75	85	110	125	135	140
≥ 24-inch	65	75	85	100	120	125	135	140

RECOMMENDATIONS

As mentioned, the model verification was performed without any SCADA or field data. To confirm that the recommended improvements are necessary or sufficiently sized, it is recommended that model calibration be performed when the SCADA system is operational in the future.

Section 7
Water System Evaluation Criteria

This section presents the evaluation criteria and methodologies used to evaluate the City's existing and future water system. For most analyses, hydraulic model runs are used to conduct system evaluations. The hydraulic model development and calibration is discussed in **Section 6**. The existing and future system evaluations are discussed in **Section 8** and **Section 9**, respectively.

WATER SYSTEM EVALUATION CRITERIA

System evaluation criteria are used in the evaluation of both the existing and future water systems. The criteria are developed based on typical system evaluation criteria used by similar water utilities, local codes, engineering judgment, commonly accepted industry standards, and input from City staff. The "industry standards" are typically ranges of acceptable values for the criteria in question and therefore, they are utilized more as a check to confirm that the values being developed are reasonable.

Three primary criteria used for water system evaluation are pressures, pipeline velocities, and adequacy of the water supply and storage capacity for operational, emergency, and fire flow requirements. **Table 7-1** summarizes the system evaluation criteria used in this master plan.

Water Supply

According to the American Water Works Association (AWWA) and the State of California, Department of Health Services (DHS), a water system should have an adequate water supply to meet MDD for the distribution system with the single largest source out of service. This criterion applies not only to the overall water system, but also to each individual pressure zone. The available water sources should be sufficient to meet maximum day demand (MDD), while demands greater than MDD (i.e., peak hour demand-PHD) should be supplied from reservoir storage. To provide adequate system redundancy for maintenance or temporary failure, it is recommended that the City has adequate source water capacity to meet MDD with the largest source of water (the PWR-JWL connection with TVMWD at Arrow Highway and East Street serving Reservoir 5) out of service. In addition, the source capacities shall be sufficient to refill storage reservoirs during the off-peak (typically nighttime) hours of the MDD. Hence, the water supply should be sufficient to meet MDD with the largest source out of service for 24 hours, while replenishing the reservoirs during off-peak hours (zero reservoir outflow over 24 hours).

System Pressures

Minimum system pressures are analyzed under two demand conditions, PHD and MDD plus fire flow. The minimum pressure for PHD conditions is 40 psi, while the minimum pressure for MDD plus fire flow is 20 psi based on suggested practice by AWWA (AWWA, 1995). Based on the diurnal curve presented in **Section 3**, PHD is assumed to occur at 7 AM on the maximum day. It is recommended to update the diurnal curve with a Pomona specific diurnal curve, once the new SCADA system is functional, which may shift the hour for PHD analysis.

Table 7-1
Water System Evaluation Criteria

Description	Value	Units	Evaluation Demand Conditions
Water Supply			
Meet MDD with the largest source[1] out of service while maintaining reservoir levels over the course of the day.	N/A	N/A	MDD
System Pressure			
Maximum Pressure	90	psi	PHD
Maximum Pressure for Hilly Terrain	125	psi	PHD
Minimum Pressure, without fire flow	40	psi	PHD
Minimum Pressure, with fire flow	20	psi	MDD
Pipeline Velocity			
Maximum Velocity for Transmission Pipelines (16-inch diameter and greater)	5	fps	MDD
Maximum Velocity for Distribution Pipelines (less than 16-inch diameter)	8	fps	MDD
Fire Flow Requirements			
Single family Residential	1,250	gpm	MDD for 1 hour
Medium Density Residential	1,500	gpm	MDD for 2 hours
High Density Residential	3,000	gpm	MDD for 3 hours
Commercial	3,000	gpm	MDD for 3 hours
Industrial	3,000	gpm	MDD for 3 hours
Office	3,000	gpm	MDD for 3 hours
Schools	4,000	gpm	MDD for 4 hours
Open Space	0 – 1,000	gpm	n/a
Storage Volume			
Operational	30 percent of MDD	MG	MDD
Fire Fighting	Highest fire flow requirement	MG	MDD
Emergency	50 percent MDD	MG	MDD
Booster Station Capacity			
All gravity fed zones: Meet MDD and replenish the operational storage of reservoirs with largest pump unit out of service for 24 hours	N/A	N/A	MDD
All pumped zones (without gravity storage supply): Meet PHD with largest pump unit out of service for 24 hours	N/A	N/A	PHD

1 - The largest supply source of the City is the connection with the PWR-JWL at Arrow Highway and E. Street serving Reservoir 5.

Output from the hydraulic model runs is used to evaluate system pressures. Only demand nodes are used for pressure evaluations, as lower system pressures are acceptable on transmission mains and at water facility sites. DHS sets a minimum of 5 psi in any buried water main, except for reservoir inlets and outlets, if located on water agency controlled premises or if DHS approval is obtained (California Code Section 64566).

In addition to the minimum system pressures, the system is evaluated for maximum pressures. The maximum pressure criterion is 90 psi under ADD conditions in relatively flat areas. For areas with mountainous terrain the maximum pressure criterion is 125 psi to avoid the need for multiple small pressure zones. This higher pressure is only acceptable if each service connection has a pressure-reducing valve in accordance with the UPC.

The hydraulic model is used to evaluate pressures for all demand nodes in the model.

Pipeline Velocities and Headloss

Two conditions of the City's distribution system pipeline velocities are analyzed: 1) evaluation of existing pipelines and 2) planning of future pipelines. As presented in **Table 7-1,** the maximum velocity for existing system pipelines under MDD conditions is 8 feet per second (fps). However, when system pressure criteria are satisfied, pipeline velocities can exceed 8 fps under MDD conditions. Existing pipelines that exceed the velocity criteria are only recommended for pipeline upgrades where high velocities result in low system pressures.

To reduce head loss (and pumping costs) and to minimize surge in pipelines, it is recommended that future pipelines be sized with a maximum pipeline velocity of 8 fps.

Fire Flow Demands

Fire requirements are based on the 2001 Los Angeles County Fire Department Regulation 8 Guidelines per the Los Angeles County Fire Department. *Section IV A 1a* states that all newly constructed single-family residences of less than 5,000 square feet shall require fire flow provisions of 1,250 gpm. A fire flow provision of 1,500 gpm applies to detached condominiums less than 5,000 square feet and two family dwellings (duplexes). According to Section IV A 2b, a fire flow of 5,000 gpm is required for new land development projects (undeveloped land). Other land development projects consisting of lots having existing structures have fire flows per building size. Since it is not possible to identify fire flow criteria for each building for purposes of this master plan, generalized fire flow criteria have been determined for all land use designations as listed in **Table 7-2** and shown on **Figure 7-1**.

Table 7-2
Fire Flow Criteria by Land Use Category

Fire Flow Demand Categories	Area (acres)	Area (percent)	Fire Flow Demand (gpm)
Single Family Residential	4,311	26%	1,250
Medium Density Residential	591	4%	1,500
High Density Residential	294	2%	3,000
Commercial		0%	
General Commercial	160	1%	3,000
Retail Commercial	233	1%	3,000
Shopping Centers	121	1%	3,000
Visitor Commercial	22	0%	3,000
Total Commercial	537	3%	3,000
Industrial		0%	
Heavy Industrial	418	3%	3,000
Light Industrial	812	5%	3,000
Total Industrial	1,230	8%	3,000
Office		0%	
Civic and Institutional	1,617	10%	3,000
Office	114	1%	3,000
Public	15	0%	3,000
Total Office	1,746	11%	3,000
Schools	959	6%	4,000
Open Space		0%	
Right-of-Way	44	0%	0
Parking	61	0%	0
Parks and Open Space	864	5%	1,500
Vacant Land	596	4%	0
(blank)	13	0%	0
Total Open Space	1,578	10%	0
Mixed Use	1	1 %	3,000
Total	**16,337**	**100 %**	**N/A**

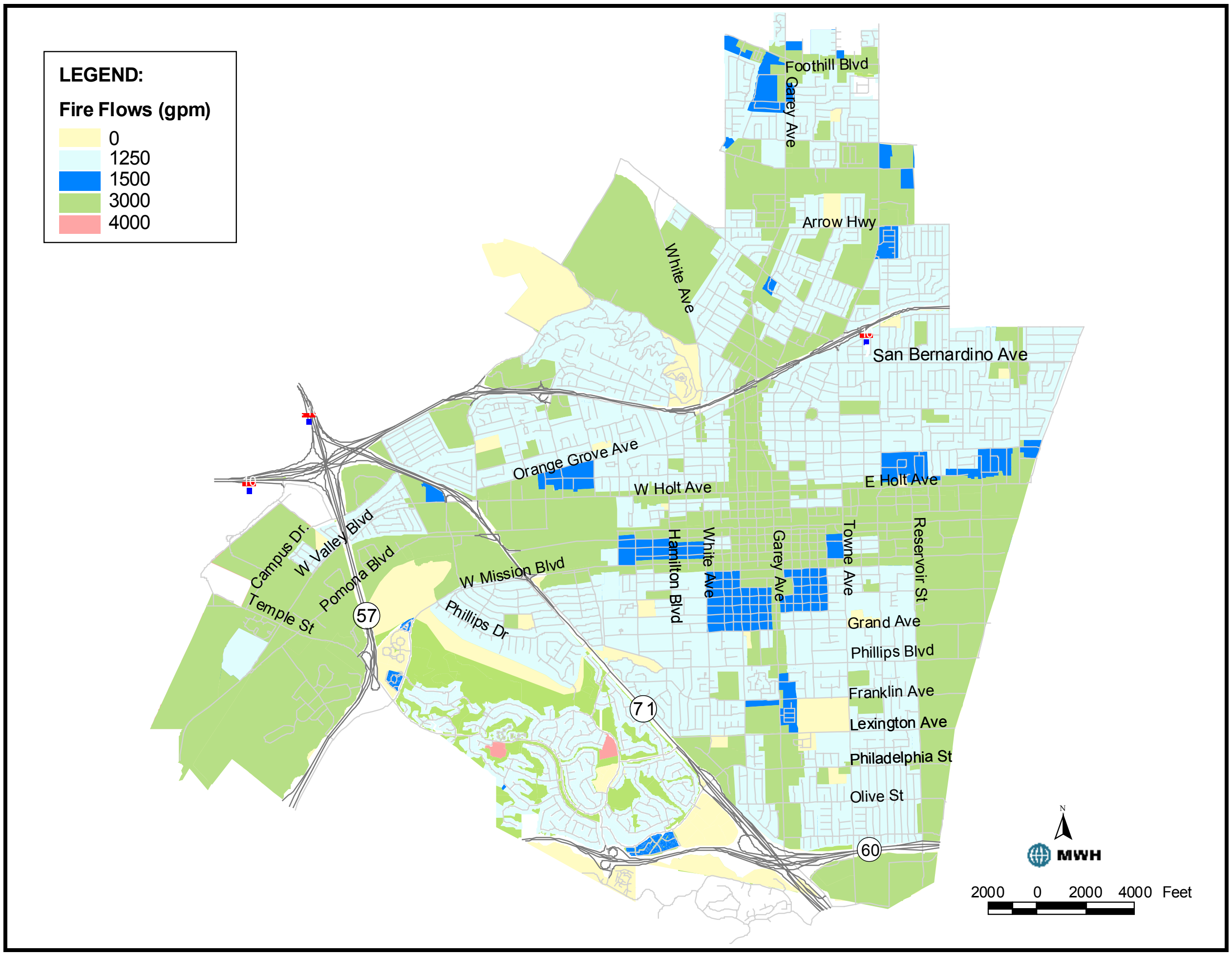
Storage Volume

Storage criteria are used to determine existing system storage deficiencies and to project the future system storage needs. The storage requirements are compared with existing and anticipated storage volumes to develop recommendations for any additional recommended reservoir facilities. The storage volume required in a water system can be divided into the following three components:

- Operational storage
- Fire protection storage
- Emergency storage.

Each component is discussed below, while the criteria are summarized in **Table 7-1**.

Figure 7-1
Fire Flow Criteria Based on Land Use



Operational Storage

Operational storage is the quantity of water required to buffer daily fluctuations in demand beyond the capabilities of the water supply and production facilities. Water production capacity is typically provided for MDD. Any operational peaks (short duration) above the MDD rate are more cost-effectively provided by storage or booster pumping rather than by “oversizing” production, where gravity storage is possible.

Based on economic considerations, systems are often designed to produce the average flow on the day of maximum demand. Water must be stored to supply the peak flows that exceed the maximum day production rate. Operational storage is then replenished during “off-peak” hours, when the demand is less than the production rate. The quantity of this operational storage is determined by a typical diurnal demand of a water system or individual pressure zone. Water system or pressure zones with primarily residential land use types often have higher hourly peaking factors compared to water systems or pressure zones that have a combination of land use types. A typical recommendation by the AWWA is to provide a volume ranging from one-quarter to one-third of the demand experienced during one maximum day. It is therefore recommended that the each zone has an operational storage volume available equal or greater than 30 percent of MDD of that zone. For zones that feed pressure-regulated zones without other supply sources, the operational storage should be based on the combined MDD of that zone with all connected pressure-regulated zones.

Fire Protection Storage

The duration of the fire flow protection depends on the required fire flow demand as specified in the Los Angeles County Fire Department Regulation 8 Guidelines. Regulation 8 specifies a duration of 2 hours for flows between 0 and 2,500 gpm, 3 hours for flows between 3,000 and 3,500 gpm, 4 hours for flows between 4,000 and 4,500 gpm, and 5 hours for flows of 5,000 gpm. The fire flow requirements used in this study are summarized in Table 7-2.

The required fire flow storage is calculated per pressure zone by multiplying the highest fire flow requirement of that zone with the corresponding duration. For example, if the highest fire flow requirement is 3,000 gpm for 3 hours, the recommended fire storage criterion of the pressure zone evaluated is 0.54 million gallons (MG). Fire protection storage should be based on the highest fire flow requirement of the main zone and all connected pressure regulated zones as fire flow storage can be provided from zones with higher HGLs, provided that the zones are connected with adequately sized PRVs or automatically operated drop valves.

Emergency Storage

The volume of water allocated for emergency uses is generally determined based on the historical record of emergencies experienced and on the amount of time expected to lapse before the emergency can be corrected. Possible emergencies include events such as water contamination, loss of electrical power ("brown outs" or "rolling black outs"), pipe rupture requiring shut-down for repair, several simultaneous fires and other unplanned events. The system reliability section provides a more detailed description of these emergencies. Since the occurrence and magnitude of an emergency cannot be accurately predicted, the volume of emergency storage is generally based upon engineering judgment or the utility's policy.

Under emergency conditions, demands can be met from supply sources that are not affected by the emergency conditions and emergency storage. Emergency storage can either be stored merely in the storage tanks or as groundwater when groundwater wells remain operational under emergency conditions. The scenario requiring the largest emergency storage volume is considered critical.

MWH conducted an emergency storage analysis of various emergency scenarios using the City's water supplies and demands. The impact of an earthquake is the most stringent emergency condition analyzed, assuming that the City needs to be able to meet minimum day demands with the AEP and Booster Station No. 3 out of service for three days.

The analysis shows that no emergency storage is required for the system as a whole due to sufficient supply capacities to meet emergency needs. However, emergency supply is needed on a zone-to-zone basis. Based on discussions with City staff, the emergency storage requirement is 50 percent of MDD. Similar to operation and fire flow storage, the emergency storage requirement is calculated per pressure zone or combination of pressure zone in case of pressure reduced zones.

It should be noted that 50 percent of MDD may provide multiple days of water supply in emergency conditions, depending on the system water demand after the emergency occurs. During an earthquake, electronic and print media notices can be distributed to inform the public of the situation and to discourage all extraneous water uses. By utilizing these communications, customers in other cities and water districts have been known to reduce their water consumption by one-half to two-thirds for a brief period until normal service conditions and facilities can be restored. Hence, minimum day demand conditions are used for the emergency system evaluations. Based on historic production records, the minimum month demand (MinMD) is approximately 0.64 times ADD (years 2001 through 2003).

Supply Analysis by Pressure Zone

A comprehensive supply analysis is performed for each pressure zone to evaluate the different sources of water available to meet the demands. The analysis takes into consideration imported water connections, groundwater wells, booster stations, zone transfers through PRVs, and inter-agency connections.

The analysis is performed under MDD conditions with the largest source, serving the pressure zone being evaluated, out of service.

System Reliability

For the reliability analysis, the following emergencies are evaluated:

- Outage of major transmission mains under MDD conditions
- Outage of imported water supplies for seven consecutive days under ADD conditions
- Outage of groundwater wells for seven consecutive days under ADD conditions
- Outage of the Pedley WTP for three days under MDD conditions

A summary of the reliability criteria is presented in **Table 7-3**, while a description for each scenario is provided below.

Table 7-3
Reliability Evaluation Criteria

Reliability Parameter	Demand	Evaluation Criteria
Transmission main breaks	MDD	Supply demand with broken transmission pipes (12-inch diameter and greater)
Imported supplies out of service	ADD	Supply demand with all MWD connections out of service for seven consecutive days
Groundwater wells out of service	ADD	Supply demand with all groundwater wells out of service for seven consecutive days
Water treatment plants out of service	MDD	Supply demand with surface water treatment plants out of service

The hydraulic model is used to evaluate these emergency scenarios for both existing and future system conditions. The demand conditions considered for each emergency scenario depend on the most likely condition that the emergency will occur where the severity of the emergency makes it justifiable that water demands are temporarily reduced through public announcements for water rationing.

Transmission main breaks and the outage of water supply facilities, such as WTPs, are evaluated under MDD conditions because these emergencies are most critical under high water demand conditions. The impact of MWD connections out of service is evaluated under ADD conditions, because MWD historically performs its system maintenance during the wintertime when demands are low. With maintenance being the primary cause for this emergency, analysis under ADD conditions is realistic. A similar criterion is used for all groundwater wells out of service.

During these emergency conditions, the City needs to maintain sufficient pressures and meet water quality requirements.

Analysis Methodology

Analyses for water supplies, storage quantities, and inter-zone water transfer capabilities are conducted using a mass balance calculations and hydraulic model runs for verification of system pressures and replenishment of reservoir levels. The total source water requirements for City's water system as a whole are determined based on anticipated maximum day demands for the existing and future systems. As described earlier, adequate source water should be available to supply MDD with the largest source of water out of service. Therefore, MDD projections are evaluated with respect to existing capacity and additional supply is recommended as needed.

Storage water requirements, or requirements for storage reservoir volumes, are evaluated on a system-wide, as well as, on zone-by-zone basis. Criteria discussed in this section are used to determine existing system deficiencies and to project future system storage needs. The storage requirements are compared with the existing and the anticipated storage volumes to develop recommendations for any additional recommended reservoir facilities.

Pumping station capacities are evaluated on a zone-by-zone basis. MDDs are compared with pumping station capacities, with the largest unit out of service, to determine necessary booster pumping station upgrades.

The existing system and anticipated future system configurations are evaluated with respect to the optimum locations for the recommended improvements in storage facilities and booster pumps. Each zone is analyzed to determine how water in adequate quantities and pressure will be provided from the available source waters and storage facilities.

Computer hydraulic model runs are made for the existing and future systems after the completion of the analyses described above. The model runs include recommended facilities such as additional groundwater wells, storage reservoirs, booster pumps, and/or pressure regulating stations. Model runs are made using steady state and 24-hour extended period simulation (EPS) runs to evaluate anticipated system pressures and pipeline velocities. Recommendations are made for any additional pipelines necessary due to system hydraulics and the adequacy of pipelines with respect to system redundancy.

Model runs have been completed using the following three conditions:

- Average day demand (ADD) conditions, 24-hour EPS simulation
- Maximum day demand (MDD) conditions, 24-hour EPS simulation
- Maximum day demand conditions with fire flow demands (MDD + FF), steady-state simulation

Maximum day plus fire flow situations are evaluated at every demand node in the existing and future system having fire hydrants. Each demand node is given a fire flow criterion based on the maximum fire flow requirement for the services that each demand node represents. Using the model, each demand node is evaluated to determine if the fire flow requirement could be met at that node while maintaining pressure at 20 psi at all demand nodes in that pressure zone. Where fire flow criteria cannot be met using a single node and the fire flow demand is 1,250 gpm or more, then the fire flow analysis is performed using two adjacent demand nodes. The Los Angeles County Fire Department requirements allow fire flows of 1,250 gpm or more to be met from two adjacent hydrants. Recommendations are made for those locations where fire flow requirements that could not be brought within acceptable residual pressure ranges. The locations and the recommended improvements are presented as part of the analyses of both the existing and future scenarios in Section 8 and Section 9.

Rehabilitation Needs

An overall assessment of the existing water system is conducted to identify areas of improvements and determine if rehabilitation, replacement, upgrades, repairs and/or additions are necessary. These assessments include field visits to each facility, reviews of existing documents, and discussions with City staff. Evaluation for rehabilitation is mostly focused on the following system components:

- Pipelines
- Groundwater Wells
- Storage Reservoirs
- Booster Pumping Stations

The City's distribution system consists of approximately 421 miles of pipeline. The majority of these pipelines is asbestos cement and was installed between the 1950s and 1960s. This material and the rest of the distribution system pipeline materials are assessed based on their pipe age and type of lining. Rehabilitation or replacement is recommended for pipes in bad condition due to problems such as internal scaling or corrosion and/or have reached their service life.

An assessment of each groundwater well is conducted to develop recommendations for replacing aging wells and for maximizing groundwater production within the water system. Replacement or rehabilitation is recommended depending on construction date, expected well service life (based on casing material and thickness), well maintenance activities, water quality, specific capacity and well pump efficiency trends over time of operation. Recommendations to maximize groundwater well production within the water system, such as additions of new wells, transmission mains, reservoirs, pressure zone boundaries, or supply facilities (treatment facilities), are also included in this WMP.

Storage reservoirs are evaluated to determine if replacement or rehabilitation is necessary. The distribution system consists of 22 storage reservoirs with a storage volume of approximately 90 MG. Recommendation of repairs, rehabilitation, replacements, upgrades and/or additions of new reservoirs are based on an assessment of the existing reservoirs' physical conditions and compliance with structural codes. Reservoirs built before 1972 require special attention in terms of compliance with new structural earthquake design codes.

Section 8
Existing Water System Evaluation

This section describes the evaluation of the existing water distribution system, identifies the deficiencies, and recommends improvements to address these deficiencies. The system evaluation is based on the criteria described in **Section 7**. The system evaluation consists of the following components:

1. An evaluation of the distribution system, including pressures, reliability, and energy optimization
2. An evaluation of the water system facilities consisting of a facility assessment and capacity analysis

Recommendations are made for each of these two evaluations, which are combined in a summary of recommended improvements, which is presented in the end of this section.

DISTRIBUTION SYSTEM ANALYSIS

In the distribution system analysis, the existing network is evaluated for system pressures under a variety of demand conditions, adequacy of pressure zones, and system reliability. In addition, the rehabilitation of old pipelines is discussed. The recommendations made in the distribution system analysis are summarized at the end of this subsection.

System Pressure Evaluation

The hydraulic model is used to evaluate the system pressures for the following three scenarios:

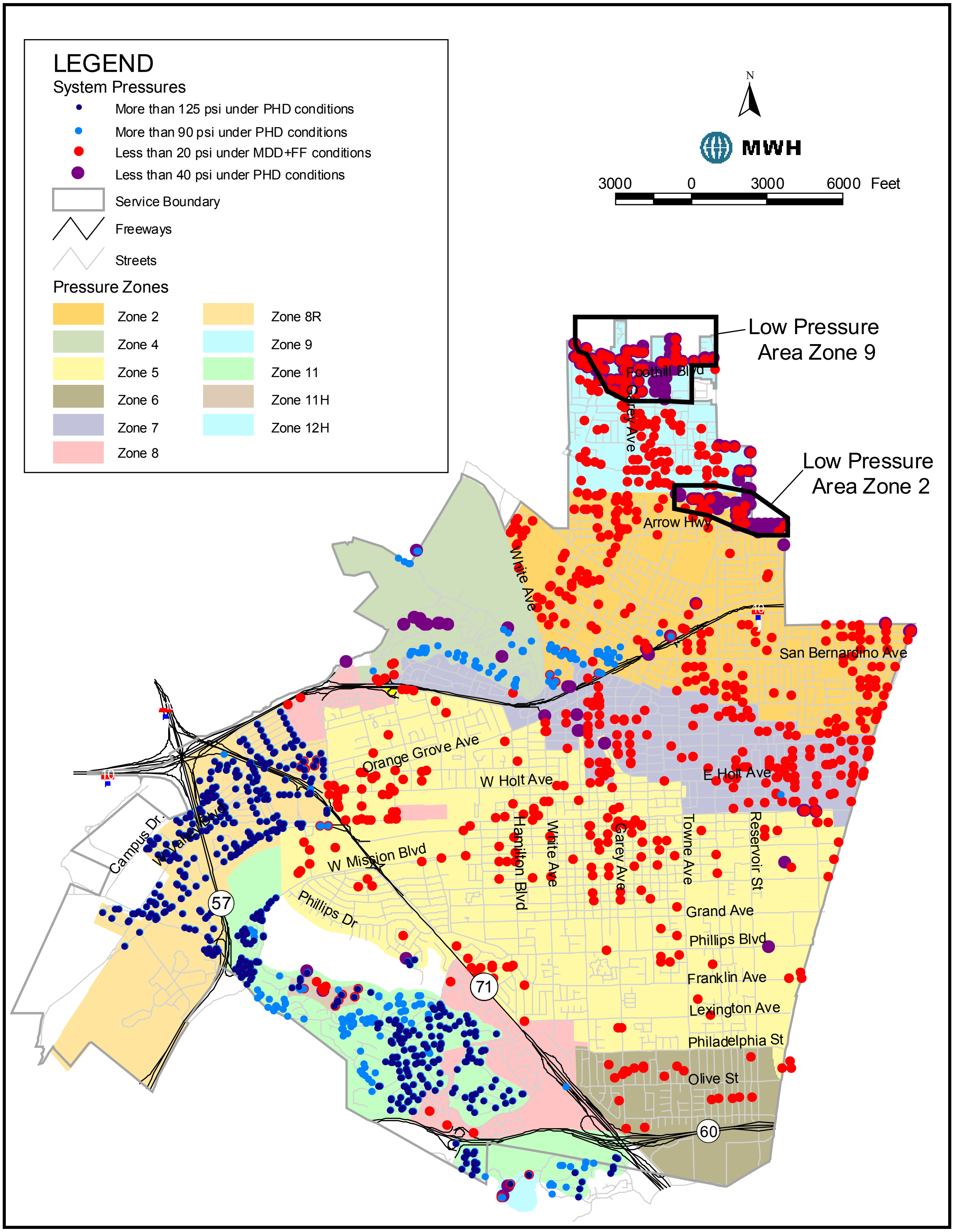
1. Meet PHD while maintaining a minimum pressure of 40 psi
2. Meet PHD while not exceeding the maximum pressure of 90 psi and 125 psi for hilly terrain (if possible)
3. Meet MDD and fire flow while maintaining a minimum pressure of 20 psi

The results of these analyses are discussed below.

Minimum Pressure with PHD

For the first criterion, the model is run for 24 hours with MDD. The demands at 7 AM on the maximum day are equal to PHD. The pressures are evaluated only for the 5,773 demand nodes, because the pressure criteria do not apply to transmission mains or at water facility locations, provided that the minimum pressure exceeds 5 psi. The model run identifies 218 demand nodes or approximately 4 percent of the system with pressures below 40 psi. Low pressures vary between 4 and 40 psi. All low-pressures areas are shown on **Figure 8-1**.

Figure 8-1
Low and High Pressure Areas



To identify improvements required to meet the minimum pressure criterion of 40 psi under MDD with existing water demand, pipelines with head losses of 5 feet per 1,000 feet or greater are considered for replacements or upgrades. About 258,000 lineal feet or 48 miles of pipeline replacements or upgrades are recommended, which are depicted on **Figure 8-2** and **Figure 8-3**. About 20 miles of these replacements are located in the City's major arterial streets (referred to as major streets for this master plan) listed in **Table 8-1**. The majority of these pipelines (40 of the 48 miles) are pipelines that were installed prior to 1950 and would be part of the pipeline rehabilitation program if not identified in this category. The pressure improvements presented on **Figure 8-2** are separated into the four categories. These categories, the prefixes used to indicate the category of each improvement, and the total lengths of improvements by category are summarized in **Table 8-2.** The length and diameter of each individual improvement is summarized at the end of this section in **Table 8-24**. The labels in **Figure 8-2** correspond with the improvements listed in **Table 8-24**.

Table 8-1
Major (Arterial) Streets

No	Street Name	No	Street Name
1	Arrow Highway	12	Philadelphia Street
2	Dudley Street	13	Phillips Boulevard
3	East End Avenue	14	Pomona Boulevard
4	Fairplex/Ganesha Boulevard	15	Reservoir Street
5	Foothill Blvd	16	Riverside Drive
6	Garey Avenue	17	San Bernardino Avenue
7	Holt Avenue	18	Temple Avenue
8	Indian Hill Boulevard	19	Towne Avenue
9	Mills Avenue	20	Valley Boulevard
10	Mission Boulevard	21	White Avenue
11	Orange Grove Avenue		

Table 8-2
Summary of Pressure Improvements

Improvement Type	Prefix[1]	Length (miles)
Pressure Improvements installed before 1950	PA	27
Pressure Improvements in Major Streets installed before 1950	MA	17
Pressure Improvements in Major Streets	MP	3
Remaining Pressure Improvements	P	1
Total		**48**

1- "PA" indicates Pressure - Age; "MA" indicates Major Street - Age; "MP" indicates Major Street - Pressure; "P" indicates Pressure.

Figure 8-2
Pressure Improvements

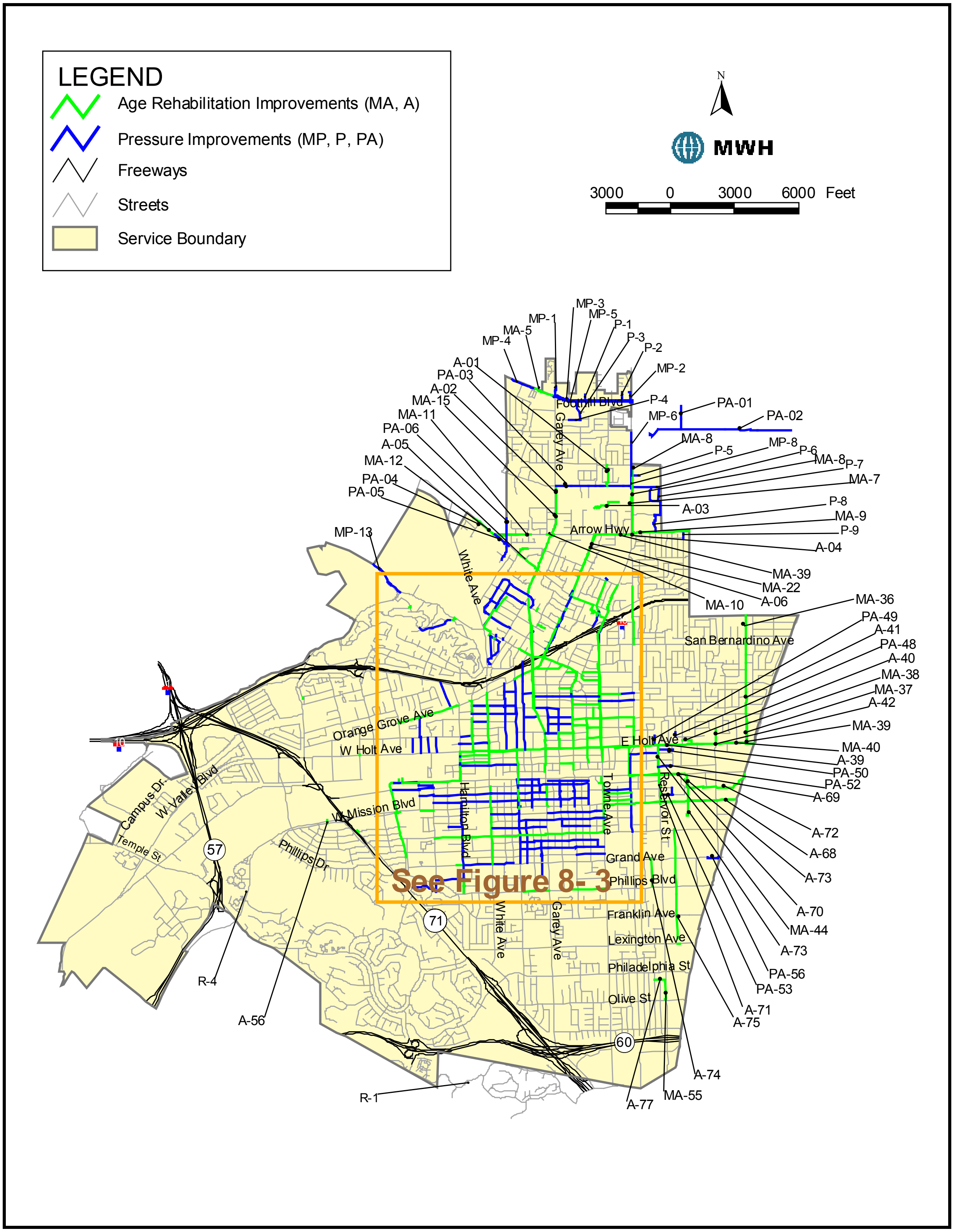
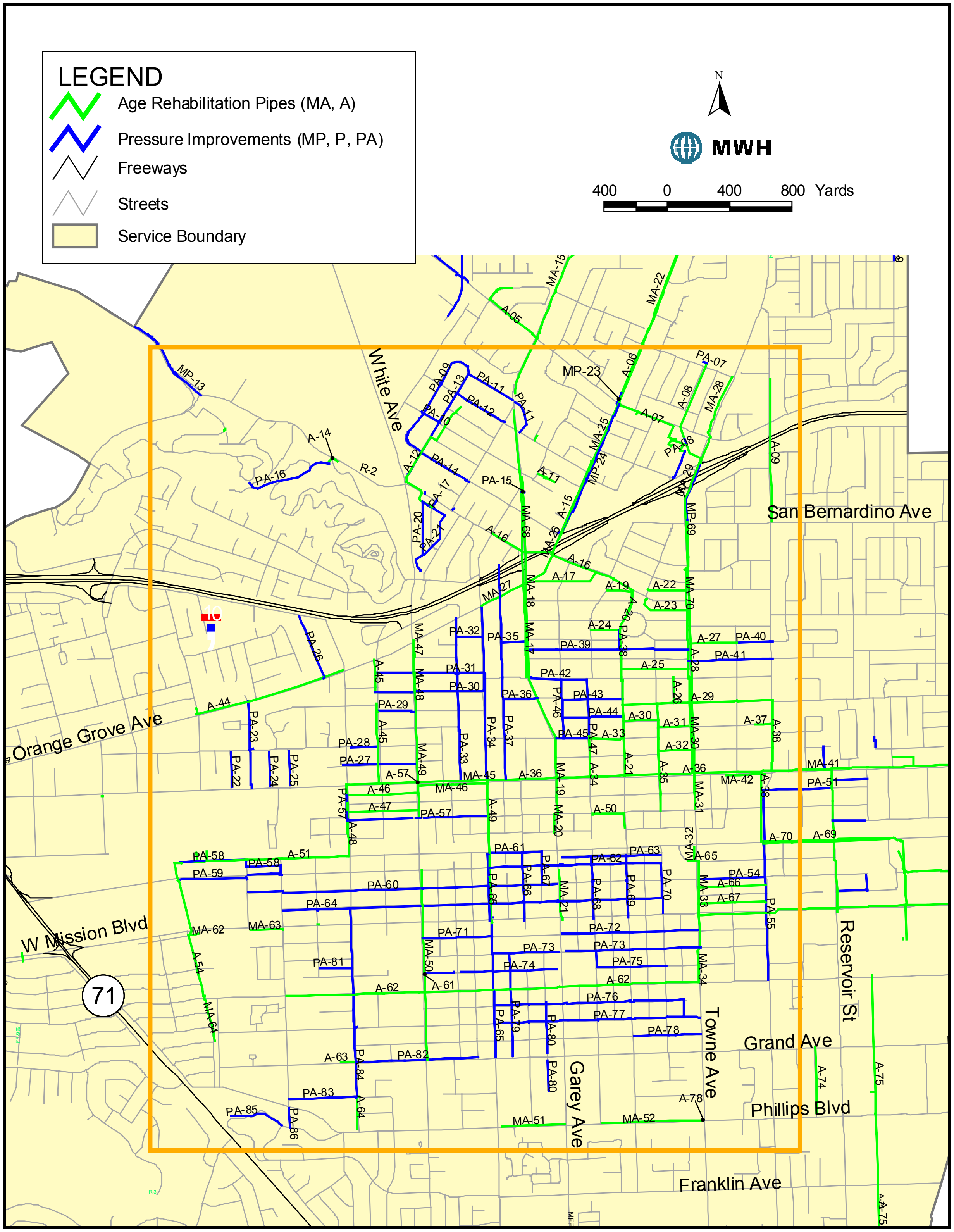


Figure 8-3
Pressure Improvements – Detail



Maximum Pressure with PHD

The model is also used to identify areas where the maximum pressure exceeds 90 psi and 125 psi for hilly terrain. This evaluation is conducted under PHD conditions. There are 630 demand nodes or approximately 11 percent of the system with maximum pressures in excess of 125 psi. High pressures varied between 120 psi and 199 psi are found in Zone 8R and Zone 11, Zone 11H and Zone 12H. These high-pressure areas are depicted on **Figure 8-1**.

No improvements are recommended for these high-pressure areas, because the City does not have a history receiving high-pressure complaints from customers. To avoid possible problems stemming from high pressures, the City recommends to developers that design projects, in areas exceeding 80 psi, include the installation of pressure regulators consistent with the Uniform Plumbing Code.

Minimum Pressure with MDD plus Fire Flow

The hydraulic model is used to evaluate the impact of fire flows on the distribution system. Fire flows ranging from 1,000 to 4,000 gpm are applied to the model to evaluate if the system could meet the fire flow demand under MDD conditions, while maintaining a minimum pressure of 20 psi. For this analysis, the *H_2OMAP Fireflow Simulation* is used. Based on the model runs, 706 fire flow locations are identified as having insufficient residual system pressures, this equates to 12 percent of nodes assigned fire flows.

- Pipeline replacements are necessary to improve pressures in the areas identified in the fire flow simulation as low-pressure (<20 psi) areas. Pipelines identified in the City's FY 1992 CIP that have not been installed are recommended for improvements again in this evaluation. As a result, about 190,000 lineal feet or 36 miles of pipeline replacements or upgrades are recommended for fire flow improvements. About 19,200 linear feet or 4 miles of these replacements are located in the City's major arterial streets, and are indicated with a prefix "MFF-". The remaining portion of the fire flow improvements have a prefix "FF-". The fire flow improvements by category are summarized in **Table 8-3**. The improvements are depicted on **Figure 8-4** and **Figure 8-5** and summarized in **Table 8-24**.

- Many of the pipeline improvements involve upgrading undersized 4-in diameter pipelines to 6- and 8-inch diameter pipelines.

Table 8-3
Summary of Fire Flow Improvements

Improvement Type	Prefix[1]	Length (miles)
Fire Flow Improvements located in Major Streets	MFF	4
Remaining Fire Flow Improvements	FF	32
Total		**36**

1- "MFF" indicates Fire Flow – Major Street; "FF" indicates Fire Flow.

Figure 8-4
Improvements for Existing System Fire Flow Deficiencies

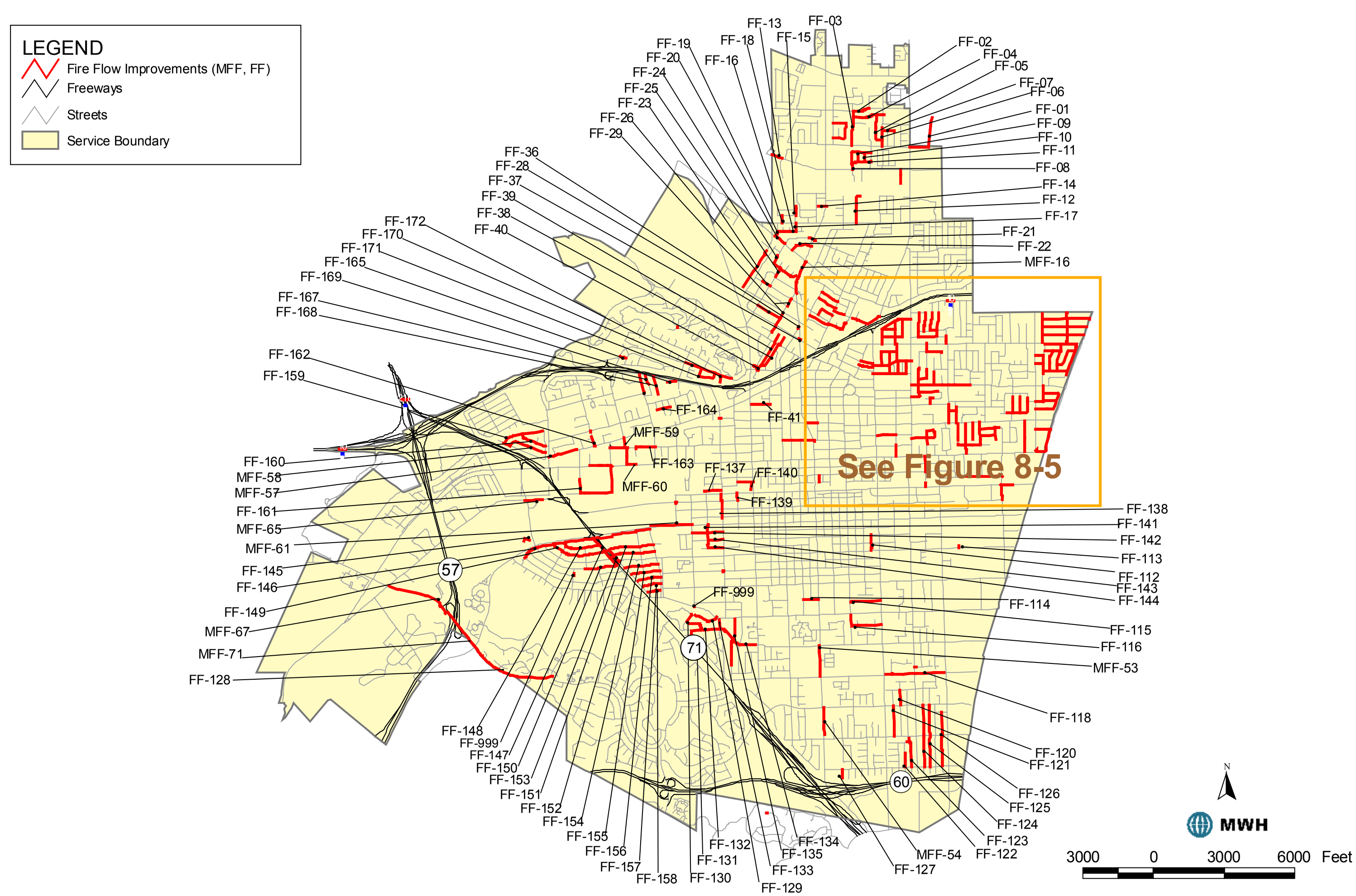
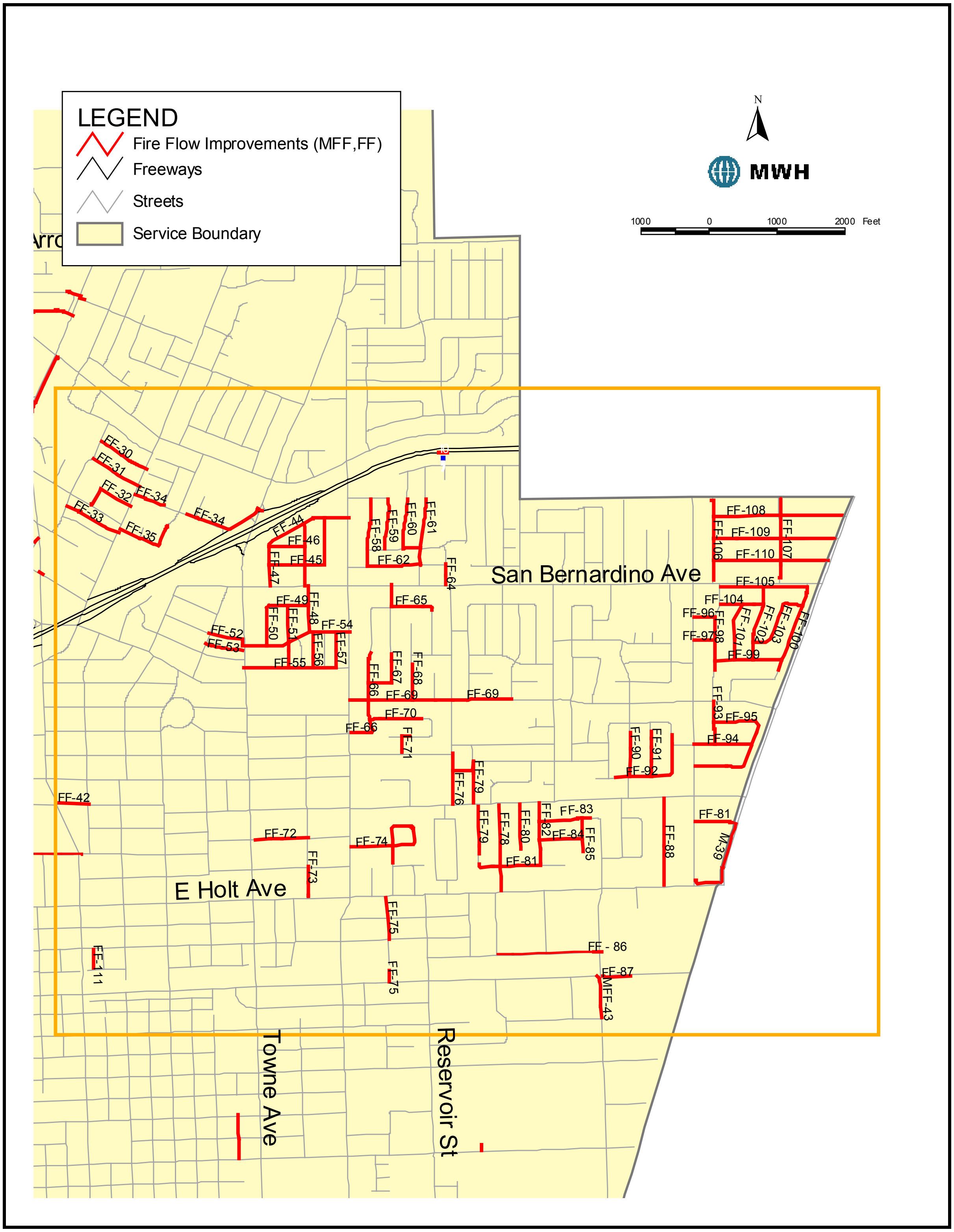


Figure 8-5
Improvements for Existing System Fire Flow Deficiencies – Detail



Adequacy of Pressure Zones

The model is used to evaluate the adequacy of pressure zones boundaries under MDD conditions. Based on the model simulation, it is concluded that the pressure zone boundaries are generally adequate to provide sufficient pressures within the zones, without exceeding the maximum pressures on most locations. Two areas show low pressures under PHD and MDD with fire flow conditions due to high ground elevations compared to the HGL of the pressure zone. These two areas are:

- The top of Zone 9, primarily north of Foothill Boulevard. This area cannot be rezoned, as Zone 9 is the highest zone of the system. Pipeline upgrades recommended along Foothill Boulevard and Grove Street reduce the dynamic head losses between Reservoir 13 and the top of Zone 9 to address the low-pressure deficiencies.

- The top of Zone 2, primarily along Arrow Highway and between Mountain Avenue and Towne Avenue. Pipeline upgrades recommended along Arrow Highway and Towne Avenue reduce the dynamic head losses between Reservoir 2 and top of Zone 2. One possibility could be to rezone or increase Zone 9 area. However the improvements recommended will also address the low-pressure deficiencies. No rezoning recommendations are made at this point. It is recommended to re-evaluate the option of rezoning with a calibrated model and compare the cost of rezoning to the cost of installing the improvements depicted in **Figure 8-2** and **Figure 8-5**. The increase of reservoir storage in Zone 9 should also be considered.

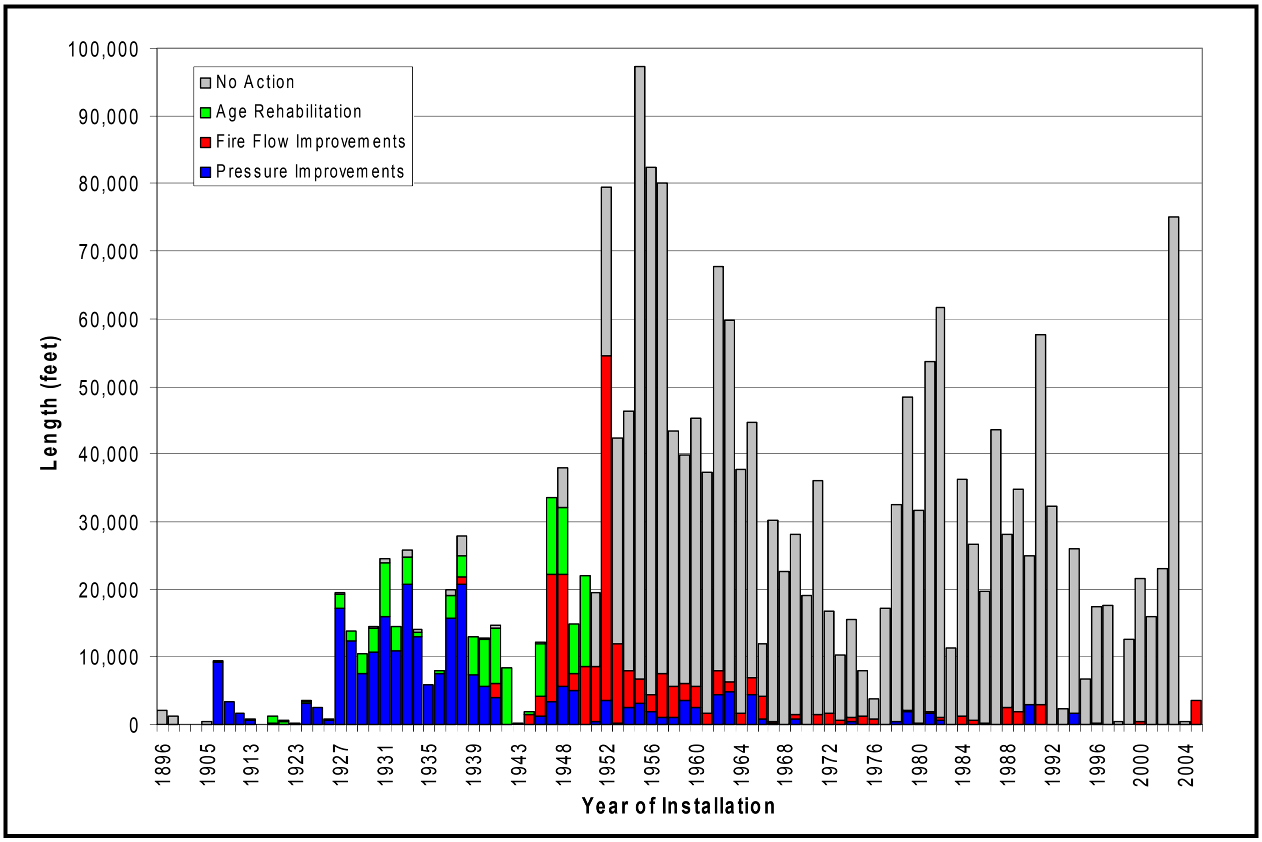
Distribution System Rehabilitation

The existing distribution system consists of approximately 421 miles ranging in age from one to 109 years. The distribution of pipeline length by age is presented on **Figure 8-6**. As shown on **Figure 8-6**, the majority of the City's distribution system was constructed after 1955, with two major growth periods in 1952-1965 and 1979-1992. The City undertook a major pipeline replacement program beginning in 1999.

Based on a typical useful life of 75 years and a planning horizon of year 2025, all pipelines installed before 1950, with a combined length of 75.4 miles, should be replaced or rehabilitated by year 2025. This equates to an average replacement rate of 3.8 miles per year (mi/yr) over the next 20 years. However, due to the high spike in pipeline construction in the period 1950 through 1965, the replacement rate would be much higher (8.9 mi/yr) in the next twenty year period from 2025 through 2045. To avoid large variations in pipeline rehabilitation work, it is recommended that the City plan to replace about 5.6 miles of pipeline per year. This is the average rate required to replace the entire system (421 miles) every 75 years. It should be noted that this replacement rate is similar to the City's pipeline replacement rate in the five-year period 1999 through 2004, when the City installed about 150,000 lineal feet or 28 miles of pipeline (5.7 mi/yr).

At a recommended replacement rate of 5.6 mi/yr, 112 miles of pipeline will need replacement in the next 20 years. Based on the pipeline age distribution, this means that all pipes installed prior to 1955 would need to be replaced by 2025. However, 84 miles of pipeline replacements are already recommended to address pressure and fire flow deficiencies as listed in **Table 8-2** and **Table 8-3**. These pressure and fire flow improvements are indicated on **Figure 8-6**. As shown on this figure, the majority (67 miles) of these pipelines was installed in or before 1955, while the remaining 17 miles were installed after 1955. In addition to these 84 miles of pipeline improvements, 22 miles of other pipelines that were installed in or before 1950 will reach the end of their useful life and require replacement by 2025. This results in a total of 106 miles of pipelines that need to be replaced within the planning horizon of this WMP. The average replacement rate would be 5.3 mi/yr, which is considered equivalent, for planning purposes, to the 5.6 mi/yr replacement rate needed to replace the entire system every 75 years. It should be noted that additional pipeline improvements are included in the future system analysis, slightly increasing the replacement rate.

Figure 8-6
Development of City's Water Distribution System



Although the majority of the City's distribution system consists of asbestos cement (54 percent) pipes, pipe material needs to be considered for the replacement strategy. Based on a study performed by the U. S. Bureau of Reclamation (USBR, 1994) on the historical performance of buried pipelines, it was concluded that cast iron pipes have the highest failure rate and ductile iron pipes had the second highest failure rate. Pipe materials with low failure rates include steel, PVC, and asbestos cement. To determine which pipes need replacement and which pipes can be relined, coupons should be taken by selectively hot-tapping pipes of various ages and materials (excluding PVC and AC) to conduct standard materials testing to evaluate pipeline conditions. A detailed evaluation of the relation between pipeline age and material versus pipeline failure and leak history should be conducted as an initial step in a replacement program.

Other criteria that should be considered when selecting a pipe for rehab or replacement stems from the need to be synergistic with the City's street rehabilitation program. If a street is scheduled to be paved or modified, all other things being equal, this information would be critical. On occasion, it sometimes becomes necessary to relocate a pipeline from the alley to the street. Improved access and protection of the main can be increased given that the main lies in the public right of way.

Summary of Distribution System Recommendations

Based on the system pressure evaluation, pressure zone analysis, reliability evaluation, and assessment of rehabilitation needs, 105 miles of pipelines are recommended to address the identified deficiencies. This includes 36 miles of age improvements, 36 miles of fire flow improvements, and 33 miles of pressure improvements. These improvements are summarized by category in **Table 8-4,** while the diameter distribution of these improvements is summarized in **Table 8-5**. A detailed summary of fire flow and age improvements by diameter is presented in **Appendix B**. In addition, it is recommended to conduct flow testing and coupon testing prior to pipeline rehabilitation to determine the actual condition of the selected pipelines.

Table 8-4
Summary of Existing System Distribution System Improvements

Improvement Type	Prefix	Length (miles)
Pressure Improvements in Minor Streets installed before 1950	PA	28
Pressure Improvements in Major Streets installed before 1950	MA	15
Pressure Improvements in Major Streets installed after 1950	MP	4
Remaining Pressure Improvements	P	1
Fire Flow Improvements located in Major Streets	MFF	4
Remaining Fire Flow Improvements	FF	32
Age Improvements of all remaining pipes installed before 1950	A	21
Total		**105**

Table 8-5
Recommended Pipeline Rehabilitation

Proposed Diameter (inches)	Age Rehabilitation (lineal ft)	Fire Flow Improvements (lineal ft)	Pressure Improvements (lineal ft)	Total (lineal ft)
6	23,800	120,300	95,300	239,400
8	53,600	39,100	32,200	124,900
10	35,900	10,200	10,000	56,100
12	14,400	10,100	11,200	35,700
14	9,300	0	0	9,300

Table 8-5 (Cont'd)
Recommended Pipeline Rehabilitation

Proposed Diameter (inches)	Age Rehabilitation (lineal ft)	Fire Flow Improvements (lineal ft)	Pressure Improvements (lineal ft)	Total (lineal ft)
16	35,700	10,800	18,100	64,600
18	14,300	2,100	5,000	21,400
20	1,900	0	200	2,100
Total (ft)	**188,900**	**192,600**	**172,000**	**553,500**
Total (mi)	**36**	**36**	**33**	**105**

Pipeline Rehabilitation Techniques

There are a number of possible solutions to problems arising from internal scaling, corrosion and deposition in water distribution pipes. These range from simple periodic cleaning to replacement of the pipe using "trenchless" techniques. Installation of a replacement pipe along a new route by open trench laying, directional drilling, and microtunneling, may also be viable in certain circumstances. The aim of the selection process is to consider all the following factors to arrive at the most cost-effective, technically viable solution:

1. The nature of the problem(s) to be solved (scale, corrosion, structural deterioration, inadequate capacity, etc.)
2. The hydraulic and operating pressure requirements for the rehabilitated main
3. The materials, dimensions, and geometry of the water main
4. The types and locations of valves, fittings, and service connections
5. The length of time in which the main can be taken out of service
6. Site-specific factors (traffic, slope/terrain, soil/rock excavation, water table, etc.)

Cleaning Techniques

Although cleaning a water pipe may not be the best solution for water quality or flow and pressure problems, cleaning may offer the lowest-cost, immediate solution to some of these problems. However, cleaning is more frequently used as a necessary preliminary step before carrying out one of the lining processes described later.

Flushing

While improving water quality is the primary purpose of flushing, careful observation of the system hydraulics during the process may indicate problems in mains, such as inadequate capacity, undiscovered restrictions, or closed or partially closed valves.

Cable-Attached Devices

Systems that use cable-attached devices for cleaning distribution mains include drag cleaning, hydraulic-jet cleaning, and electric scraper cleaning. In each case, the length of hose or cable determines the length of the pipe section that can be cleaned.

- **Drag Cleaning**: The process in which a cable-and-winch pulls a mechanical cleaner, composed of a series of steel scraper blades and rubber squeegees, through the pipe. This cleansing method is appropriate when water pressure or volume is insufficient to propel a hydraulically driven device, or when excessive pressure would be required for hydraulic cleaning, especially with small-diameter mains.

- **Hydraulic-Jet Cleaning**: A pipe-cleaning method in which a special nozzle attached to a hose emits a jet of water at high velocity and pressure that removes debris and deposits from the interior of the pipe. The principal advantage of hydraulic-jet cleaning is removal of very tough deposits.

- **Electric Scrapers**: Electric scrapers are used to clean large-diameter lines by incorporating revolving brushes or rotating arms. The principal advantage of this method is the ability of the operator to evaluate the effectiveness of the cleaning process as it proceeds through the line.

Fluid-Propelled Cleaning Devices

Fluid-propelled cleaning devices such as foam pigs and mechanical metal scrapers are used and not constrained by the cable length to advance them along the main (i.e., they use water pressure).

- **Foam Pigs**: Foam pigs are flexible, bullet-shaped cleaning tools manufactured of low-density polyurethane foam. Pigs are propelled down water mains by the pressure and volume of water in the distribution system. Cleaning is accomplished by the frictional drag and flexible characteristics of the foam pig, which removes foreign objects, iron tuberculation, and other matter as it passes through the pipes.

- **Metal Scrapers**: A metal cleaning scraper consists of a steel frame shaped like a piston. The cleaner is propelled through the water main by means of water pressure and often accomplishes cleaning with a single pass in a continuous operation. An opening must be provided at each end of the section to be cleaned for entry and exit of the cleaning tool. The principal advantage of this method is the ability to clean long stretches of heavily deposited pipe at 2 to 10 ft/sec in a single, continuous operation with minimal excavation points.

Interior Lining Techniques

Lining a pipeline can minimize the need for frequent flushing and/or cleaning. Linings have also been installed to reduce or eliminate leaks through corroded areas of pipe or bad joints. A smooth lining in a corroding pipe helps to maximize hydraulic carrying capacity and to minimize pumping costs. Additionally, some lining systems can correct structural failures, bridge breaks, and missing sections in corroded pipe, thus restoring service through a continuous pipeline.

In-place lining of water mains can be accomplished by one or more of the following general methods: Cement-mortar lining, epoxy lining, slip lining with an inner lining pipe or tube, and cured-in-place lining.

Cement-Mortar Lining

Pipe that is lined with cement mortar is protected from oxidation because of the composition of the portland cement. Today, cement mortar is applied to new ductile-iron pipes and most new steel pipes before installation, making this method a standard in the water industry.

The lining machine is placed in the pipe at 300 to 1,500 ft intervals, depending on pipe diameter, valve locations, bends, profile, and alignment. The lining machine applies the pumped mortar and is equipped with rotating trowels or a conical drag trowel positioned just behind the dispensing head. As the machine moves through the pipe, it leaves a smooth, troweled (non-structural) finish. A reinforced cement-mortar lining may also provide structural improvement.

Epoxy Lining

The process for in-situ epoxy resin lining (ERL) of iron and steel has been performed in North America since the early 1990s to rehabilitate old, unlined water mains. The epoxy materials approved for use were first certified by ANSI/NSF Standard 61 in 1995.

Epoxy lining of potable water mains is currently classified as a non-structural renewal method. The process involves cleaning the pipe to remove existing corrosion buildup and then spraying a thin (1 mm) liquid epoxy coating onto the inner wall of the pipe. A lining machine applies the epoxy material with a centrifugal spinner applicator. The coating cures in 1 day and provides a smooth and durable finish, resistant to mineral deposits and future tuberculation buildup.

Prior to lining, pipes must be thoroughly cleaned to remove tuberculation and produce a clean surface to which the epoxy lining will adhere. Techniques such as drag-scraping will provide a sufficiently clean surface for ERL.

Slip-Lining

Another viable method of rehabilitating existing water pipelines is the insertion of flexible thermoplastic liners directly into the mains. The key benefit of slip-lining is that it creates a new, integral pressure pipe inside the old, deficient pipeline without a complete excavation. While slip-lining has been widely used by sewer and natural gas utilities since the early 1980s, other pipe-lining techniques have been more widespread for use in transmission and distribution systems for source water and treated, potable water.

Using a process known as thermal butt fusion, the ends of several consecutive 40-ft lengths of flexible pipe are joined at a convenient location aboveground to form a single length of pipe, usually hundreds of feet long. One end of this pipe is then pulled by cable into the entry pit and through the section of old pipe. The new pipe is then reconnected to the existing mains.

However, an inserted liner substantially reduces the effective cross-sectional area of the pipe. Consequently, the future flow requirements must be considered when deciding to slip-line. Finally, the geometry of the unlined pipe must be considered, as liners generally do not install easily through elbows exceeding 45 degrees. Regardless of these drawbacks, slip-lining is a useful lining method.

Cured-in-Place Lining

Cured-in-place pipe (CIPP) lining techniques involve inserting a polymer fiber tube or hose impregnated or coated with a thermoset resin system into the host pipe. The resin is then cured, either under ambient conditions or by application of heat using steam or water, to produce either a rigid "pipe within a pipe" or a semi-rigid liner which depends on adherence to the pipe wall for support.

Pipe Bursting

Pipe bursting is a trenchless method of replacing existing water mains by breaking and displacing existing pipe and installing a replacement pipe in the void created. The pipe-bursting process replaces the original pipe with a new pipe that is the same diameter or larger. The system consists of a pneumatic, hydraulic, or static bursting unit that splits the existing pipe while simultaneously installing a replacement pipe of the same or larger diameter and pressure rating.

The bursting action of the tool increases the external dimensions of existing pipe sufficiently to break it into pieces, which the tool compresses into the surrounding ground. In addition to breaking the pipe, this action creates the void into which the bursting unit is pulled or pushed, allowing forward progress. These systems work with existing pipe varying in diameter from 4-in to 48-in. The pipe to be replaced can be either fracturable material or material that can be sliced by cutters integrated into the bursting unit. Pipe-bursting equipment and technologies are often subject to patent protection.

A review of plans should identify service connections, valves, hydrants, and fittings, which must be excavated and disconnected before pipe-bursting operations commence. A temporary bypass system may be needed to maintain service to consumers.

Pit excavation is needed to accommodate replacement pipe sections. Pits should be centered over the existing line, and excavation sizes should be verified in the field prior to construction of the project. Polyethylene pipe is a common choice for replacement pipe. Sections should be assembled and joined on the job site by the butt-fusion method. Care must be taken not to damage the inserted pipe as it passes through the fragments of the old pipe.

Pipe-bursting technologies are subject to patent protection, so the contractor should warrant to the utility that the equipment to be used is furnished in accordance with applicable licensing or use agreements and that the prices quoted cover all applicable royalties and fees required under such agreements. The contractor should protect the utility against any costs, loss, damage, or expense arising out of any claim of infringement of patent or trademark or any violation of a licensing agreement.

Pipe bursting technology could be used if the host pipe does not have adequate structural strength and thus making it an unattractive candidate for relining. This technology could also be used when relining with a smaller diameter pipe (resulting in reduced capacity) is not a viable option.

Bypass Piping

As noted earlier, depending on the cleaning or lining method used, temporary distribution system shutdowns may occur. Some processes require relatively brief shutdowns, so work can be completed without installing bypass lines. Conversely, some cleaning techniques and all lining methods require more extensive shutdowns that may create the need to install bypass piping.

The installation of bypass lines can be the most time-consuming and labor-intensive operation of a cleaning or lining project. However, the use of bypass piping does allow fairly long shutdowns while still maintaining acceptable service to consumers.

A residential area bypass line is usually 3 to 4 inches in diameter with provisions for a 0.75-in or 1-in. hose connection to each residence or business along the main. Site conditions affect the amount of potential damage to the line, possible tripping hazards, and any obstructions to pedestrians and vehicular traffic. In a business or commercial area, bypass lines are usually 4 in. or larger in diameter.

Once bypass piping has been used to maintain service during cleaning or lining projects, care during the reconnection phase is very important to avoid further service interruptions. Upon completing the cleaning or lining, the permanent pipelines must be flushed and disinfected according to AWWA C651. Following this step, the lines are ready for service, the bypass lines can be disconnected, and customers reconnected to the permanent service lines.

Recommendation

It is recommended that the City of Pomona consider pipelining techniques as an alternative to pipe replacement in those locations where the existing unlined pipe is structurally sound, has an remaining useful life of at least 20 years and no increase in diameter is required to correct pressure or fireflow deficiencies. The structural integrity of the pipeline can be evaluate through coupon testing as discussed earlier. An economic analysis should be performed to determine whether relining is cost-effective compared to replacement.

STORAGE VOLUME ANALYSIS

The City currently has 22 storage reservoirs, located throughout the City's distribution system with a total volume of 87.7 million gallons (MG). Storage analysis for the existing system is discussed below.

The storage analyses are performed per pressure zone. According to the planning criteria discussed in **Section 7**, the operational storage requirement is 30 percent of MDD, while the fire flow storage should provide sufficient water for the highest fire flow requirement of the zone evaluated. In addition, emergency storage equivalent to 50 percent of MDD is required.

A summary of the storage volumes required and storage volumes available are presented by pressure zone in **Table 8-6** This table indicates that the City has a surplus of 46 MG storage capacity for the system as a whole under existing demand conditions. When the required and

Table 8-6
Storage Volume Evaluation

Pressure Zone Description	Demands			Storage Required						Storage Evaluation		
	ADD (mgd)	Peaking Factor	MDD (mgd)	Fire Flow (gpm)	Duration (hrs)	Fire Flow (MG)	Operational (MG)	Emergency (MG)	Required (MG)	Available (MG)	Surplus/ Deficit (MG)	Recom-mended (MG)
Zone 9	**1.79**	**1.70**	**3.04**	**4,000**	**4**	**0.96**	**0.91**	**1.52**	**3.39**	**12.96**	**9.57**	**-**
Zone 11	2.18	1.70	3.71	4,000	4	0.96	1.11	1.85	3.93	4.15	0.22	-
Sub-zone Hydro 11	0.12	1.70	0.21	0[2]	0	0.00	0.06	0.10	0.17	0.00	-0.17	**-**
Sub-zone Hydro 12	0.03	1.70	0.05	0[2]	0	0.00	0.02	0.03	0.04	0.00	-0.04	-
Zone 11 Total	**2.34**	**1.70**	**3.97**	**N/A**	**N/A**	**0.96**	**1.19**	**1.99**	**4.14**	**4.15**	**0.01**	**-**
Zone 2	**4.37**	**1.70**	**7.43**	**4,000**	**4**	**0.96**	**2.23**	**3.71**	**6.90**	**9.53**	**2.63**	-
Zone 4	**0.62**	**1.70**	**1.06**	**3,000**	**3**	**0.54**	**0.32**	**0.53**	**1.39**	**3.50**	**2.11**	-
Zone 7	**2.56**	**1.70**	**4.35**	**4,000**	**4**	**0.96**	**1.30**	**2.17**	**4.44**	**6.79**	**2.35**	-
Zone 8	0.95	1.70	1.62	3,000	3	0.54	0.49	0.81	1.84	15.24	13.40	-
Sub-zone 8R	2.28	1.70	3.88	4,000	4	0.96	1.16	1.94	4.06	0.00	-4.06	-
Zone 8 Total	**3.24**	**1.70**	**5.50**	**N/A**	**N/A**	**1.50**	**1.65**	**2.75**	**5.90**	**15.24**	**9.34**	-
Zone 5	**8.91**	**1.70**	**15.15**	**4,000**	**4**	**0.96**	**4.54**	**7.57**	**13.08**	**30.61**	**17.53**	-
Zone 6	**1.27**	**1.70**	**2.16**	**4,000**	**4**	**0.96**	**0.65**	**1.08**	**2.69**	**4.90**	**2.21**	-
Grand Total	**25.09**	**N/A**	**42.65**	**N/A**	**N/A**	**7.80**	**12.80**	**21.33**	**41.92**	**87.68**	**45.76**	**N/A**

1 - Bold text indicates zones where storage is provided for tributary pumped or reduced-pressure zones.
2 – The hydropneumatic zones are served water for fire fighting through helicopter drops and fire pumps.

available volumes are compared on a zone to zone basis, three zones with a storage deficit were identified. These zones are Zone 11, Sub-zone Hydro 11, and Sub-zone 8R.

The required storage volume in Zone 11, including Sub-zone Hydro 11 and Sub-zone Hydro 12 is 4.14 MG, while the available storage is 4.15 MG. Thus, for the combined Zone 11, there is no storage deficiency identified. However, Zone 11H has a storage deficiency of 0.17 MG. The City is planning to construct a 0.1 MG reservoir (Reservoir 11H) to replace the hydropneumatic system. The remaining storage deficiency in Zone 11H (post Reservoir 11H construction) and in Zone 12H would be addressed by the means of surplus storage in Zone 11. There is enough booster capacity in Booster 11H (A, B) and 12H (A, B) to supply emergency and operational storage to Zone 11H and Zone 12H respectively. Fire fighting in these pressure zones is typically carried out by employing fire pumper trucks and helicopter drops.

The fire hydrants near reservoir sites typically experience low pressures due to the lack of adequate elevation difference. These hydrants are located on large diameter pipelines (12-inch and larger) to minimize headloss during a fire. Rezoning to provide higher pressures at the hydrants is not a feasible solution and thus is not recommended. Pressurizing the system is of limited use in these areas because the storage reservoir limits the maximum system head. Instead, the City should advise the Fire Department of the location of these low-pressure hydrants, and that pumper trucks should be employed for fire fighting in the vicinity of reservoir sites.

Reduced Sub-zone 8R also has a storage deficit as shown in the table, but the combined available storage for Zone 8 exceeds the required storage and thus no recommendations are made for Zone 8 (combined).

SUPPLY ANALYSIS BY PRESSURE ZONE

A comprehensive supply analysis is performed for each pressure zone to identify existing system deficiencies. This analysis considers the following system components:

- Imported Water Connections
- Booster Stations
- Groundwater Wells
- Inter-Agency Connections

Total supply available for a pressure zone (from the components listed above) is compared with the total demand for the pressure zone. The total demand in the pressure zone consists of MDD for the zone evaluated plus any zone transfers from that zone thorough PRVs or boosters.

The analysis is performed under the following condition:

- Provide MDD with single largest source out of service for the pressure zone evaluated.

Single largest source for this analysis can be an imported water connection, groundwater well, pump unit at a booster station or an inter-agency connection. If multiple booster stations feed a zone, only the largest unit of all pumps is considered to be out of service, rather than the largest unit of each station feeding the zone.

In the analysis presented below, there are a few scenarios where more than one alternative for supplying water to a pressure zone is possible (i.e., different boosters, zone transfers etc.). In such cases, zone transfers are preferred over pumping to reduce energy costs. If there are multiple booster units available to pump water to a pressure zone, then the units that match the supply balance for this analysis are selected. However, the system operators have the flexibility of operating a combination of pumps during the required pumping hours in a day.

This analysis also shows the impacts on other zones if the largest source is out of service in the pressure zone being evaluated. The single largest source is initially identified based on capacities of all the supply sources. A system-wide supply balance is then performed with the identified largest source out of service to evaluate the impacts. It is observed that for some zones the largest source based on capacity being out of service does not have the most critical impact on the supply for the zone evaluated. In such a case, the single largest source is the one that results in the highest system deficiency.

Based on the assumptions described above, the analysis for each pressure zone is presented below.

Zone 9 Supply Analysis

Analysis for Zone 9 is presented in **Table 8-7**. Pedley WTP is identified as the single largest water source for this zone. MDD conditions occur in hot summer months when the surface flow to the Pedley WTP is expected to be minimal. For this analysis, it is assumed that there will be no flow from Pedley WTP, which renders groundwater wells along with the boosters at Booster Station 9 as the main sources of supply for Zone 9.

The existing MDD for Zone 9 as shown in the table is about 3 mgd. There is no excess water available in Zone 9 for transfer to Zone 2.

The available supply from the Tunnel wells is 1.6 mgd. Thus, the remaining water required to satisfy the total demand in Zone 9 is about 1.4 mgd. As shown in the table, the total capacity of Booster Station 9 is 4.2 mgd, which is more than what is required to meet the Zone 9 demands. Thus, it is assumed that booster 9C (with 1.8 mgd capacity) will be operational during a few hours of the day in order to supply the required 1.4 mgd to Zone 9 under this scenario.

The analysis shows that there are no deficiencies in Zone 9 under the existing demand conditions. This scenario of Pedley WTP being out of service also does not impact any other zones. A supply balance for Zone 9 analysis is presented in **Appendix C**.

Table 8-7
Zone 9 Supply Analysis with Pedley WTP Out of Service

Source	Capacity (mgd)	Evaluated Capacity (mgd)
Supply		
Wells		
20 (Inactive)	0.00	0.00
37 (Inactive)	0.00	0.00
T-1	0.45	0.45
T-2	0.34	0.34
T-3	0.48	0.48
T-4	0.35	0.35
Subtotal, Wells	1.61	1.61
Pedley WTP[1]	4.00	0.00
Boosters		
9A	0.51	0.00
9B	1.92	0.00
9C	1.82	1.43
Subtotal, boosters	4.25	1.43
Total Supply	**9.86**	**3.04**
Demands		
MDD	3.04	3.04
Zone Transfer to Zone 2	0.00	0.00
Total Demand	**3.04**	**3.04**
Surplus/Deficit		**0.00**

1 – Largest source out of service so considered capacity is 0 mgd.

Zone 2 Supply Analysis

The supply analysis for Zone 2 is presented in **Table 8-8**. As shown in the table, the largest source based on capacity for Zone 2 is Booster 2F with 2.77 mgd capacity. Analysis performed with Pedley WTP out of service represents a worse case than does Booster 2F out of service. This is because with Pedley WTP out of service, there is no surplus water in Zone 9 available for transfer to Zone 2 and also boosting is required at Booster Station 9 to supply Zone 9. This results in a higher demand in Zone 2. As a result of this higher demand, more pumping is required at Booster Station 2.

The total demand in Zone 2 per this analysis is 8.8 mgd with a total available supply of 11.7 mgd. It is assumed that Booster Station 2 is operated (with 2D off) to supply the required 8.8 mgd.

There are virtually no deficiencies in Zone 2 under existing demand conditions with Pedley WTP out of service and thus there are no improvements necessary. Other zones are also not impacted under this scenario as shown in Zone 2 supply balance in **Appendix C**.

Table 8-8
Zone 2 Supply Analysis with Pedley WTP Out of Service

Source	Capacity (mgd)	Evaluated Capacity (mgd)
Supply		
Wells		
13	0.37	0.37
27	1.16	1.16
9B	0.39	0.39
Subtotal, Wells	1.92	1.92
Boosters		
2C	2.12	2.12
2D	1.09	0.00
2E	2.20	2.00
2F	2.77	2.77
Subtotal, boosters	8.18	6.89
Zone 9 water transfer[1]	1.60	0.00
Total Supply	**11.70**	**8.81**
Demands		
MDD	7.43	7.43
Zone Transfer to Zone 7	0.00	0.00
PS 9 to Zone 9[2]	4.25	1.40
Total Demand	**11.67**	**8.83**
Surplus/Deficit	**0.03**	**(0.02)**

1 – Pedley WTP out results in no water transfer from Zone 9
2 – Based on Demand in Zone 9

Zone 5 Supply Analysis

Zone 5 is the largest zone in the system with a MDD of 15.1 mgd. This zone is mainly fed from the groundwater wells treated at the AEP. The treated water from the AEP is stored in Reservoir 6 and is pumped into Zone 5 through Booster Station 3 (units A, B, C, F, & G). In addition to this, Zone 5 is also fed from the groundwater wells pumping into Reservoir 5 and the 30 cfs (19.4 mgd) imported water connection from the PWR-JWL line to Reservoir 5 by gravity. The analysis presented below in **Table 8-9** is performed assuming this connection is out of service under MDD conditions.

The total demand in Zone 5 consists of MDD for Zone 5 plus satisfying the demand in Zone 2 through Booster Station 2. This scenario considers Pedley WTP to be operational at 4 mgd capacity. This results in surplus water from Zone 9 being transferred to Zone 2 and thus less pumping required at Booster Station 2.

The supply balance for this analysis is presented in **Appendix C**. As seen in the table below, in the case where the imported water connection from the PWR-JWL to Reservoir 5 is out of service, more water can be obtained through the 30 cfs connection at Reservoir 8 and transferred to Zone 5 through PRVs to satisfy the demands in the system. Consequently, there are no deficiencies identified in this analysis under the existing demand conditions.

Table 8-9
Zone 5 Supply Analysis with MWD Connection at Reservoir 5 Out of Service

Source	Capacity (mgd)	Evaluated Capacity (mgd)
Supply		
Wells		
1	0.00	0.00
3	0.86	0.86
7	0.99	0.99
22	0.00	0.00
32	0.00	0.00
8B	1.57	1.57
Subtotal, Wells	3.42	3.42
Boosters		
3A	3.51	3.51
3B	3.13	3.13
3C	5.32	5.32
3F	7.23	7.23
Subtotal, boosters	19.19	19.19
Available booster capacity[1]		12.50
MWD Connection[2]	19.40	0.00
Zone Transfer from Zone 8	2.13	2.13
Zone Transfer from Zone 11	0.00	0.00
Total Supply	**42.00**	**18.05**
Demands		
MDD	15.15	15.15
PS 2 to Zone 2[3]	8.18	2.90
PS 5 to Zone 8	0.00	0.00
PS 10 to Zone 8	0.00	0.00
PS 1 to Zone 4	0.00	0.00
Total Demand	**23.33**	**18.05**
Surplus/Deficit	**18.68**	**0.00**

1 – Based on water available at Reservoir 6 for pumping to Zone 5 after feeding Zone 6 demands and Zone 7 demands
2 – Largest source out of service
3 – Based on demand in Zone 2 with Pedley WTP operating at 4 mgd capacity

Zone 6 Supply Analysis

The AEP is identified as the single largest source for Zone 6. There are currently 14 groundwater wells pumping into the AEP for nitrate removal as shown in **Table 8-10**. With the

AEP being out of service, Wells 2 and 5B are the only wells considered as available supply for Zone 6 on top of the zone transfer from Zone 8.

The total demand in Zone 6 consists of 2.2 mgd of MDD and 3.1 mgd of demand from Zone 7. When the AEP is out of service, more water is required from the connections on the PWR-JWL line to Reservoir 8 and Reservoir 5. Water from Zone 8 can then be transferred through PRVs to satisfy the total demand in Zone 6. There are no deficiencies identified for Zone 6 in this analysis. System-wide supply balance for this analysis is presented in **Appendix C**.

Table 8-10
Zone 6 Supply Analysis with AEP Out of Service

Source	Capacity (mgd)	Evaluated Capacity (mgd)
Supply		
Wells to AEP[1]		
6	1.43	0.00
10	1.24	0.00
11	0.64	0.00
12	0.86	0.00
14	0.74	0.00
15	0.69	0.00
16	1.11	0.00
17	0.74	0.00
18	0.90	0.00
21	1.20	0.00
23	1.16	0.00
25	1.48	0.00
26	0.83	0.00
34	1.50	0.00
System Wells		
2	1.59	1.59
29	0.52	0.52
5B	1.15	1.15
Subtotal, Wells	17.78	3.26
Zone Transfer from Zone 8	2.60	2.60
Total Supply	**20.38**	**5.86**
Demands		
MDD	2.16	2.16
PS 3 (D, E) to Zone 7[2]	4.77	3.10
PS 3 (A, B, C, F) to Zone 5	0.60	0.60
Total Demand	**7.53**	**5.86**
Surplus/Deficit	**12.85**	**0.00**

1 – AEP is the largest source out of service
2 – Based on demand in Zone 7

Zone 4 Supply Analysis

Zone 4 is primarily supplied water by Booster Stations 1 and 8. Booster 7A is capable of pumping water from the Orange County Feeder at PM-11 connection or from the PWR-JWL pipeline. This booster is only used for emergency purposes and not during normal system operation, making Booster Station 1 and 8 the primary sources of water for Zone 4.

The total demand in Zone 4 under MDD conditions is only 1.1 mgd. The total available booster capacity with Booster 1A (single largest unit) out of service exceeds the total demand as shown in **Table 8-11**. Thus, no improvements are necessary for Zone 4 under existing demand conditions.

A supply balance of the system under Booster 1A being out of service is shown in **Appendix C**.

Table 8-11
Zone 4 Supply Analysis with Booster 1B Out of Service

Source	Capacity (mgd)	Evaluated Capacity (mgd)
Supply		
Boosters		
7A	1.88	1.88
1A	1.24	1.24
1B[1]	2.57	0.00
8A	1.05	1.05
8B	1.09	1.09
Subtotal, boosters	7.84	5.27
Total Supply	**7.84**	**5.27**
Demands		
MDD	1.06	1.06
Zone Transfer to Zone 7	0.00	0.00
Total Demand	**1.06**	**1.06**
Surplus/Deficit	**6.78**	**4.21**

1 – Largest source out of service

Zone 7 Supply Analysis

The supply analysis for Zone 7 is presented in **Table 8-12**. Booster 3E is identified as the largest unit supplying water to Zone 7. When this unit is out of service, zone transfer from Zone 2 is required on top of the 0.9 mgd available from the Well 35.

In the analysis shown below, zone transfer from Zone 2 has been used to serve the demand in Zone 7. The system-wide supply balance is presented in **Appendix C**. As shown in the table below, the total demand for Zone 7 can be supplied with the largest unit being out of service and thus there are no improvements recommended for the existing demand conditions.

Table 8-12
Zone 7 Supply Analysis with Booster 3E Out of Service

Source	Capacity (mgd)	Evaluated Capacity (mgd)
Supply		
Wells		
30 (Inactive)	0.00	0.00
35	0.90	0.90
Subtotal, Wells	0.90	0.90
Boosters		
3D	1.07	1.07
3E[1]	3.70	0.00
Subtotal, boosters	4.77	1.07
Zone Transfer from Zone 2	2.40	2.40
Zone Transfer from Zone 4	0.00	0.00
Total Supply	**8.08**	**4.37**
Demands		
MDD	4.35	4.35
Zone Transfer to Zone 8	0.00	0.00
Total Demand	**4.35**	**4.35**
Surplus/Deficit	**3.73**	**0.02**

1 – Largest source out of service

Zone 8 & 8R Supply Analysis

Zones 8 and 8R are treated as combined zones for this analysis as shown in **Table 8-13** and the term “Zone 8” used in the description below refers to Zone 8 and 8R combined. The imported water connection from the PWR-JWL to Reservoir 8 is identified as the single largest source for these combined zones.

Zone 8 has very little groundwater available through Well 28 and in the event when the imported water connection is out of service at Reservoir 8, water from Zone 5 needs to be pumped to Zone 8 through Booster Station 5 and Booster Station 10. This in turn results in higher amount of imported water being delivered at Reservoir 5 connection.

The total demand in Zone 8 consists of 5.5 mgd of MDD for the combined zones plus 4 mgd for Zone 11-combined (Zone 11, 11H, & 12H). There is enough pumping capacity at Booster Stations 5 and 10 as shown in the table to supply water to Zone 8 from Zone 5. There are no deficiencies identified under the existing demand conditions.

System-wide supply balance under the scenario of imported water connection at Reservoir 8 being out of service is presented in **Appendix C**.

Table 8-13
Zone 8, 8R Supply Analysis with MWD Connection at Res. 8 Out of Service

Source	Capacity (mgd)	Evaluated Capacity (mgd)
Supply		
Wells		
28	0.46	0.46
Subtotal, Wells	0.46	0.46
MWD Connection[1]	19.4	0.00
Boosters		
5A	2.71	2.71
5B	3.63	3.63
5C	3.35	3.35
10A	3.03	3.03
10B	2.96	2.96
Subtotal, boosters	15.69	15.69
Available booster capacity[2]	15.69	9.10
Zone Transfer from Zone 4	0.00	0.00
Total Supply	**35.55**	**9.56**
Demands		
MDD[3]	5.50	5.50
Zone Transfer to Zone 6	0.00	0.00
Zone Transfer to Zone 5	0.00	0.00
PS 11 (A-F) to Zone 11[4]	7.59	2.00
PS 12 (A-C) to Zone 11[4]	3.03	2.00
PS 8A,B to Zone 4	2.14	0.00
Total Demand	**18.26**	**9.50**
Surplus/Deficit	**17.29**	**0.06**

1 – Single largest source out of service
2 – Based on demand in Zone 8
3 – Maximum Day Demand for Zone 8 and 8R combined
4 – Operators to select the pump units to provide the required supply to Zone 11-combined

Zone 11, 11H, & 12H Supply Analysis

Zone 11, hydropneumatic Zone 11H, and hydropneumatic Zone 12H are treated as a combined pressure zone for this analysis. The supply sources for Zone 11-combined are Booster Station 11 and 12. Booster 11F is identified as the largest unit serving the zone.

As shown in **Table 8-14** the total demand in Zone 11-combined is 4 mgd. The total boosting capacity between Booster Station 11 and 12 with booster 11F out of service is 8.9 mgd. Thus, there are no deficiencies identified for Zone 11-combined under existing demand conditions. System-wide supply balance for this analysis is presented in **Appendix C**.

Table 8-14
Zone 11, 11H, 12H Supply Analysis with Booster 11F Out of Service

Source	Capacity (mgd)	Evaluated Capacity (mgd)
Boosters		
11A	1.07	1.07
11B	1.02	1.02
11C	1.04	1.04
11D	1.06	1.06
11E	1.69	1.69
11F[1]	1.71	0.00
12A	1.12	1.12
12B	0.93	0.93
12C	0.98	0.98
Subtotal, boosters	10.62	8.91
Total Supply	**10.62**	**8.91**
Demands		
MDD[2]	3.97	3.97
Total Demand	**3.97**	**3.97**
Surplus/Deficit	**6.65**	**4.94**

1 – Single largest source out of service
2 – Maximum Day Demands for Zone 11, Zone 11H, and Zone 12H

Conclusions

The supply analysis by pressure zone indicates that there are no deficiencies in the system for existing demand conditions. The inactive groundwater wells (Wells 20 & 37 in the Claremont Heights Basin, Wells 24B & 36 in the Chino Basin, and Well 32 in the Pomona Basin) due to water quality issues should be brought online in future by providing treatment or blending. If these wells are returned to service, the City would increase its groundwater production capacity by approximately 4.5 mgd. This will result in reduced imported water purchases to supply the City, which in turn may increase cost savings.

SYSTEM RELIABILITY ANALYSIS

To provide adequate system redundancy for maintenance or temporary failure, it is recommended that the City have adequate source water capacity to meet the water demands with the largest source of water out of service. For the water source evaluation, four evaluation criteria were established. As described in **Section 7**, the water system should have adequate source water to:

1. Major transmission main (12-inch and larger) breaks under MDD conditions
2. Outage of imported water supplies for seven consecutive days under ADD conditions
3. Outage of AEP for three consecutive days under MDD conditions

4. Outage of the Pedley WTP for three days under MDD conditions

Demands in excess of MDD, such as during peak hours, should be supplied from reservoir storage.

Major Transmission Main Breaks

The hydraulic model is used to evaluate the impact of transmission main breaks on the distribution system. All pipelines of 12-inch in diameter and greater are broken (closed in the model) one at a time to evaluate if the system could meet MDD while maintaining a minimum pressure of 40 psi. For this analysis, *H2OMAP Water Protector* is used. Pipe breaks are identified as critical when pressures are insufficient, water demands cannot be met, or a combination of both. These critical pipelines are identified with labels R-1 through R-6 on **Figure 8-7**. Based on the model runs, the following pipes are identified as critical:

- **R-1**: The 4,700 lineal feet of 12-inch diameter pipeline on Phillips Ranch Road and Scenic Ridge Drive between Village Loop Road and Lazy Meadow Road. If this pipeline breaks, a portion of Zone 11 that is located south of State Route 60 (Pomona Freeway) and Hydro Zone 12 becomes isolated. The customers located in this area have a combined demand of 250 gpm, which represents about 850 residential connections. In this case, the area could be served by installing a second, redundant, pipeline. Due to topography the only looping option would be to install a pipeline along Scenic Ridge Road, Rock Springs Drive, and Riverside Drive to connect the most eastern part of Zone 11 with Zone 6. It should be noted that this alignment includes a crossing under State Route 60 and would require a 75 HP booster station to serve PHD of 850 gpm and increase the head by 250 feet. Considering the length of pipeline required and the freeway crossing, it is assumed to be more cost-effective solution to address this scenario is to add an inter-agency connection with the City of Chino Hills near the intersection of Rimrock Avenue and Homeridge Lane. Details on this connection are discussed under inter-agency connections.

- **R-2**: The 1,400 lineal feet of 16-inch diameter pipeline on McKinley Avenue from Paige Drive to White Avenue. If this pipeline breaks, the customers who are served from Zone 5 on the suction side of Booster Station 1 become isolated. These customers have a combined demand of 62 gpm, which represents about 210 residential connections. These customers could be served from Zone 4 by installing a 200 lineal foot pipeline parallel to the existing 16-inch diameter pipeline.

- **R-3**: The 8-inch diameter pipeline between Village Loop Road and West Storrs Place at the discharge side of Booster Station 11. If this pipeline breaks, a portion of Zone 11 that includes 1,500 lineal feet along West Storrs Place and 300 lineal feet along Redwood View Drive becomes isolated. The customers located along these streets have a combined demand of 26 gpm, which represents about 88 residential connections. Due to topography, this area can not be looped within Zone 11. This area could be served in case of a pipeline break if a second pipeline to this area would be installed. Due to topography, the only looping option would be to install a connection with the 8-inch diameter pipeline along West Storrs Place. As this is a Zone 5 pipeline, this connection would require a 5 HP booster station to serve

PHD of 88 gpm and increase the head by 160 feet. No pipeline would be required as both the Zone 5 and Zone 11 pipelines run parallel along Storrs Place.

- **R-4**: The 1,000 lineal feet of 12-inch diameter pipeline on Mission Boulevard from Rancho Laguna Drive to north of Rancho Laguna Drive. If this pipeline breaks, a portion of Zone 11, that is located west of Mission Boulevard between the State Route 57 and Phillips Drive, becomes isolated. The customers located in this area have a combined demand of 140 gpm, which represents about 475 residential connections. This area could be served in case of a pipeline break when a second pipeline to this area would be installed. The shortest pipeline would be roughly 400 lineal feet and would run between Camino del Milagro and Lucera Court. However, due to the absence of a public street, a longer pipeline could be required depending on easement options.

- **R-5**: The 14-inch diameter pipeline on Los Coyotes Drive at the intersection of Alta Mira Place. If this pipeline breaks, a portion of Zone 11, that includes 1,700 lineal feet along Los Coyotes Drive west of Alta Mira Place and Los Padres Place, becomes isolated. The customers located in along these streets have a combined demand of 26 gpm, which represents about 88 residential connections. Due to topography this area, installation of a looping pipeline is not an option. No recommendations are made, and a pipeline break would result in temporary interrupted water service.

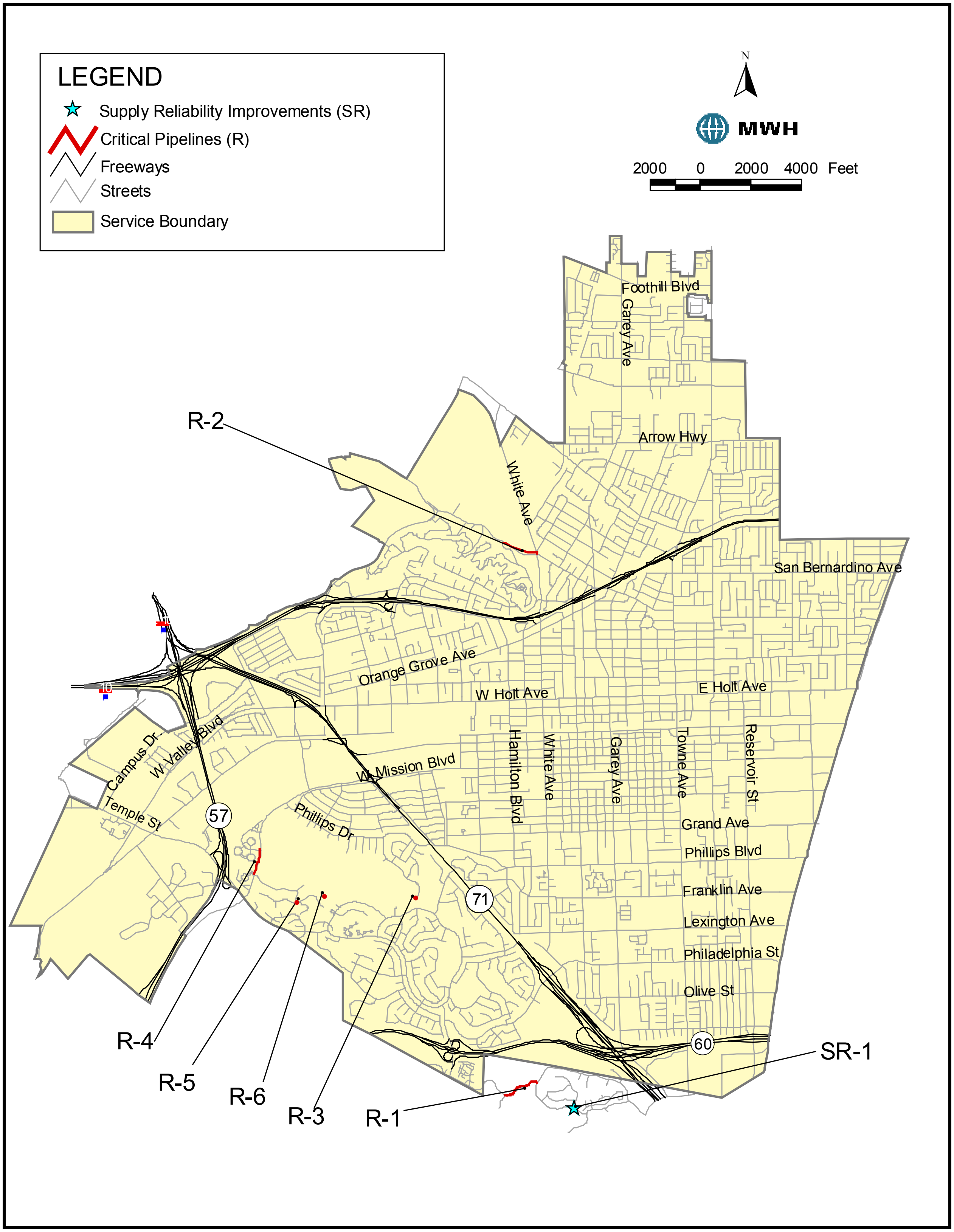
- **R-6**: The 16-inch diameter pipeline between Los Coyotes Drive and the suction side of hydro pumping station 11. If this pipeline breaks, Hydro Zone 11 becomes isolated. The customers located in this zone have combined demand of 85 gpm, which represents about 290 residential connections. Due to topography this area, installation of a looping pipeline is not an option. No recommendations are made, and a pipeline break would result in temporary interrupted water service.

The improvements listed above, that would serve to improve system reliability are not included in the CIP, with the exception of the inter-agency connection with the City of Chino Hills (pipe break R-1 listed as SR-1 in CIP table). This recommendation is included as it impacts the largest number of customers, while the other pipe breaks impact fairly small numbers of customers. It is assumed that it would be acceptable to interrupt water service temporarily in these areas while the main break is repaired. A temporary hose connection around the break could provide limited service during the outage. To limit the duration of interrupted water service, it is recommended that the City include these pipeline breaks in an emergency response plan that identifies which valves need to be closed and where to connect a temporary pipeline/hose to serve these areas.

Outage of Imported Water Supplies

As discussed in **Section 7**, the worst case scenario of MWD and TVMWD being out of service at the Weymouth and Miramar WTP results in no water supply at PM-15 (connections to Reservoir 5 and Reservoir 8) and PM-11 connection. For the emergency analyses, it is assumed that all the active groundwater wells, except those that require blending with imported water, and the Pedley WTP can deliver water up to the maximum capacity. It is also assumed that during such an emergency event, ADD conditions can be achieved by water conservation through public notifications.

Figure 8-7
Critical Pipelines and Reliability Improvements



The water supply situation without MWD water is summarized in **Table 8-15**. The groundwater wells that meet the current water quality regulations have a combined capacity of 23 mgd while the Pedley WTP has a capacity of 4 mgd. Thus, the total supply capacity without MWD water is 27 mgd. With an average day demand of 25.1 mgd, the approximate supply surplus is 1.9 mgd or 13.4 MG in 7 days. In the event that the Pedley WTP were to be offline (no surface water flows) during such an MWD outage, the remaining system supply would not be sufficient to meet ADD conditions. However emergency storage could be used to meet the demands during such a situation.

Table 8-15
Water Source Reliability – MWD Out of Service

Water Demand	1 day (mgd)	7 days (MG)
ADD	25.1	175.6
MDD	42.7	298.6
Water Supply	**27.0**	**189.0**
Groundwater	23.0	161.0
Surface water/WTP	4.0	28.0
Surplus/Deficit meeting ADD	**1.9**	**13.4**

In addition to this water balance approach, the hydraulic model is used to verify the impact on the distribution system in case the MWD connections are off-line during seven consecutive days. The model runs are performed for the existing distribution system without improvements. Based on the model runs, the system is not able to operate for the seven-day period. Reservoirs 5A, 5B, and 5C drained completely during the model simulation. It should be noted that the model became unstable after 154 hours due to the number of empty reservoirs. This indicates that demands can be met from the remaining sources and storage for approximately 6 days.

The hydraulic model used for this analysis is not calibrated due to lack of SCADA data and thus the model results cannot be verified. But the water balance calculation indicates that there is enough supply in the system to handle an emergency when MWD water is not available for 7 days. Also the model indicates that the system can handle such an emergency for more than 6 days. Thus, it is concluded that the City is currently able to meet the criterion of MWD being out of service for seven consecutive days. Based on this conclusion, no recommendations are made for the system.

Outage of AEP

The existing system is also evaluated for the condition when the AEP is out of service for three consecutive days. This results in loss of water from all the groundwater wells pumping into the AEP for treatment and blending. The City has the option of obtaining sufficient water supplies from MWD and other groundwater wells to meet MDD as shown in **Table 8-16**. For this analysis, it is assumed that water from the MWD connections can be delivered at 90 percent of their maximum capacities. Also MDD conditions are expected in hot summer days and, thus, it is assumed that there will be no surface water available for treatment at the Pedley WTP. With an MDD of 42.7 mgd, the supply surplus equals 6.6 mgd or 19.7 MG in 3 days.

Table 8-16
Water Source Reliability – AEP Out of Service

Water Demand	1 day (mgd)	3 days (MG)
ADD	25.1	75.3
MDD	42.7	128.0
Water Supply	**49.2**	**147.7**
Groundwater	12.5	37.5
Imported water/WTP	36.7	110.2
Surplus/Deficit meeting MDD	**6.6**	**19.7**

In addition to this water balance approach, the hydraulic model is used to verify the impact on the distribution system if the AEP were out of service for three consecutive days. Based on the model runs, the system is able to operate for the three-day period without the AEP supply. None of the reservoirs drained during the model simulation. Thus, no improvements are recommended.

Outage of Pedley Water Treatment Plant

The existing system is also evaluated for the condition when Pedley WTP is out of service under MDD conditions. The City has the option of obtaining sufficient water supplies from MWD and groundwater wells to meet MDD as shown in **Table 8-17**. For this analysis, it is assumed that water from MWD connections can be delivered at 90 percent of their maximum capacities. With an MDD of 42.7 mgd, the supply surplus equals 21.1 mgd or 63.3 MG in 3 days.

In addition to this water balance approach, the hydraulic model is used to verify the impact on the distribution system if Pedley WTP were out of service for three consecutive days. Based on the model runs, the system was able to operate for the three-day period without the Pedley supply. None of the reservoirs drained during the model simulation. No improvements are recommended for such an event.

Table 8-17
Water Source Reliability – Pedley WTP Out of Service

Water Demand	1 day (mgd)	3 days (MG)
ADD	25.1	75.3
MDD	42.7	128.0
Water Supply	**63.7**	**191.2**
Groundwater	27.0	81.1
Imported water/WTP	36.7	110.2
Surplus/Deficit meeting MDD	**21.1**	**63.3**

REHABILITATION ANALYSIS

Rehabilitation analysis is performed for the City's reservoirs, wells, and booster stations. The analysis is performed taking into considerations the following factors:

- Age of the facility being evaluated
- Historical maintenance and repair records
- Information available from City's operations staff

Any facility older than its expected average useful life in year 2005 is recommended for replacement. Facilities that would exceed their useful lives between the years 2006 and 2025, which is the planning horizon of this master plan, are recommended as future system improvements.

Reservoir Replacement Assessment

The City currently has 22 existing storage reservoirs with a total capacity of 87.7 MG as shown in **Table 8-18**.

Table 8-18
Reservoir Replacement Assessment

Reservoir No.	Type of Construction	Year Installed	Capacity (MG)
2A	Concrete	1993	3.67
2B	Steel	1957	2.93
2C	Steel	1964	2.93
3A	Concrete	1998	5.66
4A	Concrete	1984	2.50
4B	Concrete	1964	1.00
5A	Concrete	1928	4.90
5B	Concrete	1968	9.55
5C	Concrete	2004	10.50
6A	Concrete	1934	4.90
7A	Steel	1941	0.93
7B	Steel	1957	2.93
7C	Steel	1966	2.93
8A	Steel	1957	2.93
8B	Steel	1964	2.93
9A	Concrete	1969	5.30
10A	Steel	1977	3.75
10B	Steel	1989	5.63
11A	Steel	1981	3.65
12A	Steel	1981	0.50
13A	Concrete	1997	3.83
13B	Concrete	2002	3.83
Total	--	--	87.68

Reservoirs 3A, 5C, 13A, and 13B were built after 1995 so they are less than 10 years old. These four reservoirs do not have any age-related improvements necessary.

The City has budgeted for seismic upgrades at Res. 2B, 7B, and 10A sites to be completed before FY 2008. The unfunded portion of these upgrades is included in this master plan as shown in **Section 11**.

An engineering evaluation was done by Harper & Associates Engineering, Inc. (HAE, 2002) for all the City's reservoirs except the four listed in the previous paragraph. The recommendations made in this report are already included in the City's 2004/05 CIP. The City would be able to extend the lives of the reservoirs by implementing the projects identified in the HAE report beyond the planning horizon of this master plan (2025) with the exception of Reservoir 7A. Additional projects not identified in HAE report are listed below.

1. Replacement of Reservoir 7A: Replacing Reservoir 7A is recommended instead of recoating and doing structural/seismic retrofits. This reservoir is 78 years old and will be close to 100 years by 2025. Recoating and structural retrofits does not appear to be a cost-effective rehabilitation solution for this reservoir. City should consider replacement of this reservoir as a part of reliability enhancement for Zone 7.

2. New roofs for Reservoirs 5A & 6A: The roofs on Reservoirs 5A and 6A are in a poor condition and replacement with metal roof with wooden supports is recommended . These improvements were not included in the HAE report.

Well Replacement Assessment

The City currently has 29 active potable groundwater wells and 9 inactive wells as shown in **Table 8-19**. Some of the inactive wells have nitrate and other water quality issues. Wellhead treatment is planned for some of these sites, making them available for supply in the future (discussed in **Section 9**).

A supply analysis presented earlier in this section indicates that there are no deficiencies identified with these wells being out of service due to water quality issues. But the operational philosophy of the City is to minimize its reliance on imported water. This is possible by increasing groundwater pumping, increasing use of recycled water, or by increasing the treatment capacity of Pedley WTP (when water is available, of course). Thus, groundwater wells should be maintained in good condition to allow for maximum production.

Based on industry-wide historical data, the average useful service life of a groundwater well is about 75 years. Using this criterion, nine wells are identified for replacement before 2025. These nine wells are: Tunnel Well 1, Tunnel Well 3, Well 4, Well 6, Well 11, Well 12, Well 13, Well 20, and Well 21. Well 4 replacement (due to collapsed casing) is already a funded project in City's 2004/05 CIP. Thus, Well 4 replacement is included in this report as a recommendation but is not assigned any dollar value.

Well 20 is inactive due to high nitrates. The supply analysis discussed earlier in this section indicates that the system has enough supply without water from this well. But as discussed earlier, the City needs to increase its groundwater production to minimize its reliance on imported water. Thus, it is recommended that this well be replaced with a new well and brought

Table 8-19
Well Replacement Assessment

Well No.	Year Drilled	Casing Material	Status	Average Life (yrs)	Year of Retirement	Already in 2004 CIP?
Tunnel Well 01	1904	concrete, steel	ACT	75	1979	No
Tunnel Well 02	1985	Steel	ACT	75	2060	
Tunnel Well 03	1926	concrete, steel	ACT	75	2001	No
Tunnel Well 04	1989	ND	ACT	75	2064	
1	1990	ND	INACT	75	2065	
2	1967	Steel	ACT	75	2042	
3	1954	unknown	ACT	75	2029	
4	1940	Steel	INACT	75	2015	Yes
5B	1991	Steel	ACT	75	2066	
6	1933	Steel	ACT	75	2008	No
7	1957	Steel	ACT	75	2032	
8B	1993	Steel	ACT	75	2068	
9B	1991	Steel	ACT	75	2066	
10	1965	Steel	ACT	75	2040	
11	1947	Steel	ACT	75	2022	No
12	1947	Steel	ACT	75	2022	No
13	1947	Steel	ACT	75	2022	No
14	1951	Steel	ACT	75	2026	
15	1951	Steel	ACT	75	2026	
16	1953	Steel	ACT	75	2028	
17	1953	Steel	ACT	75	2028	
18	1954	Steel	ACT	75	2029	
20	1927	ND	INACT	75	2002	No
21	1927	Steel	ACT	75	2002	No
22	1962	ND	INACT	75	2037	
23	1964	Steel	ACT	75	2039	
24B	1991	ND	INACT	75	2066	Yes[1]
25	1968	Steel	ACT	75	2043	
26	1970	Steel	ACT	75	2045	
27	1973	Steel	ACT	75	2048	
28	1973	Steel	ACT	75	2048	
29	1975	Steel	ACT	75	2050	
30	1977	Steel	INACT	75	2052	
32	1996	ND	INACT	75	2071	
34	1993	Steel	ACT	75	2068	
35	1993	Steel	ACT	75	2068	
36	1996	Steel	INACT	75	2071	Yes[1]
37	1997	Steel	INACT	75	2072	

1 – Wells 24B & 36 are being repiped to pump to the AEP for treatment. These wells are excluded from the CIP in this master plan.

online after addressing the water quality issue (blending or wellhead treatment) in future. Based on this discussion, replacement of this well is excluded from the existing system recommendations and will be addressed as a part of the future system evaluation. Well 21 is 78 years old but the City recently equipped it with new pumping equipment. New discharge piping for this well was also installed to pump the water from this well into the AEP for treatment. It is recommended that the City conduct video logging of the well not later than 10 years to determine the condition of the casing. Based on this video evaluation replacement or rehabilitation of the casing is recommended. Well 21 is excluded from the list of improvements for this master plan.

Also it is recommended that disinfection be provided at Wells 27. This project is identified in the City's 2004/05 CIP as an unfunded project.

Thus, the six wells (excluding Well 4) identified for replacement as a part of the existing system improvements are: Tunnel Well 1, Tunnel Well 3, Well 6, Well 11, Well 12, and Well 13.

It is recommended that the City perform video logging of these wells and visual inspection of the pumping equipment to identify potential problems with the casing, shaft, pumping equipment, water quality etc. These video logs should be evaluated to determine the physical condition of the wells including casing breaks, clogged perforations or other issues that would justify rehabilitation or replacement. This evaluation can be used to determine the cost of rehabilitation required at each of these well sites. These rehabilitation costs should then be compared with the cost of replacement for each of these wells with appropriate consideration of remaining useful life to determine whether rehabilitation or replacement is most appropriate. The City should also take into consideration system reliability while selecting one alternative over the other.

Booster Station Replacement Assessment

The City currently has 11 operating booster stations and 2 hydropneumatic booster stations constructed between 1957 and 1996 as shown in **Table 8-20**. All of these booster stations were visited as part of this WMP to obtain a better understanding of the operations, status of the equipment and any problems. Based on these field visits, it is observed that no improvements are necessary for the pump housing at any of these sites.

The installation year for each of these booster units is shown in the table below. It should be noted that the installation year reflects the year when a new pump was installed at a particular station.

The expected average useful life of pumps and motors is 30 years. Based on this criterion, 27 of the existing 41 pump units and motors will need replacement before the planning horizon of 2025 of this WMP. Out of these 27 units, 9 units are older than 30 years at the time of writing this report. It should be noted that Boosters 2A and 2B, which used to serve Zone 7, are going to be abandoned as Booster Station 2 no longer serves Zone 7. These two boosters will be replaced by Booster 14 to serve Zone 7. Thus, Boosters 2A and 2B are excluded from this assessment. Also Boosters 2G, 3G, Booster Station 14 and Booster Station 15 are in design; these facilities are considered in the future system evaluation and excluded from this assessment.

Table 8-20
Booster Station Replacement Assessment

Booster Station	Unit No.	Year Installed	Year of Retirement
Booster 1	A	1989	2019
	B	2002	2032
Booster 2	A	1989	To be abandoned
	B	1990	To be abandoned
	C	2002	2032
	D	1965	1995
	E	1965	1995
	F	2001	2031
Booster 3	A	1995	2025
	B	2001	2031
	C	2004	2034
	D	1994	2024
	E	2003	2033
	F	2005	2035
Booster 4	A	1992	2022
	B	1992	2022
Booster 5	A	1964	1994
	B	1995	2025
	C	1996	2026
Booster 7	A	1988	2018
Booster 8	A	1959	1989
	B	1959	1989
Booster 9	A	1957	1987
	B	1957	1987
	C	1957	1987
Booster 10	A	1998	2028
	B	1988	2018
Booster 11	A	1978	2008
	B	1978	2008
	C	2003	2033
	D	1978	2008
	E	1989	2019
	F	2002	2032
Hydro 11	A	2001	2031
	B	2001	2031
Booster 12	A	1981	2011
	B	1981	2011
	C	1981	2011
Hydro 12	A	1981	2011
	B	1981	2011

Based on this assessment, it is recommended that the City replace two pump units a year for the next 20 years and continues doing regular maintenance of these units to keep them in good condition. The City should also upgrade the electrical panels and SCADA devices simultaneously with pump and motor replacement.

SYSTEM OPERATION ANALYSIS

The City's control and monitoring system and system-wide pumping operations were evaluated and recommendations made to improve the efficiency of the system.

Supervisory Control and Data Acquisition (SCADA) System

The City uses a (SCADA) system to monitor and control its water production and distribution system. The SCADA system is comprised of three major components; central control system, communication system, and field equipment. The City is currently in the final phase of replacing the central control system, which includes new hardware and software for the control system. This upgrade does not include any modifications to the other two components of the SCADA system.

Based on the City's this recent upgrade to the control system, it is recommended that no immediate improvements are necessary for the SCADA system. However, based on the expected life span of the upgraded control system, and the aging field equipment, it is anticipated that the entire SCADA system, all three components, will require replacement within the next 7-10 years. Below is a brief description of the improvements required. The replacement costs are included in Section 11.

Central Control

The central control system is comprised of hardware and software. As time passes, a point in reached in which the software, with all of its upgrades, patches, and improvements, are no longer compatible with the hardware. The hardware/software incompatibility requires a complete upgrade to the central control system and usually occurs every 7-10 years. Since the City is nearly complete with its upgrade to the central control system, a new central control system won't be necessary until 2012-2015. When planning for the replacement of the central control component, it is recommended that the other two components also be replaced.

Communication

The communication component of the SCADA system currently uses a FCC-licensed 900 MHz serial spread spectrum radio frequency. This system is fully compatible with the existing and recently upgraded central control system as well as with the field equipment. However, as new field equipment is upgraded, it is also recommended that the City upgrade their communication system to use an Ethernet based radio system using TCP/IP protocol. This communication system, in combination with the upgrade field equipment, will allow for peer-to-peer communication between sites. Currently, all communication is routed through a central control system that limits the flexibility of controlling the system and represents also creates a significant vulnerability. The new communication system would allow new field equipment to run each of the City's sites using a distributed control strategy, reducing the vulnerability of a central control system and also reducing the complexity of system control.

Field Equipment

The City's field equipment was installed in the 1990s and has already reached the expected useful life. Maintenance of the field equipment has been increasingly difficult and expensive as the replacement parts are no longer manufactured. The existing field equipment, Remote Transmitting Units (RTUs), are sometimes referred to as "dumb unit". These units are "dumb" in that they were designed to communicate between the remote site and central control, but were not design to "think" or control the remote site itself. The RTU requires that the central control send command to the RTU, so that the RTU can in turn, open and close switches to control the site.

Most new SCADA system use "smart" units, or Programmable Logic Controller (PLCs) to control all of the remote sites. PLCs have the ability to "think" and control the site without input from a central control system. PLCs can also communicate directly with other site without passing through a central control system. A good example of the difference between the existing RTU system and the new PLC system is a pump that is controlled by the water level in a reservoir (both at different sites.) When the level in the reservoir is low, the pump turns on. When the level in the reservoir is high, the pump turns off. The existing system first polls the reservoir site for the water elevation (polling take place every 6 minutes). The central control then determines if the pump needs to be on or off. The next time the central control system polls, it sends a command to the pump to turn on or off. RTUs only respond to requests and do not initiate communication. The new system, utilizing PLCs, would eliminate the central control system "thinking". A PLC at the reservoir site would sense a low or high level and send a command directly to the pump's PLC to turn on or off. This distributed control is faster, more reliable, and more efficient.

It is recommended that the entire SCADA system be replaced using this distributed control architecture. The replacement costs are included in Section 11.

Energy Usage Analysis

To enhance the system operations in regards to energy efficiency, the City has recently upgraded all motors of the groundwater wells with high efficiency equipment, with the exception of Well 8B. These upgrades are part of the energy maintenance contract that the City has with Siemens. It is recommended that the City also replace all booster station pumps and motors as recommended under "Booster Station Replacement Assessment" with high efficiency equipment.

To evaluate how the City can further enhance the energy efficiency of their system operations, a reconnaissance-level Time of Use (TOU) analysis was conducted. Facilities that are operated with TOU restrictions are typically operated for up to 18 hours per day, avoiding the 6-hour peak hour energy charges from 12:00 PM to 6 PM. This analysis is performed for all pressure zones that have gravity storage reservoirs that could supply the system demands between noon and 6 PM. These pressure zones are Zone 2, Zone5, Zone, 7, Zone 9, and Zone 11. The TOU analysis consists of the following two steps:

1. Evaluate if the existing storage reservoirs have sufficient surplus capacity to store the zone demand that occurs between noon and 6 PM. Based on the diurnal curve, this demand is estimated to be about 19.4 percent of MDD.
2. Evaluate if the booster pumping capacity from wells and booster stations is sufficient to pump the zone MDD (24 hours) in 18 hours, provided that sufficient surplus storage capacity is available.

The analysis assumes that it is not cost efficient to build additional reservoir storage capacity if step 1 of the analysis indicates that the storage surplus is insufficient to store the additional six hours of demand. The results of the analysis are presented in **Table 8-21**.

Table 8-21
Time of Use Energy Analysis

STEP 1: Storage Capacity Evaluation						
Pressure Zone	**MDD (mgd)**	**Demand 12 to 6 PM (gpm)**	**Required Zone Storage (MG)**	**Available Storage (MG)**	**Storage Surplus (MG)**	**TOU Operation Feasible ?**
Zone 9	3.0	0.6	3.4	13.0	9.6	Yes
Zone 11	3.7	0.7	4.3	4.2	-0.1	No[1]
Zone 2	0.2	0.0	6.9	9.5	2.6	Yes
Zone 7	7.4	1.4	4.4	6.8	2.4	Yes
Zone 5	4.3	0.8	13.1	30.6	17.5	Yes
STEP 2: Pumping Capacity Evaluation						
Pressure Zone	**MDD in 24 hrs (gpm)**	**MDD in 18 hrs (gpm)**	**Well Supply (gpm)**	**Booster Station Supply (gpm)**	**Total Supply (gpm)**	**TOU Operation Feasible ?**
Zone 9	2,109	2,812	1,111	2,917	4,028	Yes
Zone 11	2,576	3,435	0	7,361	7,361	Yes
Zone 2	145	193	1,319	5,694	7,014	Yes
Zone 7	5,158	6,877	833	3,333	4,167	No
Zone 5	3,018	4,024	2,361	13,333	15,694	Yes

1 – After the construction of the new 0.1-MG Reservoir 11H, TOU operations is feasible.

As shown in **Table 8-21**, the City has sufficient surplus storage capacity to accommodate six hours of additional demand in Zones 2, 5, 7, and 9. As mentioned under the storage evaluation, Zone 11 does not currently have sufficient storage. As the City is planning to construct a new 0.1 MG storage reservoir (Reservoir 11H) in the near future, step 2 of the analysis is conducted for Zone 11 as well. Based on the available pumping capacities, TOU operations could be implemented in Zones 2, 5, 9, and 11. Due to insufficient pumping capacity, TOU operation is not feasible in Zone 7 without the installation of additional at least 2,710 gpm (6,877 – 4,167) or 3.9 mgd booster pumps. No recommendations to allow TOU operations in Zone 7 are included in the CIP.

The estimated annual energy savings are estimated based on rate schedule TOU-8 from Southern California Edison (SCE, 2005) and the historical fluctuation in seasonal water demands. The estimated energy cost with and without TOU operations for Zones 2, 5, 9, and 11 are summarized in **Table 8-22**.

Table 8-22
Time of Use Energy Savings

Rate Schedule Period	Hours	Energy Rate ($/kWh)[1]	ADD (mgd)	Weighted Pumping Head (ft)	kWh	Energy Cost without TOU	Energy Cost with TOU[2]
Winter - Off Peak	3,583	$ 0.1030	3.9	150	366,923	$ 37,786	$ 37,786
Winter - Mid Peak	2,249	$ 0.1693	2.5	150	144,564	$ 24,470	$ 24,470
Summer - Off Peak	1,623	$ 0.1007	2.6	150	108,589	$ 10,937	$ 10,937
Summer - Mid Peak	783	$ 0.1431	1.2	150	25,274	$ 3,616	$ 5,224
Summer - High Peak	522	$ 0.2111	0.8	150	11,233	$ 2,371	
Total/Weighted	**8,760**	**$ 0.1296**	**11.0**	**150**	**656,584**	**$ 79,181**	**$ 78,417**

1 – Southern California Edison – Schedule TOU-8 (April, 2005)
2 – The summer high peak pumping is assumed to occur during mid peak hours

As shown in **Table 8-22**, the energy rates are divided into five rate periods, three during the four summer months (June through September) and two during the remainder of the year. Based on the historical water production in the period 1999 through 2003, it is determined that about 42 percent of the water demands occur during the four summer months when the summer energy rates apply. The combined demands of the four pressure zones are 18.7 mgd under MDD and 11.0 mgd under ADD conditions. These demands are prorated to the number of hours in each energy rate category. The annual energy cost for pumping without TOU is estimated at $79,181, while the cost with TOU restrictions is estimated at $78,417. Hence, the annual savings are about $760 per year or one percent. The savings are small because there are only 522 hours per year that fall into the summer high peak rate and the difference with the summer mid peak rate is only $0.07 per kWh.

Although these savings are a rough estimate, as energy rates and seasonal demands fluctuate, it can be concluded that TOU operation with the current rate schedule is not beneficial compared to the increased operator attention required for reservoir level fluctuations. It is recommended that the City revisit this analysis to determine additional savings by avoiding mid-peak pumping during other times of the year with a calibrated system model. In addition, it can be concluded that it is most likely not cost effective to install additional pumping capacity to allow TOU operations in Zone 7.

INTER AGENCY CONNECTIONS

The following inter-agency connections are proposed to enhance the City's reliability:

- Connection with the City of Chino Hills in the south eastern portion of Zone 11. A possible location would be at the intersection of Rimrock Avenue and Homeridge Lane. This connection would enable gravity supply through a pressure reducing valve from the City of

Pomona (Zone 11 with an HGL of 1,143 ft) to the City of Chino Hills (Zone 1,034). Supply from the City of Chino Hills to the City of Pomona would require pumping with a pumping head of about 110 feet. This connection could consist of a PRV with hook-ups for a portable pump. Another option would be to use a portable pump that connects the two systems with temporary hoses that are connected between the City's hydrant and a fire hydrant along Rimrock Avenue in the City of Chino Hills.

- Connection with Monte Vista Water District (MVWD) in the north east corner of Zone 2. Based on fire flow deficiencies discussed under the distribution system analysis, additional emergency supply to these areas would enhance the fire flow reliability prior to the installation of the proposed improvements. A connection could be installed in the vicinity of San Bernardino Avenue and Mills Avenue, to connect to the 12-inch diameter pipeline on San Bernardino Street. This connection would provide emergency supply between the City of Pomona (Zone 2 with an HGL of 1,202 ft) and MVWD (Zone 1,207). Due to the similar HGL of both zones, this connection could consist of a pipeline with a valve and a two-way flow meter to provide gravity supply if the HGL differential is sufficient. In addition, this connection would likely need hookups for a portable pump that could pump both directions. Another option would be to connect the two systems at adjacent fire hydrants with temporary hoses and a portable pump.

- Connection with MVWD in the north east corner of Zone 7. Based on fire flow deficiencies discussed under the distribution system analysis, additional emergency supply to these areas would enhance the fire flow reliability prior to the installation of the proposed improvements. A connection could be installed in the vicinity of East Kingsley Avenue and Mills Avenue, to connect to the 8-inch diameter pipeline on East Kingsley Avenue. This connection would provide emergency supply between the City of Pomona (Zone 7 with an HGL of 1,107 ft) and MVWD (Zone 1,207). The City of Pomona could be supplied by gravity through a PRV, while hookups for a portable pump would be required to provide water to MVWD. Another option would be to connect the two systems at adjacent fire hydrants with temporary hoses and a portable pump.

- Connection with Three Valleys Municipal Water District (TVMWD) on the Pedley Water Treatment Plant (WTP). This connection, located at Pedley WTP, would provide a backup supply in the event of the loss of the tunnel wells supply in a dry year or an outage of the Pedley WTP. This connection would require bringing a pipeline over from Mills Avenue and onto the site along the north and west part of the property. This connection could be located in the vicinity of the intersection of Mills Avenue and Chaparral Drive.

- Connection with TVMWD in the north west corner of Zone 9. Based on pressure and fire flow deficiencies discussed under the distribution system analysis, additional emergency supply to these areas would enhance the supply reliability prior to the installation of the proposed improvements. A connection could be installed in the vicinity of the intersection of Foothill Boulevard and Williams Avenue. This connection would provide emergency supply from TVMWD (from the Miramar Plant) and Zone 9 with an HGL of 1,309 feet.

Connections with the City of La Verne are not considered as the City has three imported water connections with MWD on the western side of the City's service area that provide backup supplies. Additional connections are not required on this side of the City. The proposed connections with MVWD could be substituted with connections to Southern California Water Company. The connections listed above would enhance the City's system reliability, however are not required based on the emergency analysis discussed in this report, with the exception of the connection with Chino Hills (see reliability deficiency R-1). It is recommended that the City enter discussions with the City of Chino Hills, TVMWD, and MVWD to evaluate the mutual benefits of these connections. The only connection included in the cost estimates presented in the Capital Improvement Program (CIP) of this report is the connection with the City of Chino Hills.

OTHER RECOMMENDATIONS

Other system-wide recommendations not included in the previous sections are discussed below.

Geographical Information System (GIS)

The City historically maintained information on the water and recycled water infrastructure assets by means of atlas maps and hard copy as-built drawings. Several years ago, the City transferred these records to a geographic information system (GIS) by digitizing the location information from the atlas sheets. The process included input of key attribute information in the GIS database, such as year installed, diameter, material, construction order (CO), etc..

The City has not, in recent years, had a formalized program to update the GIS database to reflect changes in the water and recycled water systems. Recently completed CIP projects have not been added to the GIS, nor have abandoned pipes been flagged. Additionally, data inconsistencies and missing data limit the usefulness of the current GIS database.

Inconsistencies or limitations noted in the water GIS database during completion of this Master Plan are listed below:

- The water facilities are not located accurately. For instance, a water pipeline physically located in the north side of the street, may not be located in the north side of the street in the GIS system.
- Many pipelines that are shown to continue from one atlas sheet to another were observed in the GIS system to be segmented into two separate pipelines, sometimes with differing associated data.
- Attribute data is inconsistent and incomplete. The data for pipeline diameter, for instance, was inconsistently entered (i.e. six, 6, 6", 6-inches, 6 inches). In addition, not all of the essential data was complete, and much of the non-essential data was, in many cases, less than 50% complete.

Although several of these inconsistencies were noted during model development, the development of the water model did not repair the GIS system. The model required a limited subset of the GIS data (all pipes equal to and greater than 4-inches, but with limited attribute data) and spatial accuracy (location within the street) was not critical to model creation. Therefore, the City GIS system, as it pertains to water facilities, contains a significant amount of erroneous data. In addition, the GIS system data does not contain any new facilities that have been installed since the atlas sheets were originally scanned in late 1999, and is even missing some projects installed prior to 1999. Consequently, use of the City's GIS system as an operational and planning tool is severely limited.

If the City plans to utilize a GIS system as an operational and planning tool, MWH recommends that the City invest in creating a new water GIS system. Our experience indicates that it would be more efficient to create new water GIS layers rather than to attempt to correct or re-populate the existing data. This new system should be accurate to the degree necessary to achieve the goals of the Utility Services Department and/or City. Based on recent similar projects, it is recommended that the City budget $300,000 for the creation of the water GIS layers.

A good GIS system could be an invaluable operational and planning tool. If the GIS were linked to condition assessment data, the GIS could provide an effective means of tracking condition and rehabilitation/replacement projects. Prior to the creation of new water GIS layers, the Utility Services Department and/or City should establish goals and objectives for this new GIS system. GIS plays an important role in asset management and a better understanding of how GIS fits, or would fit, into the Utility Services Department's business processes would better define the capabilities of this new GIS system.

Program Environmental Impact Report

California Environmental Quality Act (CEQA) compliance is required for discretionary projects proposed by public agencies. Discretionary projects are projects that require the exercise of judgment or deliberation when the public agency or body decides to approve or disapprove a particular activity, as distinguished from situations where the public agency or body merely has to determine whether there has been conformity with applicable statutes, ordinances, or regulations. The formal adoption of a master plan by City Council would be such a discretionary project or action that would trigger CEQA compliance. Similarly, the implementation of capital improvement projects identified in a master plan would also require CEQA compliance.

CEQA requires that an environmental impact report (EIR) be prepared for a project that is determined to have a significant adverse effect on the environment. CEQA provides that Program Environmental Impact Reports (Program EIRs) can be prepared for an agency program or series of actions that are linked geographically or temporally and can be characterized as one large project. For master plans, a program level of analysis allows evaluation of the overall service area-wide impacts of implementation the plans, including consideration of growth-inducing impacts from provision of additional water and wastewater infrastructure. If specific near-term elements are well defined, project-level analysis can be included in the Program EIR. Later, as other individual elements are proposed, they can "tier off" the Program EIR. As each plan element is proposed for implementation, the City would prepare an Initial Study to determine which effects, if any, were not covered in the Program EIR and whether a subsequent EIR or Negative Declaration was the appropriate CEQA document to complete environmental compliance.

Preparation of a Program EIR can significantly facilitate implementation of capital projects. MWH therefore recommends that the City should prepare a joint Program EIR for the Water and Sewer Master Plans and that $150,000 be budgeted for the water portion of the work.

Meter Replacements

It is recommended that the City replace its water meters every 10 years per AWWA standards. As shown in **Table 8-23**, there are about 29,800 meters in year 2003. The future demand projections indicate an increase of 22 percent of demand over the next 20 years. This increase in demand can be translated into an increase in number of meters. Using a 10-year replacement period, there will be an 11 percent increase in the number of meters over the next 10 years. Applying this percentage results in 33,600 meters. This number adjusted for a 20-year period results in replacement of 3,360 meters per year or 67,200 meters in 20 years.

Table 8-23
Potable Water Meters

Year	Metered	Unmetered	Total
2001	29,512	441	29,953
2002	29,632	442	30,074
2003	29,838	451	30,289

Service Lateral Replacements

The City staff has reported problems with polyethylene (PE) and galvanized steel service laterals. According to an estimate (by the City staff), about 500 service laterals in the Phillips Ranch area are constructed of PE.

PE and galvanized steel laterals have been used throughout the City but the exact lengths are not known. It is recommended that the City conduct field verification to find out the extent of these laterals. These laterals could be replaced with copper, which is the City's standard pipe material for service laterals. Due to lack of sufficient information on the extent of these problematic service laterals, the cost of replacements of these laterals is not included in this master plan.

Hydrant Replacements

It is recommended that the City replace or retrofit fire hydrants installed under the old fire hydrant specifications with new hydrants per current standards. The current standards include an automatic break-off check valve assembly at the base of the fire hydrant to prevent water loss and property damage. Hydrants that meet the new standards or automatic break-off check valve assemblies should be retrofitted on existing hydrants where feasible in those parts of the City experiencing high numbers of traffic accidents. These replacements would be done only in areas that currently have adequately sized water mains and hydrant laterals. The recommended target rate of replacement of hydrants is 20 per year.

Flow and Coupon Testing

Multiple tests at various locations throughout the distribution system are recommended to be conducted to determine the condition of pipelines identified for replacement or rehabilitation. The primary focus of this testing should be on the older steel and cast iron pipelines. Flow tests can be used to measure the C-value of pipelines without the need for excavation, while coupon tests will provide information on the actual condition of the pipe material. Based on these tests, a decision can be made on replacing or lining the pipelines in question.

Water System Security Upgrades

Security upgrades should be provided at the Water Yard, wells, and reservoir sites in order to comply with the recommendations outlined in the Vulnerability Assessment Report (B&V, 2003). These upgrades will help prevent incidents of vandalism thereby enhancing the overall system integrity.

Corporate Yard Facility

The City of Pomona, Utility Services Department's operational headquarters or "Yards" is located at 148 North Huntington Boulevard, Pomona, CA 91768. The Yards were originally constructed starting in the late 1890s through 1910. The facility is located in the central part of Pomona, south of Monterey Avenue, west of White Avenue, east of Hamilton Avenue, and north of Southern Pacific Railroad.

Since Pomona is the sole provider of water, recycled water, wastewater collection and residential solid waste service within the city, it is important that this location remain viable. The Yards serves as a central staging area for a number of different city divisions: Water/Wastewater Operations, Fleet Maintenance, Solids Waste Services, and Warehousing. In addition to housing staff, the facility serves as a place for staging equipment. In this case, there is an annex portion attached to the western portion that serves to accommodate piping, equipment, and other necessary materials to carry on operations effectively.

The Water/Wastewater Operations Division offices at the Yards were mainly constructed of non-reinforced brick and mortar materials. The Central Stores Warehouse is corrugated metal. Given today's building standards, the structures are not likely to remain undamaged during a sizeable seismic event. As a matter of fact, a portion of the offices has been condemned by the City's safety office.

Construction of a new corporate yard facility will likely include the Water/Wastewater operations functions and their respective equipment layout, Solid Waste Services, Fleet Maintenance, Streets, Traffic and Police Communications, and possibly the Parks Division. In addition, the City is considering the new yard as the site for a new refuse transfer station. The budget for the water and wastewater share of the new corporate yard is based on City-furnished information and is presented in **Section 11**.

REVIEW OF EXISTING CAPITAL IMPROVEMENT PROGRAM

The City's 2004/05 Capital Improvement Program (CIP) was reviewed as part of the existing system evaluation, future system evaluation, and also during the development of the recommended CIP improvements identified in Section 11. The City's existing CIP includes several projects that were also identified as part of this study. The projects already funded in the City's 2004/05 CIP are assigned a zero dollar value in this master plan.

SUMMARY OF RECOMMENDATIONS

The existing system improvements are depicted on **Figure 8-8** and listed in **Table 8-24**.

Figure 8-8
Existing System Improvements

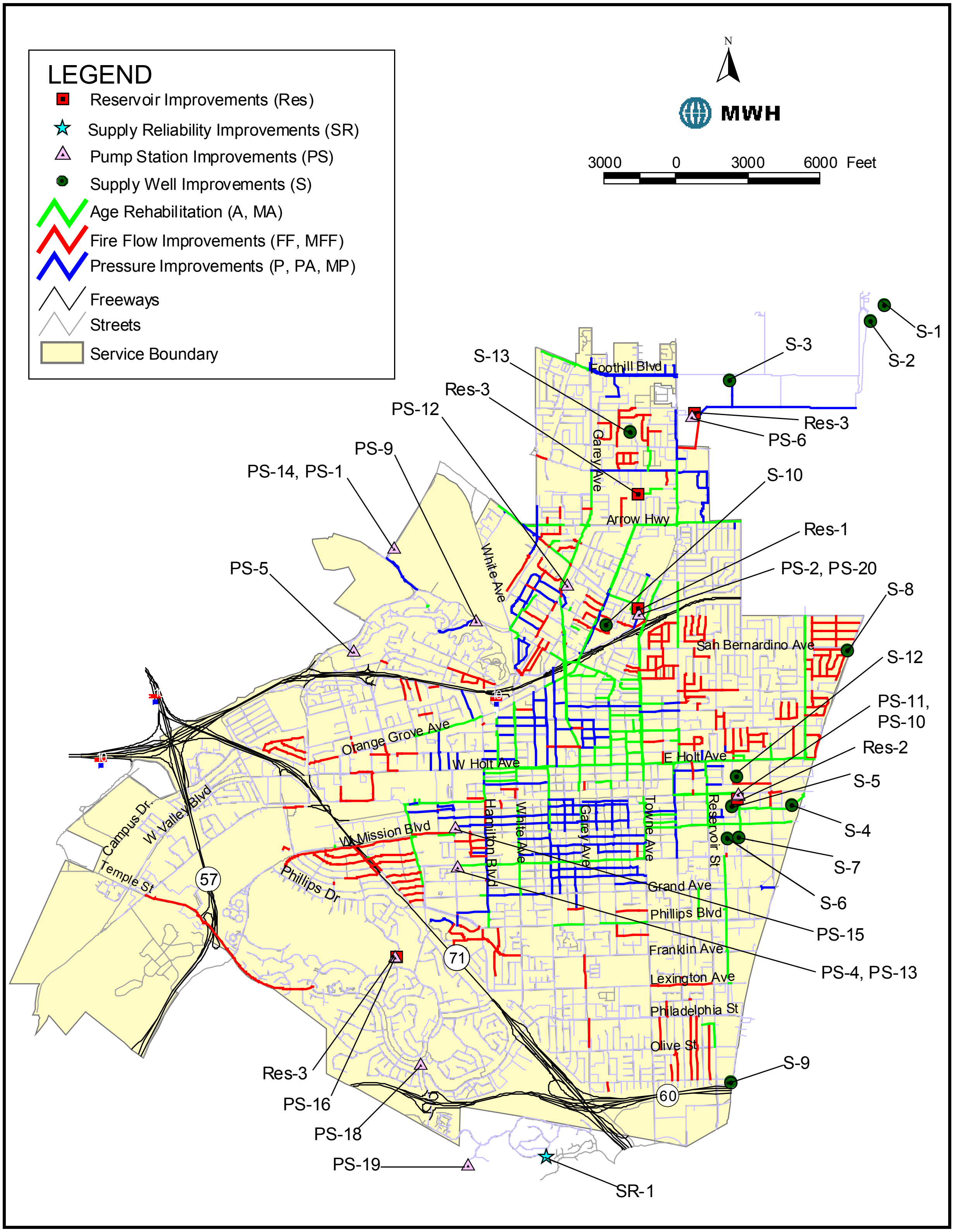


Table 8-24
Summary Of Recommendations

CIP ID	Improvement Type	Description	Diameter (in)	Size	Unit
Various "A" IDs	Age - Rehab	6-inch diameter pipelines throughout the distribution system	6	1,000	lineal feet
Various "A" IDs	Age - Rehab	6-inch diameter pipelines throughout the distribution system	6	800	lineal feet
Various "A" IDs	Age - Rehab	6-inch diameter pipelines throughout the distribution system	6	900	lineal feet
Various "A" IDs	Age - Rehab	6-inch diameter pipelines throughout the distribution system	6	10,100	lineal feet
Various "A" IDs	Age - Rehab	8-inch diameter pipelines throughout the distribution system	8	800	lineal feet
Various "A" IDs	Age - Rehab	8-inch diameter pipelines throughout the distribution system	8	2,200	lineal feet
Various "A" IDs	Age - Rehab	8-inch diameter pipelines throughout the distribution system	8	2,800	lineal feet
Various "A" IDs	Age - Rehab	8-inch diameter pipelines throughout the distribution system	8	26,500	lineal feet
Various "A" IDs	Age - Rehab	10-inch diameter pipelines throughout the distribution system	10	100	lineal feet
Various "A" IDs	Age - Rehab	10-inch diameter pipelines throughout the distribution system	10	10,500	lineal feet
Various "A" IDs	Age - Rehab	10-inch diameter pipelines throughout the distribution system	10	6,300	lineal feet
Various "A" IDs	Age - Rehab	12-inch diameter pipelines throughout the distribution system	12	7,500	lineal feet
Various "A" IDs	Age - Rehab	14-inch diameter pipelines throughout the distribution system	14	9,400	lineal feet
Various "A" IDs	Age - Rehab	16-inch diameter pipelines throughout the distribution system	16	5,100	lineal feet
Various "A" IDs	Age - Rehab	16-inch diameter pipelines throughout the distribution system	16	5,200	lineal feet
Various "A" IDs	Age - Rehab	16-inch diameter pipelines throughout the distribution system	16	16,300	lineal feet
Various "A" IDs	Age - Rehab	18-inch diameter pipelines throughout the distribution system	18	5,000	lineal feet
Various "A" IDs	Age - Rehab	18-inch diameter pipelines throughout the distribution system	18	200	lineal feet
Various "A" IDs	Age - Rehab	20-inch diameter pipelines throughout the distribution system	20	2,000	lineal feet
Various "FF & MFF" IDs	Fire Flow	6-inch diameter pipelines throughout the distribution system	6	1,300	lineal feet
Various "FF & MFF" IDs	Fire Flow	6-inch diameter pipelines throughout the distribution system	6	53,900	lineal feet
Various "FF & MFF" IDs	Fire Flow	6-inch diameter pipelines throughout the distribution system	6	63,100	lineal feet
Various "FF & MFF" IDs	Fire Flow	6-inch diameter pipelines throughout the distribution system	6	2,100	lineal feet
Various "FF & MFF" IDs	Fire Flow	8-inch diameter pipelines throughout the distribution system	8	7,800	lineal feet
Various "FF & MFF" IDs	Fire Flow	8-inch diameter pipelines throughout the distribution system	8	11,600	lineal feet
Various "FF & MFF" IDs	Fire Flow	8-inch diameter pipelines throughout the distribution system	8	22,100	lineal feet
Various "FF & MFF" IDs	Fire Flow	10-inch diameter pipelines throughout the distribution system	10	800	lineal feet
Various "FF & MFF" IDs	Fire Flow	10-inch diameter pipelines throughout the distribution system	10	800	lineal feet
Various "FF & MFF" IDs	Fire Flow	10-inch diameter pipelines throughout the distribution system	10	8,700	lineal feet
Various "FF & MFF" IDs	Fire Flow	12-inch diameter pipelines throughout the distribution system	12	2,600	lineal feet
Various "FF & MFF" IDs	Fire Flow	12-inch diameter pipelines throughout the distribution system	12	2,000	lineal feet
Various "FF & MFF" IDs	Fire Flow	12-inch diameter pipelines throughout the distribution system	12	2,900	lineal feet
Various "FF & MFF" IDs	Fire Flow	16-inch diameter pipelines throughout the distribution system	16	6,900	lineal feet
Various "FF & MFF" IDs	Fire Flow	16-inch diameter pipelines throughout the distribution system	16	100	lineal feet
Various "FF & MFF" IDs	Fire Flow	16-inch diameter pipelines throughout the distribution system	16	3,900	lineal feet
Various "FF & MFF" IDs	Fire Flow	18-inch diameter pipelines throughout the distribution system	18	2,100	lineal feet
Various "PA" IDs	Pressure - Age	6-inch diameter pipelines throughout the distribution system	6	54,200	lineal feet
Various "PA" IDs	Pressure - Age	6-inch diameter pipelines throughout the distribution system	6	38,400	lineal feet
Various "PA" IDs	Pressure - Age	6-inch diameter pipelines throughout the distribution system	6	1,700	lineal feet
Various "PA" IDs	Pressure - Age	6-inch diameter pipelines throughout the distribution system	6	900	lineal feet
Various "PA" IDs	Pressure - Age	8-inch diameter pipelines throughout the distribution system	8	19,800	lineal feet
Various "PA" IDs	Pressure - Age	8-inch diameter pipelines throughout the distribution system	8	10,000	lineal feet
Various "PA" IDs	Pressure - Age	10-inch diameter pipelines throughout the distribution system	10	4,900	lineal feet
Various "PA" IDs	Pressure - Age	10-inch diameter pipelines throughout the distribution system	10	3,200	lineal feet
Various "PA" IDs	Pressure - Age	16-inch diameter pipelines throughout the distribution system	16	6,900	lineal feet
Various "PA" IDs	Pressure - Age	16-inch diameter pipelines throughout the distribution system	16	300	lineal feet

Table 8-24 (Cont'd)
Summary Of Recommendations

CIP ID	Improvement Type	Description	Diameter (in)	Size	Unit
Various "PA" IDs	Pressure - Age	16-inch diameter pipelines throughout the distribution system	16	100	lineal feet
Various "PA" IDs	Pressure - Age	18-inch diameter pipelines throughout the distribution system	18	5,100	lineal feet
MA-05	Major Street	16-inch diameter pipeline on Foothill Blvd. from Towne Ave. to Williams Ave.	16	920	lineal feet
MA-07	Major Street	12-inch diameter pipeline on Towne Ave. from S/O Bonita Ave. to N/O Indigo Ct.	12	250	lineal feet
MA-08	Major Street	18-inch diameter pipeline on Towne Ave. from Harrison Ave. to Arrow Hwy	18	3,240	lineal feet
MA-09	Major Street	12-inch diameter pipeline on Arrow Hwy from Towne Ave. to Mountain Ave.	12	2,670	lineal feet
MA-10	Major Street	10-inch diameter pipeline on Arrow Hwy from Orange Grove Ave. to Towne Ave.	10	1,770	lineal feet
MA-11	Major Street	8-inch diameter pipeline on Arrow Hwy from Fulton Rd. to E/O Mariposa St.	8	1,140	lineal feet
MA-12	Major Street	6-inch diameter pipeline on Arrow Hwy from W/O Fair Ave. to Fulton Rd.	6	1,830	lineal feet
MA-15	Major Street	10-inch diameter pipeline on Garey Ave. from Santa Fe St. to N/O Penfield St.	10	4,240	lineal feet
MA-17	Major Street	10-inch diameter pipeline on Garey Ave. from 10 FWY to Alvarado St.	10	2,370	lineal feet
MA-18	Major Street	18-inch diameter pipeline on Garey Ave. from Willow St. to Holt Ave.	18	5,920	lineal feet
MA-19	Major Street	10-inch diameter pipeline on Garey Ave. from Holt Ave. to Monterey Ave.	10	650	lineal feet
MA-20	Major Street	6-inch diameter pipeline on Garey Ave. from Monterey Ave. to Commercial St.	6	350	lineal feet
MA-21	Major Street	6-inch diameter pipeline on Garey Ave. from 2nd St. to Mission Blvd.	6	970	lineal feet
MA-22	Major Street	6-inch diameter pipeline on Orange Grove Ave. from Arrow Hwy to La Verne Ave.	6	3,090	lineal feet
MA-25	Major Street	16-inch diameter pipeline on Orange Grove Ave. from La Verne Ave. to San Juan St.	16	1,240	lineal feet
MA-26	Major Street	16-inch diameter pipeline on Orange Grove Ave. from S/O San Juan St. to Artesia St.	16	1,600	lineal feet
MA-27	Major Street	16-inch diameter pipeline on Orange Grove Ave. from 10 FWY to Park Ave.	16	1,930	lineal feet
MA-28	Major Street	16-inch diameter pipeline on Towne Ave. from Bangor St. to 10 FWY	16	1,770	lineal feet
MA-29	Major Street	16-inch diameter pipeline on Towne Ave. from Reservoir 5A to San Bernardino Ave.	16	1,780	lineal feet
MA-30	Major Street	8-inch diameter pipeline on Towne Ave. from McKinley Ave. to Holt Ave.	8	3,530	lineal feet
MA-31	Major Street	10-inch diameter pipeline on Towne Ave. from Holt Ave. to Monterey Ave.	10	630	lineal feet
MA-32	Major Street	8-inch diameter pipeline on Towne Ave. from 1st St. to 2nd St.	8	270	lineal feet
MA-33	Major Street	10-inch diameter pipeline on Towne Ave. from 2nd St. to Mission Blvd.	10	1,030	lineal feet
MA-34	Major Street	8-inch diameter pipeline on Towne Ave. from Mission Blvd. to 9th St.	8	1,290	lineal feet
MA-36	Major Street	8-inch diameter pipeline on Indian Hill Blvd. from American Ave. to Kingsley Ave.	8	4,510	lineal feet
MA-37	Major Street	8-inch diameter pipeline on Indian Hill Blvd. from Kingsley Ave. to Holt Ave.	8	1,330	lineal feet
MA-38	Major Street	6-inch diameter pipeline on East End Ave. from N/O Pasadena St. to Holt Ave.	6	640	lineal feet
MA-39	Major Street	10-inch diameter pipeline on Arrow Hwy from Garey Ave. to Pine Ave.	10	300	lineal feet
MA-40	Major Street	10-inch diameter pipeline on Holt Ave. from Mills Ave. to Reservoir St.	10	4,250	lineal feet
MA-41	Major Street	8-inch diameter pipeline on Holt Ave. from Reservoir St. to San Antonio Ave.	8	1,150	lineal feet
MA-42	Major Street	6-inch diameter pipeline on Holt Ave. from San Antonio Ave. to Paloma Dr.	6	710	lineal feet
MA-44	Major Street	10-inch diameter pipeline on Reservoir St. from Holt Ave. to 1st St.	10	1,360	lineal feet
MA-45	Major Street	12-inch diameter pipeline on Holt Ave. from Garey Ave. to Hamilton Blvd.	12	3,970	lineal feet
MA-46	Major Street	6-inch diameter pipeline on Holt Ave. from Park Ave. to White Ave.	6	1,320	lineal feet
MA-47	Major Street	8-inch diameter pipeline on White Ave. from Orange Grove Ave. to Columbia Ave.	8	320	lineal feet
MA-48	Major Street	6-inch diameter pipeline on White Ave. from Alvarado St. to Randolph St.	6	360	lineal feet
MA-49	Major Street	8-inch diameter pipeline on White Ave. from Orange Grove Ave. to Monterey Ave.	8	3,330	lineal feet
MA-50	Major Street	8-inch diameter pipeline on White Ave. from 2nd St. to Grand Ave.	8	3,640	lineal feet
MA-51	Major Street	6-inch diameter pipeline on Phillips Blvd. from Park Ave. to Garey Ave.	6	1,210	lineal feet
MA-52	Major Street	6-inch diameter pipeline on Phillips Blvd. from Gibbs St. to Towne Ave.	6	1,950	lineal feet
MA-55	Major Street	6-inch diameter pipeline on Reservoir St. from Ellen Pl. to Mills Ave.	6	960	lineal feet
MA-62	Major Street	6-inch diameter pipeline on Mission Blvd. from Dudley St. to E/O Dudley St.	6	200	lineal feet
MA-63	Major Street	6-inch diameter pipeline on Mission Blvd. from Oak Ave. to Buena Vista Ave.	6	640	lineal feet
MA-64	Major Street	6-inch diameter pipeline on Dudley St. from Vejar St. to Mc Comas St.	6	1,430	lineal feet
MA-68	Major Street	10-inch diameter pipeline on Garey Ave. from S/O Penfield St. to 10 FWY	10	2,720	lineal feet

Table 8-24 (Cont'd)
Summary Of Recommendations

CIP ID	Improvement Type	Description	Diameter (in)	Size	Unit
MA-70	Major Street	6-inch diameter pipeline on Towne Ave. from San Bernardino Ave. to McKinley Ave.	12	1,280	lineal feet
MP-01	Major Street	12-inch diameter pipeline on Garey Ave. from Foothill Blvd. to N/O Foothill Blvd.	12	520	lineal feet
MP-03	Major Street	16-inch diameter pipeline on Foothill Blvd. from Towne Ave. to Garey Ave.	16	3650	lineal feet
MP-04	Major Street	10-inch diameter pipeline on Foothill Blvd. from Williams Ave. to W/O Bradford St.	10	1,160	lineal feet
MP-05	Major Street	16-inch diameter pipeline on from Foothill Blvd. to Towne Ave.	16	3750	lineal feet
MP-06	Major Street	12-inch diameter pipeline on Towne Ave. from S/O Grove St. to Bonita Ave.	12	2580	lineal feet
MP-69	Major Street	12-inch diameter pipeline on Towne Ave. from 10 FWY to San Bernardino Ave.	12	1,220	lineal feet
MP-13	Major Street	12-inch diameter pipeline on Fairplex Dr. from McKinley Ave. to McKinley Ave.	12	1850	lineal feet
MP-2	Major Street	12-inch diameter pipeline on Towne Ave. from Foothill Blvd. to N/O Foothill Blvd.	12	490	lineal feet
MP-23	Major Street	20-inch diameter pipeline on Orange Grove Ave. from La Verne Ave. to N/O La Verne Ave.	20	220	lineal feet
MP-24	Major Street	16-inch diameter pipeline on Orange Grove Ave. from La Verne Ave. to Artesia St.	16	2800	lineal feet
P-1	Pressure	12-inch diameter pipeline on Alley 600 ft W/O Sumner Ave. from 240 ft N/O Foothill Blvd. to N/O Foothill Blvd.	12	240	lineal feet
P-2	Pressure	12-inch diameter pipeline on Alley 450 ft E/O Lynoak Ave. from 400 ft N/O Foothill Blvd. to N/O Foothill Blvd.	12	400	lineal feet
P-3	Pressure	10-inch diameter pipeline on Flaxton St. from Foxbury Ave. to Foothill Blvd.	10	920	lineal feet
P-4	Pressure	8-inch diameter pipeline on Foxbury Ave. from Abbott St. to Flaxton St.	8	550	lineal feet
P-5	Pressure	8-inch diameter pipeline from Towne Ave. to 400 E/O Towne Ave. between Bonita Ave. and Harrison Ave.	8	370	lineal feet
P-6	Pressure	12-inch diameter pipeline on Bonita Ave. from Towne Ave. to Carnegie Ave.	12	1,270	lineal feet
P-7	Pressure	12-inch diameter pipeline on Carnegie Ave. from Bonita Ave. to Towne Center Dr.	12	2,690	lineal feet
P-8	Pressure	16-inch diameter pipeline on Towne Center Dr. from Towne Center Dr. to Arrow Hwy	16	780	lineal feet
P-9	Pressure	6-inch diameter pipeline on Logan St. from Arrow Hwy to Vicente Ave.	6	290	lineal feet
Res-1	Reservoirs	Replacement of Wooden Roofing of Reservoir 5A	N/A	47,100	square ft
Res-2	Reservoirs	Replacement of Wooden Roofing of Reservoir 6A	N/A	47,100	square ft
Res-3	Reservoirs	Reservoir Seismic Upgrades or priority 1 reservoirs	N/A	X[IW1]	reservoirs
PS-01	Pump Station Rehab	Repair leaking Booster 7A feedline (15 ft deep from 54" MWD OC Feeder)	10	600	lineal feet
PS-02	Pump Station Rehab	Replacement of pumps of PS 2 (units D, E)	N/A	175	HP
PS-04	Pump Station Rehab	Replacement of pumps of PS 5 (unit A)	N/A	50	HP
PS-05	Pump Station Rehab	Replacement of pumps of PS 8 (units A, B)	N/A	80	HP
PS-06	Pump Station Rehab	Replacement of pumps of PS 9 (units A, B, C)	N/A	140	HP
PS-09	Pump Station Rehab	Replacement of pumps of PS 1 (unit A)	N/A	75	HP
PS-10	Pump Station Rehab	Replacement of pumps of PS 3 (unit A)	N/A	100	HP
PS-11	Pump Station Rehab	Replacement of pumps of PS 3 (unit D)	N/A	100	HP
PS-12	Pump Station Rehab	Replacement of pumps of PS 4 (units A, B)	N/A	60	HP
PS-13	Pump Station Rehab	Replacement of pumps of PS 5 (unit B)	N/A	50	HP
PS-14	Pump Station Rehab	Replacement of pumps of PS 7 (unit A)	N/A	60	HP
PS-15	Pump Station Rehab	Replacement of pumps of PS 10 (unit B)	N/A	40	HP
PS-16	Pump Station Rehab	Replacement of pumps of PS 11 (units A, B, D, E)	N/A	280	HP
PS-18	Pump Station Rehab	Replacement of pumps of PS 12 (units A, B, C)	N/A	225	HP
PS-19	Pump Station Rehab	Replacement of pumps of PS 12H (units A, B)	N/A	15	HP
PS-20	Pump Station Rehab	Replacement of pumps of PS 2 (unit D)	N/A	50	HP
S-01	Water Supply	Replacement and Abandonment of Tunnel Well No. 1	N/A	314	gpm
S-02	Water Supply	Replacement and Abandonment of Tunnel Well No. 3	N/A	331	gpm
S-03	Water Supply	Replacement and Abandonment of Well 13	N/A	258	gpm
S-03	Water Supply	Well head treatment for replacement of Well 13	N/A	258	gpm
S-04	Water Supply	Replacement and Abandonment of Well 4	N/A	523	gpm
S-05	Water Supply	Replacement and Abandonment of Well 6	N/A	990	gpm

Table 8-24 (Cont'd)
Summary Of Recommendations

CIP ID	Improvement Type	Description	Diameter (in)	Size	Unit
S-06	Water Supply	Replacement and Abandonment of Well 11	n/a	443	gpm
S-07	Water Supply	Replacement and Abandonment of Well 12	n/a	597	gpm
S-08	Water Supply	Disinfection of Well 27	n/a	807	gpm
S-10	Water Supply	Piping, equipping and treatment of Well 32	n/a	unknown	gpm
S-11	Water Supply	Destruction of abandoned wells (Wells 1, 4, 22)	n/a	3	wells
S-12	Water Supply	Arsenic Treatment for Well 35	n/a	650	gpm
S-13	Water Supply	Piping, equipping and treatment of Well 37	n/a	unknown	gpm
SR-1	Supply Reliability	Install Inter-Agency connection with the City of Chino Hills	8	n/a	lineal feet
Other-1	Other	Replacement of SCADA communication, central control, and remote field equipement	n/a	n/a	n/a
Other-2	Other	Program EIR for Water and Recycled Water Master Plan	n/a	n/a	n/a
Other-3	Other	GIS	n/a	n/a	n/a
Other-4	Other	Water Meter Replacements	n/a	16,800	meters/period
Other-4	Other	Water Meter Replacements	n/a	16,800	meters/period
Other-4	Other	Water Meter Replacements	n/a	16,800	meters/period
Other-4	Other	Water Meter Replacements	n/a	16,800	meters/period
Other-5	Other	Replacement of Water Service Laterals in Phillips Ranch Area	n/a	500	laterals
Other-6	Other	Study to indentify additional Water Service Laterals that need replacement	n/a	1	study
Other-7	Other	Replacement of Fire Hydrants with Breakoff Heads (20/yr)	n/a	100	hydrants
Other-7	Other	Replacement of Fire Hydrants with Breakoff Heads (20/yr)	n/a	100	hydrants
Other-7	Other	Replacement of Fire Hydrants with Breakoff Heads (20/yr)	n/a	100	hydrants
Other-7	Other	Replacement of Fire Hydrants with Breakoff Heads (20/yr)	n/a	100	hydrants
Other-8	Other	Pipeline Assessment through coupon testing	n/a	multiple	tests
Other-9	Other	Water System Security Upgrade	n/a	n/a	n/a
Other-10	Other	Corporate Yard Facility (Water System Share)	n/a	n/a	n/a
Other-11	Other	Feasibility Study for Pedley WTP	n/a	n/a	n/a

Section 9
Future System Evaluation

This section describes the engineering and hydraulic evaluation of the future water distribution system and identifies the infrastructure needed to address future growth, based on water demand projections through the year 2025 as presented in **Section 3**. The system evaluations are based on the criteria as described in **Section 7**, using the hydraulic model to evaluate the hydraulic performance of the distribution system. Recommended improvements are summarized at the end of this section, while the Capital Improvement Program (CIP) with cost estimates and proposed phasing for these improvements is presented in **Section 11**.

DISTRIBUTION SYSTEM ANALYSIS

The hydraulic model is used to evaluate the system pressures under the demand conditions of year 2025 for the following three criteria.

1. Meet PHD while maintaining a minimum pressure of 40 psi
2. Meet PHD while not exceeding the maximum pressure of 90 psi and 125 psi for hilly terrain (if possible)
3. Meet MDD and fire flow while maintaining a minimum pressure of 20 psi

The results of these analyses are discussed below.

System Pressures under Maximum Day and Peak Hour Conditions

For the first criterion, the model is run for 24 hours with MDD. The demands at 7 AM on the maximum day are equal to PHD. The pressures are evaluated only for the 5,773 demand nodes, because the pressure criteria do not apply to transmission mains or at water facility locations, provided that the minimum pressure exceeds 5 psi. The model run identifies 94 demand nodes or approximately 2 percent of the system with pressures below 40 psi. Low pressures vary between 2 and 40 psi. Most of these locations are isolated areas and are relatively insignificant to the overall system successful operation. Thus, no recommendations are made for these junctions with low pressures during Year 2025 PHD conditions.

System Pressures under Fire Flow Conditions

The hydraulic model is used to evaluate the impact of fire flows on the distribution system. Fire flows ranging from 1,000 to 4,000 gpm are applied to the model to evaluate if the system could meet the fire flow demand under MDD conditions, while maintaining a minimum pressure of 20 psi. For this analysis, the *H_2OMAP Fireflow Simulation* is used. Based on the model runs, 277 fire flow locations are identified as having insufficient residual system pressures, this equates to 5 percent of the nodes assigned fire flows. About 6,700 lineal feet of 8-inch and 10-inch diameter pipelines are recommended to address these future deficiencies. These recommended improvements are summarized in **Table 9-1** and shown on **Figure 9-1**. All future fire flow improvements are indicated with a prefix “F-FF”.

Figure 9-1
Future Potable Water System Improvements

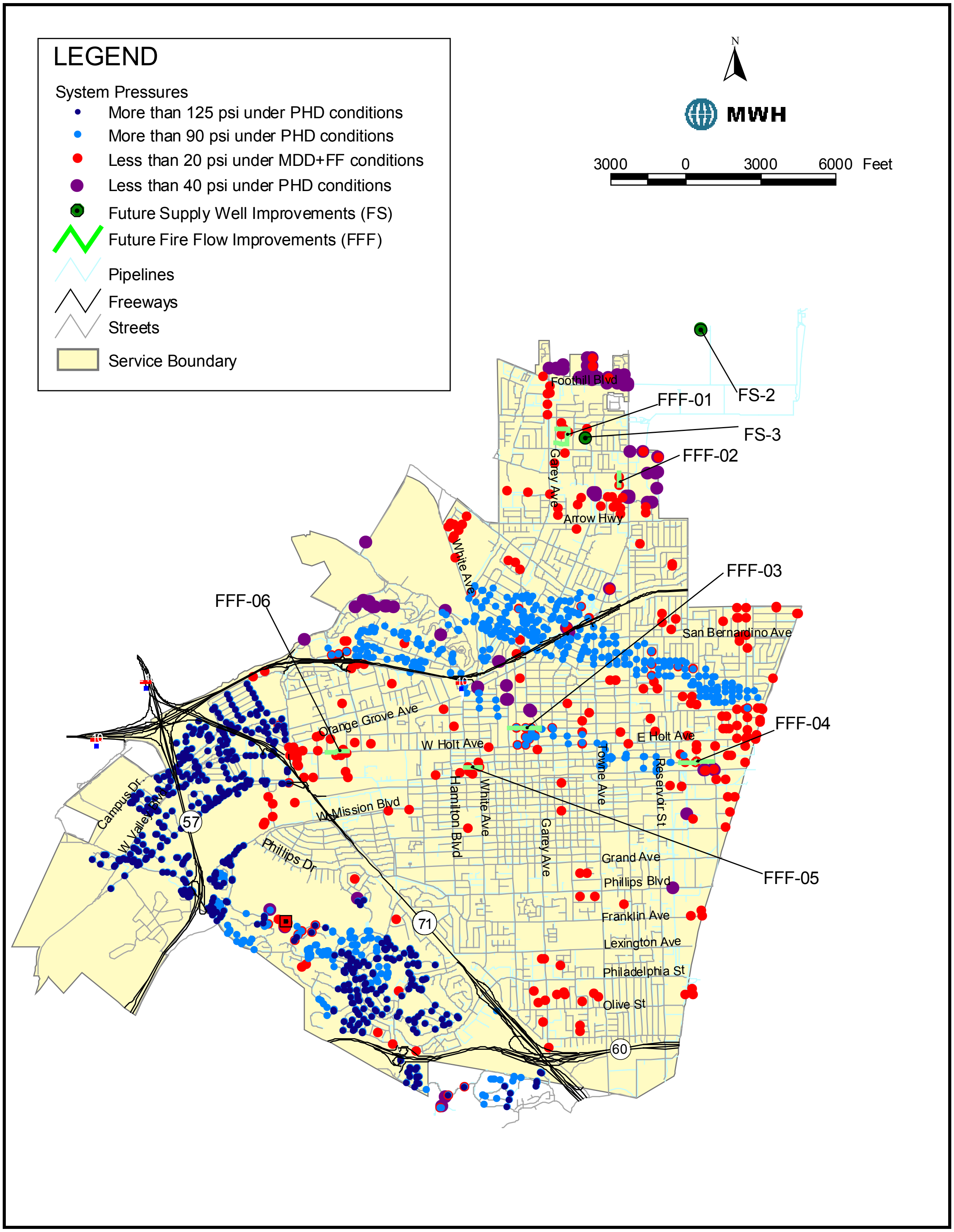


Table 9-1
Future Pipeline Replacements for Fire Flow

Diameter (in)	Pipe Length (ft)
8	2,600
10	4,100
Total Length	**6,700**

It should be noted that the fire flow analysis under future demand conditions is based on the fire flow requirements per land use category as defined in the latest General Plan. Thus, the future analysis is performed with the same land use information as used for the existing system analysis. Hence, the future fire flow recommendations are solely based on the projected demand increase, rather than a change in land use. For areas that are not fully developed per the General Plan, fire flow improvements recommended for the existing system can be considered as future improvements when the area develops. With an overlap of existing and future recommended improvements, it is recommended that the need for the improvement be evaluated on a case-by-case basis, since the land developer should finance the future growth-related improvements.

Maximum System Pressures under Peak Hour Conditions 2025

The model is also used to identify areas where the maximum pressure exceeds 90 psi and 125 psi for hilly terrain. This evaluation is conducted under PHD conditions. There are 602 demand nodes or approximately 10 percent of the system with maximum pressures in excess of 125 psi. High pressures varying between 120 psi and 190 psi are found in Zone 8R and Zone 11, Zone 11H and Zone 12H. This is a very hilly area where it is not feasible to change pressure zone boundaries to eliminate such pressure ranges. No improvements are recommended for these high-pressure areas, because the City does not have a history of receiving high-pressure complaints from customers. To prevent possible problems stemming from high pressures, future design drawings should continue to include an indication when pressure regulators are required in areas that exceed 80 psi.

To prevent possible problems stemming from high pressures, future CIP design drawings should continue to include an indication when pressure regulators are required in areas that exceed 80 psi. For new development, whether commercial or residential, City staff recommends the installation of pressure regulating valves for proposed building and water development plans for this reason.

STORAGE VOLUME ANALYSIS

The storage analyses are performed for each pressure zone. According to the planning criteria discussed in **Section 7**, the operational storage requirement is 30 percent of MDD, while the fire flow storage should provide sufficient water for the highest fire flow requirement of the zone evaluated. In addition, emergency storage equivalent to 50 percent of MDD is required.

Table 9-2 summarizes the required and available storage volumes by pressure zone. This table indicates that the City of Pomona has a surplus of 38 MG storage capacity for the system as a

Table 9-2
Storage Volume Evaluation

Pressure Zone	Demands			Storage Required						Storage Evaluation		
Description	ADD (mgd)	Peaking Factor	MDD (mgd)	Fire Flow (gpm)	Duration (hrs)	Fire Flow (MG)	Operational (MG)	Emergency (MG)	Required (MG)	Available (MG)	Surplus/ Deficit (MG)	Recommended (MG)
Zone 9	**2.56**	**1.70**	**4.35**	**4,000**	**4.00**	**0.96**	**1.30**	**2.17**	**4.44**	**12.96**	**8.52**	**-**
Zone 11	2.71	1.70	4.61	4,000	4.00	0.96	1.38	2.31	4.65	4.15	-0.50	-
Sub-zone Hydro 11	0.12	1.70	0.21	0[1]	0.00	0.00	0.06	0.10	0.17	0.00	-0.17	**-**
Sub-zone Hydro 12	0.03	1.70	0.05	0	0.00	0.00	0.02	0.03	0.04	0.00	-0.04	-
Zone 11 Total	**2.87**	**1.70**	**4.87**	**N/A**	**N/A**	**0.96**	**1.46**	**2.44**	**4.86**	**4.15**	**-0.71**	**-**
Zone 2	**4.90**	**1.70**	**8.33**	**4,000**	**4.00**	**0.96**	**2.50**	**4.17**	**7.63**	**9.53**	**1.90**	-
Zone 4	**0.62**	**1.70**	**1.06**	**3,000**	**3.00**	**0.54**	**0.32**	**0.53**	**1.39**	**3.50**	**2.11**	-
Zone 7	**2.87**	**1.70**	**4.87**	**4,000**	**4.00**	**0.96**	**1.46**	**2.44**	**4.86**	**6.79**	**1.93**	-
Zone 8	1.03	1.70	1.75	3,000	3.00	0.54	0.53	0.88	1.94	15.24	13.30	-
Sub-zone 8R	3.11	1.70	5.29	4,000	4.00	0.96	1.59	2.64	5.19	0.00	-5.19	-
Zone 8 Total	**4.14**	**1.70**	**7.04**	**N/A**	**N/A**	**1.50**	**2.11**	**3.52**	**7.13**	**15.24**	**8.11**	-
Zone 5	**11.16**	**1.70**	**18.98**	**4,000**	**4.00**	**0.96**	**5.69**	**9.49**	**16.14**	**30.61**	**14.47**	-
Zone 6	**1.47**	**1.70**	**2.50**	**4,000**	**4.00**	**0.96**	**0.75**	**1.25**	**2.96**	**4.90**	**1.94**	-
Grand Total	**30.59**	**N/A**	**52.01**	**N/A**	**N/A**	**7.80**	**15.60**	**26.00**	**49.41**	**87.68**	**38.27**	**N/A**

1 – Hydro zones 11 & 12 do not require any fire flow storage. Helicopter drops and fire pumps are used for fire fighting in these zones.

whole. In **Section 8** Existing System Evaluation, recommendations are made for Zone 11. This future storage analysis shows that the combined deficit for Zone 11 is 0.7 MG. Reservoir 11H will provide 0.1 MG storage capacity as discussed in **Section 8**. Thus, there is a need for an additional 0.6-MG capacity in Zone 11. The total demand in Zone 11-combined under future MDD conditions is 4.9 mgd. Booster Stations 11, 12, and 15 serve Zone 11 with a combined capacity of 12 mgd. Thus, there is enough surplus boosting capacity available for Zone 11, eliminating the need for providing the additional 0.6 MG in reservoir storage capacity. Based on this, no additional storage capacity improvements are identified for the City's system under future demand conditions.

SUPPLY ANALYSIS BY PRESSURE ZONE

A supply analysis by pressure zone is conducted for future MDD conditions with single largest source out of service for the pressure zone evaluated. Zone demands in this analysis are based on demand projections for the future discussed earlier in this report. The assumptions involved in this analysis are similar to those presented in **Section 8**. The results of this analysis are discussed below.

Zone 9 Supply Analysis

Analysis for Zone 9 is presented in **Table 9-3**. The analysis is performed with Pedley WTP being out of service.

Table 9-3
Zone 9 Supply Analysis with Pedley WTP Out of Service

Source	Capacity (mgd)	Evaluated Capacity (mgd)
Supply		
Wells		
20	0.86	0.86
37	1.01	1.01
T-1	0.45	0.45
T-2	0.34	0.34
T-3	0.48	0.48
T-4	0.35	0.35
Subtotal, Wells	3.48	3.48
Pedley WTP[1]	4.00	0.00
Boosters		
9A	0.51	0.00
9B	1.92	0.00
9C[2]	1.82	0.85
Subtotal, boosters	4.25	0.85
Total Supply	**11.73**	**4.35**
Demands		
MDD	4.35	4.35
Zone Transfer to Zone 2	0.00	0.00
Total Demand	**4.35**	**4.35**
Surplus/(Deficit)	**7.38**	**0.00**

1 – Largest source out of service so considered capacity is 0 mgd.
2 – Operate 9C for 11 hours in a day to supply 0.8 mgd to Zone 9

The future MDD for Zone 9 as shown in the table is about 4.3 mgd. There is no excess water available in Zone 9 when Pedley WTP is out of service for transfer to Zone 2.

The available supply from the groundwater wells as shown in the table below is 3.5 mgd. Thus the remaining water required for satisfying the total demand in Zone 9 is about 0.8 mgd. As shown in the table, the total capacity of Booster Station 9 is 4.2 mgd, which is more than what is required to meet the Zone 9 demands. Thus, it is assumed that booster 9C (with 1.8 mgd capacity) will only be operational for 11 hours per day in order to supply the required 0.8 mgd to Zone 9 under this scenario.

The analysis shows that there are no deficiencies in Zone 9 under the future demand conditions. This scenario of Pedley WTP being out of service also does not impact supply in any other zone of the system. A supply balance for Zone 9 analysis is presented in **Appendix D**.

Zone 2 Supply Analysis

The supply analysis for Zone 2 is presented in **Table 9-4**. As shown in the table, the largest source based on capacity for Zone 2 is Booster 2F with 2.77 mgd capacity. Analysis performed with Booster 2F out of service does not result in as severe a deficiency for Zone 2 as the one performed with Pedley WTP being out of service. This is because with Pedley WTP out of service, there is no surplus water in Zone 9 available for transfer to Zone 2 and also boosting is

Table 9-4
Zone 2 Supply Analysis with Pedley WTP Out of Service

Source	Capacity (mgd)	Evaluated Cap. (mgd)
Supply		
Wells		
13	0.37	0.37
27	1.16	1.16
9B	0.39	0.39
Subtotal, Wells	1.92	1.92
Boosters		
2C	2.12	0.00
2D	1.09	0.00
2E[1]	2.20	0.85
2F	2.77	2.77
2G	3.60	3.60
Subtotal, boosters	11.78	7.22
Zone 9 water transfer[2]	3.20	0.00
Total Supply	**16.90**	**9.14**
Demands		
MDD	8.33	8.33
Zone Transfer to Zone 7	0.00	0.00
PS 9 to Zone 9[3]	4.25	0.80
Total Demand	**12.58**	**9.13**
Surplus/(Deficit)	**4.32**	**0.01**

1 – Operate Booster 2D for 10 hours a day to supply the required demand in Zone 2
2 – Pedley WTP out results in no water transfer from Zone 9
3 – Based on Demand in Zone 9

required at Booster Station 9 to supply Zone 9. This results in a higher demand in Zone 2. As a result of this higher demand, more pumping is required at Booster Station 2.

The total demand in Zone 2 per this analysis is 9.1 mgd with a total available supply of 16.90 mgd. It is assumed that Booster Station 2 is operated (with 2C and 2D off) to supply the required 9.1 mgd. It is also assumed that Booster 2E would be operated only for 10 hours a day to satisfy the demand in Zone 2.

There are no deficiencies in Zone 2 under future demand conditions with Pedley WTP out of service and thus there are no improvements necessary. Other zones are also not impacted under this scenario as shown in Zone 2 supply balance in **Appendix D**.

Zone 5 Supply Analysis

Zone 5 is the largest zone in the system with a MDD of 19 mgd. This zone is mainly fed from the groundwater wells treated at the AEP through Booster Station 3 (A, B, C, F, & G). The other source of supply, primarily used during peak summer months, is a 30 cfs (19.4 mgd) imported water connection from the PWR-JWL line discharging to Reservoir 5 by gravity. The analysis presented below in **Table 9-5** is performed assuming this connection is out of service under future MDD conditions, which are likely to occur during hot summer months.

The total demand in Zone 5 consists of MDD for Zone 5 plus satisfying the demand in Zone 2 through Booster Station 2. This scenario considers Pedley WTP to be operational at 4 mgd capacity. This results in surplus water from Zone 9 being transferred to Zone 2 and thus less pumping is required at Booster Station 2.

The supply balance for this analysis is presented in **Appendix D**. As seen in the table below, when the imported water connection from the PWR-JWL to Reservoir 5 is out of service, more water can be obtained through the 30 cfs connection at Reservoir 8 and transferred to Zone 5 through PRVs to satisfy the demands in the system. Consequently, there are no deficiencies identified in this analysis under the future demand conditions.

Zone 6 Supply Analysis

The AEP is identified as the single largest source for Zone 6. Thirteen groundwater wells will be pumping into the AEP for nitrate removal in the future scenario as shown in **Table 9-6**. With the AEP being out of service, Wells 2, 5B, and 29 are the only wells considered as available supply for Zone 6 on top of the zone transfer from Zone 8.

The total demand in Zone 6 consists of 2.5 mgd of MDD and 3.7 mgd of demand from Zone 7. When the AEP is out of service, more water is required from the connections on the PWR-JWL line to Reservoir 8 and Reservoir 5. The analysis takes into consideration that no more than 90 percent of maximum capacity will be delivered at these two connections. Water from Zone 8 can then be transferred through PRVs to satisfy the total demand in Zone 6. There are no deficiencies identified for Zone 6 in this analysis. System-wide supply balance for this analysis is presented in **Appendix D**.

Table 9-5
Zone 5 Supply Analysis with MWD Connection
at Reservoir 5 Out of Service

Source	Capacity (mgd)	Evaluated Cap. (mgd)
Supply		
Wells		
1 (to be abandoned)	0.00	0.00
3	0.86	0.86
7	0.99	0.99
22 (to be abandoned)	0.00	0.00
32	0.72	0.72
8B	1.57	1.57
Subtotal, Wells	4.14	4.14
Boosters		
3A	3.51	3.51
3B	3.13	3.13
3C	5.32	5.32
3F	7.23	7.23
3G	5.04	5.04
Subtotal, boosters	24.23	24.23
Available booster capacity[1]		14.70
MWD Connection[2]	19.40	0.00
Zone Transfer from Zone 8	3.40	3.40
Zone Transfer from Zone 11	0.00	0.00
Total Supply	**47.76**	**22.24**
Demands		
MDD	18.98	18.98
PS 2 to Zone 2[3]	11.78	3.20
PS 5 to Zone 8	9.70	0.00
PS 10 to Zone 8	6.00	0.00
PS 1 to Zone 4	3.80	0.00
PS 14 to Zone 7	1.10	0.00
Total Demand	**51.36**	**22.18**
Surplus/(Deficit)	**(3.59)**	**0.02**

1 – Based on water available at Reservoir 6 for pumping to Zone 5 after feeding Zone 6 demands and Zone 7 demands
2 – Largest source out of service
3 – Based on demand in Zone 2 with Pedley WTP operating at 4 mgd capacity

Table 9-6
Zone 6 Supply Analysis with AEP Out of Service

Source	Capacity (mgd)	Evaluated Cap. (mgd)
Supply		
Wells to AEP[1]		
4	1.15	0.00
6	1.43	0.00
10	1.24	0.00
11	0.64	0.00
12	0.86	0.00
14	0.74	0.00
15	0.69	0.00
16	1.11	0.00
17	0.74	0.00
18	0.90	0.00
21	1.20	0.00
23	1.16	0.00
24	0.51	0.00
25	1.48	0.00
26	0.83	0.00
34	1.50	0.00
36	1.44	0.00
System Wells		
2	1.59	1.59
5B	1.15	1.15
29	0.52	0.52
Subtotal, Wells	20.88	3.30
Zone Transfer from Zone 8	2.95	2.95
Total Supply	**23.83**	**6.21**
Demands		
MDD	2.50	2.50
PS 3 (D,E) to Zone 7[2]	4.77	3.70
PS 3 (A,B,C,F) to Zone 5	24.20	0.00
Total Demand	**31.48**	**6.20**
Surplus/(Deficit)	**(7.65)**	**0.01**

1 – AEP is the largest source out of service
2 – Based on demand in Zone 7

Zone 4 Supply Analysis

Zone 4 is primarily supplied water by Booster Stations 1 and 8. Booster 7A is capable of pumping water from the Orange County Feeder at the PM-11 connection. This booster is only used for emergency purposes and not during normal system operation, making Booster Station 1 and 8 the primary sources of water for Zone 4.

The total demand in Zone 4 under future MDD conditions is only 1.1 mgd. The total available booster capacity with Booster 1A (single largest unit) out of service exceeds the total demand as shown in **Table 9-7**. Thus, no improvements are necessary for Zone 4 under future demand conditions. A supply balance of the system under Booster 1A being out of service is shown in **Appendix D**.

Table 9-7
Zone 4 Supply Analysis with Booster 1B Out of Service

Source	Capacity (mgd)	Evaluated Cap. (mgd)
Supply		
Boosters		
7A	1.88	0.00
1A	1.24	0.00
1B[1]	2.57	0.00
8A	1.05	0.00
8B	1.09	1.09
Subtotal, boosters	7.84	1.09
Total Supply	**7.84**	**1.09**
Demands		
MDD	1.06	1.06
Zone Transfer to Zone 7	0.00	0.00
Zone Transfer to Zone 8	0.00	0.00
Total Demand	**1.06**	**1.06**
Surplus/(Deficit)	**6.78**	**0.03**

1 – Largest source out of service

Zone 7 Supply Analysis

The supply analysis for Zone 7 is presented in **Table 9-8**. Booster 3E is identified as the largest unit supplying water to Zone 7. When this unit is out of service, zone transfer from Zone 2 is required on top of the 0.9 mgd available from Well 35.

Table 9-8
Zone 7 Supply Analysis with Booster 3E Out of Service

Source	Capacity (mgd)	Evaluated Cap. (mgd)
Supply		
Wells		
30 (Inactive)	0.00	0.00
35	0.90	0.90
Subtotal, Wells	0.90	0.90
Boosters		
3D	1.07	1.07
3E[1]	3.70	0.00
14	1.10	1.10
Subtotal, boosters	5.87	2.17
Zone Transfer from Zone 2	1.80	1.80
Zone Transfer from Zone 4	0.00	0.00
Total Supply	**8.58**	**4.87**
Demands		
MDD	4.87	4.87
Zone Transfer to Zone 8	0.00	0.00
Total Demand	**4.87**	**4.87**
Surplus/(Deficit)	**3.70**	**0.00**

1 – Largest source out of service

In the analysis shown below, water is pumped from Zone 5 to Zone 7 through Booster 14. Zone transfer from Zone 2 has been used to serve the remaining demand in Zone 7. The system-wide supply balance is presented in **Appendix D**. As shown in the table below, the total demand for Zone 7 can be supplied with the largest unit (Booster 3E) being out of service and thus there are no improvements recommended for the future demand conditions.

Zone 8 & 8R Supply Analysis

Zones 8 and 8R are treated as combined zones for this analysis as shown in **Table 9-9** and the term "Zone 8" used in the description below refers to Zone 8 and 8R combined. The imported water connection from the PWR-JWL to Reservoir 8 is identified as the single largest source for these combined zones.

Zone 8 has very little groundwater available through Well 28 and in the event when the imported water connection is out of service at Reservoir 8, water from Zone 5 needs to be pumped to

Table 9-9
Zone 8, 8R Supply Analysis with MWD Connection at Res. 8 Out of Service

Source	Capacity (mgd)	Evaluated Cap. (mgd)
Supply		
Wells		
28	0.46	0.46
Subtotal, Wells	0.46	0.46
MWD Connection[1]	19.40	0.00
Boosters		
5A	2.71	2.71
5B	3.63	3.63
5C	3.35	3.35
10A	3.03	3.03
10B	2.96	2.96
Subtotal, boosters	15.69	15.69
Available booster capacity[2]	15.69	11.57
Zone Transfer from Zone 4	0.00	0.00
Total Supply	**35.55**	**11.97**
Demands		
MDD[3]	7.04	7.04
Zone Transfer to Zone 6	0.00	0.00
Zone Transfer to Zone 5	0.00	0.00
PS 11 (A-F) to Zone 11[4]	7.59	1.90
PS 12 (A-C) to Zone 11[4]	3.03	3.03
PS 15 to Zone 11[4]	1.40	0.00
PS 8A,B to Zone 4	2.14	0.00
Total Demand	**21.20**	**11.97**
Surplus/(Deficit)	**14.35**	**0.00**

1 – Single largest source out of service
2 – Based on demand in Zone 8
3 – Maximum Day Demand for Zone 8 and 8R combined
4 – Operators to select the pump units and hours of operation to supply the demand in Zone 11-combined

Zone 8 through Booster Station 5 and Booster Station 10. This in turn results in higher amount of imported water being delivered at Reservoir 5 connection.

The total demand in Zone 8 consists of 7 mgd of MDD for the combined zones plus 4.9 mgd for Zone 11-combined (Zone 11,11H, &12H). There is enough pumping capacity at Booster Stations 5 and 10 as shown in the table to supply water to Zone 8 from Zone 5. There are no deficiencies identified under the future demand conditions.

System-wide supply balance under the scenario of imported water connection at Reservoir 8 being out of service is presented in **Appendix D**.

Zone 11, 11H, & 12H Supply Analysis

Zone 11, hydropneumatic Zone 11H, and hydropneumatic Zone 12H are treated as a combined pressure zone for this analysis. The supply sources for Zone 11-combined are Booster Stations 11, 12, and 15. Booster 11F is identified as the largest unit serving the zone.

As shown in **Table 9-10** the total demand in Zone 11-combined is 4.9 mgd. The total boosting capacity between Booster Station 11,12, and 15 with booster 11F out of service is 10.3 mgd. This excess capacity provides flexibility to the operations staff to select the pump units needed to supply the required 4.9 mgd to Zone 11-combined. The table below assumes some pumps being off and 12C running only for about an hour per day in order to satisfy the demand in Zone 11-combined. Thus, there is a surplus of booster capacity for Zone 11-combined under future demand conditions. System-wide supply balance for this analysis is presented in **Appendix D**.

Table 9-10
Zone 11, 11H, 12H Supply Analysis with Booster 11F Out of Service

Source	Capacity (mgd)	Evaluated Cap. (mgd)
Supply		
Boosters[1]		
11A	1.07	1.07
11B	1.02	0.00
11C	1.04	1.04
11D	1.06	1.06
11E	1.69	1.69
11F[2]	1.71	0.00
12A	1.12	0.00
12B	0.93	0.00
12C	0.98	0.05
15	1.40	0.00
Subtotal, boosters	12.02	4.85
Total Supply	**12.20**	**4.90**
Demands		
MDD[3]	4.90	4.90
Total Demand	**4.90**	**4.90**
Surplus/(Deficit)	**7.15**	**0.00**

1 – Operators to select pump units and hours of operation to supply the demand in Zone11-combined
1 – Single largest source out of service
2 – Maximum Day Demands for Zone 11, Zone 11H, and Zone 12H

SYSTEM RELIABILITY ANALYSIS

To provide adequate system redundancy for maintenance or temporary failure, it is recommended that the City have adequate source water capacity to meet the water demands with the largest source of water out of service. For the water source evaluation, four evaluation criteria were established. As described in **Section 7**, the water system should have adequate source water during emergency events like:

1. Major transmission main (12-inch and larger) breaks under MDD conditions
2. Outage of imported water supplies for seven consecutive days under ADD conditions
3. Outage of AEP for three consecutive days under MDD conditions
4. Outage of the Pedley WTP for three days under MDD conditions

Demands in excess of MDD, such as during peak hours, should be supplied from reservoir storage.

Major Transmission Main Breaks

The major transmission main improvements that are recommended in **Section 8** would address both the existing and future deficiencies. There are no additional growth-related improvements required for the future system. Based on this, the analysis performed with the help of hydraulic model of the system in **Section 8** for major transmission main breaks is not repeated in this section for the sake of simplicity.

Outage of Imported Water Supplies

As discussed in **Section 7**, the worst case scenario of MWD and TVMWD being out of service at the Weymouth and Miramar WTP results in no water supply at PM-15 (connections to Reservoir 5 and Reservoir 8) and PM-11 connection. For the emergency analyses, it is assumed that all the active groundwater wells, except those that require blending with imported water (Well 3, Well 7, & Well 8B), and the Pedley WTP can deliver water up to the maximum capacity. It is also assumed that during such an emergency event, ADD conditions can be achieved by water conservation through public notifications.

The water supply situation without MWD water is summarized in **Table 9-11**. The groundwater wells that would meet the water quality regulations (Well 1 and Well 22 assumed to be abandoned) have a combined capacity of 28.7 mgd while the Pedley WTP has a capacity of 4 mgd. Thus, the total supply capacity without MWD water is 32.7 mgd. With an average day demand of 30.6 mgd, the approximate supply surplus is 2.1 mgd or 14.7 MG in 7 days. If the Pedley WTP were to be offline (no surface water flows) during such an MWD outage, the remaining system supply would not be sufficient to meet ADD conditions. However, the City has 26 MG of emergency storage in the reservoirs, which can be used to meet ADD for seven days during such an emergency event.

The hydraulic model was not run for this condition since it was not calibrated and the existing system model would not run for 7 days due to depleted storage. It is recommended that the City verify these spreadsheet calculations with the help of a calibrated hydraulic model of the distribution system.

Table 9-11
Water Source Reliability – MWD Out of Service

Water Demand	1 day (mgd)	7 days (MG)
Demand		
ADD	30.6	214.1
MDD	52.0	364.1
Water Supply		
Groundwater	28.7	200.9
Surface water/WTP	4.0	28.0
Total Supply	**32.7**	**228.9**
Surplus/(Deficit) meeting ADD	**2.1**	**14.7**

Outage of AEP

The future system is also evaluated for the condition when the AEP is out of service for three consecutive days. This results in loss of water from all the groundwater wells pumping into the AEP for treatment and blending (approximately 17.6 mgd). The City has the option of obtaining sufficient water supplies from MWD and other groundwater wells to meet MDD as shown in **Table 9-12**. For this analysis, it is assumed that water from the MWD connections can be delivered at 90 percent of their maximum capacity. Also MDD conditions are expected in hot summer days and, thus, it is assumed that there will be no surface water available for treatment at the Pedley WTP. With an MDD of 52.0 mgd, the supply deficit equals 0.2 mgd or 0.6 MG in 3 days. This deficit can easily be overcome by emergency storage in the reservoirs.

Table 9-12
Water Source Reliability – AEP Out of Service

Water Demand	1 day (mgd)	3 days (MG)
Demand		
ADD	30.6	91.8
MDD	52.0	156.0
Water Supply		
Groundwater	15.1	45.3
Imported water/WTP	36.7	110.2
Total Supply	**51.8**	**155.4**
Surplus/(Deficit) meeting MDD	**-0.2**	**-0.6**

As with the imported outage analysis, it is recommended that the City verify this scenario with a calibrated hydraulic model of the system. Based on the spreadsheet calculations, no deficiencies are identified and thus no improvements are recommended.

Outage of Pedley Water Treatment Plant

The future system is evaluated for the condition when Pedley WTP is out of service under MDD conditions. The City has the option of obtaining sufficient water supplies from MWD and groundwater wells to meet MDD as shown in **Table 9-13**. For this analysis, it is assumed that water from MWD connections can be delivered at 90 percent of their maximum capacity. With an MDD of 52.0 mgd, the supply surplus equals 17.4 mgd or 52.3 MG in three days.

Table 9-13
Water Source Reliability – Pedley WTP Out of Service

Water Demand	1 day (mgd)	3 days (MG)
Demand		
ADD	30.6	91.8
MDD	52.0	156.0
Water Supply		
Groundwater	32.7	98.1
Imported water/WTP	36.7	110.2
Total Supply	**69.4**	**208.3**
Surplus/Deficit meeting MDD	**17.4**	**52.3**

It is recommended that the City verify this scenario with a calibrated hydraulic model of the system. Based on the above-presented calculations, no deficiencies are identified and thus no improvements are recommended for such an event.

REHABILITATION ANALYSIS

Rehabilitation analysis is performed for the City's reservoirs, wells, and booster stations taking into considerations the following factors:

- Age of the facility being evaluated
- Historical maintenance and repair records
- Information available from City's operations staff

The improvements identified in this analysis are driven by increase in water demand due to population growth.

Reservoir Replacement Assessment

No additional reservoir replacements other than those identified in **Section 8** are necessary for the future system. It is recommended that the City evaluate the condition of the reservoirs every five years and makes necessary improvements (coating, painting, structural retrofits etc.) as identified in the evaluation.

City staff will continue to drain and inspect at least five (5) reservoirs each year. In this manner, staff seeks to complete the entire storage system every 5 years.

Well Replacement Assessment

Well 20 is identified for replacement due to age. Well 20 pumps directly into the distribution system of Zone 9. This well is currently inactive due to nitrate issues. No existing supply deficiencies result with this well offline. Replacement of this well is recommended as a future system improvement in order to offset imported water needs due to increased demands.

It is recommended that Well 20 be abandoned and replaced at its current site. Wellhead treatment should also be provided at Well 20. This will allow the City increase its active production capacity in the Claremont Heights Basin. It is also recommended that Well 37 be brought online by equipping it and providing wellhead treatment in order to increase the active production capacity in the Pomona Basin.

Well 21 is also identified as a candidate for age replacement in this analysis. Since this well was currently equipped to pump into the AEP, it is recommended that the City revisit the condition of this well in 10 years and consider abandoning and replacing this well at its current site. The discharge piping should be salvaged in order to maintain the capability of pumping into the AEP, thereby eliminating the need for wellhead treatment.

Booster Station Replacement Assessment

Boosters 2G, 3G, 14, and 15 are identified as future improvements. Design and installation of these boosters are already identified in the City's 2004/05 CIP. Thus, these improvements are listed in this master plan's CIP without assigning any dollar value to them.

Additionally it is recommended that the City continue to perform regular maintenance of the pumps and motors and associated pumping equipment. Condition of the pump housing should be evaluated every five years and necessary retrofits should be performed based on this evaluation.

SUMMARY OF RECOMMENDATIONS

The recommendations for the future system are depicted on **Figure 9-1** and listed in **Table 9-14**.

Table 9-14
Summary Of Recommendations

CIP ID	Improvement Type	Description	Diameter (in)	Size	Unit
n/a	Reservoirs	New Reservoir 11H	n/a	0.10	MG
FS-2	Water Supply	Replacement and Abandonment of Well 20	n/a	258	gpm
FS-2	Water Supply	Well head treatment for Well 20	n/a	258	gpm
FS-3	Water Supply	Well head treatment for Well 37 (unfunded portion)	n/a	700	gpm
F-FF-1	Fire Flow	8-inch diameter pipeline on Aldama Ave., Lublin St.,& Browning Ave. from Aldama Ave. & Abbott St. to Browning Ave. & Abbott St.	8	1,700	lineal feet
F-FF-2	Fire Flow	10-inch diameter pipeline 400 feet West of Towne Ave. forming a T-intersection with E Bonita Ave.	10	600	lineal feet
F-FF-3	Fire Flow	10-inch diameter pipeline on W Pearl St. from N Park Ave. to East of Garey Ave.	10	1,400	lineal feet
F-FF-4	Fire Flow	10-inch diameter pipeline on Price St. from Clark Ave. to West of N East End Ave.	10	1,500	lineal feet
F-FF-5	Fire Flow	8-inch diameter pipeline on 220' S of W Monterey Ave. from N Huntington Blvd. to N White Ave.	8	700	lineal feet
F-FF-6	Fire Flow	10-inch diameter pipeline on W Holt Ave. from New York Dr. to Erie St.	10	1,000	lineal feet
n/a	Pump Stations	Addition of Booster 2G (currently under design)	n/a	200	HP
n/a	Pump Stations	Addition of Booster 3G (currently under design)	n/a	150	HP
n/a	Pump Stations	Addition of Booster 14 (currently under design)	n/a	50	HP
n/a	Pump Stations	Addition of Booster 15 (currently under design)	n/a	77	HP
F-Other-1	Other	Conduct a study to assess the condition of the Simpson Wells and pipelines	n/a	1	study

Section 10
Recycled Water System

This section describes the existing recycled water system and identifies the potential for expanding the system within the planning horizon of this master plan. This section starts with a discussion of recycled water regulations. Subsequently, the historical and existing recycled water demands are discussed, followed with a description of the potential future recycled water customers. The recycled water supplies are discussed and compared with the existing and projected future recycled water demands. This section is concluded with a recycled water system analysis to determine the most cost-effective recycled water system expansions within the City of Pomona. The cost estimates and phasing of improvements identified in this section are addressed in **Section 11**, the Capital Improvement Program (CIP)

RECYCLED WATER REGULATIONS

The use of recycled water is regulated through the California Code of Regulations (CCR). Pertinent excerpts from Titles 17 and 22 of the CCR pertinent statutes are compiled in the California Health Laws related to Recycled Water, also referred to as "The Purple Book", which was updated in June, 2001.

The California recycled water regulations promote the use of recycled water to offset a portion of the increase in potable water supply needs. As discussed in **Section 3**, the water demand of the City is expected to increase, hence an increase in recycled water supply would reduce the need for additional potable water supply sources. The City's recycled water supply is provided by the Los Angeles County Sanitation Districts' (LACSD) Pomona Water Reclamation Plant (PWRP), which treats its wastewater to tertiary treatment standards including disinfection. According to Title 22, tertiary-treated recycled water could be used for the following:

- Irrigation at golf courses, cemeteries, residential landscaping, parks, and playgrounds
- Watering ornamental nursery stock, and non-edible and edible vegetation
- Recreational lakes and ponds, and water bodies for wildlife habitat
- Cooling towers, air conditioners, and evaporative condensers
- Flushing toilets, decorative fountains, commercial laundries, commercial car washes
- Industrial boiler and other process feed
- Washing down roads and sidewalks
- Fire fighting

The California Water Code (Section 13550) states that potable domestic water use for non-potable demands is "a waste of water if recycled water is of adequate quality and is available for these (non-potable) uses and can be furnished at a reasonable cost to the user." In addition, recycled water could also be used if it "is not detrimental to public health and will not adversely affect downstream water rights, degrade water quality, and is not injurious to plant life, fish, and wildlife." Water quality and health effects pose major concerns to the public in regards to the use of this source. However, regulations and guidelines for recycled water have been established by the California Department of Health Services (DHS) and are published in the Code of California Regulations - Title 22. These regulations and guidelines provide water utilities with requirements for treatment, water quality and reliability of the recycled water before public use.

RECYCLED WATER DEMANDS

The City's existing recycled water customers and demands are summarized in this section. The data presented herein are based on historical recycled water consumption records (billing data) from July 1993 to February 2004. Note that the data are presented in calendar years and not fiscal years.

Existing Recycled Water Customers

Originally, the City delivered recycled water to ten users, three were classified as "gravity" system (Zone 1) customers and seven are classified as "pressure" system (Zone 2) customers. **Table 10-1** lists the original customers and their recycled water use, while **Figure 10-1** shows the location of the original recycled water customers.

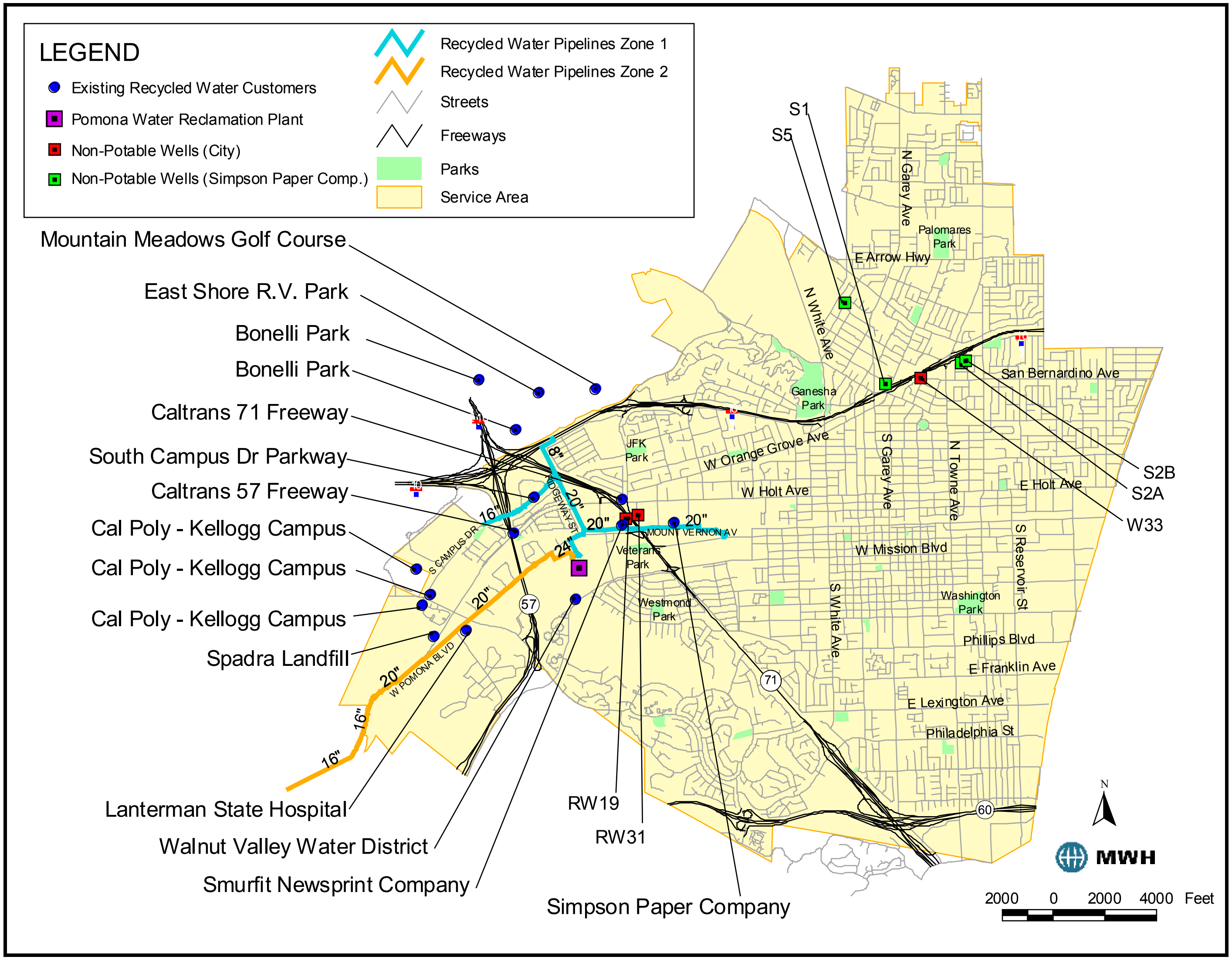
Table 10-1
Original Recycled Water Users

Customer	Zone	Recycled Water Use
Cal Poly Pomona (Kellogg Campus)	Pressure Zone 2	Irrigation, livestock
Frank G. Bonelli Regional Park[1]	Pressure Zone 2	Irrigation
City of Pomona Parks Department	Pressure Zone 2	Irrigation
Cal Trans – State Route 71	Pressure Zone 2	Irrigation
Cal Trans – State Route 57	Pressure Zone 2	Irrigation
Smurfit Newsprint Company	Pressure Zone 2	Industrial
Pomona (Simpson) Paper Company	Pressure Zone 2	Industrial
Lanterman State Hospital	Gravity Zone 1	Irrigation
Los Angeles County Spadra Landfill	Gravity Zone 1	Irrigation
Walnut Valley Water District	Gravity Zone 1	Irrigation

1 - Bonelli Park, Mountain Meadows Golf Course, and East Shore R. V. Park

Recycled water for the pressurized recycled water system is supplemented with water pumped from Wells 19 and 31. These customers include Frank G. Bonelli Regional Park (Bonelli Park, Mountain Meadows Golf Course, and East Shore R. V. Park), Cal Poly Pomona (Kellogg Campus), Cal Trans (State Routes 71 and 57), Smurfit Newsprint Company, Pomona (Simpson) Paper Company, and Pomona Parks Department. The other recycled water system is served by water that flows by gravity through a 21-inch pipeline (the Northside Line). This gravity system was sold to the Los Angeles County Sanitation Districts in mid-April 2004. When the City owned the gravity system, its customers included Lanterman State Hospital, LACSD's Spadra Landfill, and Walnut Valley Water District (WVWD). **Figure 10-1** illustrates the locations of the pressurized and gravity pipelines, the major recycled water facilities, and the original recycled water users.

Figure 10-1
Recycled Water System and Original Customer Locations

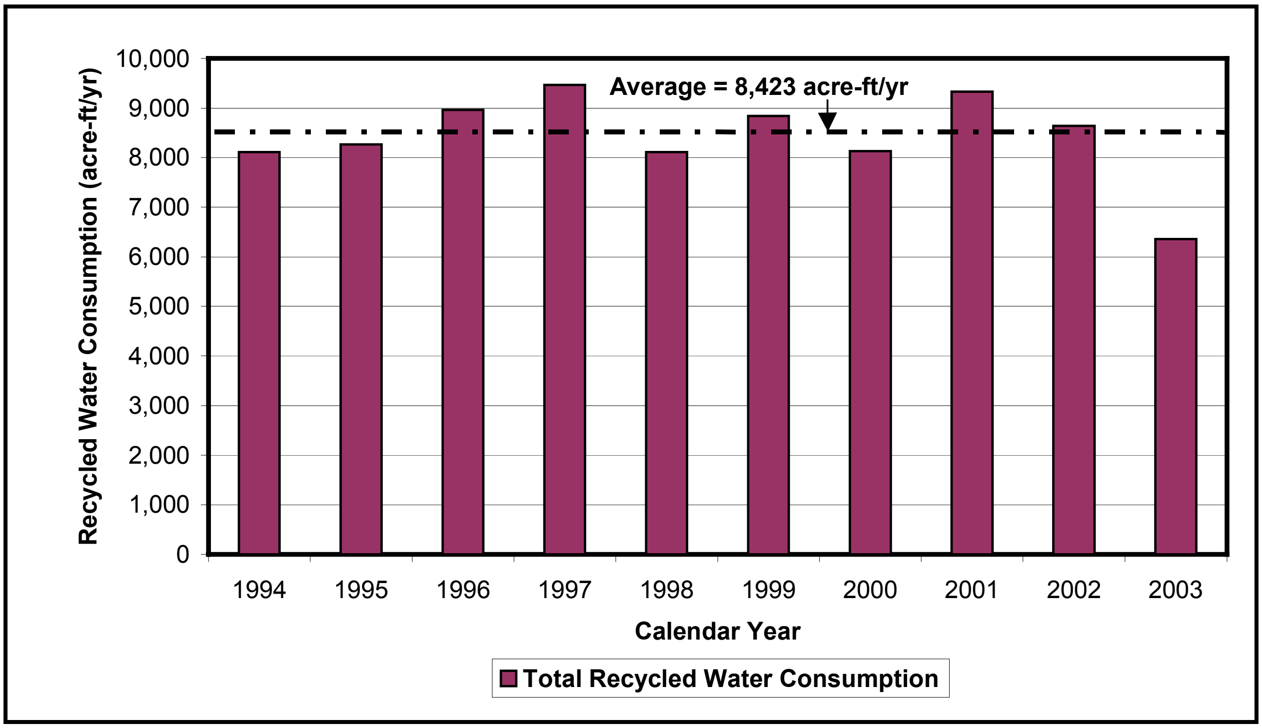


Historical Recycled Water Demands

The City's historical recycled water demands from 1994 to 2003 are presented in **Figure 10-1**. The average demand in this ten-year period was 8,423 acre-ft/yr. Total demand increased by about 17 percent from 1994 to 1997 and they fluctuated between 1998 to 2001. There was a significant drop of approximately 32 percent from 9,335 acre-ft/yr in 2001 to 6,357 acre-ft/yr in 2003. This decline in water use was due to Pomona (Simpson) Paper Company going out of business in 2002.

The average day demand (ADD) and maximum day demand (MDD) of the original customers are summarized in **Table 10-2**. Data presented in this table is based on historical data from calendar year (CY) 1999 through CY 2003. The average recycled water demands for the gravity and the pressure systems are approximately 1,590 acre-ft/yr and 6,682 acre-ft/yr, respectively. Maximum day demands are determined using maximum to average day demand ratios, which are obtained from the City's 1992 WMP. **Table 10-2** shows that the MDD of the pressurized system is approximately 9.4 mgd.

Figure 10-2
Historical Recycled Water Demands (1996 to 2003)



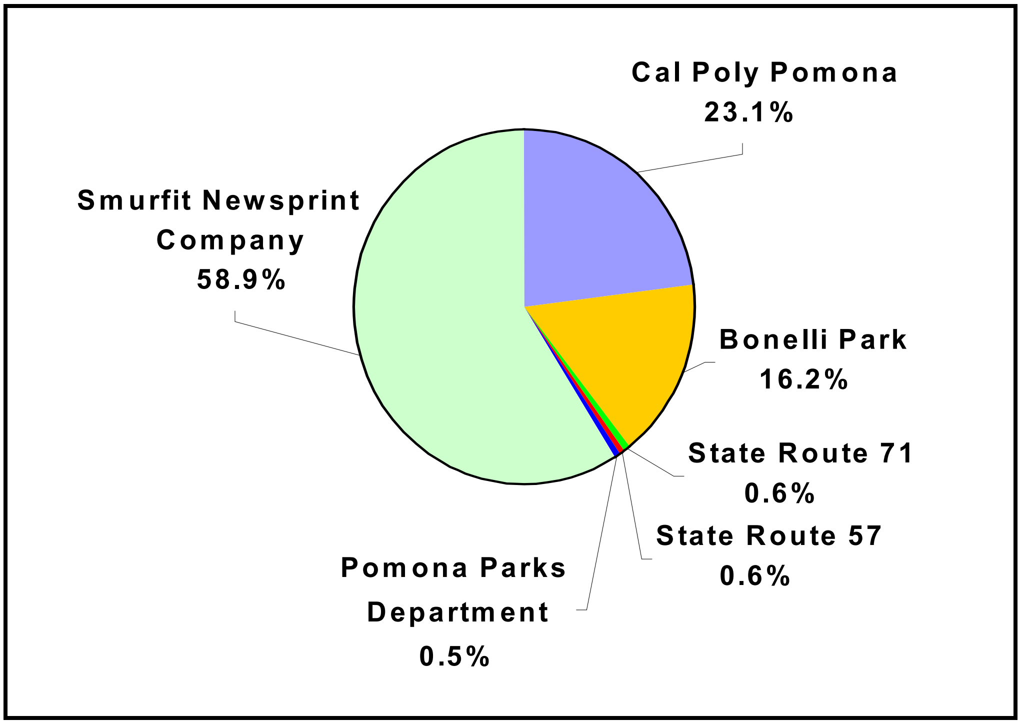
The recycled water demand distribution of the existing users (gravity system only) based on year 2003 data is graphically presented in **Figure 10-3**.

Table 10-2
Recycled Water Demands of Original Users

User	MDD/ADD Ratio [1]	ADD (acre-ft/yr) [2]	MDD (mgd)
Zone I – Gravity System (sold to LACSD)			
Walnut Valley Water District	4.2	1,086	4.1
Los Angeles County Spadra Landfill	2.6	494	1.1
Lanterman State Hospital	2.6	10	0.02
Subtotal	--	***1,590***	***5.2***
Zone II – Pressure System			
Cal Poly Pomona	2.5	1,140	2.5
Bonelli Park	2.6	894	2.1
Cal Trans – State Route 71	2.6	26	0.1
Cal Trans – State Route 57	2.6	35	0.1
City of Pomona Parks Department	2.6	25	0.1
Smurfit Newsprint Company	1.1	3,875	3.8
Pomona (Simpson) Paper Company[4]	1.1	687	0.7
Subtotal	--	***6,682***	***9.4***
Total Original Recycled Water Demand	--	**8,272**	**14.6**
Total Existing Recycled Water Demand[5]	--	**5,995**	**8.6**

1 – Based on the 1992 Water Master Plan (MW, 1992).
2 – Average demands from CY 1999 to CY 2003.
3 – According to City staff, the Lanterman State Hospital will be converted to residential and commercial areas in the future
4 – Pomona (formerly Simpson) Paper Company closed down as of October 2002.
5 – Without the gravity system and Simpson Paper Company

Figure 10-3
Demand Distribution of Existing Recycled Water Users (CY 2003)



As shown **Figure 10-3**, the largest user is Smurfit Newsprint Company (59 percent) followed by Cal Poly Pomona (23 percent). Smurfit Newsprint Company has an average annual demand of approximately 3,960 acre-ft/yr. Bonelli Park is the third largest existing recycled water user with 795 acre-ft/yr (16 percent).

Recycled Water Demand Projections

The future recycled water demands of the current users on the pressurized system are assumed to remain the same as their existing demands, with the exception of Pomona (Simpson) Paper Company that closed down in 2002. It is unknown whether a similar large water user will occupy the site of this paper mill in the future. The total future ADD and MDD of the existing customers is 5.4 mgd and 8.6 mgd, respectively.

To assess the feasibility of converting some of the existing potable users to recycled water, windshield surveys of the locations of the top 50 potable water users were conducted on April 30, 2004 and May 6, 2004. The top 50 potable water users are obtained from the 2003 billing data. These users and their respective water demands are listed in **Table 10-3**. As shown in **Table 10-3**, the user with the highest potable water demand is Smurfit Newsprint Company. It should be noted this paper company is also the City's top recycled water user.

During the field visits, each customer is specified as a potential or a non-potential recycled water user. As shown in **Table 10-3**, 15 of the top 50 potable users are identified as potential recycled water users. These potential users include parks, schools, cemeteries, and car washes. Nine additional potential users, which are referred to as "pick-up" users, are also identified based on their locations relative to the existing customers and the top 50 users.

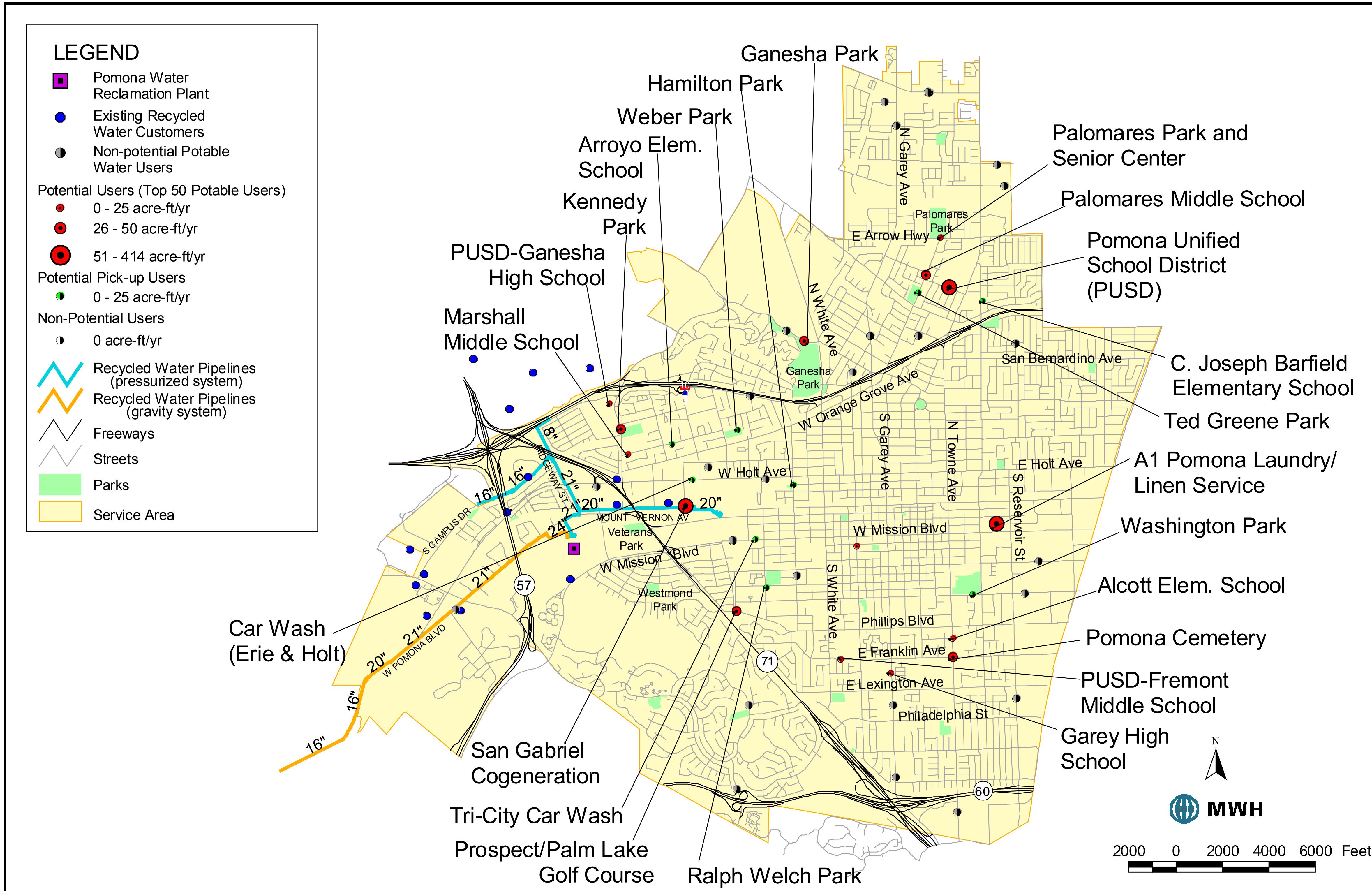
As it is beyond the scope of this project to contact these customers and determine their potential recycled water use, future demands are estimated based on an assumed recycled water use percentage and multiplying this with the existing potable water demand. The estimated recycled water demand of these users and observations made during the field visits are summarized in **Table 10-3**, while the location of these users are identified as customers that could (partially) convert to recycled water are depicted on **Figure 10-4**. The potential users' current potable demand is 671 gpm or 1,082 acre-ft/yr. Approximately 524 gpm or 845 acre-ft/yr of this demand could be supplied by recycled water in the future.

With the conversion of these 24 potable water users, the recycled water demand could increase by 846 acre-ft/yr from 5,995 acre-ft/yr (5.4 mgd) to 6,841 acre-ft/yr (6.1 mgd). The MDD is estimated to increase from 8.6 mgd to 10.2 mgd, assuming that all potential recycled water users would convert and that the MDD peaking factor for these users is 2.6 based on typical evapotranspiration patterns for this area. This is a potential increase of 17 percent. The feasibility of converting these potable water users is discussed in the following subsections. First the availability of recycled water supplies is evaluated, followed by an evaluation of the cost-effectiveness to expand the recycled water distribution system to serve these customers.

Table 10-3
Potential Additional Recycled Water Demands

Name	Service Address	Existing Average Day Demand (gpm)	Assumed Recycled Water Use Percentage (percent)	Potential Recycled Water Demand (gpm)	Potential Recycled Water Demand (acre-ft/yr)	Comments
Potential Recycled Water Users (From Top 50 Potable Users)						
San Gabriel Co-generation Plant	102 Erie St.	257	100	257	414	Assumed that 100 percent of current potable demand could be supplied by recycled water.
Pomona Unified School District (PUSD)	475 Bangor St.	46	70	32	52	About 70 percent irrigated areas and 30 percent buildings. Irrigated areas include baseball, football, and soccer fields.
Ganesha High School (PUSD)	1201 Fairplex Dr.	32	30	9	15	About 30 percent irrigated areas, which include big sports field, and track and field with bleachers.
Prospect/Palm Lake Golf Course	1300 W Phillips Blvd.	31	95	30	48	Big golf course with approximately 95 percent irrigated areas.
Palomares Middle School	2211 N Orange Grove Ave.	31	60	18	30	School has a big ball field, with approximately 60 percent irrigated areas and 40 percent buildings.
Fremont Middle School (PUSD)	725 W Franklin Ave.	26	50	13	21	School has a big ball field, with approximately 50 percent irrigated areas and 50 percent buildings.
Marshall Middle School	2017 Arroyo Ave.	25	50	12	20	Good size ball-field and track and field. About 50 percent irrigated areas.
Palomares Park and Senior Center	499 E Arrow Hwy.	21	50	10	17	Park has a playground, two onsite reservoirs, and a soccer field. There is quite a bit of irrigation in front.
Pomona Cemetery	800 E Franklin Ave.	20	95	19	30	Approximately 95 to 100 percent are irrigated areas.
Pomona Civic Center	400 Civic Center Plaza	19	10	2	3	Mostly government buildings (Superior Court, Library, City Hall). Water use is mostly indoor use. Some irrigation outside of the library (approximately 10 percent).
Alcott Elementary School	1600 S Towne Ave.	18	30	5	9	Approximately 30 percent irrigated areas and 70 percent buildings.
Ganesha Park	550 W McKinley Ave.	18	100	18	29	The entire park is irrigated.
Garey High School (PUSD)	1800 S Garey Ave.	18	50	9	14	About 50 percent of the high school is irrigated. Irrigated area includes ball fields.
Kennedy Park	1151 1/2 Fairplex Dr.	17	95	16	26	About 95 percent of the park is irrigated.
A1 Pomona Laundry/A1 Linen Service	396 La Mesa St.	44	95	42	67	Assumed a recycled water percentage of 95 percent.
Potential Recycled Water Users (Pickup Users)						
Ted Greene Park	2147 N. Orange Grove Ave.	7	100	7	11	Irrigated areas include ball field, playground, green field with tall palm trees.
Weber Park	1001 Corinthian Way	7	95	7	11	Estimated as 95 percent irrigated areas.
C. Joseph Barfield Elementary School	2181 San Antonio Ave.	12	50	6	10	Approximately 50 percent irrigated areas and 50 percent buildings.
Washington Park	935 E. Grand Ave.	5	80	4	6	A recreation park with a baseball field, tennis courts, basketball courts, soccer field, parking, and park hall. About 80 percent irrigation.
Car Wash	1650 W. Holt Ave.	4	80	3	5	Car wash located on Erie St. and Holt Ave.
Arroyo Elementary School	1607 Arroyo Ave.	7	20	1	2	Very little irrigation (approximately 20%). The City could pick up some of the irrigation here if pipeline goes to this location.
Tri-City Car Wash	1344 W. Mission Blvd.	4	80	3	5	Located on Mission Blvd. and Buena Vista Ave. (across from Mobile Home Park).
Hamilton Park	395 N. Hamilton Blvd.	2	40	1	1	About 40 percent irrigation.
Ralph Welch Park	1098 Buena Vista Ave.	0	100	0	0	Assumed 100 percent irrigation, which includes a baseball field. Current potable demand is very small.
Total		**671**	**1,625**	**524**	**846**	

Figure 10-4
Potential Recycled Water Customers



RECYCLED WATER SUPPLY

Existing Recycled Water Supply

The City currently has two recycled water supply sources, the LACSD's PWRP and three non-potable water wells (Wells 19, 31, and 33). Both Wells 19 (400 gpm) and Well 31 (240 gpm) pump water from the Spadra Basin, while Well 33 (178 gpm) pumps water from the Pomona Basin. Thus, the combined capacity of these three existing non-potable water wells is 818 gpm or 1.2 mgd.

In 1966, the City contracted with the LACSD for the right to purchase and resell all of the effluent from the PWRP for non-potable uses. This agreement expired in February 2001. According to Earl Hartling of LACSD, the current contract stipulates that the City has rights to approximately two-thirds of the plant's production. The remaining one-third is supplied to the Spadra Landfill and the WVWD along the Northside Line, which no longer belongs to the City.

The WRP has a design capacity of 15 mgd, with typical flows from 11.5 mgd to 12 mgd. The plant produces high quality tertiary effluent that can be used for a variety of industrial and irrigation purposes. The effluent is delivered to three chlorine contact chambers that store the water until it enters the recycled water distribution system. The recycled water is provided on an interruptible basis and the available water is rationed during peak summer months. When recycled water is unavailable, demands are met with domestic make-up water from Reservoir 8 and/or water from non-potable wells in the Spadra and Pomona Basins. Based on historical consumption data from 1998 to 2003, approximately 93 percent of the recycled water demands are supplied by recycled water from the WRP, three percent of the demands are supplied by non-potable wells, and about four percent is supplemented by domestic (potable) make-up water.

The combined recycled water supply capacity of the PWRP (8 mgd allocated for the City) and the three existing recycled water wells (1.2 mgd) is 9.2 mgd.

Future Recycled Water Supply Needs

The recycled water demand of the existing customers without Pomona (Simpson) Paper Company and the gravity system customers under ADD and MDD conditions is 5.4 mgd and 8.6 mgd, respectively. Based on a cost-effectiveness analysis of potential expansion of the recycled water system (discussed below), it is determined that it is cost-effective to add seven of the users identified in **Table 10-3**, which have a combined demand of 594 acre-ft/yr (0.5 mgd under ADD conditions and 1.0 mgd under MDD conditions). Hence, addition of these users would increase the ADD and MDD to 5.9 and 9.6 mgd, respectively.

To meet these demands, the City can use three recycled water supply sources, which are shown on **Figure 10-4**. These sources are:

- PWRP
- Non-potable wells drilled by the City (Wells 19, 31, and 33)

- Non-potable wells acquired from Pomona (Simpson) Paper Company (S-1, S-2A, S-2B, and S5)

Since the City has water rights for two thirds of the PWRP effluent, the City's recycled water supply capacity is limited to about 8 mgd. It should be noted that there are no plans to increase the flows or the capacity of the PWRP (LACSD, 2004). Due to the configuration of the sewer system near the PWRP, the plant can only receive flows from upstream wastewater dischargers. It is not economically feasible to produce additional recycled water effluent from the plant because sewage would need to be pumped, which requires more energy and capital. LACSD's San Jose Creek WRP (100 mgd) and the Joint Water Pollution Control Plant (320 mgd) have adequate capacities to treat these downstream flows. Hence, the capacity from this source is assumed to remain at 8 mgd.

As mentioned under the existing supply, the combined capacity of the three existing non-potable water wells (Wells 19, 31, and 33) is 818 gpm or 1.2 mgd. The City purchased the water rights, four non-potable water wells and the associated distribution system from Simpson Paper Company in 1999. It is assumed that these four non-potable wells have an average production capacity of 400 gpm per well, resulting in a combined capacity of 1,600 gpm or 2.3 mgd. However, based on verbal information from USD staff, the water quality and construction of the wells do not meet current health standards and are not in useable condition.

The combined recycled water supply capacity of the PWRP (8 mgd allocated for the City), the three existing recycled water wells (1.2 mgd) and the four Simpson Paper Wells (2.3 mgd) is 11.5 mgd. Excluding the Simpson Paper wells, the current recycled water supply capacity is 9.0 mgd. With a historical MDD of 14.6 mgd (with Simpson Paper and the gravity system), the available recycled water was often insufficient to meet the demands during the summer peak months. The supply shortfall is currently met by "make-up" water from potable water supplies.

The seasonal water supply balance to meet the projected future is summarized in **Table 10-4**. To be conservative, it is assumed that the Simpson Wells can not be used to serve any of the future recycled water demands.

As shown in **Table 10-4**, the City has sufficient capacity to meet the projected recycled water demand throughout the year. Hence, potable "make-up" water is not required. It is recommended that the City conduct a study to evaluate the cost-effectiveness of rehabilitating the Simpson Wells and the associated pipelines, as this would increase the supply capacity and flexibility for seasonal demand variations.

RECYCLED WATER SYSTEM EVALUATION

This subsection describes the City's existing recycled water system, followed by the cost-effectiveness analysis for recycled water system expansions. This section is concluded with system recommendations associated with the system expansions that are identified as being cost-effective.

Table 10-4
Seasonal Demand and Supply Comparison

Month	Irrigation Factor[1]	Days per Month	Irrigation Demand[2] (MG/mo)	Industrial Demand[3] (MG/mo)	Total Demand (MG/mo)	Total Supply[4] (MG/mo)	Supply Surplus/ (Deficit)
Jan	0.000	31	0	119	119	285	166
Feb	0.000	28	0	107	107	258	150
Mar	0.043	31	32	119	151	285	134
Apr	0.096	30	72	115	187	276	89
May	0.126	31	94	119	213	285	72
Jun	0.147	30	110	115	225	276	51
Jul	0.167	31	125	119	244	285	41
Aug	0.163	31	122	119	241	285	44
Sep	0.118	30	88	115	203	276	73
Oct	0.075	31	56	119	175	285	110
Nov	0.046	30	34	115	149	276	127
Dec	0.019	31	14	119	133	285	152
Total	**1.000**	**365**	**750**	**1,398**	**2,147**	**3,358**	**1,211**

1 – Source: (DWR, 2005)
2 – Based on an average daily demand of 2.05 mgd (existing users, segment 1, and segment 4)
3 – Based on an average daily demand of 3.83 mgd (Smurfit Paper Company and co-generation plant)
4 – Based on 9 mgd supply from WRP and Wells 19, 31, and 33.

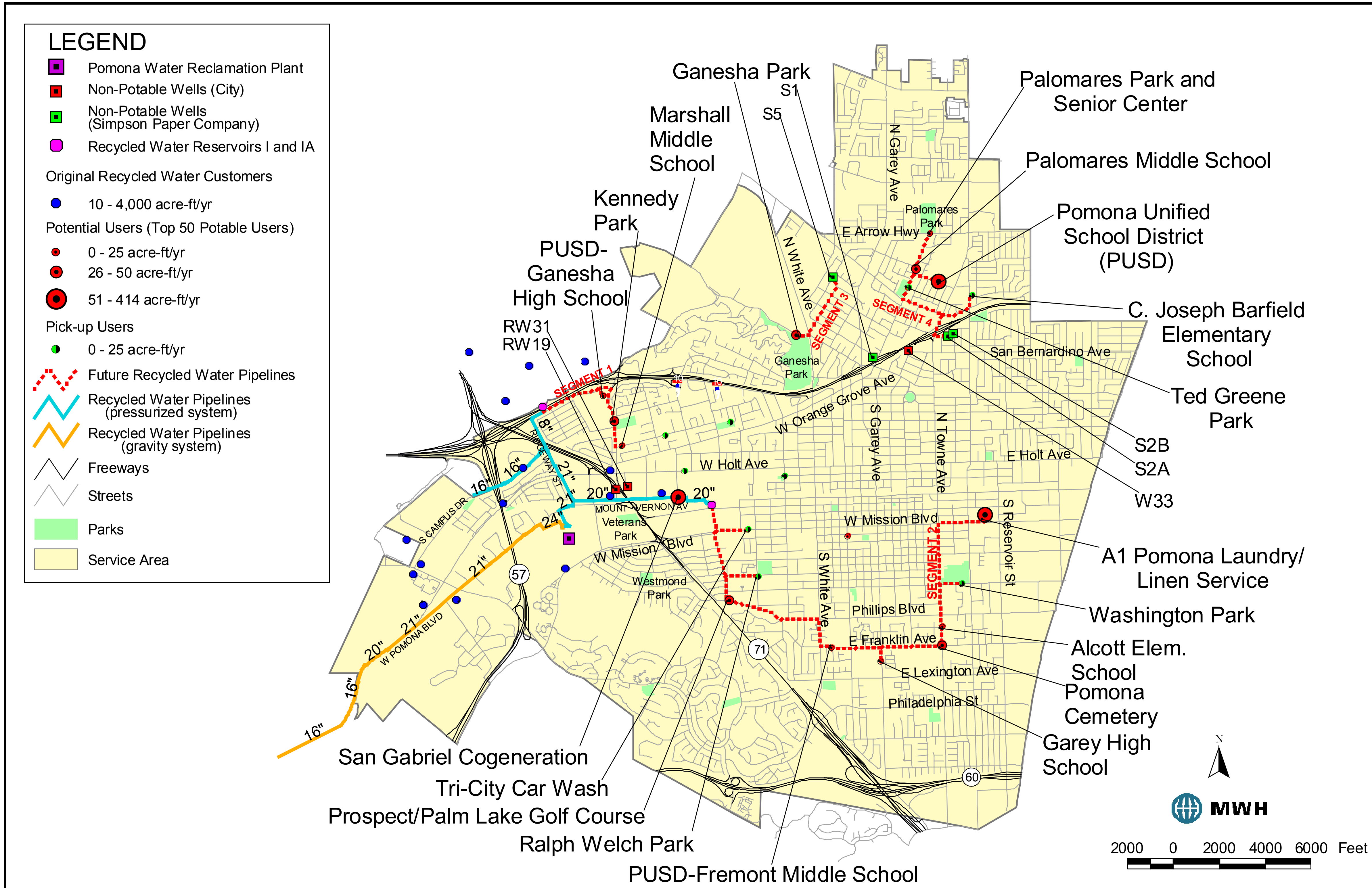
Existing Recycled Water System

The City's existing recycled water system includes two reservoirs, two blending facilities, five booster stations, two receiving tanks that supply recycled water to the paper companies, and three wells. The locations of these facilities are listed in **Table 10-5** while the system layout is presented in **Figure 10-5**.

Table 10-5
Recycled Water System Facilities

Recycled Water Facilities	Location
Reclamation Plant (PWRP)	295 S. Humane Way
Two Reservoirs	1573 W. Second St.
Blending Facility (Tank A)	570 Ridgeway
Blending Facility (Tank B)	Ridgeway at San Jose Wash
Bonelli Booster	Ridgeway at San Jose Wash
Caltrans Booster	2761 S. Campus Dr.
Caltrans Booster	567 Ridgeway
Cal Poly Booster	2801 S. Campus Dr.
Recycled Booster 19	131 N. Bellevue Ave.
Recycled Booster 31	302 Short St.
Smurfit Newsprint Company (Receiving Tank)	120 N. Bellevue Ave.
Simpson Paper Company (Receiving Tank)	100 Erie St.
Recycled Well 19	131 N. Bellevue Ave.
Recycled Well 31	302 Short St.

Figure 10-5
Existing Recycled Water System and Proposed Expansions



The primary source of recycled water supply is the PWRP. The effluent from the plant is delivered to three chlorine contact chambers that store the water until it enters the recycled water distribution system. Two of the chambers feed the pressurized system, which includes two reservoirs with a combined capacity of 3.7 MG and a 490-hp pump station with six booster pumps that feed a 21-inch transmission main. The characteristics of the reservoirs, booster pumps, and non-potable water wells are summarized in **Table 10-6**, **Table 10-7**, and **Table 10-8**, respectively.

Table 10-6
Existing Recycled Water Reservoirs

Reservoir	Construction Year	Maximum Water Elevation (ft)	Pressure Zone Served	Type of Material	Capacity (MG)
Reclaimed Reservoir A	1980	849	Pressure Zone 2	Steel	3.0
Reclaimed Reservoir B	1986	849	Pressure Zone 2	Steel	0.7
Total Capacity					**3.7**

Table 10-7
Existing Recycled Water Booster Pumps

Pump No.	Capacity (hp)	Rated Capacity (gpm)	Head (ft)	Zone Served
LL-A	125	3,200	90	Pressure Zone 2
LL-B	125	3,200	90	Pressure Zone 2
LL-C	60	2,200	90	Pressure Zone 2
LL-D	60	2,200	90	Pressure Zone 2
LL-E	60	2,200	90	Pressure Zone 2
LL-F	60	2,200	90	Pressure Zone 2
Total Capacity	**490**	**15,200**		

Table 10-8
Existing Recycled Water Wells

Well No.	Groundwater Basin	Address	Pressure Zone	Year Drilled	Depth (ft)	Capacity (gpm)
19	Spadra	131 N. Bellevue	Zone 1	1951	287	400
31	Spadra	302 Short St.	Zone 1	1956	250	325
33	Spadra	1829 N. San Bernardino St.	Zone 1	1936	884	178
Total Capacity						**903**

The pressurized system's 21-inch diameter transmission main from the booster station splits into two 20-inch pipelines. One runs east along Pomona Boulevard and Mount Vernon Avenue and serves the Smurfit Newsprint Company and Simpson Paper Company. The other 20-inch pipeline runs north along Ridgeway Street to a tee at South Campus Drive and State Route 71. From this intersection, an 8-inch pipeline continues north along Ridgeway Street and easterly along Murchison Avenue where it stops at a 4.5 MG storage reservoir located in Bonelli Park. This reservoir is owned by the Los Angeles County Parks and Recreation Department. From the tee mentioned above, another 16-inch pipeline runs west along South Campus Drive, which serves the Cal Poly Pomona and State Route 57 irrigation.

During periods when the recycled water supply is insufficient or not available, the pressurized system demands are met with domestic make-up from Reservoir 8 and/or supplemented by water from two non-potable wells (Wells 19 and 31). Water from Reservoir 8 is sent via an air gap into two 3,000-gallon receiving tanks and distributed into the system. Water from Wells 19 and 31 is primarily distributed to the Smurfit Co. The water is also via an air gap into the tanks and boosted into the system that serves the Smurfit Co.

The third contact chamber is directly tied to the irrigation structure that feeds the Northside Pipeline, a 21-inch unreinforced concrete gravity pipeline (the Northside Line) that serves the gravity-fed system. The customers served by this system include the Spadra Landfill, Lanterman Hospital, and the WVWD system. The gravity system is supplemented by a modulating float control valve, which takes water from the pressure system when required. As mentioned earlier, the City sold this part of the recycled water system to the LADSD in April 2004.

Future Recycled Water System

The analysis of the future recycled water system is divided into two portions, 1) expansion of the recycled water distribution system and 2) the need for additional storage.

Distribution System Expansion

To identify the cost-effectiveness of expanding the existing recycled water system, the cost of serving existing potable water with recycled water customers is compared with the cost of potable water supply. Conversion to recycled water is considered cost-effective when the estimated cost of serving recycled water is less than or equal to the cost of Tier 2 MWD water ($481 per acre-ft), as future water supplies are partially met through imported water. As the current Tier 2 imported water rate of $481 per acre-ft is anticipated to increase in the future, recycled water could become more and more attractive as the cost differential between potable water and recycled water increases.

To calculate the cost of serving recycled water to the potential users identified during the field visits and evaluation of potable water billing data, the potential system expansions are clustered in segments. Each segment consist of the shortest pipeline alignment that connect the largest potential recycled water customers with the existing recycled water system or the Simpson Paper wells. Potential pick-up demands are added to the segments when these users are located in close proximity to the potential alignments. The pipeline alignments are sized based on the cumulative demand of the multiple users that would be connected to a particular segment. The unit cost of recycled water per segment is calculated by dividing the amortized pipeline cost with the total recycled water demand served of that segment. The following assumptions are made for this analysis:

- Minimum Pipeline Diameter : 4-inch diameter
- Pipeline Velocity : 5 feet per second under PHD conditions
- PHD/ADD Peaking Factor : 7.8

- Pipeline Construction Cost : $61 per lineal foot (4-inch diameter)
  : $85 per lineal foot (6-inch diameter)
  : $101 per lineal foot (8-inch diameter)
- Construction Cost Contingency : 30 percent of the construction cost
- Admin. and Engineering Design : 12.5 percent of the construction cost
- Construction Management : 10 percent of construction cost
- Discount Rate : 4 percent
- Useful Life of Pipelines : 50 years

For segments that could serve multiple customers, the incremental unit cost are calculated to determine which portion of the segment is the most cost-effective. For example, the amortized capital cost of the 3,000 lineal foot pipeline to serve Ganesha High School is $18,100 per year. With a potential recycled water demand of 15.3 acre-ft/yr, this equates to a unit cost of $1,184 per acre-ft. When this segment is expanded with Kennedy Park (41 acre-ft/yr) and Marshall Middle School (20 acre-ft/yr), the amortized capital cost increases to $39,200 per year, however the unit cost of serving 61.3 acre-ft/yr decreases to $640 per acre-ft.

The cost-effectiveness analysis of recycled water system expansion is presented in **Table 10-9**, while the segment and its alignments are depicted on **Figure 10-5**.

As shown in **Table 10-9**, the cost effectiveness of each segment is presented by comparing the unit cost with the cost of Tier 2 MWD water. As discussed in the supply section and presented in **Table 10-4**, it is assumed that recycled water can be served 12 months per year, without the need for additional make-up water. The potential users of Segment 4 that can be connected to the Simpson wells, can be served 12 months per year as the well capacity is sufficient to meet the peak hour demands of these users, avoiding the need for reservoir storage for these users.

Based on the cost-effectiveness evaluation presented in **Table 10-9**, the cost-effective system expansions are addition of the San Gabriel Co-generation Plant (414 acre-ft/yr), Segment 1 (61 acre-ft/yr), and Segments 4A through 4D (119 acre-ft/yr). This would increase the City's recycled water demand from 5,595 acre-ft/yr by 594 acre-ft/yr to 6,189 acre-ft/yr. This is a 10 percent increase compared to the existing recycled water demand.

The most cost-effective expansion of the recycled water system is the addition of the San Gabriel Co-generation Plant. This plant is located on 102 Erie Street, which is directly along the existing 20-inch diameter recycled water pipeline along Mount Vernon Avenue. Due to the short pipeline required to connecting this customer and the large potential demand, the estimated recycled unit cost is as low as $9 per acre-ft.

The second most cost-effective recycled system expansion is the addition of Segment 4. The potential users of Segment 4A through 4D are Palomares Middle School, Ted Greene Park, Pomona USD, Palomares Senior Center and Park, and Joseph Barfield Elementary School. The unit cost to connect these segments is $348 per acre-ft. The total recycled water demand of the Segment 4 users is 119 acre-ft/yr (or 74 gpm under ADD conditions). With a PHD peaking factor of 7.8, the PHD is about 580 gpm. Assuming that Simpson Paper Well 2A and Well 2B have a well capacity of about 400 gpm each, these wells would provide sufficient supply to meet the PHD of the Segment 4 users. It should be noted that the combination of Segment 4A and 4B, serving Palomares Middle School, Ted Greene Park, and Pomona USD, is the most cost-effective solution ($284 per acre-ft). As the unit cost of the entire segment ($348 per acre-ft) is below $481 per acre-ft, it is recommended to install the entire segment and promote the use of recycled water in the City where feasible.

The third segment that is identified as being cost-effective is Segment 1, which serves Ganesha High School, Kennedy Park, and Marshall Middle School. The unit cost to connect these segments is $457 per acre-ft.

Reservoir Storage

The existing recycled water reservoirs have a combined capacity of 3.7 MG. The required storage is based on the MDD peaking factors and the diurnal patterns. Assuming that irrigation takes place 8 hours per day, the required storage is 67 percent of the MDD for those users that are connected to the existing recycled water system and that have a variable diurnal pattern (not flat). When the peaking factors and diurnal patterns as listed in **Table 10-10** are assumed, the total operational storage capacity required to buffer the hourly fluctuation in of demands under future maximum day conditions is 3.3 MG. Hence, the available storage capacity is sufficient for existing and future demands with the system expansion proposed in this section. Additional seasonal storage to avoid the possible need for potable make-up water in summer months is not recommended, as this is not cost-effective.

Other Improvements

In addition to the proposed pipelines and the study to access the condition of the Simpson Wells, the following recommendations are made for the recycled water system.

- Abandonment and replacement of Well 33, which was installed in 1936 and thus exceeds the life expectancy of 75 years in year 2008.
- Replacement of the pump of Well 19, which was installed in 1951, in the period 2020-2025.
- Addition of ten new fire hydrants. These hydrants will facilitate the use of recycled water for street sweeping, sewer pipeline flushing, and possibly graffiti removal operations. These hydrants, of course, would be painted purple and would be restricted to non-potable use only. Any onsite improvements, such as new piping and fixtures, necessary to accommodate the use of recycled water at the new sites would have to be determined at a later date.

Summary of Recommendations

Based on the evaluation results presented above, the following recommendations are made:

- Addition of San Gabriel Co-generation Plant (500 lineal feet of 8-inch diameter pipeline)
- Addition of Segment 1 (6,500 lineal feet of 4-inch diameter pipeline)
- Addition of Segment 4 (3,400 lineal feet of 4-inch diameter pipeline)

Table 10-9
Cost-Effectiveness Analysis for Recycled Water System Expansion

Segment	Potential Recycled Water Customers	Recycled Water Demands (acre-ft/yr)	Pipeline Length (feet)	Calculated Pipeline Diameter (inches)	Recommended Pipeline Diameter (inches)	Unit Cost ($/lineal foot)	Total Construction Cost ($)	Total Capital Cost ($)	Amortized Cost ($)	Unit Cost ($/acre-ft)	Cost Effective?[1]
1A	Ganesha High School	15	3,000	1.2	4	$61	$182,000	$278,000	$12,900	$844	no
1B	Ganesha High School and Kennedy Park	41	5,100	2.0	4	$61	$310,000	$473,000	$22,000	$533	no
1C	Ganesha High School, Kennedy Park & Marshall Middle School (school and ball field) [1]	61	6,500	2.5	4	$61	$395,000	$602,000	$28,000	$457	yes
2A	Prospect/Palmlake Golf Course, Tri-City Car Wash & Ralph Welch Park	53	7,100	2.3	4	$61	$431,000	$657,000	$30,600	$575	no
2B	Prospect/Palmlake Golf Course, Tri-City Car Wash, Ralph Welch Park & Fremont Middle School	74	12,900	2.7	4	$61	$783,000	$1,194,000	$55,600	$753	no
2C	Prospect/Palmlake Golf Course, Tri-City Car Wash, Ralph Welch Park & Fremont Middle School & Garey High School	88	15,800	3.0	4	$61	$959,000	$1,462,000	$68,100	$773	no
2D	Prospect/Palmlake Golf Course, Tri-City Car Wash, Ralph Welch Park, Fremont Middle School, Garey High School, Pomona Cemetery & Alcott Elem. School	127	19,300	3.5	4	$61	$1,172,000	$1,787,000	$83,200	$653	no
2E	Prospect/Palmlake Golf Course, Tri-City Car Wash, Ralph Welch Park, Fremont Middle School, Garey High School, Pomona Cemetery, Alcott Elem. School & Washington Park	133	22,100	3.6	4	$61	$1,342,000	$2,047,000	$95,300	$716	no
2F	Prospect/Palmlake Golf Course, Tri-City Car Wash, Ralph Welch Park, Fremont Middle School, Garey High School, Pomona Cemetery, Alcott Elem. School, Washington Park & A1Pomona Laundry/A1 Linen Service	201	27,100	4.5	6	$85	$2,304,000	$3,514,000	$163,600	$816	no
3	Ganesha Park	29	3,400	1.7	4	$61	$206,000	$314,000	$14,600	$498	no
4A	Palomares Middle School and Ted Greene Park	41	5,000	2.0	4	$61	$304,000	$464,000	$21,600	$530	no
4B	Palomares Middle School, Ted Greene Park, and Pomona USD	93	6,100	3.0	4	$61	$370,000	$564,000	$26,300	$284	yes
4C	Palomares Middle School, Ted Greene Park, Pomona USD, and Palomares Senior Center and Park	109	7,800	3.3	4	$61	$474,000	$723,000	$33,700	$308	yes
4D	Palomares Middle School, Ted Greene Park, Pomona USD, Palomares Senior Center and Park, and Joseph Barfield Elementary School	119	9,600	3.4	4	$61	$583,000	$889,000	$41,400	$348	yes
Other	San Gabriel Co-generation Plant	414	500	6.4	8	$101	$51,000	$78,000	$3,600	$9	yes

1 – Assumed to be cost effective when the recycled water unit cost are equal or less than $481 per acre-ft

Table 10-10
Storage Requirements

Customers Category	ADD (mgd)	MDD (mgd)	MDD/ADD Factor	Storage Required (MG)	Diurnal Curve[1]
Cal Poly Pomona	1.02	2.54	2.50	1.70	Irrigation
Bonelli Park	0.80	2.08	2.60	1.38	Irrigation
Cal Trans – State Route 71	0.02	0.06	2.60	0.04	Irrigation
Cal Trans – State Route 57	0.03	0.08	2.60	0.05	Irrigation
City of Pomona Parks Department	0.02	0.06	2.60	0.04	Irrigation
Segment 1 (Ganesha High School, Kennedy Park, and Marshall Middle School)	0.05	0.14	2.60	0.09	Irrigation
Subtotal Irrigation Pattern Users	***1.95***	***4.96***	***n/a***	***3.31***	
Smurfit Newsprint Company	3.46	3.81	1.10	0.00	Flat
Simpson Paper Company	0.00	0.00	1.10	0.00	Flat
San Gabriel Co-generation Plant	0.37	0.55	1.50	0.00	Flat
Subtotal Flat Pattern Users	***3.83***	***4.36***	***N/A***	***0.00***	
Segment 4 (Palomares Middle School, Ted Greene Park, Pomona USD, Palomares Senior Center and Park, and Joseph Barfield Elementary School)	0.11	0.28	2.60	0.00	Irrigation
Subtotal Users served by Wells	***0.13***	***0.34***	***N/A***	***0.00***	
Grand Total	**5.85**	**9.52**		**3.31**	

1 – Irrigation Pattern has a peaking factor of 3.0 from 10 PM to 6 AM (8 hours) and a peaking factor of 0.0 for the remaining hours
2 – Flat pattern has a peaking factor of 1.0 for 24 hours.

However, as the capacity and condition of the old Simpson Paper wells are unknown, an assessment of these wells and the associated pipelines is required. It is assumed that new 4-inch diameter pipelines would need to be installed to serve the Segment 4 users. If the existing pipelines acquired from Simpson Paper Company could be used to serve (some of) the users of Segments 4, the unit cost of these segments would decrease. On the contrary, if the Simpson wells need to be replaced, the unit cost would increase.

The pipelines associated with Segments 3 and 2 are not included in the Capital Improvement Program (CIP) of this master plan. However, State grant funding or the increase in recycled water availability from the PWRP could make additional segments cost-effective. When the weighted unit cost of all segments is considered, segments 2 and 3 are feasible as their higher unit cost is offset by the lower unit cost of segments 1 and 4. The weighted unit cost of all segments is $305 per acre-ft.

If additional recycled water pipeline segments are desired, the recommended priority for installing these segments is as follows:

1. Segments 3: 29 acre-ft/yr (Ganesha Park)

2. Segments 2A: 53 acre-ft/yr (Prospect/Palmlake Golf Course, Tri-City Car Wash & Ralph Welch Park)
3. Segments 2B through 2E (Fremont Middle School, Garey High School, Pomona Cemetery, Alcott Elem. School, and Washington Park)
4. Segment 2F(Pomona Laundry/A1 Linen Service)

The system expansions and recycled water expansion recommendations described in this section along with rehabilitation recommendations are included in the CIP presented in **Section 11** of this report. This section also addresses the phasing of these recommendations. The financial plan to implement the potable and recycled water CIP is described in **Section 12**.

Section 11
Capital Improvement Program

This section describes the recommended Capital Improvement Program (CIP) for the City's potable and recycled water system. This CIP identifies the improvements necessary to address current deficiencies as well as to provide continued reliable water service through the year 2025. This section is separated into four parts, 1) a discussion of the cost estimating basis, 2) the potable water CIP, 3) the recycled water CIP, and 4) the combined CIP.

The discussion of both the potable water and the recycled water CIP is divided into a summary of the recommended existing system improvements, followed by the future system improvements, a phasing plan, and is concluded with cost estimates by improvement and phase. The financial plan for the combined CIP that describes various financing sources is discussed in **Section 12**.

COST ESTIMATING BASIS

Construction cost estimates are developed based on costs obtained from industry manufacturers, MWH's experience on similar water system master planning projects and data provided by the City. All estimates have been adjusted to an Engineering News Record (ENR) Construction Cost Index of 8,266 (Los Angeles, April 2005). This ENR index is used to adjust construction costs for inflation and current business conditions. For example, if a reservoir in this CIP will be constructed in five years, its cost should be adjusted for inflation by the ratio of the anticipated ENR index in 2007 to the current ENR index. Assuming a year 2007 ENR index of 8,700 and a current cost of $1 million, the future cost of the reservoir will be $1,052,500 ($1,000,000 × 8,700/8,266). The ENR Cost Index is calculated periodically based on various industry factors that adjusts cost and include factors such as inflation for material costs and labor costs. The cost estimates presented in this master plan are consistent with the American Association of Cost Engineers guidelines for developing reconnaissance-level estimates, which range between 50 percent above and 30 percent below actual capital expenditures.

Pipeline construction costs estimates are based on recent cost data for work completed by MWH in other communities and the unit cost per inch-diameter is estimated to decrease with increasing diameter. Costs for pump station improvements are derived from cost data of past projects and are based on the existing or anticipated pump horsepower. Because it is not known where new wells will be drilled, a fixed construction cost for well abandonment and replacement is used in this CIP. Costs for roof replacement of existing reservoirs are based on the use of wooden trusses with corrugated steel roofing. The cost for water treatment is based on vendor data.

Based on the level of detail that a water system master plan provides, cost estimates require that a 30 percent contingency be applied to the construction cost estimates to account for potential construction complexity, site conditions and construction bid variability. This contingency factor is used for both existing system and future system recommendations. As more details regarding construction issues become apparent and the recommended projects proceed through the preliminary and detailed design process, many of the unknown issues will be resolved and the contingency amount can be lowered. The environmental, engineering, administration, and legal costs are estimated to be 12.5 percent of construction costs plus contingency. The construction management cost is estimated to be 10 percent of the construction cost plus contingency. Hence, the capital cost is estimated to be 159 percent of the base construction cost. The contractor's overhead and profit are included in the cost estimates. Costs for acquisition of land, rights-of-way and easements are not included because all facilities replacements will take place on existing City-owned sites.

POTABLE WATER SYSTEM CIP

The potable water distribution system and water supply facilities are evaluated using the criteria discussed in **Section 7**. This evaluation has been conducted for both existing water demand conditions and the projected future demands for year 2025. Based on these evaluations, the recommendations are divided into two categories; 1) existing system improvements addressing existing water system deficiencies, and 2) future system improvements necessary to meet the projected water demands for year 2025.

Existing System Improvements

As discussed in **Section 8**, the existing system improvements are divided into the following 12 categories:

- Pipeline Pressure Improvements (P)
- Pipeline Pressure Improvements in major arterial streets (MP)
- Pipeline Pressure Improvements with an age of more than 75 years (PA)
- Pipeline Pressure Improvements in major arterial streets and an age of more than 75 year (MA)
- Pipeline Pressure Improvements for fire flow deficiencies (FF)
- Pipeline Pressure Improvements for fire flow deficiencies in major arterial streets (MFF)
- Pipelines with an age of more than 75 years not included in any of the other categories (A)
- Reservoirs Improvements (Res)
- Pump Stations Improvements (PS)
- Water Supply Improvements (S)
- Supply Reliability Improvements (SR)
- Other Capital Improvements.

These recommendations are summarized in **Table 11-1**. A more detailed description of these recommendations can be found in **Table 8-8** and are shown on **Figure 8-8**.

Table 11-1
Summary of Existing System Improvements

Category ID	Improvements Description	Quantity	Unit
P	Pipeline Improvements	1	miles
MP	Pipeline Improvements in major streets	4	miles
PA	Pipeline Improvements with an age of more than 75 years	28	miles
MA	Pipeline Improvements in major streets with an age of more than 75 years	15	miles
FF	Pipeline Improvements for fire flow deficiencies	32	miles
MFF	Pipeline Improvements for fire flow deficiencies in major streets	4	miles
A	Pipelines with an age of more than 75 years (not included in PA or MA)	21	miles
Res	Reservoirs Improvements – roof rehabilitation	2	reservoirs
	Reservoirs Improvements – seismic upgrades	3	reservoir
PS	Pump Stations Improvements – pump replacements	14	stations
	Pump Stations Improvements – rehabilitation	1	station
S	Water Supply Improvements – abandonment and replacement	7	wells
	Water Supply Improvements – well head treatment	2	wells
	Water Supply Improvements – piping, equipping, and treatment	2	wells
	Water Supply Improvements – disinfection	2	wells
	Water Supply Improvements – destruction of abandoned wells	3	wells
SR	Supply Reliability Improvements – new inter-agency connection	1	connections
Other	Other Improvements – SCADA	1	n/a
	Other Improvements – GIS	1	n/a
	Other Improvements – PEIR	1	n/a
	Meter Replacements	40,400	meters
	Pipeline Flow and Coupon Testing	tbd[1]	n/a
	Water System Security Upgrade	1	system
	Corporate Yard Facility (Water System Share)	1	Yard
	Feasibility Study for Pedley WTP	1	Study

1 – tbd = to be determined

Future System Improvements

As discussed in **Section 9**, the future system improvements are divided into the following four categories:

- Pipeline Pressure Improvements for future fire flow deficiencies (F-FF)

- Reservoir Improvements (F-Res)
- Booster Station Improvements (F-PS)
- Future Water Supply Improvements (F-S)

These recommendations are summarized in **Table 11-2**. A more detailed description of these recommendations can be found in **Table 9-14** and are shown on **Figure 9-1**.

Table 11-2
Summary of Future System Improvements

Category ID	Improvements Description	Quantity	Unit
F-FF	Pipeline Improvements for fire flow deficiencies	1	mile
F-S	Water Supply Improvements – abandonment and replacement	1	wells
	Water Supply Improvements – well head treatment	2	well

Phasing

The recommended improvements are phased based on system needs. Projects addressing both existing and future deficiencies are phased over the next 20 years using the following four periods:

- Year 2006 through year 2010
- Year 2011 through year 2015
- Year 2016 through year 2020
- Year 2021 through year 2025

Improvements impacting the most significant deficiencies, the largest number of customers, and important water facilities are scheduled first. The majority of the existing system recommendations are scheduled prior to future system recommendations, with the exception of improvements with lower priority or projects where existing and future recommendations could be combined. Lower priority recommendations include pipeline, well, or pumping station rehabilitation. The phasing period is specified for each project individually. The most important projects are phased first, while on-going projects such as pipeline rehabilitation are used to make the capital expenditures more even from year to year.

It should be noted that additional capital improvements are required beyond year 2025 to maintain the City's water system. By 2025, pipelines constructed in 1950 will be 75 years old. Since these pipelines would be nearing the end of their useful lives, a regular replacement program is required. When pipelines installed between 1950 and 1970 are replaced (or relined if appropriate) in the period 2025 to 2045, the pipeline rehabilitation rate will be approximately 9 miles per year, almost double the current rate. The total length of recommended pipe improvements included in this CIP is approximately 108 miles, which equates to an average replacement rate of 5.4 miles per year. Similarly, routine rehabilitation or replacement of reservoirs, pumping stations, wells and other facilities will also be required. Postponing improvements recommended in this CIP is not desirable, as this will result in deferring improvements that are required around year 2025 and beyond.

The basis for phasing the individual projects varies per category. The methodology used for each category is discussed in more detail below.

Phasing of Pipeline Improvements

Pipeline improvements are phased based on a combination of system needs, vicinity to other pipeline improvements, the type of street, and replacement rate. To identify the system need for each pipeline improvement, a ranking matrix is developed with City staff. The rank of an improvement is determined by multiplying the street type factor by the improvement type factor. Improvements with the highest ranking factor are phased first, while improvements with the lowest ranking factor as phased last. The ranking matrix is presented in **Table 11-3**.

Table 11-3
Priority Ranking Matrix for Phasing of Pipeline Improvements

Category	Street Type Ranking[1] M=2, other=1	Improvement Type Ranking[2] P=4, FF=3, A=2, FFF=1,	Combined Ranking Factor	Total Length (mi)
P	1	4	4	1
PA	1	6	6	28
MP	2	4	8	4
FF	1	3	3	32
MFF	2	3	6	4
A	1	2	2	21
MA	2	2	4	15
FFF	1	1	1	1
Total Length				**106**

1 – M = Major Streets
2 – P = Pressure Improvements, FF = Fire Flow Improvements, A = Age Improvements, FFF = Future Fire Flow Improvements

The following basis is used for these ranking factors:

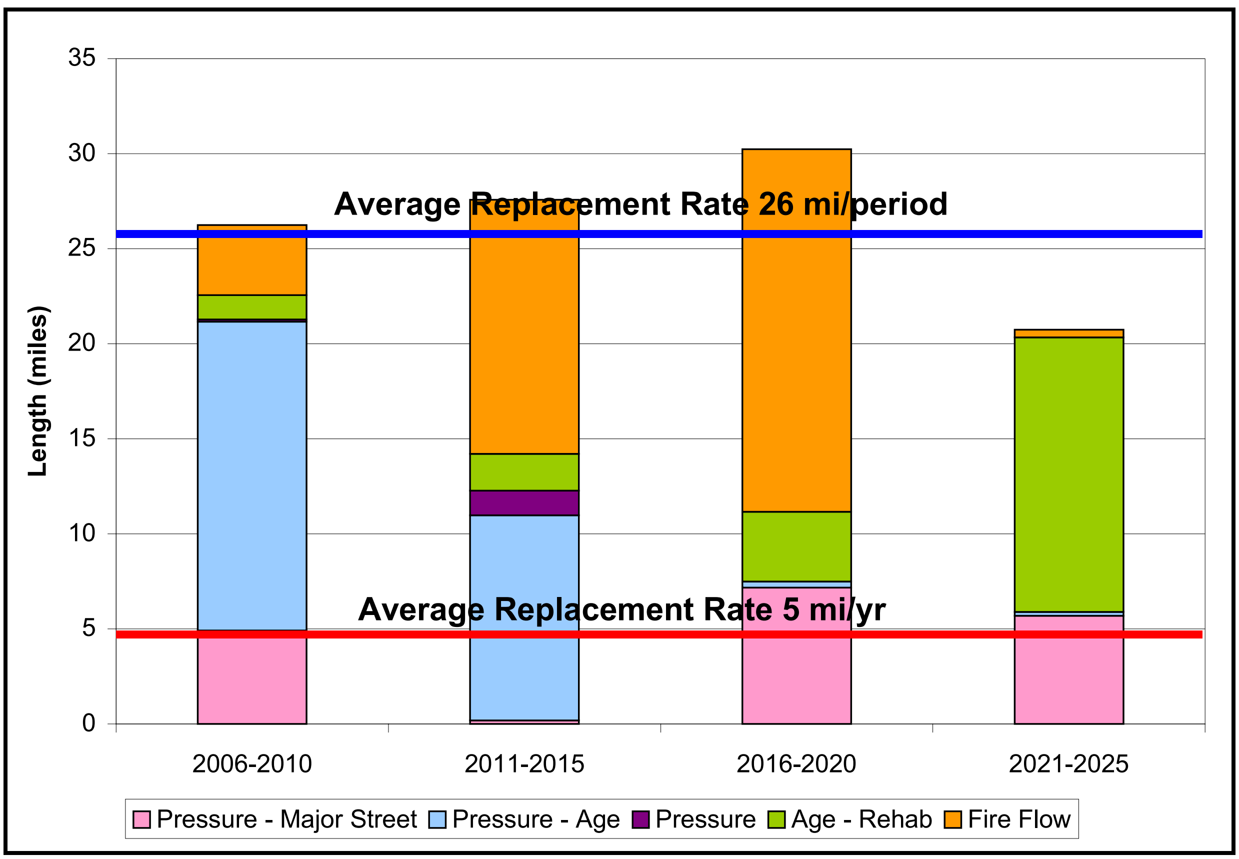
- All improvements located in major streets (M) are ranked higher than other streets based on City Council strategic goals
- Pressure improvement (deficiencies under summer demand conditions) are ranked higher than fire flow improvements (only deficient in summer + fire)
- Age improvements are ranked lower than fire flow improvements
- Future improvements are ranked lower than existing system improvements

Based on these factors, pressure improvements in major streets (MP) have the highest priority and are phased first. Although pressure improvements for aged pipelines (PA) and fire flow deficiencies in major streets (MFF) have the same ranking, the PA improvements are phased first as pressure deficiencies occur under summer (normal) conditions, while fire flow deficiencies only occur under fire flow (emergency) conditions. Pressure improvements in major streets of aged pipes (MA) are scheduled next, followed by the remaining pressure improvement (P). Fire flow improvements (FF) and the remaining aged pipelines (A) are phased next, while the future fire flow improvements (FFF) are scheduled last.

This order is the general sequence of pipeline improvements phasing, however the location of improvements in relation to other improvements is also considered by grouping pipelines that are recommended in the same street or area. For example, pipeline improvements that are located in the same street but have a different ranking based on the ranking matrix, are all assigned the same (highest) ranking factor to reduce construction cost for excavation, repavement, traffic control, and construction management.

With pipeline improvements ranked and grouped, the total length of improvements in each category is calculated. Then, the total number of miles for each category per 5-year period is calculated to accomplish a uniform replacement rate of approximately 26 to 27 miles per period or 5.3 miles per year. The phasing of the recommended pipelines is graphically presented on **Figure 11-1**, while the phasing and cost estimates of the existing system and future system improvements are summarized in **Table 11-1** and **Table 11-2**.

Figure 11-1
Pipeline Replacement Rate



Phasing of Rehabilitation Improvements

The phasing of reservoir, well, or pumping station rehabilitation improvements is based on the year of installation, the estimated useful life, and the calculated year of replacement. The useful life of groundwater wells is typically about 75 years, hence all wells installed before 1935 are scheduled for replacement in the period 2006-2010. Active wells are identified as existing system improvements, while the abandonment and replacement of wells, such as Well 20, that are currently inactive are identified as future system improvements. These future improvements are phased later.

Active wells are identified as existing system improvements, while the abandonment and replacement of Well 20 that is currently inactive, is identified as a future system improvement. This future improvement is phased later.

The useful life of reservoirs is also estimated at 75 years, however the condition assessment conducted in 2000 (HAE, 2002) is used to identify the actual rehabilitation needs and priorities. The three existing system reservoir improvements are phased based on age, with one reservoir in each of the first three 5-year periods.

Booster station pumps are estimated to have a useful life of 30 years, hence, most booster pump units are included in this 20-year CIP for replacement. Based on discussions with City staff, it was determined that the condition of the pumping station structures is such that replacement is not required during the next 20-years.

The phasing of the recommended facility improvements is graphically presented on **Figure 11-2**, while the phasing and cost estimates of the existing system and future system improvements are summarized in **Table 11-4** and **Table 11-5**, respectively.

Phasing of Other Improvements

In addition to the pipeline and facility improvements, the CIP includes other improvements that are related to efficient and proper water system operations. These improvements include:

- Preparation of a Program Environmental Impact Report (PEIR) for this master plan
- Update of the water system GIS
- Upgrade of the City's SCADA system
- Replacement of water meters
- Replacement of water service laterals
- Study to identify additional water service lateral that need replacement
- Coupon and flow testing
- Assessment of the Simpson wells and pipelines
- Feasibility Study for Pedley WTP
- Water System Security Upgrade
- Corporate Yard Facility (Water System Share)
- Replacement of fire hydrants with breakoff heads

Figure 11-2
Phasing of Potable Water System Improvements

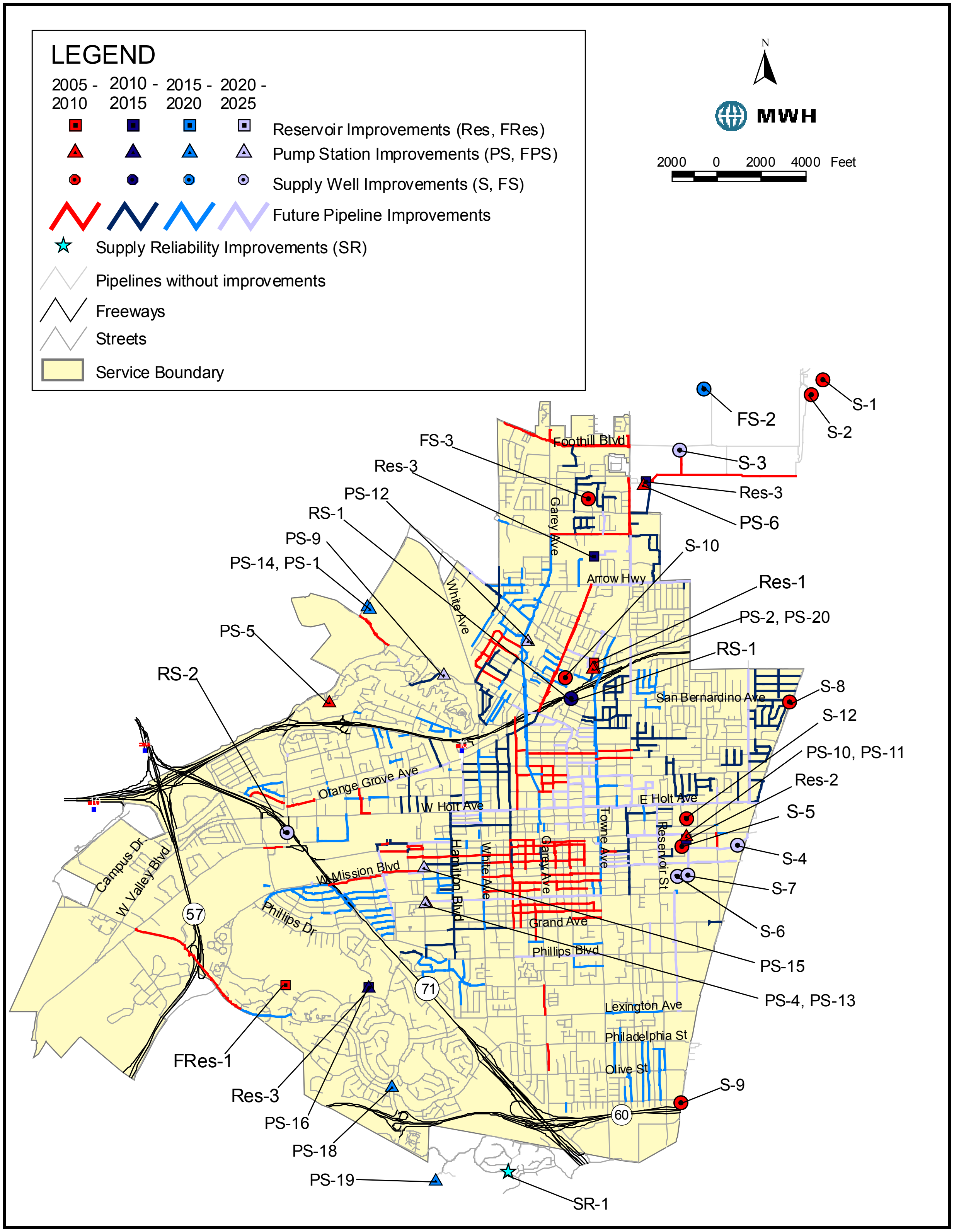


Table 11-4
Cost Estimates and Phasing of Existing System Improvements

CIP ID	Included in 04/05 CIP?	Phase	Water System	Improvement Type	Description	Diameter (in)	Size	Unit	Unit Cost	Unit	Constr. Cost	Conting. (30%)	Eng & Adm (12.5%)	Constr. Mgmt. (10%)	Total Cost (rounded)
Various "A" IDs	no	2006-2010	Potable	Age - Rehab	6-inch diameter pipelines throughout the distribution system	6	1,000	lineal feet	$85	$/ft	$86,000	$26,000	$14,000	$12,000	$138,000
Various "A" IDs	no	2011-2015	Potable	Age - Rehab	6-inch diameter pipelines throughout the distribution system	6	800	lineal feet	$85	$/ft	$69,000	$21,000	$12,000	$9,000	$111,000
Various "A" IDs	no	2016-2020	Potable	Age - Rehab	6-inch diameter pipelines throughout the distribution system	6	900	lineal feet	$85	$/ft	$77,000	$24,000	$13,000	$11,000	$125,000
Various "A" IDs	no	2021-2025	Potable	Age - Rehab	6-inch diameter pipelines throughout the distribution system	6	10,100	lineal feet	$85	$/ft	$859,000	$258,000	$140,000	$112,000	$1,369,000
Various "A" IDs	no	2006-2010	Potable	Age - Rehab	8-inch diameter pipelines throughout the distribution system	8	800	lineal feet	$101	$/ft	$81,000	$25,000	$14,000	$10,000	$130,000
Various "A" IDs	no	2011-2015	Potable	Age - Rehab	8-inch diameter pipelines throughout the distribution system	8	2,200	lineal feet	$101	$/ft	$223,000	$67,000	$37,000	$29,000	$356,000
Various "A" IDs	no	2016-2020	Potable	Age - Rehab	8-inch diameter pipelines throughout the distribution system	8	2,800	lineal feet	$101	$/ft	$284,000	$86,000	$47,000	$37,000	$454,000
Various "A" IDs	no	2021-2025	Potable	Age - Rehab	8-inch diameter pipelines throughout the distribution system	8	26,500	lineal feet	$101	$/ft	$2,682,000	$805,000	$436,000	$349,000	$4,272,000
Various "A" IDs	no	2011-2015	Potable	Age - Rehab	10-inch diameter pipelines throughout the distribution system	10	100	lineal feet	$111	$/ft	$12,000	$4,000	$2,000	$2,000	$20,000
Various "A" IDs	no	2016-2020	Potable	Age - Rehab	10-inch diameter pipelines throughout the distribution system	10	10,500	lineal feet	$111	$/ft	$1,169,000	$351,000	$190,000	$152,000	$1,862,000
Various "A" IDs	no	2021-2025	Potable	Age - Rehab	10-inch diameter pipelines throughout the distribution system	10	6,300	lineal feet	$111	$/ft	$702,000	$211,000	$115,000	$92,000	$1,120,000
Various "A" IDs	no	2021-2025	Potable	Age - Rehab	12-inch diameter pipelines throughout the distribution system	12	7,500	lineal feet	$121	$/ft	$911,000	$274,000	$149,000	$119,000	$1,453,000
Various "A" IDs	no	2021-2025	Potable	Age - Rehab	14-inch diameter pipelines throughout the distribution system	14	9,400	lineal feet	$135	$/ft	$1,266,000	$380,000	$206,000	$165,000	$2,017,000
Various "A" IDs	no	2011-2015	Potable	Age - Rehab	16-inch diameter pipelines throughout the distribution system	16	5,100	lineal feet	$150	$/ft	$764,000	$230,000	$125,000	$100,000	$1,219,000
Various "A" IDs	no	2016-2020	Potable	Age - Rehab	16-inch diameter pipelines throughout the distribution system	16	5,200	lineal feet	$150	$/ft	$779,000	$234,000	$127,000	$102,000	$1,242,000
Various "A" IDs	no	2021-2025	Potable	Age - Rehab	16-inch diameter pipelines throughout the distribution system	16	16,300	lineal feet	$150	$/ft	$2,442,000	$733,000	$397,000	$318,000	$3,890,000
Various "A" IDs	no	2006-2010	Potable	Age - Rehab	18-inch diameter pipelines throughout the distribution system	18	5,000	lineal feet	$164	$/ft	$820,000	$246,000	$134,000	$107,000	$1,307,000
Various "A" IDs	no	2021-2025	Potable	Age - Rehab	18-inch diameter pipelines throughout the distribution system	18	200	lineal feet	$164	$/ft	$33,000	$10,000	$6,000	$5,000	$54,000
Various "A" IDs	no	2011-2015	Potable	Age - Rehab	20-inch diameter pipelines throughout the distribution system	20	2,000	lineal feet	$177	$/ft	$355,000	$107,000	$58,000	$47,000	$567,000
Various "FF & MFF" IDs	no	2006-2010	Potable	Fire Flow	6-inch diameter pipelines throughout the distribution system	6	1,300	lineal feet	$85	$/ft	$111,000	$34,000	$19,000	$15,000	$179,000
Various "FF & MFF" IDs	no	2011-2015	Potable	Fire Flow	6-inch diameter pipelines throughout the distribution system	6	53,900	lineal feet	$85	$/ft	$4,582,000	$1,375,000	$745,000	$596,000	$7,298,000
Various "FF & MFF" IDs	no	2016-2020	Potable	Fire Flow	6-inch diameter pipelines throughout the distribution system	6	63,100	lineal feet	$85	$/ft	$5,364,000	$1,610,000	$872,000	$698,000	$8,544,000
Various "FF & MFF" IDs	no	2021-2025	Potable	Fire Flow	6-inch diameter pipelines throughout the distribution system	6	2,100	lineal feet	$85	$/ft	$179,000	$54,000	$30,000	$24,000	$287,000

Table 11-4 (Cont'd)
Cost Estimates and Phasing of Existing System Improvements

CIP ID	Included in 04/05 CIP?	Phase	Water System	Improvement Type	Description	Diameter (in)	Size	Unit	Unit Cost	Unit	Constr. Cost	Conting. (30%)	Eng & Adm (12.5%)	Constr. Mgmt. (10%)	Total Cost (rounded)
Various "FF & MFF" IDs	no	2006-2010	Potable	Fire Flow	8-inch diameter pipelines throughout the distribution system	8	7,800	lineal feet	$101	$/ft	$790,000	$237,000	$129,000	$103,000	$1,259,000
Various "FF & MFF" IDs	no	2011-2015	Potable	Fire Flow	8-inch diameter pipelines throughout the distribution system	8	11,600	lineal feet	$101	$/ft	$1,174,000	$353,000	$191,000	$153,000	$1,871,000
Various "FF & MFF" IDs	no	2016-2020	Potable	Fire Flow	8-inch diameter pipelines throughout the distribution system	8	22,100	lineal feet	$101	$/ft	$2,237,000	$672,000	$364,000	$291,000	$3,564,000
Various "FF & MFF" IDs	no	2006-2010	Potable	Fire Flow	10-inch diameter pipelines throughout the distribution system	10	800	lineal feet	$111	$/ft	$90,000	$27,000	$15,000	$12,000	$144,000
Various "FF & MFF" IDs	no	2011-2015	Potable	Fire Flow	10-inch diameter pipelines throughout the distribution system	10	800	lineal feet	$111	$/ft	$90,000	$27,000	$15,000	$12,000	$144,000
Various "FF & MFF" IDs	no	2016-2020	Potable	Fire Flow	10-inch diameter pipelines throughout the distribution system	10	8,700	lineal feet	$111	$/ft	$969,000	$291,000	$158,000	$126,000	$1,544,000
Various "FF & MFF" IDs	no	2006-2010	Potable	Fire Flow	12-inch diameter pipelines throughout the distribution system	12	2,600	lineal feet	$121	$/ft	$316,000	$95,000	$52,000	$42,000	$505,000
Various "FF & MFF" IDs	no	2011-2015	Potable	Fire Flow	12-inch diameter pipelines throughout the distribution system	12	2,000	lineal feet	$121	$/ft	$243,000	$73,000	$40,000	$32,000	$388,000
Various "FF & MFF" IDs	no	2016-2020	Potable	Fire Flow	12-inch diameter pipelines throughout the distribution system	12	2,900	lineal feet	$121	$/ft	$353,000	$106,000	$58,000	$46,000	$563,000
Various "FF & MFF" IDs	no	2006-2010	Potable	Fire Flow	16-inch diameter pipelines throughout the distribution system	16	6,900	lineal feet	$150	$/ft	$1,034,000	$311,000	$169,000	$135,000	$1,649,000
Various "FF & MFF" IDs	no	2011-2015	Potable	Fire Flow	16-inch diameter pipelines throughout the distribution system	16	100	lineal feet	$150	$/ft	$15,000	$5,000	$3,000	$2,000	$25,000
Various "FF & MFF" IDs	no	2016-2020	Potable	Fire Flow	16-inch diameter pipelines throughout the distribution system	16	3,900	lineal feet	$150	$/ft	$585,000	$176,000	$96,000	$77,000	$934,000
Various "FF & MFF" IDs	no	2011-2015	Potable	Fire Flow	18-inch diameter pipelines throughout the distribution system	18	2,100	lineal feet	$164	$/ft	$345,000	$104,000	$57,000	$45,000	$551,000
Various "PA" IDs	no	2006-2010	Potable	Pressure - Age	6-inch diameter pipelines throughout the distribution system	6	54,200	lineal feet	$85	$/ft	$4,608,000	$1,383,000	$749,000	$600,000	$7,340,000
Various "PA" IDs	no	2011-2015	Potable	Pressure - Age	6-inch diameter pipelines throughout the distribution system	6	38,400	lineal feet	$85	$/ft	$3,265,000	$980,000	$531,000	$425,000	$5,201,000
Various "PA" IDs	no	2016-2020	Potable	Pressure - Age	6-inch diameter pipelines throughout the distribution system	6	1,700	lineal feet	$85	$/ft	$145,000	$44,000	$24,000	$19,000	$232,000
Various "PA" IDs	no	2021-2025	Potable	Pressure - Age	6-inch diameter pipelines throughout the distribution system	6	900	lineal feet	$85	$/ft	$77,000	$24,000	$13,000	$11,000	$125,000
Various "PA" IDs	no	2006-2010	Potable	Pressure - Age	8-inch diameter pipelines throughout the distribution system	8	19,800	lineal feet	$101	$/ft	$2,004,000	$602,000	$326,000	$261,000	$3,193,000
Various "PA" IDs	no	2011-2015	Potable	Pressure - Age	8-inch diameter pipelines throughout the distribution system	8	10,000	lineal feet	$101	$/ft	$1,012,000	$304,000	$165,000	$132,000	$1,613,000
Various "PA" IDs	no	2006-2010	Potable	Pressure - Age	10-inch diameter pipelines throughout the distribution system	10	4,900	lineal feet	$111	$/ft	$546,000	$164,000	$89,000	$71,000	$870,000
Various "PA" IDs	no	2011-2015	Potable	Pressure - Age	10-inch diameter pipelines throughout the distribution system	10	3,200	lineal feet	$111	$/ft	$357,000	$108,000	$59,000	$47,000	$571,000
Various "PA" IDs	no	2006-2010	Potable	Pressure - Age	16-inch diameter pipelines throughout the distribution system	16	6,900	lineal feet	$150	$/ft	$1,034,000	$311,000	$169,000	$135,000	$1,649,000
Various "PA" IDs	no	2011-2015	Potable	Pressure - Age	16-inch diameter pipelines throughout the distribution system	16	300	lineal feet	$150	$/ft	$45,000	$14,000	$8,000	$6,000	$73,000

Table 11-4 (Cont'd)
Cost Estimates and Phasing of Existing System Improvements

CIP ID	Included in 04/05 CIP?	Phase	Water System	Improvement Type	Description	Diameter (in)	Size	Unit	Unit Cost	Unit	Constr. Cost	Conting. (30%)	Eng & Adm (12.5%)	Constr. Mgmt. (10%)	Total Cost (rounded)
Various "PA" IDs	no	2021-2025	Potable	Pressure - Age	16-inch diameter pipelines throughout the distribution system	16	100	lineal feet	$150	$/ft	$15,000	$5,000	$3,000	$2,000	$25,000
Various "PA" IDs	no	2011-2015	Potable	Pressure - Age	18-inch diameter pipelines throughout the distribution system	18	5,100	lineal feet	$164	$/ft	$837,000	$252,000	$137,000	$109,000	$1,335,000
MA-05	no	2006-2010	Potable	Major Street	16-inch diameter pipeline on Foothill Blvd. from Towne Ave. to Williams Ave.	16	920	lineal feet	$150	$/ft	$138,000	$42,000	$23,000	$18,000	$221,000
MA-07	no	2021-2025	Potable	Major Street	12-inch diameter pipeline on Towne Ave. from S/O Bonita Ave. to N/O Indigo Ct.	12	250	lineal feet	$121	$/ft	$31,000	$10,000	$6,000	$5,000	$52,000
MA-08	no	2021-2025	Potable	Major Street	18-inch diameter pipeline on Towne Ave. from Harrison Ave. to Arrow Hwy	18	3,240	lineal feet	$164	$/ft	$532,000	$160,000	$87,000	$70,000	$849,000
MA-09	no	2021-2025	Potable	Major Street	12-inch diameter pipeline on Arrow Hwy from Towne Ave. to Mountain Ave.	12	2,670	lineal feet	$121	$/ft	$325,000	$98,000	$53,000	$43,000	$519,000
MA-10	no	2021-2025	Potable	Major Street	10-inch diameter pipeline on Arrow Hwy from Orange Grove Ave. to Towne Ave.	10	1,770	lineal feet	$111	$/ft	$198,000	$60,000	$33,000	$26,000	$317,000
MA-11	no	2016-2020	Potable	Major Street	8-inch diameter pipeline on Arrow Hwy from Fulton Rd. to E/O Mariposa St.	8	1,140	lineal feet	$101	$/ft	$116,000	$35,000	$19,000	$16,000	$186,000
MA-12	no	2021-2025	Potable	Major Street	6-inch diameter pipeline on Arrow Hwy from W/O Fair Ave. to Fulton Rd.	6	1,830	lineal feet	$85	$/ft	$156,000	$47,000	$26,000	$21,000	$250,000
MA-15	no	2016-2020	Potable	Major Street	10-inch diameter pipeline on Garey Ave. from Santa Fe St. to N/O Penfield St.	10	4,240	lineal feet	$111	$/ft	$472,000	$142,000	$77,000	$62,000	$753,000
MA-17	no	2016-2020	Potable	Major Street	10-inch diameter pipeline on Garey Ave. from 10 FWY to Alvarado St.	10	2,370	lineal feet	$111	$/ft	$264,000	$80,000	$43,000	$35,000	$422,000
MA-18	no	2016-2020	Potable	Major Street	18-inch diameter pipeline on Garey Ave. from Willow St. to Holt Ave.	18	5,920	lineal feet	$164	$/ft	$971,000	$292,000	$158,000	$127,000	$1,548,000
MA-19	no	2016-2020	Potable	Major Street	10-inch diameter pipeline on Garey Ave. from Holt Ave. to Monterey Ave.	10	650	lineal feet	$111	$/ft	$73,000	$22,000	$12,000	$10,000	$117,000
MA-20	no	2016-2020	Potable	Major Street	6-inch diameter pipeline on Garey Ave. from Monterey Ave. to Commercial St.	6	350	lineal feet	$85	$/ft	$30,000	$9,000	$5,000	$4,000	$48,000
MA-21	no	2011-2015	Potable	Major Street	6-inch diameter pipeline on Garey Ave. from 2nd St. to Mission Blvd.	6	970	lineal feet	$85	$/ft	$83,000	$25,000	$14,000	$11,000	$133,000
MA-22	no	2006-2010	Potable	Major Street	6-inch diameter pipeline on Orange Grove Ave. from Arrow Hwy to La Verne Ave.	6	3,090	lineal feet	$85	$/ft	$263,000	$79,000	$43,000	$35,000	$420,000
MA-25	no	2006-2010	Potable	Major Street	16-inch diameter pipeline on Orange Grove Ave. from La Verne Ave. to San Juan St.	16	1,240	lineal feet	$150	$/ft	$186,000	$56,000	$31,000	$25,000	$298,000
MA-26	no	2006-2010	Potable	Major Street	16-inch diameter pipeline on Orange Grove Ave. from S/O San Juan St. to Artesia St.	16	1,600	lineal feet	$150	$/ft	$240,000	$72,000	$39,000	$32,000	$383,000
MA-27	no	2006-2010	Potable	Major Street	16-inch diameter pipeline on Orange Grove Ave. from 10 FWY to Park Ave.	16	1,930	lineal feet	$150	$/ft	$290,000	$87,000	$48,000	$38,000	$463,000
MA-28	no	2016-2020	Potable	Major Street	16-inch diameter pipeline on Towne Ave. from Bangor St. to 10 FWY	16	1,770	lineal feet	$150	$/ft	$266,000	$80,000	$44,000	$35,000	$425,000
MA-29	no	2016-2020	Potable	Major Street	16-inch diameter pipeline on Towne Ave. from Reservoir 5A to San Bernardino Ave.	16	1,780	lineal feet	$150	$/ft	$267,000	$81,000	$44,000	$35,000	$427,000
MA-30	no	2016-2020	Potable	Major Street	8-inch diameter pipeline on Towne Ave. from McKinley Ave. to Holt Ave.	8	3,530	lineal feet	$101	$/ft	$358,000	$108,000	$59,000	$47,000	$572,000
MA-31	no	2016-2020	Potable	Major Street	10-inch diameter pipeline on Towne Ave. from Holt Ave. to Monterey Ave.	10	630	lineal feet	$111	$/ft	$71,000	$22,000	$12,000	$10,000	$115,000

Table 11-4 (Cont'd)
Cost Estimates and Phasing of Existing System Improvements

CIP ID	Included in 04/05 CIP?	Phase	Water System	Improvement Type	Description	Diameter (in)	Size	Unit	Unit Cost	Unit	Constr. Cost	Conting. (30%)	Eng & Adm (12.5%)	Constr. Mgmt. (10%)	Total Cost (rounded)
MA-32	no	2016-2020	Potable	Major Street	8-inch diameter pipeline on Towne Ave. from 1st St. to 2nd St.	8	270	lineal feet	$101	$/ft	$28,000	$9,000	$5,000	$4,000	$46,000
MA-33	no	2016-2020	Potable	Major Street	10-inch diameter pipeline on Towne Ave. from 2nd St. to Mission Blvd.	10	1,030	lineal feet	$111	$/ft	$115,000	$35,000	$19,000	$15,000	$184,000
MA-34	no	2016-2020	Potable	Major Street	8-inch diameter pipeline on Towne Ave. from Mission Blvd. to 9th St.	8	1,290	lineal feet	$101	$/ft	$131,000	$40,000	$22,000	$18,000	$211,000
MA-36	no	2021-2025	Potable	Major Street	8-inch diameter pipeline on Indian Hill Blvd. from American Ave. to Kingsley Ave.	8	4,510	lineal feet	$101	$/ft	$457,000	$138,000	$75,000	$60,000	$730,000
MA-37	no	2021-2025	Potable	Major Street	8-inch diameter pipeline on Indian Hill Blvd. from Kingsley Ave. to Holt Ave.	8	1,330	lineal feet	$101	$/ft	$135,000	$41,000	$22,000	$18,000	$216,000
MA-38	no	2006-2010	Potable	Major Street	Abandon 4-inch diameter steel main and relocate water services	n/a	15	services	$1,200	$/connection	$18,000	$0	$2,300	$1,800	$22,100
MA-39	no	2021-2025	Potable	Major Street	10-inch diameter pipeline on Arrow Hwy from Garey Ave. to Pine Ave.	10	300	lineal feet	$111	$/ft	$34,000	$11,000	$6,000	$5,000	$56,000
MA-40	no	2021-2025	Potable	Major Street	10-inch diameter pipeline on Holt Ave. from Mills Ave. to Reservoir St.	10	4,250	lineal feet	$111	$/ft	$474,000	$143,000	$78,000	$62,000	$757,000
MA-41	no	2021-2025	Potable	Major Street	8-inch diameter pipeline on Holt Ave. from Reservoir St. to San Antonio Ave.	8	1,150	lineal feet	$101	$/ft	$117,000	$36,000	$20,000	$16,000	$189,000
MA-42	no	2021-2025	Potable	Major Street	6-inch diameter pipeline on Holt Ave. from San Antonio Ave. to Paloma Dr.	6	710	lineal feet	$85	$/ft	$61,000	$19,000	$10,000	$8,000	$98,000
MA-44	no	2021-2025	Potable	Major Street	10-inch diameter pipeline on Reservoir St. from Holt Ave. to 1st St.	10	1,360	lineal feet	$111	$/ft	$152,000	$46,000	$25,000	$20,000	$243,000
MA-45	no	2021-2025	Potable	Major Street	12-inch diameter pipeline on Holt Ave. from Garey Ave. to Hamilton Blvd.	12	3,970	lineal feet	$121	$/ft	$483,000	$145,000	$79,000	$63,000	$770,000
MA-46	no	2021-2025	Potable	Major Street	6-inch diameter pipeline on Holt Ave. from Park Ave. to White Ave.	6	1,320	lineal feet	$85	$/ft	$113,000	$34,000	$19,000	$15,000	$181,000
MA-47	no	2016-2020	Potable	Major Street	8-inch diameter pipeline on White Ave. from Orange Grove Ave. to Columbia Ave.	8	320	lineal feet	$101	$/ft	$33,000	$10,000	$6,000	$5,000	$54,000
MA-48	no	2016-2020	Potable	Major Street	6-inch diameter pipeline on White Ave. from Alvarado St. to Randolph St.	6	360	lineal feet	$85	$/ft	$31,000	$10,000	$6,000	$5,000	$52,000
MA-49	no	2016-2020	Potable	Major Street	8-inch diameter pipeline on White Ave. from Orange Grove Ave. to Monterey Ave.	8	3,330	lineal feet	$101	$/ft	$337,000	$102,000	$55,000	$44,000	$538,000
MA-50	no	2016-2020	Potable	Major Street	8-inch diameter pipeline on White Ave. from 2nd St. to Grand Ave.	8	3,640	lineal feet	$101	$/ft	$369,000	$111,000	$60,000	$48,000	$588,000
MA-51	no	2006-2010	Potable	Major Street	Abandon 4-inch diameter steel main and relocate water services	n/a	20	services	$1,200	$/connection	$24,000	$0	$3,000	$2,400	$29,400
MA-52	no	2006-2010	Potable	Major Street	Abandon 4-inch diameter steel main and relocate water services	n/a	80	services	$1,200	$/connection	$96,000	$0	$12,000	$9,600	$117,600
MA-55	no	2006-2010	Potable	Major Street	Abandon 4-inch diameter AC main and relocate water services	n/a	12	services	$1,200	$/connection	$14,400	$0	$1,800	$1,500	$17,700
MA-62	no	2006-2010	Potable	Major Street	Abandon 4-inch diameter steel main and relocate water services	n/a	3	services	$1,200	$/connection	$3,600	$0	$500	$400	$4,500
MA-63	no	2006-2010	Potable	Major Street	Abandon 4-inch diameter steel main and relocate water services	n/a	6	services	$1,200	$/connection	$7,200	$0	$900	$800	$8,900
MA-64	no	2021-2025	Potable	Major Street	6-inch diameter pipeline on Dudley St. from Vejar St. to Mc Comas St.	6	1,430	lineal feet	$85	$/ft	$122,000	$37,000	$20,000	$16,000	$195,000

Table 11-4 (Cont'd)
Cost Estimates and Phasing of Existing System Improvements

CIP ID	Included in 04/05 CIP?	Phase	Water System	Improvement Type	Description	Diameter (in)	Size	Unit	Unit Cost	Unit	Constr. Cost	Conting. (30%)	Eng & Adm (12.5%)	Constr. Mgmt. (10%)	Total Cost (rounded)
MA-68	no	2016-2020	Potable	Major Street	10-inch diameter pipeline on Garey Ave. from S/O Penfield St. to 10 FWY	10	2,720	lineal feet	$111	$/ft	$303,000	$91,000	$50,000	$40,000	$484,000
MA-70	no	2016-2020	Potable	Major Street	12-inch diameter pipeline on Towne Ave. from San Bernardino Ave. to McKinley Ave.	12	1,280	lineal feet	$121	$/ft	$156,000	$47,000	$26,000	$21,000	$250,000
MP-01	no	2006-2010	Potable	Major Street	12-inch diameter pipeline on Garey Ave. from Foothill Blvd. to N/O Foothill Blvd.	12	520	lineal feet	$121	$/ft	$64,000	$20,000	$11,000	$9,000	$104,000
MP-03	no	2006-2010	Potable	Major Street	16-inch diameter pipeline on Foothill Blvd. from Towne Ave. to Garey Ave.	16	3650	lineal feet	$150	$/ft	$547,000	$165,000	$89,000	$72,000	$873,000
MP-04	no	2006-2010	Potable	Major Street	10-inch diameter pipeline on Foothill Blvd. from Williams Ave. to W/O Bradford St.	10	1,160	lineal feet	$111	$/ft	$130,000	$39,000	$22,000	$17,000	$208,000
MP-05	no	2006-2010	Potable	Major Street	16-inch diameter pipeline on from Foothill Blvd. to Towne Ave.	16	3750	lineal feet	$150	$/ft	$562,000	$169,000	$92,000	$74,000	$897,000
MP-06	no	2006-2010	Potable	Major Street	12-inch diameter pipeline on Towne Ave. from S/O Grove St. to Bonita Ave.	12	2580	lineal feet	$121	$/ft	$314,000	$95,000	$52,000	$41,000	$502,000
MP-69	no	2016-2020	Potable	Major Street	12-inch diameter pipeline on Towne Ave. from 10 FWY to San Bernardino Ave.	12	1,220	lineal feet	$121	$/ft	$149,000	$45,000	$25,000	$20,000	$239,000
MP-13	no	2006-2010	Potable	Major Street	12-inch diameter pipeline on Fairplex Dr. from McKinley Ave. to McKinley Ave.	12	1850	lineal feet	$121	$/ft	$225,000	$68,000	$37,000	$30,000	$360,000
MP-2	no	2006-2010	Potable	Major Street	12-inch diameter pipeline on Towne Ave. from Foothill Blvd. to N/O Foothill Blvd.	12	490	lineal feet	$121	$/ft	$60,000	$18,000	$10,000	$8,000	$96,000
MP-23	no	2006-2010	Potable	Major Street	20-inch diameter pipeline on Orange Grove Ave. from La Verne Ave. to N/O La Verne Ave.	20	220	lineal feet	$177	$/ft	$39,000	$12,000	$7,000	$6,000	$64,000
MP-24	no	2006-2010	Potable	Major Street	16-inch diameter pipeline on Orange Grove Ave. from La Verne Ave. to Artesia St.	16	2800	lineal feet	$150	$/ft	$420,000	$126,000	$69,000	$55,000	$670,000
P-1	no	2006-2010	Potable	Pressure	12-inch diameter pipeline on Alley 600 ft W/O Sumner Ave. from 240 ft N/O Foothill Blvd. to N/O Foothill Blvd.	12	240	lineal feet	$121	$/ft	$30,000	$9,000	$5,000	$4,000	$48,000
P-2	no	2006-2010	Potable	Pressure	12-inch diameter pipeline on Alley 450 ft E/O Lynoak Ave. from 400 ft N/O Foothill Blvd. to N/O Foothill Blvd.	12	400	lineal feet	$121	$/ft	$49,000	$15,000	$8,000	$7,000	$79,000
P-3	no	2011-2015	Potable	Pressure	10-inch diameter pipeline on Flaxton St. from Foxbury Ave. to Foothill Blvd.	10	920	lineal feet	$111	$/ft	$103,000	$31,000	$17,000	$14,000	$165,000
P-4	no	2011-2015	Potable	Pressure	8-inch diameter pipeline on Foxbury Ave. from Abbott St. to Flaxton St.	8	550	lineal feet	$101	$/ft	$56,000	$17,000	$10,000	$8,000	$91,000
P-5	no	2011-2015	Potable	Pressure	8-inch diameter pipeline from Towne Ave. to 400 E/O Towne Ave. between Bonita Ave. and Harrison Ave.	8	370	lineal feet	$101	$/ft	$38,000	$12,000	$7,000	$5,000	$62,000
P-6	no	2011-2015	Potable	Pressure	12-inch diameter pipeline on Bonita Ave. from Towne Ave. to Carnegie Ave.	12	1,270	lineal feet	$121	$/ft	$155,000	$47,000	$26,000	$21,000	$249,000
P-7	no	2011-2015	Potable	Pressure	12-inch diameter pipeline on Carnegie Ave. from Bonita Ave. to Towne Center Dr.	12	2,690	lineal feet	$121	$/ft	$327,000	$99,000	$54,000	$43,000	$523,000
P-8	no	2011-2015	Potable	Pressure	16-inch diameter pipeline on Towne Center Dr. from Towne Center Dr. to Arrow Hwy	16	780	lineal feet	$150	$/ft	$117,000	$36,000	$20,000	$16,000	$189,000
P-9	no	2011-2015	Potable	Pressure	6-inch diameter pipeline on Logan St. from Arrow Hwy to Vicente Ave.	6	290	lineal feet	$85	$/ft	$25,000	$8,000	$5,000	$4,000	$42,000

Table 11-4 (Cont'd)
Cost Estimates and Phasing of Existing System Improvements

CIP ID	Included in 04/05 CIP?	Phase	Water System	Improvement Type	Description	Diameter (in)	Size	Unit	Unit Cost	Unit	Constr. Cost	Conting. (30%)	Eng & Adm (12.5%)	Constr. Mgmt. (10%)	Total Cost (rounded)
Res-1	no	2006-2010	Potable	Reservoirs	Replacement of Wooden Roofing of Reservoir 5A	n/a	47,100	square ft	$17	$/sq ft	$801,000	$241,000	$131,000	$105,000	$1,278,000
Res-2	no	2011-2015	Potable	Reservoirs	Replacement of Wooden Roofing of Reservoir 6A	n/a	47,100	square ft	$17	$/sq ft	$801,000	$241,000	$131,000	$105,000	$1,278,000
Res-3	734K funded	2011-2015	Potable	Reservoirs	Reservoir Seismic Upgrades or priority 1 reservoirs (Reservoirs 2B, 7B, and 10A)	n/a	3	reservoirs	$1,966,000	lumpsum	lumpsum	lumpsum	lumpsum	lumpsum	$1,966,000
PS-01	no	2016-2020	Potable	Pump Station Rehab	Repair leaking Booster 7A feedline (15 ft deep from 54" MWD OC Feeder)	10	600	lineal feet	$111	$/ft	$67,000	$21,000	$11,000	$9,000	$108,000
PS-02	no	2006-2010	Potable	Pump Station Rehab	Replacement of pumps of PS 2 (units D, E)	n/a	175	HP	$1,290	$/HP	$226,000	$68,000	$37,000	$30,000	$361,000
PS-04	no	2006-2010	Potable	Pump Station Rehab	Replacement of pumps of PS 5 (unit A)	n/a	50	HP	$3,000	$/HP	$150,000	$45,000	$25,000	$20,000	$240,000
PS-05	no	2006-2010	Potable	Pump Station Rehab	Replacement of pumps of PS 8 (units A, B)	n/a	80	HP	$1,800	$/HP	$144,000	$44,000	$24,000	$19,000	$231,000
PS-06	no	2006-2010	Potable	Pump Station Rehab	Replacement of pumps of PS 9 (units A, B, C)	n/a	140	HP	$1,500	$/HP	$210,000	$63,000	$35,000	$28,000	$336,000
PS-09	no	2021-2025	Potable	Pump Station Rehab	Replacement of pumps of PS 1 (unit A)	n/a	75	HP	$2,250	$/HP	$169,000	$51,000	$28,000	$22,000	$270,000
PS-10	no	2006-2010	Potable	Pump Station Rehab	Replacement of pumps of PS 3 (unit A)	n/a	100	HP	$1,800	$/HP	$180,000	$54,000	$30,000	$24,000	$288,000
PS-11	no	2021-2025	Potable	Pump Station Rehab	Replacement of pumps of PS 3 (unit D)	n/a	100	HP	$1,800	$/HP	$180,000	$54,000	$30,000	$24,000	$288,000
PS-12	no	2006-2010	Potable	Pump Station Rehab	Replacement of pumps of PS 4 (units A, B)	n/a	60	HP	$3,000	$/HP	$180,000	$54,000	$30,000	$24,000	$288,000
PS-13	no	2021-2025	Potable	Pump Station Rehab	Replacement of pumps of PS 5 (unit B)	n/a	50	HP	$3,000	$/HP	$150,000	$45,000	$25,000	$20,000	$240,000
PS-14	no	2021-2025	Potable	Pump Station Rehab	Replacement of pumps of PS 7 (unit A)	n/a	60	HP	$3,000	$/HP	$180,000	$54,000	$30,000	$24,000	$288,000
PS-15	no	2021-2025	Potable	Pump Station Rehab	Replacement of pumps of PS 10 (unit B)	n/a	40	HP	$4,000	$/HP	$160,000	$48,000	$26,000	$21,000	$255,000
PS-16	no	2011-2015	Potable	Pump Station Rehab	Replacement of pumps of PS 11 (units A, B, D, E)	n/a	280	HP	$1,350	$/HP	$378,000	$114,000	$62,000	$50,000	$604,000
PS-18	no	2016-2020	Potable	Pump Station Rehab	Replacement of pumps of PS 12 (units A, B, C)	n/a	225	HP	$1,500	$/HP	$338,000	$102,000	$55,000	$44,000	$539,000
PS-19	no	2016-2020	Potable	Pump Station Rehab	Replacement of pumps of PS 12H (units A, B)	n/a	15	HP	$1,500	$/HP	$23,000	$7,000	$4,000	$3,000	$37,000
PS-20	no	2006-2010	Potable	Pump Station Rehab	Replacement of pumps of PS 2 (unit D)	n/a	50	HP	$1,800	$/HP	$90,000	$27,000	$15,000	$12,000	$144,000
S-01	no	2006-2010	Potable	Water Supply	Replacement and Abandonment of Tunnel Well No. 1	n/a	314	gpm	$1,101,000	$/well	$1,101,000	$331,000	$179,000	$144,000	$1,755,000
S-02	no	2006-2010	Potable	Water Supply	Replacement and Abandonment of Tunnel Well No. 3	n/a	331	gpm	$1,101,000	$/well	$1,101,000	$331,000	$179,000	$144,000	$1,755,000
S-03	no	2021-2025	Potable	Water Supply	Replacement and Abandonment of Well 13	n/a	258	gpm	$1,101,000	$/well	$1,101,000	$331,000	$179,000	$144,000	$1,755,000
S-03	no	2021-2025	Potable	Water Supply	Well head treatment for replacement of Well 13	n/a	258	gpm	$670,000	$/well	$670,000	$201,000	$109,000	$88,000	$1,068,000
S-04	only 100K	2021-2025	Potable	Water Supply	Replacement and Abandonment of Well 4	n/a	523	gpm	$1,101,000	$/well	$1,101,000	$331,000	$179,000	$144,000	$1,755,000

Table 11-4 (Cont'd)
Cost Estimates and Phasing of Existing System Improvements

CIP ID	Included in 04/05 CIP?	Phase	Water System	Improvement Type	Description	Diameter (in)	Size	Unit	Unit Cost	Unit	Constr. Cost	Conting. (30%)	Eng & Adm (12.5%)	Constr. Mgmt. (10%)	Total Cost (rounded)
S-05	no	2006-2010	Potable	Water Supply	Replacement and Abandonment of Well 6	n/a	990	gpm	$1,101,000	$/well	$1,101,000	$331,000	$179,000	$144,000	$1,755,000
S-06	no	2021-2025	Potable	Water Supply	Replacement and Abandonment of Well 11	n/a	443	gpm	$1,101,000	$/well	$1,101,000	$331,000	$179,000	$144,000	$1,755,000
S-07	no	2021-2025	Potable	Water Supply	Replacement and Abandonment of Well 12	n/a	597	gpm	$1,101,000	$/well	$1,101,000	$331,000	$179,000	$144,000	$1,755,000
S-08	no	2006-2010	Potable	Water Supply	Disinfection of Well 27	n/a	807	gpm	$80,000	$/well	$80,000	$25,000	$14,000	$11,000	$130,000
S-10	500K funded	2006-2010	Potable	Water Supply	Piping, equipping and treatment of Well 32	n/a	unknown	gpm	$570,000	lumpsum	lumpsum	lumpsum	lumpsum	lumpsum	$570,000
S-11	100K funded	2006-2010	Potable	Water Supply	Destruction of abandoned wells (Wells 1, 4, 22)	n/a	3	wells	$250,000	lumpsum	lumpsum	lumpsum	lumpsum	lumpsum	$250,000
S-12	140K funded	2006-2010	Potable	Water Supply	Arsenic Treatment for Well 35	n/a	650	gpm	$1,050,000	lumpsum	lumpsum	lumpsum	lumpsum	lumpsum	$1,050,000
S-13	1.6M funded	2006-2010	Potable	Water Supply	Piping, equipping and treatment of Well 37	n/a	unknown	gpm	$800,000	lumpsum	lumpsum	lumpsum	lumpsum	lumpsum	$800,000
SR-1	no	2006-2010	Potable	Supply Reliability	Install Inter-Agency connection with the City of Chino Hills	8	n/a	lineal feet	$70,000	$/8" meter	$70,000	$21,000	$12,000	$10,000	$113,000
Other-1	no	2016-2020	Potable	Other	Replacement of SCADA communication, central control, and remote field equipement	n/a	n/a	n/a	$2,500,000	$/system	$2,500,000	$750,000	$407,000	$325,000	$3,982,000
Other-2	no	2006-2010	Potable	Other	Program EIR for Water and Recycled Water Master Plan	n/a	n/a	n/a	$150,000	lumpsum	lumpsum	lumpsum	lumpsum	lumpsum	$150,000
Other-3	no	2006-2010	Potable	Other	GIS	n/a	n/a	n/a	$300,000	lumpsum	lumpsum	lumpsum	lumpsum	lumpsum	$300,000
Other-4	no	2006-2010	Potable	Other	Water Meter Replacements	n/a	16,800	meters/period	$250	$/meter	$4,200,000	lumpsum	lumpsum	lumpsum	$4,200,000
Other-4	no	2011-2015	Potable	Other	Water Meter Replacements	n/a	16,800	meters/period	$250	$/meter	$4,200,000	lumpsum	lumpsum	lumpsum	$4,200,000
Other-4	no	2016-2020	Potable	Other	Water Meter Replacements	n/a	16,800	meters/period	$250	$/meter	$4,200,000	lumpsum	lumpsum	lumpsum	$4,200,000
Other-4	no	2021-2025	Potable	Other	Water Meter Replacements	n/a	16,800	meters/period	$250	$/meter	$4,200,000	lumpsum	lumpsum	lumpsum	$4,200,000
Other-5	no	2006-2010	Potable	Other	Replacement of Water Service Laterals in Phillips Ranch Area	n/a	500	laterals	$1,200	$/lateral	$600,000	lumpsum	lumpsum	lumpsum	$600,000
Other-6	no	2006-2010	Potable	Other	Study to indentify additional Water Service Laterals that need replacement	n/a	1	study	$25,000	$/period	$25,000	lumpsum	lumpsum	lumpsum	$25,000
Other-7	no	2006-2010	Potable	Other	Replacement of Fire Hydrants with Breakoff Heads (20/yr)	n/a	100	hydrants	$500	$/hydrant	$50,000	lumpsum	lumpsum	lumpsum	$50,000
Other-7	no	2011-2015	Potable	Other	Replacement of Fire Hydrants with Breakoff Heads (20/yr)	n/a	100	hydrants	$500	$/period	$50,000	lumpsum	lumpsum	lumpsum	$50,000
Other-7	no	2016-2020	Potable	Other	Replacement of Fire Hydrants with Breakoff Heads (20/yr)	n/a	100	hydrants	$500	$/period	$50,000	lumpsum	lumpsum	lumpsum	$50,000
Other-7	no	2021-2025	Potable	Other	Replacement of Fire Hydrants with Breakoff Heads (20/yr)	n/a	100	hydrants	$500	$/period	$50,000	lumpsum	lumpsum	lumpsum	$50,000
Other-8	no	2006-2010	Potable	Other	Pipeline Assessment through coupon testing	n/a	multiple	tests	$500,000	lumpsum	lumpsum	lumpsum	lumpsum	lumpsum	$500,000
Other-9	500K funded	2006-2010	Potable	Other	Water System Security Upgrade	n/a	n/a	n/a	$925,000	lumpsum	lumpsum	lumpsum	lumpsum	lumpsum	$925,000
Other-10	partially	2006-2010	Potable	Other	Corporate Yard Facility (Water System Share)	n/a	n/a	n/a	$4,800,000	lumpsum	lumpsum	lumpsum	lumpsum	lumpsum	$4,800,000
Other-11	no	2006-2010	Potable	Other	Feasibility Study for Pedley WTP	n/a	n/a	n/a	$200,000	lumpsum	lumpsum	lumpsum	lumpsum	lumpsum	$200,000
RS-1	no	2011-2015	Recycled	Recycled Water System	Replacement and Abandonment of Well 33	n/a	178	gpm	$1,101,000	$/well	$1,101,000	$331,000	$179,000	$144,000	$1,755,000
RS-2	no	2021-2025	Recycled	Recycled Water System	Replacement of pumps of Recycled Water Well 19	n/a	25	HP	$4,000	$/HP	$100,000	$30,000	$17,000	$13,000	$160,000
Total											**$92,870,200**	**$22,584,000**	**$12,293,500**	**$9,846,500**	**$149,105,200**

Table 11-5
Cost Estimates and Phasing of Future System Improvements

CIP ID	Included in 04/05	Phase	Water System	Improvement Type	Description	Diameter (in)	Size	Unit	Unit Cost	Unit	Constr. Cost	Conting. (30%)	Eng & Admin (12.5%)	CMS (10%)	Total Cost (rounded)
n/a	yes	2005-2010	Potable	Reservoirs	New Reservoir 11H	n/a	0.10	MG	$1	$/gallon	not included	not included	not included	not included	not included
FS-2	no	2010-2015	Potable	Water Supply	Replacement and Abandonment of Well 20	n/a	258	gpm	$1,101,000	$/well	$1,101,000	$331,000	$179,000	$144,000	$1,755,000
FS-2	no	2010-2015	Potable	Water Supply	Well head treatment for Well 20	n/a	258	gpm	$670,000	$/well	$670,000	$201,000	$109,000	$88,000	$1,068,000
FS-3	partially	2005-2010	Potable	Water Supply	Well head treatment for Well 37 (unfunded portion)	n/a	700	gpm	$800,000	$/well	$800,000	lumpsum	lumpsum	lumpsum	$800,000
F-FF-1	no	2020-2025	Potable	Fire Flow	8-inch diameter pipeline on Aldama Ave., Lublin St.,& Browning Ave. from Aldama Ave. & Abbott	8	1,700	lineal feet	$101	$/ft	$173,000	$52,000	$29,000	$23,000	$277,000
F-FF-2	no	2020-2025	Potable	Fire Flow	10-inch diameter pipeline 400 feet West of Towne Ave. forming a T-intersection with E	10	600	lineal feet	$111	$/ft	$67,000	$21,000	$11,000	$9,000	$108,000
F-FF-3	no	2020-2025	Potable	Fire Flow	10-inch diameter pipeline on W Pearl St. from N Park Ave. to East of Garey Ave.	10	1,400	lineal feet	$111	$/ft	$156,000	$47,000	$26,000	$21,000	$250,000
F-FF-4	no	2020-2025	Potable	Fire Flow	10-inch diameter pipeline on Price St. from Clark Ave. to West of N East End Ave.	10	1,500	lineal feet	$111	$/ft	$167,000	$51,000	$28,000	$22,000	$268,000
F-FF-5	no	2020-2025	Potable	Fire Flow	8-inch diameter pipeline on 220' S of W Monterey Ave. from N Huntington Blvd. to N	8	700	lineal feet	$101	$/ft	$71,000	$22,000	$12,000	$10,000	$115,000
F-FF-6	no	2020-2025	Potable	Fire Flow	10-inch diameter pipeline on W Holt Ave. from New York Dr. to Erie St.	10	1,000	lineal feet	$111	$/ft	$112,000	$34,000	$19,000	$15,000	$180,000
n/a	yes	2005-2010	Potable	Pump Stations	Addition of Booster 2G (currently under design)	n/a	200	HP	$0	$/HP	not included	not included	not included	not included	not included
n/a	yes	2005-2010	Potable	Pump Stations	Addition of Booster 3G (currently under design)	n/a	150	HP	$0	$/HP	not included	not included	not included	not included	not included
n/a	yes	2005-2010	Potable	Pump Stations	Addition of Booster 14 (currently under design)	n/a	50	HP	$0	$/HP	not included	not included	not included	not included	not included
n/a	yes	2005-2010	Potable	Pump Stations	Addition of Booster 15 (currently under design)	n/a	77	HP	$0	$/HP	not included	not included	not included	not included	not included
F-RS-1	no	2005-2010	Recycled	Recycled Water System	Pipelines to serve users of Segment 1 (Ganesha High School, Kennedy Park and Marshall Middle School)	4	6,500	lineal feet	$61	$/ft	$395,000	$119,000	$65,000	$52,000	$631,000
F-RS-2	no	2005-2010	Recycled	Recycled Water System	Pipelines to serve users of Segment 4 (Palomeras Middle School, Ted Greene Park,	4	3,400	lineal feet	$61	$/ft	$207,000	$63,000	$34,000	$27,000	$331,000
F-RS-3	no	2005-2010	Recycled	Recycled Water System	Pipelines to serve San Gabriel Co-Generation Plant	8	500	lineal feet	$101	$/ft	$51,000	$16,000	$9,000	$7,000	$83,000
F-RS-4	no	2005-2010	Recycled	Recycled Water System	Addition of 10 fire hydrants	n/a	10	hydrants	$3,000	$/hydrant	$30,000	$9,000	$5,000	$4,000	$48,000
F-Other-1	no	2005-2010	Recycled	Other	Conduct a study to assess the condition of the Simpson Wells and pipelines	n/a	1	study	$150,000	lumpsum	lumpsum	lumpsum	lumpsum	lumpsum	$150,000
Total											**$4,000,000**	**$966,000**	**$526,000**	**$422,000**	**$6,064,000**

Although the City recently upgraded their SCADA system, it is considered prudent to include a SCADA upgrade within the planning horizon of this master plan due to fast development of information technology. This SCADA upgrade is phased near the end of this CIP, while the PEIR and update of the GIS are phased in the first 5-year period.

The replacement of potable water meters and fire hydrant heads are distributed evenly among the four 5-year periods, with an average replacement rate of 3,360 water meters per year. It is recommended that the City replace the 3,300 meters in the Phillips Ranch Area first, as these are about 30 years old. Automatic meter reading is recommended as it reduces labor cost. The City could also prioritize meter replacements based on meter size, starting with meters of 3-inches and larger.

The replacement of service laterals in the Phillips Ranch area and the study to identify additional water service laterals that need replacement are phased for the first 5-year period. Potential service lateral replacement recommendations of this study are not included in this CIP. The assessment of potable water pipelines through coupon and flow testing, the assessment of the Simpson wells and the associated pipelines, and the feasibility study for the Pedley WTP are all phased at the beginning of this CIP, in the period 2005-2010. The upgrades of the water system security system and the corporate yard facility are also phased in the first 5-year period. The replacement of fire hydrants is assumed to occur continuously at a rate of 20 hydrants per year.

Phasing and cost allocation for each of the recommended improvements are included in **Table 11-4** (existing system improvements), **Table 11-5** (future system improvements), and **Appendix B** (fire flow and age improvements by project).

Cost Estimates

The cost of the CIP is estimated by project for each five-year period using the cost estimating assumptions and the project phasing discussed above. A summary of the recommended potable water CIP is shown in **Table 11-6**, with a total capital cost of $152.0 million. The estimated cost for addressing existing system deficiencies is $147.2 million. The estimated cost for growth-induced improvements with a planning horizon of year 2025 is $4.8 million.

Table 11-6
Summary of Potable Water System Improvements

Improvement Category	Existing System ($ million)	Future System ($ million)	Total ($ million)
Pipeline Improvements (P, MP, PA, MA)	$64.0		$64.0
Fire Flow Improvements (FF, MFF, FFF)	$29.4	$1.2	$30.6
Reservoir Improvements (Res, F-Res)	$4.5		$4.5
Pump Station Improvements (PS)	$4.5		$4.5
Supply Improvements (S, SR, F-S)	$16.3	$3.6	$19.9
Other Improvements	$28.5		$28.5
Total	**$147.2**	**$4.8**	**$152.0**

RECYCLED WATER SYSTEM CIP

The recycled water distribution system and its potential for expansion are evaluated in **Section 10**. Based on this evaluation, the recommendation are divided into two categories; 1) existing system improvements addressing existing water system deficiencies, and 2) future system improvements necessary to meet the projected water demands for year 2025.

Existing System Improvements

As discussed in **Section 10**, there are only two existing recycled water system improvements, the abandonment and replacement of Well 33 and the replacement of the pump for Well 19. Due to the limited number of recycled water system recommendations, all improvements are categorized as "RS".

Future System Improvements

As discussed in **Section 10**, it is recommended the existing recycled water system be expanded to serve new customers such as Ganesha High School. This will require the construction of 1.9 miles of new recycled water pipelines and 10 new fire hydrants. . The addition of the new fire hydrants will facilitate the use of recycled water for street sweeping, sewer pipeline flushing, and possibly graffiti removal operations. All future recycled water supply improvements are indicated as "F-RS".

These existing and future recycled water system recommendations are summarized in **Table 11-7**, and are shown on **Figure 11-3**.

Table 11-7
Summary of Recycled Water System Improvements

Category ID	Improvements Description	Quantity	Unit
RS	Recycled Water Supply Improvements - abandonment and replacement	1	well
	Recycled Water Supply Improvements – pump replacement	1	well
F-RS	New Recycled Water Pipelines	1.3	miles
	Recycled Water Fire Hydrants	10	hydrants

Phasing

The recommended recycled water system improvements are based on system needs. Projects are phased over the next 20 years with a breakdown of the following four periods:

- Year 2006 through year 2010
- Year 2011 through year 2015
- Year 2016 through year 2020
- Year 2021 through year 2025

The replacement and abandonment of recycled water wells is based on a useful of life of 75 years. The expansion of the recycled water system is phased in the first 5-year period to increase the use of recycled water as soon as possible and offset the use of imported water. The addition of recycled water hydrants is included in the same period, as these would be installed during the pipeline construction. As discussed in Section 10, it may be feasible in the (near) future to expand the recycled water system further than recommended in this master plan if potable water rates increase above current levels. By expanding the recycled water system with the portions that are identified as cost-effective early on, additional expansions are encouraged as these could tap into the recommended expansions.

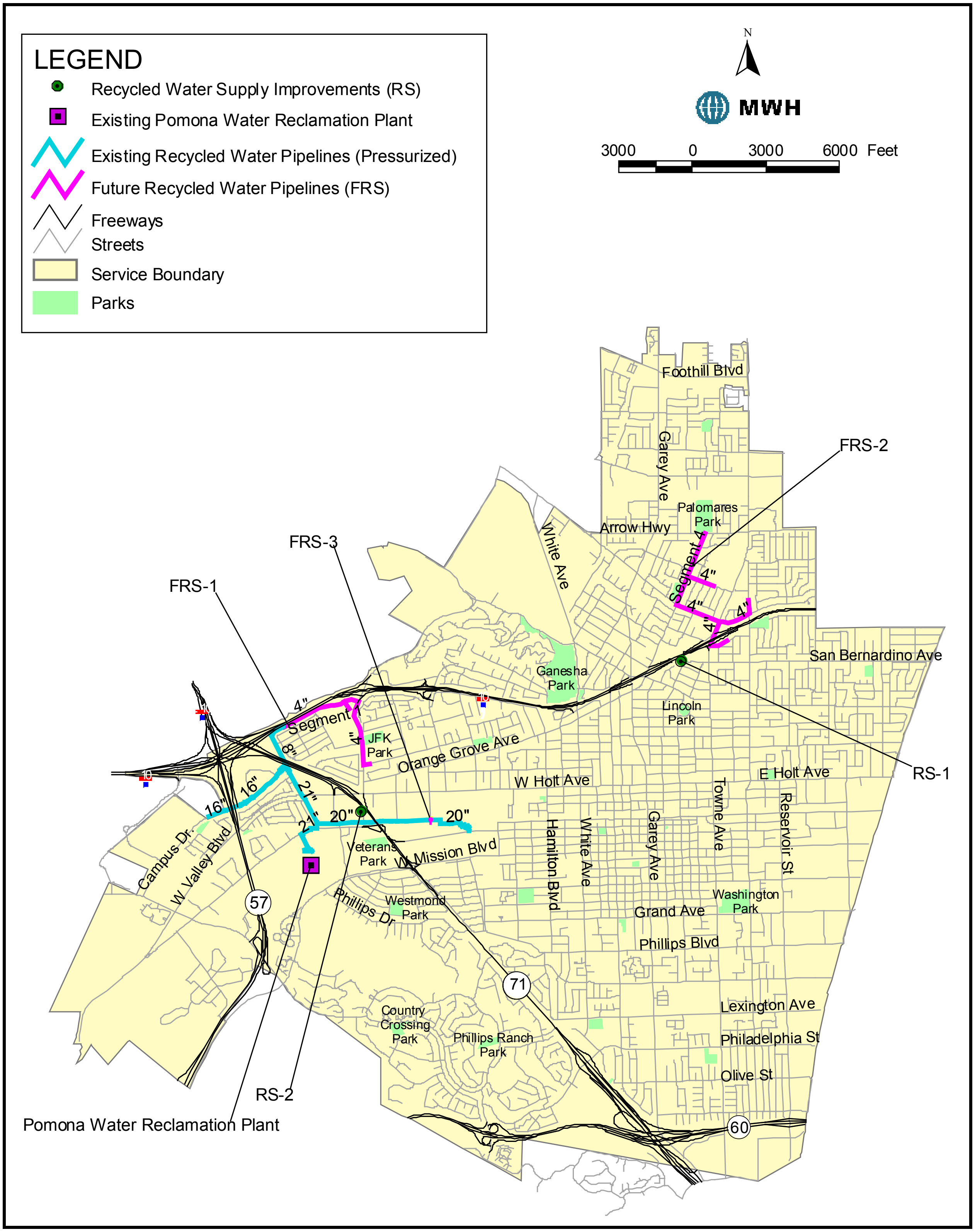
Cost Estimates

With the recommended improvements, the basis of cost estimating, and the project phasing, the cost of the CIP is estimated per project and per period. A summary of the recommended recycled water CIP is shown in **Table 11-8**, with a total capital cost of \$3.2 million. The estimated cost for addressing existing system deficiencies is \$1.9 million. The estimated cost for growth-induced improvements with a planning horizon of year 2025 is \$1.2 million.

Table 11-8
Summary of Recycled Water System Improvements

Improvement Category	Existing System (\$ million)	Future System (\$ million)	Total (\$ million)	Total (percent)
Pipeline Improvements (F-RS)		\$1.1	\$1.1	35%
Supply Improvements (RS)	\$1.9	\$0.2	\$2.1	65%
Total	**\$1.9**	**\$1.2**	**\$3.2**	**100%**

Figure 11-3
Recycled Water System Improvements



COMBINED CAPITAL IMPROVEMENT PROGRAM

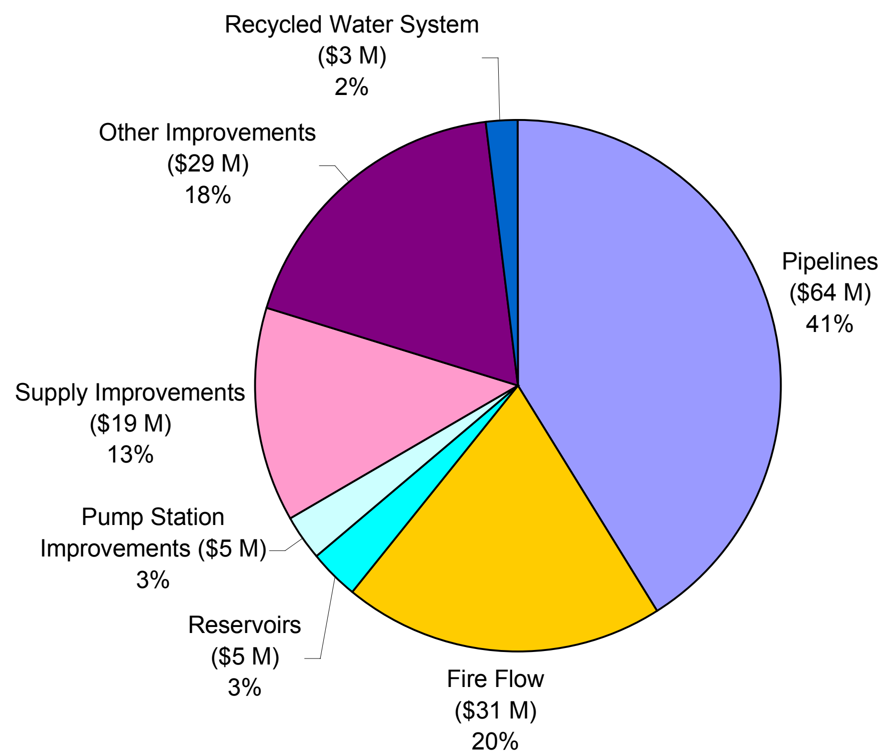
The combined potable and recycled water system CIP for the next 20 years is summarized by improvement category and phase in **Table 11-9**. The distribution of cost by improvement category is graphically presented on **Figure 11-4**.

Table 11-9
Summary of Combined CIP by Improvement Category

Improvement Category	2005-2010	2010-2015	2015-2020	2020-2025	Grand Total
Pipeline Improvements (P, MP, PA, MA)	$20,513,200	$12,520,000	$11,174,000	$19,747,000	$63,954,200
Fire Flow Improvements (FF, MFF, FFF)	$3,736,000	$10,277,000	$15,149,000	$1,485,000	$30,647,000
Reservoir Improvements (Res, F-Res)	$1,278,000	$3,244,000	$0	$0	$4,522,000
Pump Station Improvements (PS)	$1,888,000	$604,000	$684,000	$1,341,000	$4,517,000
Supply Improvements (S, SR, F-S)	$8,978,000	$2,823,000	$0	$8,088,000	$19,889,000
Other Improvements (PEIR, GIS, SCADA, meters)	$11,900,000	$4,250,000	$8,232,000	$4,250,000	$28,632,000
Recycled Water System (RS, F-RS)	$1,093,000	$1,755,000	$0	$160,000	$3,008,000
Total	**$49,386,200**	**$35,473,000**	**$35,239,000**	**$35,071,000**	**$155,169,200**

As shown in **Table 11-9** and **Figure 11-4**, the combined CIP is $155 million, with pipeline improvements contributing to the majority of the CIP ($95 million). The estimated capital cost ranges from $35 million to $49 million for each 5-year period, which equated to an average of $39 million per period or $7.8 million per year.

Figure 11-4
Potable and Recycled Water System CIP



The allocation of improvement between existing and future system potable and recycled water improvement is summarized in **Table 11-10**. As shown in **Table 11-10**, 96 percent of the $155 million CIP or $149 million is for existing system improvements, while only 4 percent is assigned to future system improvements. **Table 11-10** also shows that the majority of the CIP is for potable water system improvements ($152 million or 98 percent). The financing options for this CIP is discussed in **Section 12**.

Table 11-10
Summary of Combined CIP

CIP Category	Potable System ($ million)	Recycled System ($ million)	Total ($ million)	Capital Cost (%)
Existing System Improvements	$147.2	$1.9	$149.1	96%
Future System Improvements	$4.8	$1.2	$6.1	4%
Total	**$152.0**	**$3.2**	**$155.2**	**100%**

CIP ID	Phase	Water System	Improvement Type	Description	Total Cost (rounded)
FS-2	2010-2015	Potable	Water Supply	Replacement and Abandonment of Well 20	$1,755,000
FS-2	2010-2015	Potable	Water Supply	Well head treatment for Well 20	$1,068,000
MA-21	2011-2015	Potable	Major Street	6-inch diameter pipeline on Garey Ave. from 2nd St. to Mission Blvd.	$133,000
P-3	2011-2015	Potable	Pressure	10-inch diameter pipeline on Flaxton St. from Foxbury Ave. to Foothill Blvd.	$165,000
P-4	2011-2015	Potable	Pressure	8-inch diameter pipeline on Foxbury Ave. from Abbott St. to Flaxton St.	$91,000
P-5	2011-2015	Potable	Pressure	8-inch diameter pipeline from Towne Ave. to 400 E/O Towne Ave. between Bonita Ave. and Harrison Ave.	$62,000
P-6	2011-2015	Potable	Pressure	12-inch diameter pipeline on Bonita Ave. from Towne Ave. to Carnegie Ave.	$249,000
P-7	2011-2015	Potable	Pressure	12-inch diameter pipeline on Carnegie Ave. from Bonita Ave. to Towne Center Dr.	$523,000
P-8	2011-2015	Potable	Pressure	16-inch diameter pipeline on Towne Center Dr. from Towne Center Dr. to Arrow Hwy	$189,000
P-9	2011-2015	Potable	Pressure	6-inch diameter pipeline on Logan St. from Arrow Hwy to Vicente Ave.	$42,000
Res-2	2011-2015	Potable	Reservoirs	Replacement of Wooden Roofing of Reservoir 6A	$1,278,000
Res-3	2011-2015	Potable	Reservoirs	Reservoir Seismic Upgrades or priority 1 reservoirs (Reservoirs 2B, 7B, and 10A)	$1,966,000
PS-16	2011-2015	Potable	Pump Station Rehab	Replacement of pumps of PS 11 (units A, B, D, E)	$604,000
MA-11	2016-2020	Potable	Major Street	8-inch diameter pipeline on Arrow Hwy from Fulton Rd. to E/O Mariposa St.	$186,000
MA-15	2016-2020	Potable	Major Street	10-inch diameter pipeline on Garey Ave. from Santa Fe St. to N/O Penfield St.	$753,000
MA-17	2016-2020	Potable	Major Street	10-inch diameter pipeline on Garey Ave. from 10 FWY to Alvarado St.	$422,000
MA-18	2016-2020	Potable	Major Street	18-inch diameter pipeline on Garey Ave. from Willow St. to Holt Ave.	$1,548,000
MA-19	2016-2020	Potable	Major Street	10-inch diameter pipeline on Garey Ave. from Holt Ave. to Monterey Ave.	$117,000
MA-20	2016-2020	Potable	Major Street	6-inch diameter pipeline on Garey Ave. from Monterey Ave. to Commercial St.	$48,000
MA-28	2016-2020	Potable	Major Street	16-inch diameter pipeline on Towne Ave. from Bangor St. to 10 FWY	$425,000
MA-29	2016-2020	Potable	Major Street	16-inch diameter pipeline on Towne Ave. from Reservoir 5A to San Bernardino Ave.	$427,000
MA-30	2016-2020	Potable	Major Street	8-inch diameter pipeline on Towne Ave. from McKinley Ave. to Holt Ave.	$572,000
MA-31	2016-2020	Potable	Major Street	10-inch diameter pipeline on Towne Ave. from Holt Ave. to Monterey Ave.	$115,000
MA-32	2016-2020	Potable	Major Street	8-inch diameter pipeline on Towne Ave. from 1st St. to 2nd St.	$46,000
MA-33	2016-2020	Potable	Major Street	10-inch diameter pipeline on Towne Ave. from 2nd St. to Mission Blvd.	$184,000
MA-34	2016-2020	Potable	Major Street	8-inch diameter pipeline on Towne Ave. from Mission Blvd. to 9th St.	$211,000
MA-47	2016-2020	Potable	Major Street	8-inch diameter pipeline on White Ave. from Orange Grove Ave. to Columbia Ave.	$54,000
MA-48	2016-2020	Potable	Major Street	6-inch diameter pipeline on White Ave. from Alvarado St. to Randolph St.	$52,000

CIP ID	Phase	Water System	Improvement Type	Description	Total Cost (rounded)
MA-49	2016-2020	Potable	Major Street	8-inch diameter pipeline on White Ave. from Orange Grove Ave. to Monterey Ave.	$538,000
MA-50	2016-2020	Potable	Major Street	8-inch diameter pipeline on White Ave. from 2nd St. to Grand Ave.	$588,000
MA-68	2016-2020	Potable	Major Street	10-inch diameter pipeline on Garey Ave. from S/O Penfield St. to 10 FWY	$484,000
MA-70	2016-2020	Potable	Major Street	12-inch diameter pipeline on Towne Ave. from San Bernardino Ave. to McKinley Ave.	$250,000
MP-69	2016-2020	Potable	Major Street	12-inch diameter pipeline on Towne Ave. from 10 FWY to San Bernardino Ave.	$239,000
PS-01	2016-2020	Potable	Pump Station Rehab	Repair leaking Booster 7A feedline (15 ft deep from 54" MWD OC Feeder)	$108,000
PS-18	2016-2020	Potable	Pump Station Rehab	Replacement of pumps of PS 12 (units A, B, C)	$539,000
PS-19	2016-2020	Potable	Pump Station Rehab	Replacement of pumps of PS 12H (units A, B)	$37,000
F-FF-1	2020-2025	Potable	Fire Flow	8-inch diameter pipeline on Aldama Ave., Lublin St.,& Browning Ave. from Aldama Ave. & Abbott St. to Browning Ave. & Abbott St.	$277,000
F-FF-2	2020-2025	Potable	Fire Flow	10-inch diameter pipeline 400 feet West of Towne Ave. forming a T-intersection with E Bonita Ave.	$108,000
F-FF-3	2020-2025	Potable	Fire Flow	10-inch diameter pipeline on W Pearl St. from N Park Ave. to East of Garey Ave.	$250,000
F-FF-4	2020-2025	Potable	Fire Flow	10-inch diameter pipeline on Price St. from Clark Ave. to West of N East End Ave.	$268,000
F-FF-5	2020-2025	Potable	Fire Flow	8-inch diameter pipeline on 220' S of W Monterey Ave. from N Huntington Blvd. to N White Ave.	$115,000
F-FF-6	2020-2025	Potable	Fire Flow	10-inch diameter pipeline on W Holt Ave. from New York Dr. to Erie St.	$180,000
MA-07	2021-2025	Potable	Major Street	12-inch diameter pipeline on Towne Ave. from S/O Bonita Ave. to N/O Indigo Ct.	$52,000
MA-08	2021-2025	Potable	Major Street	18-inch diameter pipeline on Towne Ave. from Harrison Ave. to Arrow Hwy	$849,000
MA-09	2021-2025	Potable	Major Street	12-inch diameter pipeline on Arrow Hwy from Towne Ave. to Mountain Ave.	$519,000
MA-10	2021-2025	Potable	Major Street	10-inch diameter pipeline on Arrow Hwy from Orange Grove Ave. to Towne Ave.	$317,000
MA-12	2021-2025	Potable	Major Street	6-inch diameter pipeline on Arrow Hwy from W/O Fair Ave. to Fulton Rd.	$250,000
MA-36	2021-2025	Potable	Major Street	8-inch diameter pipeline on Indian Hill Blvd. from American Ave. to Kingsley Ave.	$730,000
MA-37	2021-2025	Potable	Major Street	8-inch diameter pipeline on Indian Hill Blvd. from Kingsley Ave. to Holt Ave.	$216,000
MA-39	2021-2025	Potable	Major Street	10-inch diameter pipeline on Arrow Hwy from Garey Ave. to Pine Ave.	$56,000
MA-40	2021-2025	Potable	Major Street	10-inch diameter pipeline on Holt Ave. from Mills Ave. to Reservoir St.	$757,000
MA-41	2021-2025	Potable	Major Street	8-inch diameter pipeline on Holt Ave. from Reservoir St. to San Antonio Ave.	$189,000
MA-42	2021-2025	Potable	Major Street	6-inch diameter pipeline on Holt Ave. from San Antonio Ave. to Paloma Dr.	$98,000
MA-44	2021-2025	Potable	Major Street	10-inch diameter pipeline on Reservoir St. from Holt Ave. to 1st St.	$243,000
MA-45	2021-2025	Potable	Major Street	12-inch diameter pipeline on Holt Ave. from Garey Ave. to Hamilton Blvd.	$770,000
MA-46	2021-2025	Potable	Major Street	6-inch diameter pipeline on Holt Ave. from Park Ave. to White Ave.	$181,000

CIP ID	Phase	Water System	Improvement Type	Description	Total Cost (rounded)
MA-64	2021-2025	Potable	Major Street	6-inch diameter pipeline on Dudley St. from Vejar St. to Mc Comas St.	$195,000
PS-09	2021-2025	Potable	Pump Station Rehab	Replacement of pumps of PS 1 (unit A)	$270,000
PS-11	2021-2025	Potable	Pump Station Rehab	Replacement of pumps of PS 3 (unit D)	$288,000
PS-13	2021-2025	Potable	Pump Station Rehab	Replacement of pumps of PS 5 (unit B)	$240,000
PS-14	2021-2025	Potable	Pump Station Rehab	Replacement of pumps of PS 7 (unit A)	$288,000
PS-15	2021-2025	Potable	Pump Station Rehab	Replacement of pumps of PS 10 (unit B)	$255,000
S-03	2021-2025	Potable	Water Supply	Replacement and Abandonment of Well 13	$1,755,000
S-03	2021-2025	Potable	Water Supply	Well head treatment for replacement of Well 13	$1,068,000
S-04	2021-2025	Potable	Water Supply	Replacement and Abandonment of Well 4	$1,755,000
S-06	2021-2025	Potable	Water Supply	Replacement and Abandonment of Well 11	$1,755,000
S-07	2021-2025	Potable	Water Supply	Replacement and Abandonment of Well 12	$1,755,000

Section 12
Water System Financial Plan

This section presents the water system financial plan for master planning purposes. Previous sections describe the need to make additional investments in the Pomona water system. Capital projects are needed to meet the ongoing needs of the existing and growing constituency, regulatory requirements and cost efficiency objectives including asset management considerations. Because the needed projects will have substantial cost, well beyond the ability of the City to pay for on a pay-as-you-go basis, external sources of capital must be produced. This section discusses a financing plan for the capital requirement. Annual debt service and projected operation and maintenance ("O&M") costs are combined to indicate water system projected financial results of operations. Potential impacts on rate are addressed.

In summary, this section includes:

- Capital requirements;
- Financial planning;
- Customer growth;
- O&M costs;
- Projected results of operations; and
- Rate indication.

CAPITAL REQUIREMENTS

Table 12-1 indicates that capital requirement over the forthcoming twenty years will be approximately $155 million, in 2004 dollars.

Project Costs

Table 12-1 summarizes the twenty-year master plan capital requirements, showing each year for the forthcoming five years and then years 10, 15 and 20. The data are in un-escalated 2004 thousands of dollars. Thus, $160 means $160,000 of cost based on estimates of construction cost typical in late 2004. Pomona uses a July to June fiscal period, so Fiscal Year (FY) 2005-06 means the period of July 1, 2005 through June 30, 2006.

The Master Plan CIP estimates capital cost requirements in five-year increments. For financial planning purposes, **Table 12-1** assumes that the five-year capital requirements are distributed evenly over the five-year periods, with the exception of the yard upgrade that is distributed over the second through fourth years of the CIP. This is the reason that annual capital requirements for the first and fifth year are the same and the annual capital requirements for the second through fourth years are the same.

In each of the years throughout the twenty-year period, including the intervening years not shown in **Table 12-1**, the annual amount of capital varies in the range of $8 to $12 million.

Table 12-1
Water System Capital Requirements
(2004 $000s)

Serial year:	1	2	3	4	5	10	15	20
Fiscal period:	2005-06	2006-07	2007-08	2008-09	2009-10	2014-15	2019-20	2024-25
Master Plan projects								
Future benefit projects	$ 409	$ 409	$ 409	$ 409	$ 409	$ 565	$ 0	$ 240
Existing benefit projects	9,469	11,269	11,269	10,669	9,469	6,530	7,048	6,775
Subtotal, master plan projects	$ 9,878	$ 11,678	$ 11,678	$ 11,078	$ 9,878	$ 7,095	$ 7,048	$ 7,015
Capital budget CIP								
Future benefit projects	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Existing benefit projects	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Subt., cap. budget CIP projects	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000
Total capital for construction	$ 10,878	$ 12,678	$ 12,678	$ 12,078	$ 10,878	$ 8,095	$ 8,048	$ 8,015

The table distinguishes between the costs of projects that benefit existing customer and projects that benefit future customers. About 96 percent of master plan project value will be to the benefit of existing customers. **Table 12-1** also shows that in addition to projects necessitated to meet master plan capital needs, an estimated $1 million per year is contemplated for projects identified as part of the annual capital budgeting process that are in addition to projects identified in the strategic master planning process. The capital budget CIP increases the long-term capital requirement from $160 to $180 million.

Capital Cost Escalation

For long term financial planning, it is useful to indicate capital costs in future values. **Table 12-2** shows the same projects and costs as indicated in **Table 12-1** but in escalated dollars. The costs are escalated at 2.5 percent per year. This figure is consistent with recent history of change of the Los Angeles area Construction Cost Index determined and published by *Engineering News-Record*, a McGraw Hill company. In **Table 12-2**, master plan and annual capital CIP costs are combined.

Table 12-2
Escalated Water System Capital Requirements
($000s)

Serial year:	1	2	3	4	5	10	15	20
Fiscal period:	2005-06	2006-07	2007-08	2008-09	2009-10	2014-15	2019-20	2024-25
Future benefit projects	$ 430	$ 440	$ 451	$ 463	$ 474	$ 741	$ 0	$ 403
Existing benefit projects	10,999	13,212	13,543	13,202	12,141	9,880	11,947	13,059
Total capital for construction	$ 11,429	$ 13,652	$ 13,994	$ 13,665	$ 12,615	$ 10,621	$ 11,947	$ 13,462

Table 12-2 shows that the annual amount of capital needed over the twenty year forecast period increases. The total increases from $180 million to $237 million. It is noted that additional cost was not created, it was simply recognized, as cost escalation is an economic phenomenon that cannot be ignored in financial planning for future capital formation.

FINANCIAL PLANNING

The best municipal utility financial plans reflect several important principles. Various sources of capital are incorporated into the financial plan. Capital sources are reflective of the utility's historical methods of capital formation and financial policies, as well as other opportunities that may exist.

Principles

The number one principle for municipal utility capital planning is *capital sufficiency and timing*. Above all other criteria, the City's financial plan should produce the amount of money needed for construction, at the times it is needed, or else the level of service provided to the community might suffer.

A second principle is that the financial plan should promote *fairness and equity* in its method of sharing financial burdens with the constituent citizens and businesses.

A third principle is that the money used to fund construction should be produced at *minimal practicable cost*. Thus interest cost of borrowed funds, transactions costs of borrowings, and other expenditures that do not directly result is benefit improvement to the constituency should be minimized.

A fourth principle, and certainly not the least important, is that the financial plan should incorporate ways to have *flexibility to accommodate change*. Once a course for funding is set, that course will be beneficial, but other opportunities might arise in the future. The City should continue to be vigilant in its awareness of such opportunities.

A fifth principle is that the financial plan should be *tenable and conservative*. A strategic plan that takes too close a position on cost estimating or financing methods might be a plan that does not provide practical long-term working tools and guidance.

Sources of Capital

Capital for municipal utilities is generally generated two ways: using internally produced funds (equity) and using external sources (grants and debt). Internal sources include reserved funds available for paying for construction and net income from years' operations. Net income may be produced from service charge revenue exceeding costs, impact fees, fund transfers and other internal methods. Service charge revenue exceeding costs can occur if costs come in less than budgeted or if additional revenue is budgeted such as for capital outlay, depreciation, asset management, or other mechanisms.

Pomona Funding History

Pomona has a long history of using pay-as-you-go current year net revenues for funding capital improvements. Part of this history is due to large developments donating significant water system assets. Another part is that other parts of the system have been slow growing. A significant element is that the City has been adept at producing master plans and following them so that rate and fee tariffs could be set in advance (with indexed adjustments) to adequately provide the needed internally generated capital.

Recently the City has used proceeds from the sale of revenue bonds. The most recent revenue bond sale was the 1999 revenue bonds Series AC in the amount of $27.6 million. The bonds have a 30-year repayment schedule. The bonds were rated Aaa and AAA by Moody's Investors Service and Standard and Poors, respectively. These ratings, the strongest available, indicate that the City used bond insurance to enhance its credit.

The only other currently outstanding sewer revenue bonds are the Series AA bonds, also sold in 1999, in the amount of $26.4 million. These bonds have a 30-year repayment schedule, to be repaid in full in 2029. Series AA refunded an earlier issue, Series A which had been sold in 1992, and also produced new money for water system improvements.

When municipalities sell revenue bonds, they do not pledge the assets as collateral for the credit (*i.e.*, they do not use mortgage bonds as in home financing) and they do not pledge the full faith and credit of the City (*i.e.*, they do not promise to raise taxes, use other revenues or sell other assets in order to raise funds to make annual principal and interest payments). Instead they make certain promises (or "covenants") that are included in binding legal documents called indentures. Among the promises normally made, the two principal promises made to secure the bonds are the promise to maintain a special bond reserve fund and to collect sufficient revenue from the beneficiaries of the enterprise – water rate and fee payers – to pay for annual O&M costs plus debt service plus a percentage in excess of debt service called "coverage."

Pomona has promised in its bond indenture to maintain a bond reserve fund equal to one year's debt service on all outstanding parity debt. Pomona also agreed to a rate covenant to 1.15 times annual debt service. This means that Pomona promised to adjust rates sufficiently to pay, each year, the reasonable cost of O&M plus debt service plus another fifteen percent of debt service. Pomona also agreed that if it sells additional revenue bonds at parity with Series AC (meaning bonds that have the same lien on available revenues, not superior and not junior), it would meet an additional bonds test of 1.25 net revenue coverage of debt service in order to authorize the sale of additional bonds.

Pomona has used a financing partner, the Pomona Public Financing Authority ("PPFA"). PPFA is an agency jointly used by the City of Pomona, its Redevelopment Agency and another city. It enables Pomona to proceed with financings under the Marks Roos Joint Public Financing Act.

Leasing of Water Rights

Pomona has a practice of leasing a portion of its Chino Basin water rights to other Appropriative Pool pumpers. In the past six years, 26,900 acre-ft of water has been leased, generating in excess of $5 million in revenue for the water utility. About one-half of this water has been transferred from the City's Chino Basin storage account reducing the City's stored water to about 13,000 acre-ft. In FY 2004-05, Pomona leased 2,500 acre-ft of water and received about $500,000. This revenue has been used to offset water rates and fund the utility operation. As discussed in Section 5, it is recommended that the City establish a minimum storage volume of about 11,300 acre-ft to be reserved as a drought water supply.

Other External Funding Opportunities

Aside from issuing additional revenue bonds through the PPFA, other funding opportunities may exist now or in the future.

Federal Participation

Federal participation is often sought because grant and loan terms are attractive, but the era of federal participation in local water project funding through grants or low interest loans is generally over. Sometimes local water projects can be tied with regional road projects and be eligible for partial funding under USDOT TEA funding programs. Sometimes projects that involve water recycling and other government interest niche aspects can be eligible for partial funding. Funding programs are listed in the Catalog of Federal Domestic Assistance (see: http://www.gsa.gov/fdac/).

Although in any particular year a federal program may provide an attractive funding opportunity for Pomona, it is conservative for Pomona's long-term strategic plan not to rely on such methods over the long haul and none are available for the near-term.

State Participation

State of California's revolving loan program has provided loans to local agencies for assistance with construction costs. The loans are usually priced at fifty percent of state general obligation bond interest rates. Although this has been an attractive funding source, for master planning purposes it is conservative to assume that SRF monies will not be available. Then, if they become available for any given project in any year, and if the City applies for and is awarded such loans, the cost of capital will be lower.

The Local Groundwater Management Assistance Act of 2000 (California Water Code Section 10795 *et seq*.) was enacted to provide grants to local agencies to conduct groundwater studies or to carry out groundwater monitoring and management activities. A total of $5,000,000 in funding for eligible projects is anticipated for FY 2003-04, with a $250,000 funding limitation per applicant.

Proposition 50, the Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002, authorized $500 million for integrated regional water management projects and additional money for other types of project. Pomona has applied for Prop. 50 funding for several projects and will continue to optimize its change of securing State low interest funds in the future.

In March 2000, California voters approved Proposition 13, the "Safe Drinking Water, Clean Water, Watershed Protection and Flood Protection Act." The measure authorized the state to issue $1.97 billion in bonds to fund projects under the various categories. Of that total, $45 million was reserved for distribution by MWD to Southern California programs that will improve the overall reliability the water supply.

Regional

The Metropolitan Water District of Southern California (MWD) has over the years provided grant and loan monies to local agencies for development of local resources. These programs may continue in the future.

Pomona has been approved for the MWD Local Resources program grant subsidy at rate of $100/acre-feet of water produced for at least twenty years. This program may be to apply for the recycled water system expansion if the program becomes available next year.

A groundwater storage program proposal was developed and submitted to MWD by the Inland Empire Utility Agency (IEUA). The groundwater storage program would allow MWD to store water in the Chino Basin when excess water was available, typically during "wet" years. MWD's stored groundwater could then be used during "dry" years. Participants in the program, including Pomona, would be required to pump and treat the stored water from the basin and, at the same time, reduce by the same quantity the amount of imported water.

The proposal included $1.7 million in funding for the City to expand the capacity of the Anion Exchange Plant (AEP) by 1.79 mgd. Under the program, the capacity of the AEP will be expanded to provide an additional 1.79 mgd, or 2,000 acre-ft of treated water per year. This additional treatment capacity will allow the City to pump and treat local groundwater and reduce the amount, and cost, of imported water.

Debt

Debt for water utilities is normally incurred as long-term tax exempt revenue bonds, secured by covenants to pay debt service from the net revenues of the enterprise, supported by bond reserve funds, bond insurance, and in some cases a rate stabilization reserve.

Another form of long-term debt for water system improvements (but very rarely for sewer system improvements) is general obligation ("GO") bonds. GO bonds are secured by the full faith and credit of the city and are repaid either by ad valorem taxes or by enterprise net revenues (the latter called "double barrel bonds"). Rate payers like GO bonds because many deduct their share of debt service on their federal income taxes as local tax expense. For cities in California, the state constitution requires a favorable 2/3 vote of the qualified electors (not of the voters voting) to authorize the sale of the bonds so GO bonds are not as attractive.

Because short-term tax exempt variable rate bonds ("floaters") provide access to capital at lower cost, many communities include floaters in their mix of capital sources. Floaters may take the form of tax-exempt or taxable commercial paper, bond or tax anticipation notes, or other structures. For long term planning purposes, floaters are not usually included in the capital mix because as a conservative measure. If floaters were used, they would only be used if the City's cost of capital would thus be reduced.

For projects that improve just a part of the system, not the entire system, the city may choose to use an assessment form of debt such as with Mello Roos Community Facilities District bonds. For long term master planning it is not prudent to assume this form of financing, but the City may pursue it for special projects.

Plan of Finance

Considering the principles mentioned above, the plan of finance most appropriate for the long-term master plan is to use a capitalization that includes a combination of debt and equity financing.

Capitalization

Table 12-3 shows recommended capitalization for the Master Plan financial plan. The table commences with the amount of annual capital needed, the same as the bottom line of **Table 12-2**. It is assumed for long term planning purposes that 20 percent of annual capital requirement is paid from equity sources, principally net revenues of years' operations. It is further assumed for conservative long-term planning that there are no grants-in-aid available and that reserve funds will not be drawn to pay for construction. Twenty percent equity is a common number in long term planning. The reason for this is that reciprocal of eighty percent debt funding is 125 percent, thus fully funding annual capital when prior years net revenue coverage monies are used. It is noted that although a long term strategic plan might reflect 80 percent debt to total capital ratio, in any give year or series of years the tactical capital budgeting plan may use higher or lower percentages depending on forms of finance, market conditions and cash flow considerations.

Table 12-3
Capitalization of Funding Requirements
($000s)

Serial year:	1	2	3	4	5	10	15	20
Fiscal period:	2005-06	2006-07	2007-08	2008-09	2009-10	2014-15	2019-20	2024-25
Total capital for construction	$ 11,429	$ 13,652	$ 13,994	$ 13,665	$ 12,615	$ 10,621	$ 11,947	$ 13,462
Capitalization								
PAYG target, replacement capital	20.0%							
Annual PAYG replacement capital	$ 2,200	$ 2,642	$ 2,709	$ 2,640	$ 2,428	$ 1,976	$ 2,389	$ 2,612
Anticipated grants-in-aid	0	0	0	0	0	0	0	0
Utilization of reserve funds	0	0	0	0	0	0	0	0
Total, equity funding	$ 2,200	$ 2,642	$ 2,709	$ 2,640	$ 2,428	$ 1,976	$ 2,389	$ 2,612
Balance to be financed	$ 9,229	$ 11,010	$ 11,285	$ 11,025	$ 10,187	$ 8,645	$ 9,558	$ 10,850

Table 12-3 shows a fairly constant stream of annual capital requirements to be financed.

Projected Financings

Use of tax exempt bonds is subject to local, state and federal laws and regulations. One of the federal Internal Revenue rules that usually applies to municipal revenue bond financings is that there must be a reasonable expectation that 80 percent of the proceeds of the sale of bonds must be expended with three years after the sale of bonds. Because of this rule, it is assumed for master planning purposes that bonds will be sold every other year.

Table 12-4 shows the biennial financings anticipated throughout the 20 year forecast. Because the 10th and 20th years are even years, no financings are shown, but there would be financings on the 9th, 11th, and 19th years. For each of the bienniums, the amount of proceeds produced by the bond sales equals the amount of projected capital in that year and the year following. Proceeds would be net funded and reinvested (without arbitrage) so that this schedule will produce the needed cash flow for construction payments.

Table 12-4
Schedule of Biennial Financings
($000s)

Serial Year:	1	2	3	4	5	10	15	20
Fiscal Period:	2005-06	2006-07	2007-08	2008-09	2009-10	2014-15	2019-20	2024-25
Capital to be financed	$ 9,229	$ 11,010	$ 11,285	$ 11,025	$ 10,187	$ 8,645	$ 9,558	$ 10,850
Borrowings								
Borrowing frequency: biennial								
Capital produced	$ 20,239		$ 22,310		$ 18,020		$ 19,388	
Funding sources								
SRF or other	$ 0		$ 0		$ 0		$ 0	
Long term bonds	$ 20,239		$ 22,310		$ 18,020		$ 19,388	

Table 12-5 shows the assumed financing terms for the bond sales. Approximate SRF terms are also included although **Table 12-4** indicates no utilization of that capital sources.

Table 12-5
Assumed Financing Terms

SRF or other	
Maturity, years	15
Interest rate on debt	3.0%
Costs of issuance	1.0%
Production	Equal annual debt service
Long term bonds	
Maturity, years	20
Interest rate on debt	6.0%
Costs of issuance	2.0%
Production	Equal annual debt service

For bonds, 20-year repayment schedules are shown for master planning purposes. Actual bond sales may be for longer maturity periods, as was the 1999 Series AC, but for planning purposes 20 years is more conservative at little increased annual debt service requirement.

Funding of a bond reserve (or bond reserve increment) to accommodate new bonds is not included in the Assumed Financing Terms table. It is assumed that the bond reserve increment will be capitalized into the bond sale, but will be reinvested at a rate equal to the bond interest rate. Thus there would be no arbitrage earning and no reinvestment loss, and nominal attributed transaction cost.

Table 12-6 shows the computation of annual debt service according to the terms of **Table 12-5** and the proceeds required amounts according to the needs shown in **Table 12-4**.

Table 12-6
Projected Debt Service
($000s)

Serial Year:	1	2	3	4	5	10	15	20
Fiscal Period:	2005-06	2006-07	2007-08	2008-09	2009-10	2014-15	2019-20	2024-25
Loans/bonds incurrence year 2005-06		$ 1,801	$ 1,801	$ 1,801	$ 1,801	$ 1,801	$ 1,801	$ 1,801
2007-08				1,985	1,985	1,985	1,985	1,985
2009-10						1,603	1,603	1,603
2011-12						1,446	1,446	1,446
2013-14						1,519	1,519	1,519
2015-16							1,560	1,560
2017-18							1,639	1,639
2019-20								1,725
2021-22								1,815
2023-24								1,907
Total, debt service on new debt	$ 0	$ 1,801	$ 1,801	$ 3,785	$ 3,785	$ 8,354	$ 11,553	$ 17,000
Debt service on outstanding bonds								
Series AA	$ 1,699	$ 1,698	$ 1,695	$ 1,696	$ 1,700	$ 1,696	$ 1,695	$ 1,697
Series AC	1,935	1,934	1,931	1,935	1,933	1,932	1,931	1,934
Total, debt service on outstanding bonds	$ 3,634	$ 3,632	$ 3,626	$ 3,631	$ 3,633	$ 3,628	$ 3,626	$ 3,631
Total debt service	$ 3,634	$ 5,432	$ 5,426	$ 7,416	$ 7,418	$ 11,982	$ 15,179	$ 20,631

Table 12-6 also includes the projected debt service of the outstanding bonds of the 1999 Series AA and AC bond sales.

CUSTOMER GROWTH

Customer growth is important for financial planning both as a metric used to project revenues and to measure impact of financial results on unit rate payers.

Figure 12-1 shows the City population from 2000 until 2004, as estimated in City financial documents. From these data four extrapolations are shown in the figure. The gray sold line is a lineal projection. The other three are forecasts using 0 percent, 1 percent and 2 percent annual growth.

Table 12-7 shows the numbers of water customers that were part of the system since 2000. From those actual data, projections are made through the 20-year planning period. The table includes a linear projection, the same three percentage projections as above. A fifth projection shows the estimated number of customers produced for the system hydraulic modeling discussed earlier in this report. Based on these data it is assumed that the one percent per year growth is reasonable for financial planning purposes as that figure is near and just below the hydraulic projections.

The data in the third band of information are the same as in the second band but expressed as index data with the estimate for 2004-05 defined as 100.0. Thus by the year 2025 the table shows overall customer growth of about 22 percent at one percent annual growth.

Figure 12-1
Population History and Growth

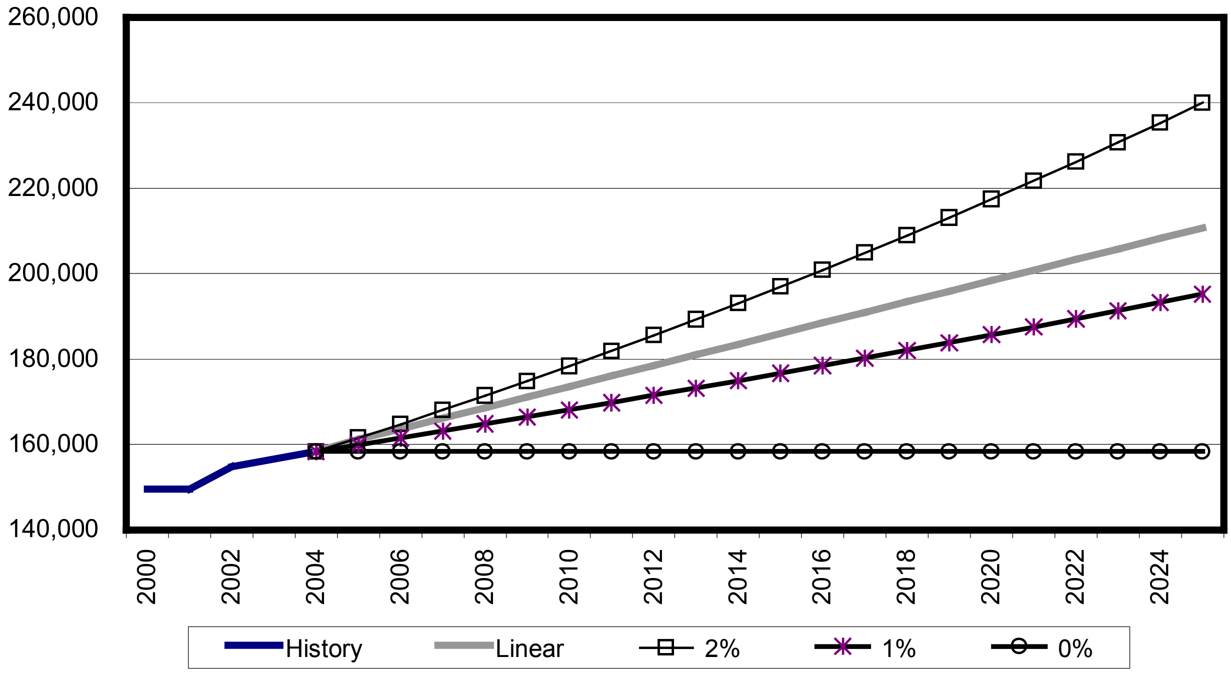


Table 12-7
Customer Growth Estimates for Financial Planning

Serial Year: Fiscal Period	2000-01	2001-02	2002-03	2003-04	2004-05	1 2005-06	2 2006-07	3 2007-08	4 2008-09	5 2009-10	10 2014-15	15 2019-20	20 2024-25
History (CYs)													
Metered	29,512	29,632	29,838										
Unmetered	441	442	451										
Total	29,953	30,074	30,289										
Projection													
Linear				30,441	30,609	30,777	30,945	31,113	31,281	31,449	32,289	33,129	33,969
2%				30,441	31,050	31,671	32,305	32,951	33,610	34,282	37,850	41,789	46,139
1%				30,441	30,746	31,053	31,364	31,677	31,994	32,314	33,962	35,695	37,516
0%				30,441	30,441	30,441	30,441	30,441	30,441	30,441	30,441	30,441	30,441
Demand based					30,084					31,762	33,276	35,184	37,112
Projection index													
Linear					100.0	100.5	101.1	101.6	102.2	102.7	105.5	108.2	111.0
2%					100.0	102.0	104.0	106.1	108.2	110.4	121.9	134.6	148.6
1%					100.0	101.0	102.0	103.0	104.1	105.1	110.5	116.1	122.0
0%					100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Demand based					100.0					105.6	110.6	117.0	123.4

COSTS OF OPERATIONS AND MAINTENANCE

Most projected revenues and O&M costs are based on Pomona's recent history.

Historical Revenues and Costs of O&M

Table 12-8 shows recent results of operations. The data shown for 199-00 through 2002-03 are from the City's *Comprehensive Annual Financial Reports* ("CAFRs"). Two columns are shown for 2003-04. The left includes straight line projections of the previous four years and the right includes data that seem reasonable for projection purposes, more influenced by the most recent two years of history.

Table 12-8
Historical Revenues and Expenses
($000s)

	1999-00	2000-01	2001-02	2002-03	2003-04	
Operating revenues	(CAFR)	(CAFR)	(CAFR)	(CAFR)	(Trend*)	(Estimated)
Charges for services	$ 16,303	$ 18,570	$ 20,084	$ 20,351	$ 22,242	$ 21,000
Miscellaneous	0	145	396	191	389	200
Subtotal, op. rev.	$ 16,303	$ 18,715	$ 20,480	$ 20,542	$ 22,631	$ 21,200
Operating expenses						
Personnel services	$ 3,705	$ 3,924	$ 3,860	$ 4,241	$ 4,319	$ 4,400
Operations	9,250	10,852	12,736	12,876	14,619	13,500
Claims expense	0	0	0	0	0	0
Depreciation	1,615	1,539	1,775	2,349	2,429	2,400
Insurance	0	0	0	0	0	0
Subtotal, op. exp.	$ 14,570	$ 16,315	$ 18,371	$ 19,466	$ 21,367	$ 20,300
Operating inc. (loss)	$ 1,733	$ 2,400	$ 2,109	$ 1,076	$ 1,264	$ 900
Non-op. rev. (exp.)						
Interest income	$ 1,301	$ 4,358	$ 1,136	$ 1,493	$ 1,411	$ 1,500
Int. exp. & fees	(2,814)	(2,692)	(3,192)	(2,304)	(2,493)	(2,500)
Sale of land and capital	0	22	0	9	9	0
Sale of surplus water	1,625	1,715	773	436	10	400
Subtotal, non-op.	112	3,403	(1,283)	(366)	(1,064)	(600)
Inc. before xfers & contrib's.	$ 1,845	$ 5,803	$ 826	$ 710	$ 201	$ 300
Operating transfers						
In	$ 0	$ 0	$ 114	$ 100	$ 157	$ 100
Out	(611)	(400)	(796)	(633)	(726)	(700)
Capital contributions	0	93	204	217	319	300
Changes in net assests	$ 1,234	$ 5,496	$ 348	$ 394	$ (49)	$ 0
Add back depreciation	1,615	1,539	1,775	2,349	2,429	2,400
Net cash receipts	$ 2,849	$ 7,035	$ 2,123	$ 2,743	$ 2,380	$ 2,400
Rounding error	$ (1)	$ (1)	$ 0	$ 0		
	$ 2,850	$ 7,036	$ 2,123	$ 2,743		

Projected Revenues and Costs of O&M

Based on the cost history shown in **Table 12-8**, forecasts through the 20 years are shown in **Table 12-9** and **Table 12-10**. **Table 12-9** shows the forecast of non-rate revenues **Table 12-10** shows the forecast of O&M.

Table 12-9
Projected Non-Rate Revenues, Contributions and Transfers
($000s)

	Change	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2014-15	2019-20	2024-25
	(per yr.)	(Base Year)									
Operating revenues											
Charges for services		(Determined subsequently)......									
Miscellaneous	0.0%	$ 200	$ 200	$ 200	$ 200	$ 200	$ 200	$ 200	$ 200	$ 200	$ 200
Non-op. rev.											
Interest income	0.0%	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500
Sale of land and capital	0.0%	0	0	0	0	0	0	0	0	0	0
Sale of surplus water	0.0%	400	400	400	200	0	0	0	0	0	0
Subtotal, non-op.		$ 1,900	$ 1,900	$ 1,900	$ 1,700	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500
Operating transfers, in	0.0%	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100
Capital contributions											
Growth rate assumed	1%										
Est'd. connections		30,441	30,746	31,053	31,364	31,677	31,994	32,314	33,962	35,695	37,516
New connections			304	307	311	314	317	320	336	353	371
Impact fee	0.0%	$	$ 3	$ 3	$ 3	$ 3	$ 3	$ 3	$ 3	$ 3	$ 3
Impact fee revenue		$ 300	$ 912	$ 921	$ 933	$ 942	$ 951	$ 960	$ 1,008	$ 1,059	$ 1,113
Total non-rate revenues		$ 2,400	$ 3,012	$ 3,021	$ 2,833	$ 2,642	$ 2,651	$ 2,660	$ 2,708	$ 2,759	$ 2,813

Table 12-10
Projected Operating and Non-Operating Expenses and Transfers
($000s)

				1	2	3	4	5	10	15	20
	Change	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2014-15	2019-20	2024-25
Operating expenses	(per yr.)	(Base Year)	(estimated)								
Personnel services	2.5%	$ 4,400	$ 4,510	$ 4,623	$ 4,738	$ 4,857	$ 4,978	$ 5,103	$ 5,773	$ 6,532	$ 7,390
Operations	3.0%	13,500	13,905	14,322	14,752	15,194	15,650	16,120	18,687	21,664	25,114
Claims expense	0.0%	0	0	0	0	0	0	0	0	0	0
Depreciation	1.0%	2,400	2,424	2,448	2,473	2,497	2,522	2,548	2,678	2,814	2,958
Insurance	0.0%	0	0	0	0	0	0	0	0	0	0
Subtotal		$ 20,300	$ 20,839	$ 21,393	$ 21,963	$ 22,548	$ 23,150	$ 23,771	$ 27,138	$ 31,010	$ 35,462
O&M of new assets		0	0	2	4	6	8	10	24	24	30
Subtotal, op. exp.		$ 20,300	$ 20,839	$ 21,395	$ 21,967	$ 22,554	$ 23,158	$ 23,781	$ 27,162	$ 31,034	$ 35,492
Non-op. expense											
Int. exp. & fees	0.0%	$ 2,500	$ 2,500	$ 2,500	$ 2,500	$ 2,500	$ 2,500	$ 2,500	$ 2,500	$ 2,500	$ 2,500
Operating transfers, Out	0.0%	$ 700	$ 700	$ 700	$ 700	$ 700	$ 700	$ 700	$ 700	$ 700	$ 700
Subtotal		$ 23,500	$ 24,039	$ 24,595	$ 25,167	$ 25,754	$ 26,358	$ 26,981	$ 30,362	$ 34,234	$ 38,692
Less depreciation		(2,400)	(2,424)	(2,448)	(2,473)	(2,497)	(2,522)	(2,548)	(2,678)	(2,814)	(2,958)
Net cash expense		$ 21,100	$ 21,615	$ 22,147	$ 22,694	$ 23,257	$ 23,836	$ 24,433	$ 27,684	$ 31,420	$ 35,734

In **Table 12-9,** projected revenues are not expected to diverge significantly, for long-term master planning purposes, from recent history.

Table 12-10 includes projection percentages for each line of data. Depreciation expense is netted because is not a cash flow activity and is not an identified revenue requirement for rate making purposes.

The table includes O&M costs of new assets, estimated at 0.5 percent of initial capital construction cost of expansion facilities. Replacement assets are assumed not to add O&M expense.

PROJECTED RESULTS OF OPERATIONS

Table 12-11 is the projected results of operations, combining revenue and expense projections addressed above and the projection of annual capital disbursements including debt service on new and outstanding bonds and pay-as-you-go equity financed capital.

The table computes additional revenue needed from water rates and fees based on two factors: revenue for operations and revenue to meet the coverage tests.

Additional revenue required to meet operations (without utilization of reserves) is computed and shown near the bottom of the table. These are the amounts that would exactly balance receipts and disbursements and project zero net cash flow.

The other factor separately computed and also shown near the bottom of the table is revenue to meet bond coverage tests. In any given year the bond covenant coverage test for the 1999 Series AA and Series AC bonds and any parity bonds is 1.15 times debt service. All the new financings are assumed to be parity bonds. Yet to authorize sale of parity bonds there is an additional bonds test in the indenture that recent production must have produced 1.25 times debt service. If the long term plan assumes a coverage-based revenue requirement equal to the stipulated values, there will be a fifty percent probability of failure. Therefore, to be conservative in revenue projections the computation shown in the table is based on a coverage target of 1.35 times debt service.

The amount of revenue from rate adjustments is based on the larger of the marginal revenue needed for operations or the marginal revenue needed for coverage. For most of the projection the revenue increases are driven by costs of operations.

At the bottom of the table, coverage computations are shown for each year, indicating a strong outlook for bond covenant compliance.

Table 12-11
Projected Results of Operations
($000s unless noted)

		Near Term Five Years					Year 10	Year 15	Year 20
		2005-06	2006-07	2007-08	2008-09	2009-10	2014-15	2019-20	2024-25
Operating revenues									
Revenue required of water rates									
Revenue at existing rates		$ 23,072	$ 23,072	$ 23,072	$ 23,072	$ 23,072	$ 23,072	$ 23,072	$ 23,072
Rev. due to prior rate adjustments		0	2,557	5,248	5,721	7,900	11,435	18,739	23,941
Rev. due to growth		231	515	858	1,169	1,580	3,610	6,730	10,352
Rev. from rate adj. this year		2,557	2,691	472	2,180	0	2,335	0	2,707
Subtotal, rate revenue		$ 25,860	$ 28,835	$ 29,651	$ 32,141	$ 32,552	$ 40,452	$ 48,541	$ 60,073
Other operating rev.		200	200	200	200	200	200	200	200
Total, operating rev.		$ 26,060	$ 29,035	$ 29,851	$ 32,341	$ 32,752	$ 40,652	$ 48,741	$ 60,273
Operating exp. (not incl. depreciation)		$ 18,947	$ 19,494	$ 20,057	$ 20,636	$ 21,233	$ 24,484	$ 28,220	$ 32,534
Net income from operations		$ 7,113	$ 9,541	$ 9,793	$ 11,705	$ 11,519	$ 16,168	$ 20,520	$ 27,739
Non-operating [rev (exp)]									
Revenue		$ 1,900	$ 1,700	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500
Expense		(2,500)	(2,500)	(2,500)	(2,500)	(2,500)	(2,500)	(2,500)	(2,500)
Total, non-op. [rev(exp)]		$ (600)	$ (800)	$ (1,000)	$ (1,000)	$ (1,000)	$ (1,000)	$ (1,000)	$ (1,000)
Op. Transfers, net [in(out)]		$ (600)	$ (600)	$ (600)	$ (600)	$ (600)	$ (600)	$ (600)	$ (600)
Capital related activity									
Pay-as-you-go capital outlay		$ 2,200	$ 2,642	$ 2,709	$ 2,640	$ 2,428	$ 1,976	$ 2,389	$ 2,612
Debt service									
Outstanding bonds		$ 3,634	$ 3,632	$ 3,626	$ 3,631	$ 3,633	$ 3,628	$ 3,626	$ 3,631
New debt		0	1,801	1,801	3,785	3,785	8,354	11,553	17,000
Subtotal, debt service		$ 3,634	$ 5,432	$ 5,426	$ 7,416	$ 7,418	$ 11,982	$ 15,179	$ 20,631
CMOM & asset management		1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Contributions		(921)	(933)	(942)	(951)	(960)	(1,008)	(1,059)	(1,113)
Total cost of capital activity		$ 5,913	$ 8,141	$ 8,193	$ 10,105	$ 9,886	$ 13,950	$ 17,509	$ 23,130
Net cash flow		$ 0	$ 0	$ 0	$ 0	$ 33	$ 618	$ 1,411	$ 3,009
Rate revenue adjustments									
To meet operations without reserves		$ 2,557	$ 2,691	$ 472	$ 2,180	$ 0	$ 1,717	$ 0	$ 0
To meet coverage target (not incl. xfers)		$ 29	$ 350	$ 0	$ 535	$ 0	$ 2,335	$ 0	$ 2,707
Net revenue debt coverage									
Rate covenant	1.15 x								
Additional bonds parity test	1.25 x								
Coverage target for operations	1.35 x								
Coverage not including transfers		2.05 x	1.78 x	1.79 x	1.57 x	1.55 x	1.35 x	1.36 x	1.35 x

LONG-TERM RATE INDICATION

Impacts on customers are measured by rate indication. Rate indication is simply the increases in revenues required of rates measured against current revenues generated by rates. This projection is summarized in **Table 12-12** and is based on a typical bi-monthly single-family water usage of 36 hundred cubic feet.

Table 12-12
Long-Term Rate Indication
($ per month)

		Near Term Five Years					Year 10	Year 15	Year 20
		2005-06	2006-07	2007-08	2008-09	2009-10	2014-15	2019-20	2024-25
Revenue from base plus rate increases		$ 25,629	$ 28,320	$ 28,793	$ 30,972	$ 30,972	$ 36,842	$ 41,811	$ 49,721
Index (base revenue = 100.0)		1.11	1.23	1.25	1.34	1.34	1.60	1.81	2.16
SFR revenue indicator/2 mo.	$ 69.58	$ 77.23	$ 85.58	$ 86.98	$ 93.24	$ 93.24	$ 111.33	$ 125.94	$ 150.29

(based on 36 ccf /2 mo, 5/8", inside)

It should be noted that **Table 12-12**is not a computation of actual rates. Actual rate projections would include consideration of reserves, impact fees, changes in user characteristics, etc. This table merely indicates how rates would generally have to increase to accommodate investment in new assets, if rates would change in direct proportion to changes in annual revenue requirements.

Appendix A - References

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Age Improvements Summary

Project ID	Phasing	6-inch	8-inch	10-inch	12-inch	14-inch	16-inch	18-inch	20-inch	Total (ft)
A-01	2020-2025		1,110							1,110
A-02	2015-2020		1,038							1,038
A-03	2020-2025				1,136		332	100		1,569
A-04	2020-2025						11			11
A-05	2015-2020		1,687							1,687
A-06	2005-2010							3,103		3,103
A-07	2020-2025				268	1,902				2,170
A-08	2020-2025				148		1,380			1,528
A-09	2020-2025				2,695					2,695
A-11	2015-2020	360								360
A-12	2010-2015						791		1,927	2,717
A-14	2010-2015						202			202
A-15	2005-2010							1,896		1,896
A-16	2020-2025		40			2,921		32		2,993
A-17	2020-2025		1,238							1,238
A-19	2020-2025		495							495
A-20	2020-2025		420							420
A-21	2020-2025				1,772	1,824				3,596
A-22	2020-2025		753							753
A-23	2020-2025	974	24							998
A-24	2020-2025	499								517
A-25	2020-2025		1,283							1,283
A-26	2020-2025	481								481
A-27	2005-2010	942								942
A-28	2015-2020			48			5,140			5,188
A-29	2020-2025	1,244	1,625							2,869
A-30	2020-2025	658								658
A-31	2020-2025	582								582
A-32	2020-2025	599								599
A-33	2020-2025	628								628
A-34	2020-2025		766							766
A-35	2020-2025		2,037							2,037
A-36	2020-2025						4,075			4,075
A-37	2020-2025	329								329
A-38	2010-2015		1,359				1,340			2,699
A-39	2020-2025		331							331
A-40	2020-2025		582							582
A-41	2020-2025		4							4
A-42	2020-2025		6							6
A-44	2020-2025			3,046						3,046
A-45	2020-2025		2,172							2,172
A-46	2020-2025	1,375								1,375
A-47	2020-2025	1,378								1,378
A-48	2010-2015		180	1,428						1,608
A-49	2010-2015			4			2,727			2,731
A-50	2020-2025			888						888
A-51	2010-2015		348	4,766						5,114
A-52	2020-2025		38							38
A-54	2020-2025		668							668
A-56	2020-2025		163							163
A-61	2020-2025	52								52
A-62	2020-2025		2,549	1,417	1,261	2,685				7,912
A-63	2010-2015		279							279
A-64	2010-2015	708								708
A-65	2020-2025				195					195
A-66	2020-2025		1,269							1,269
A-67	2020-2025		1,285							1,285
A-68	2020-2025		6,119							6,119
A-69	2020-2025						2,548			2,548
A-70	2020-2025						2,403			2,403
A-71	2020-2025		1,380							1,380
A-72	2020-2025						3,365			3,365
A-73	2020-2025		37				2,130			2,167
A-74	2020-2025	1,265								1,265
A-75	2020-2025		79	5,096						5,175
A-77	2015-2020	481								481
A-78	2020-2025						5			5
Total (ft)		**12,556**	**31,363**	**16,693**	**7,477**	**9,332**	**26,449**	**5,131**	**1,927**	**110,945**
PA-01	2005-2010		1,141							1,141
PA-02	2005-2010						6,809			6,809
PA-03	2005-2010			3,523						3,523
PA-04	2010-2015	79								79
PA-05	2010-2015	929								929
PA-06	2010-2015	2,030								2,030
PA-07	2020-2025						79			79
PA-08	2010-2015			561			112			672
PA-09	2005-2010	2,590								2,590
PA-10	2005-2010	410								410
PA-11	2015-2020	1,698								1,698
PA-12	2005-2010	990	82							1,072
PA-13	2005-2010	2,257								2,257
PA-14	2005-2010	985	89							1,074
PA-15	2010-2015		84							84
PA-16	2010-2015						24	1,662		1,686
PA-17	2010-2015		172							172
PA-20	2010-2015	1,234								1,234
PA-21	2010-2015	1,622								1,622
PA-22	2010-2015	645								645
PA-23	2010-2015	1,102	537							1,639
PA-24	2010-2015	630								630
PA-25	2010-2015	638								638
PA-26	2010-2015	1,293								1,293
PA-27	2010-2015	1,268	149							1,417
PA-28	2010-2015	507								507
PA-29	2010-2015	762								762
PA-30	2010-2015	751		1,575			78			2,403
PA-31	2010-2015	2,102								2,102
PA-32	2010-2015	500								500
PA-33	2010-2015	2,744	346							3,090
PA-34	2010-2015							3,339		3,339
PA-35	2005-2010	465								465
PA-36	2005-2010	672								672
PA-37	2005-2010	317	3,764							4,080
PA-38	2020-2025	372								372
PA-39	2005-2010	1,818	1,288							3,106
PA-40	2005-2010	670								670
PA-41	2005-2010	1,602								1,602
PA-42	2005-2010	1,091								1,091
PA-43	2005-2010	1,161								1,161
PA-44	2005-2010	1,166								1,166
PA-45	2005-2010	485	139							624
PA-46	2005-2010	1,102	44							1,145
PA-47	2005-2010	1,091								1,091
PA-48	2010-2015	166								166
PA-49	2020-2025	436								436
PA-50	2010-2015	690								690
PA-51	2010-2015	1,320								1,320
PA-52	2010-2015	606								606
PA-53	2010-2015	926								926
PA-54	2010-2015	1,220								1,220
PA-55	2010-2015	2,319	1,272							3,591
PA-56	2010-2015		584							584
PA-57	2010-2015	3,058								3,058
PA-58	2005-2010		2,268							2,268
PA-59	2005-2010	645	1,332	27						2,005
PA-60	2005-2010	2,697	3,221							5,918
PA-61	2005-2010		1,028							1,028

Fire Flow Improvements Summary

Project ID	Phasing	6-inch	8-inch	10-inch	12-inch	14-inch	16-inch	18-inch	Total (ft)
FF-01	2010-2015							2,062	2,062
FF-02	2010-2015			713					713
FF-03	2010-2015		1,486						1,486
FF-04	2010-2015		1,327						1,327
FF-05	2010-2015		1,296						1,296
FF-06	2010-2015		801						801
FF-07	2010-2015		543						543
FF-08	2010-2015	1,574							1,574
FF-09	2010-2015	439							439
FF-10	2010-2015	423							423
FF-100	2010-2015	1,346							1,346
FF-101	2010-2015	889							889
FF-102	2010-2015	1,132							1,132
FF-103	2010-2015	1,137							1,137
FF-104	2010-2015	657							657
FF-105	2010-2015	1,301							1,301
FF-106	2010-2015	1,241							1,241
FF-107	2010-2015	1,232							1,232
FF-108	2010-2015	1,984							1,984
FF-109	2010-2015	1,862							1,862
FF-11	2010-2015	844							844
FF-110	2010-2015	1,750							1,750
FF-111	2015-2020	287							287
FF-112	2015-2020	665							665
FF-113	2015-2020		94						94
FF-114	2015-2020			618					618
FF-115	2015-2020	1,275							1,275
FF-116	2015-2020	1,724							1,724
FF-118	2015-2020	2,532							2,532
FF-12	2015-2020	1,290							1,290
FF-120	2015-2020	617							617
FF-121	2015-2020	1,162	143						1,305
FF-122	2015-2020	614							614
FF-123	2015-2020	1,364							1,364
FF-124	2015-2020	2,410	223						2,632
FF-125	2015-2020	2,440	199						2,639
FF-126	2015-2020	2,165	129						2,294
FF-127	2015-2020	377							377
FF-128	2015-2020			4			2,370		2,374
FF-129	2015-2020		1,046						1,046
FF-13	2015-2020		328	110					438
FF-130	2015-2020	7	1,204						1,211
FF-131	2015-2020		941						941
FF-132	2015-2020			1,232					1,232
FF-133	2015-2020	358							358
FF-134	2015-2020	1,603		203					1,806
FF-135	2015-2020	1,988							1,988
FF-137	2015-2020	697							697
FF-138	2010-2015	1,013							1,013
FF-139	2015-2020	297							297
FF-14	2015-2020	339							339
FF-140	2015-2020	303							303
FF-141	2015-2020	729		335					1,064
FF-142	2015-2020	994	305						1,299
FF-143	2015-2020	598							598
FF-144	2015-2020			650					650
FF-145	2015-2020	296							296
FF-146	2015-2020			1,341	1,735				3,076
FF-147	2015-2020		720	69	716				1,505
FF-148	2015-2020	1,446		157					1,603
FF-149	2015-2020	2,266	78						2,343
FF-15	2015-2020		406						406
FF-150	2015-2020	1,208		72					1,280
FF-151	2015-2020	2,112							2,112
FF-152	2015-2020	1,956							1,956
FF-153	2015-2020		650						650
FF-154	2015-2020	1,419							1,419
FF-155	2015-2020	1,216							1,216
FF-156	2015-2020	695	318						1,013
FF-157	2015-2020	465	324						788
FF-158	2015-2020	241	287						528
FF-159	2015-2020		2,076						2,076
FF-16	2015-2020		296						296
FF-160	2015-2020	1,148							1,148
FF-161	2015-2020			3,098					3,098
FF-162	2015-2020	460							460
FF-163	2015-2020	693	907						1,600
FF-164	2015-2020	549							549
FF-165	2015-2020	261							261
FF-166	2015-2020	801	19						820
FF-167	2015-2020	397							397
FF-168	2015-2020	760							760
FF-169	2015-2020	341							341
FF-17	2015-2020		379						379
FF-170	2015-2020	2,032							2,032
FF-171	2015-2020	1,177							1,177
FF-172	2015-2020	289							289
FF-18	2015-2020		788						788
FF-19	2015-2020		192						192
FF-20	2015-2020	578							578
FF-21	2015-2020		290						290
FF-22	2015-2020	910							910
FF-23	2015-2020	1,871							1,871
FF-24	2015-2020	1,510							1,510
FF-25	2015-2020	429							429
FF-26	2005-2010			354					354
FF-28	2010-2015	991							991
FF-29	2010-2015		1,315						1,315
FF-30	2015-2020	815							815
FF-31	2015-2020	819							819
FF-32	2015-2020	818							818
FF-33	2015-2020		899						899
FF-34	2015-2020		1,761						1,761
FF-35	2015-2020		963						963
FF-36	2015-2020		79						79
FF-38	2015-2020	355	1,266						1,621
FF-39	2015-2020	349	1,383						1,732
FF-40	2015-2020		325						325
FF-41	2015-2020	780							780
FF-42	2015-2020	460							460
FF-44	2010-2015	665	709						1,375
FF-45	2010-2015	1,574							1,574
FF-46	2010-2015	538							538
FF-47	2010-2015	290	314						604
FF-48	2010-2015	1,676							1,676
FF-49	2010-2015	654							654
FF-50	2010-2015	576							576
FF-51	2010-2015	941							941
FF-52	2010-2015		590						590
FF-53	2010-2015	583							583
FF-54	2010-2015	1,687							1,687
FF-55	2010-2015	1,421							1,421
FF-56	2010-2015	531							531
FF-57	2010-2015	537							537
FF-58	2015-2020		1,037						1,037
FF-59	2015-2020	770	6						776
FF-60	2015-2020	769	269						1,038

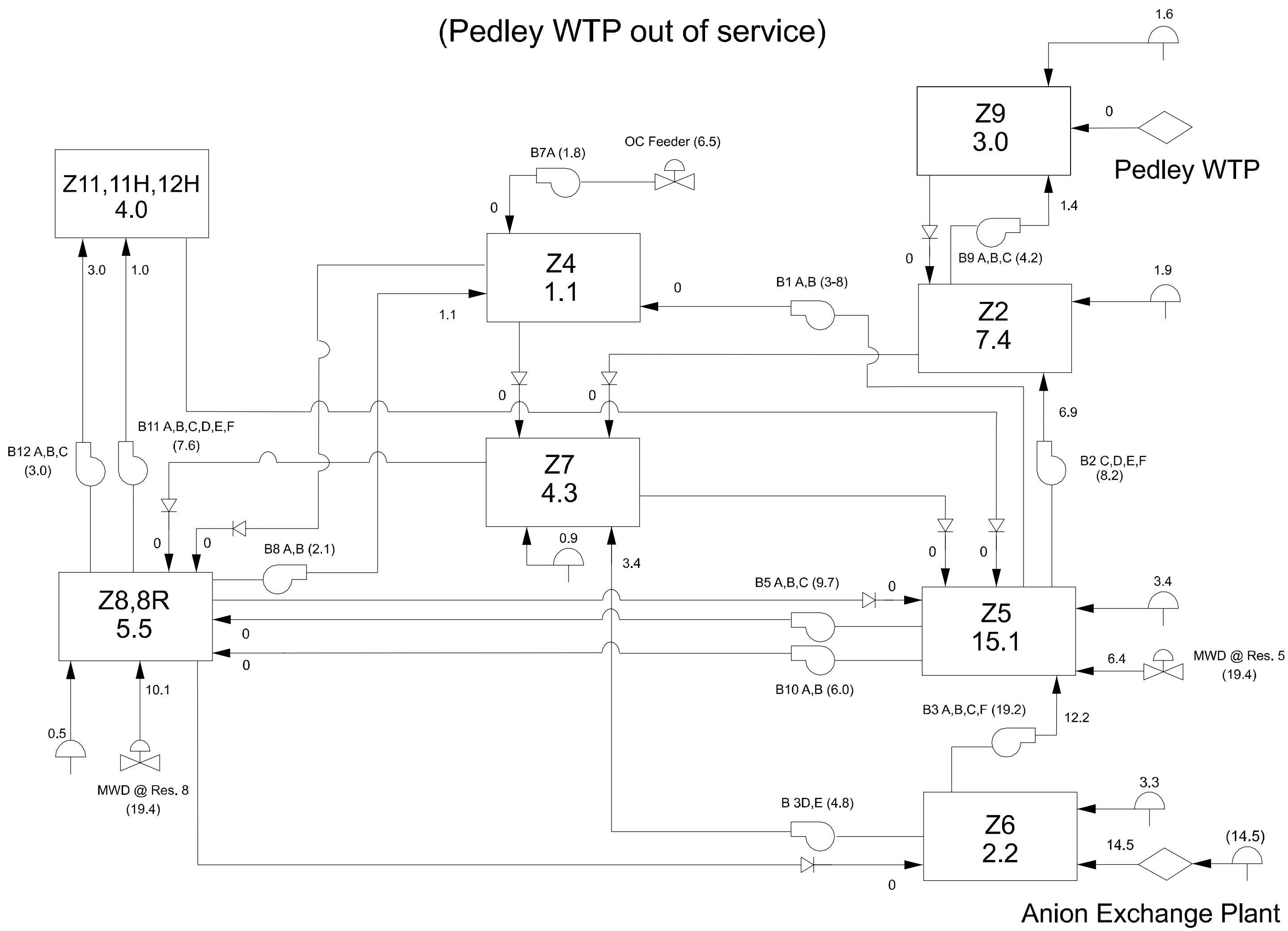
Age Improvements Summary

Project ID	Phasing	6-inch	8-inch	10-inch	12-inch	14-inch	16-inch	18-inch	20-inch	Total (ft)
PA-62	2005-2010	323	2,973							3,296
PA-63	2005-2010		1,869							1,869
PA-64	2010-2015	4,370	3,292							7,661
PA-65	2005-2010	2,602		1,284						3,886
PA-66	2005-2010	1,327								1,327
PA-67	2005-2010	632								632
PA-68	2005-2010	914	9							922
PA-69	2005-2010	829	366							1,195
PA-70	2005-2010	928	16							944
PA-71	2005-2010	1,313								1,313
PA-72	2005-2010	2,566	71							2,637
PA-73	2005-2010	3,819	47							3,865
PA-74	2005-2010	2,361								2,361
PA-75	2005-2010	1,652								1,652
PA-76	2005-2010	3,964								3,964
PA-77	2005-2010	3,881								3,881
PA-78	2005-2010	1,275								1,275
PA-79	2005-2010	1,986								1,986
PA-80	2005-2010	1,556								1,556
PA-81	2010-2015	623								623
PA-82	2010-2015		1,360	1,001						2,361
PA-83	2010-2015	1,217	68							1,285
PA-84	2010-2015	2,979	665							3,644
PA-85	2010-2015		1,056							1,056
PA-86	2010-2015		376							376
Total (ft)		**94,973**	**29,705**	**7,970**			**7,101**	**5,002**		**144,750**
MA-10	2020-2025			4,024						4,024
MA-11	2015-2020		1,131							1,131
MA-12	2020-2025	1,824								1,824
MA-14	2010-2015	140								140
MA-15	2015-2020			4,231						4,231
MA-17	2015-2020			2,362						2,362
MA-18	2015-2020							5,919		5,919
MA-19	2015-2020			644						644
MA-20	2015-2020	345								345
MA-21	2010-2015	961								961
MA-22	2005-2010	3,082								3,082
MA-25	2005-2010						1,238			1,238
MA-26	2005-2010						1,597			1,597
MA-27	2005-2010						1,928			1,928
MA-28	2015-2020						1,768			1,768
MA-29	2015-2020						1,777			1,777
MA-30	2015-2020		3,524							3,524
MA-31	2015-2020			628						628
MA-32	2015-2020		261							261
MA-33	2015-2020			1,026						1,026
MA-34	2015-2020		1,281							1,281
MA-35	2020-2025		650							650
MA-36	2020-2025		4,505							4,505
MA-37	2020-2025		1,323							1,323
MA-38	2020-2025	637								637
MA-39	2020-2025				71					71
MA-4	2005-2010			1,156						1,156
MA-40	2020-2025			4,250						4,250
MA-41	2020-2025		1,142							1,142
MA-42	2020-2025	709								709
MA-44	2020-2025			1,359						1,359
MA-45	2020-2025				3,965					3,965
MA-46	2020-2025	1,318								1,318
MA-47	2015-2020		311							311
MA-48	2015-2020	352								352
MA-49	2015-2020		3,327							3,327
MA-5	2005-2010						920			920
MA-50	2015-2020		3,634							3,634
MA-51	2020-2025	1,207								1,207
MA-52	2020-2025	1,946								1,946
MA-55	2015-2020	957								957
MA-56	2020-2025	1,080								1,080
MA-62	2020-2025	197								197
MA-63	2020-2025	638								638
MA-64	2020-2025	1,424								1,424
MA-66	2020-2025	1,372								1,372
MA-68	2015-2020			2,715						2,715
MA-69	2015-2020				1,211					1,211
MA-7	2020-2025				242					242
MA-70	2015-2020	1,273								1,273
MA-8	2020-2025						3	3,231		3,234
MA-9	2020-2025				2,665					2,665
Total (ft)		**19,460**	**21,089**	**22,395**	**8,154**		**9,230**	**9,150**		**89,479**
MP-1	2005-2010				518					518
MP-13	2005-2010				1,841					1,841
MP-2	2005-2010				487					487
MP-23	2005-2010								219	219
MP-24	2005-2010						2,794			2,794
MP-3	2005-2010						3,642			3,642
MP-5	2005-2010						3,742			3,742
MP-6	2005-2010				2,578					2,578
Total (ft)					**5,423**		**10,178**		**219**	**15,821**
P-1	2005-2010				242					242
P-2	2005-2010				404					404
P-3	2010-2015			918						918
P-4	2010-2015		546							546
P-5	2010-2015		372							372
P-6	2010-2015				1,265					1,265
P-7	2010-2015				2,693					2,693
P-8	2010-2015						779			779
P-9	2010-2015	291								291
Total (ft)		**291**	**918**	**918**	**4,605**		**779**			**7,511**
GRAND TOTAL (ft)		**127,280**	**83,075**	**47,976**	**25,659**	**9,332**	**53,737**	**19,283**	**2,146**	**368,506**

Fire Flow Improvements Summary

Project ID	Phasing	6-inch	8-inch	10-inch	12-inch	14-inch	16-inch	18-inch	Total (ft)
FF-61	2015-2020	741	258						999
FF-62	2015-2020	803							803
FF-64	2015-2020		312						312
FF-65	2015-2020		999						999
FF-66	2010-2015	1,518							1,518
FF-67	2010-2015	790							790
FF-68	2010-2015	529							529
FF-69	2010-2015		2,480						2,480
FF-70	2010-2015	796							796
FF-71	2010-2015	355							355
FF-72	2015-2020	817							817
FF-73	2015-2020	432	24						456
FF-74	2020-2025	2,073							2,073
FF-75	2015-2020			809					809
FF-76	2010-2015	507	267						775
FF-77	2010-2015	454							454
FF-78	2010-2015	1,296							1,296
FF-79	2010-2015	1,371							1,371
FF-80	2010-2015	694							694
FF-81	2010-2015	970							970
FF-82	2010-2015	949							949
FF-83	2010-2015	796							796
FF-84	2010-2015	656							656
FF-85	2010-2015	515							515
FF-86	2015-2020		123						123
FF-87	2015-2020				427				427
FF-88	2010-2015	1,320							1,320
FF-89	2010-2015				622				622
FF-90	2010-2015	673							673
FF-91	2010-2015	680							680
FF-92	2010-2015	1,470							1,470
FF-93	2010-2015	665							665
FF-94	2010-2015	880							880
FF-95	2010-2015	2,139							2,139
FF-96	2010-2015		314						314
FF-97	2010-2015	313							313
FF-98	2010-2015	809							809
FF-99	2010-2015	1,040							1,040
FF-999	2010-2015	198	63				48		309
MFF-16	2015-2020						1,467		1,467
MFF-39	2010-2015				1,368				1,368
MFF-43	2005-2010						649		649
MFF-53	2005-2010		1,312						1,312
MFF-54	2005-2010		1,149						1,149
MFF-57	2005-2010	1,201							1,201
MFF-58	2005-2010		1,648						1,648
MFF-59	2005-2010		1,128						1,128
MFF-60	2005-2010			407					407
MFF-61	2005-2010		2,490	17	1,769				4,276
MFF-65	2005-2010				780				780
MFF-67	2005-2010						2,832		2,832
MFF-71	2005-2010						3,407		3,407
Total (ft)		**120,231**	**41,273**	**10,188**	**7,418**	**0**	**10,774**	**2,062**	**191,946**

EXISTING SYSTEM SCHEMATIC
MAXIMUM DAY DEMAND CONDITIONS
Zone 2 Balance
(Pedley WTP out of service)



NOTE: ALL DEMANDS IN MGD

LEGEND

Water Treatment Plants

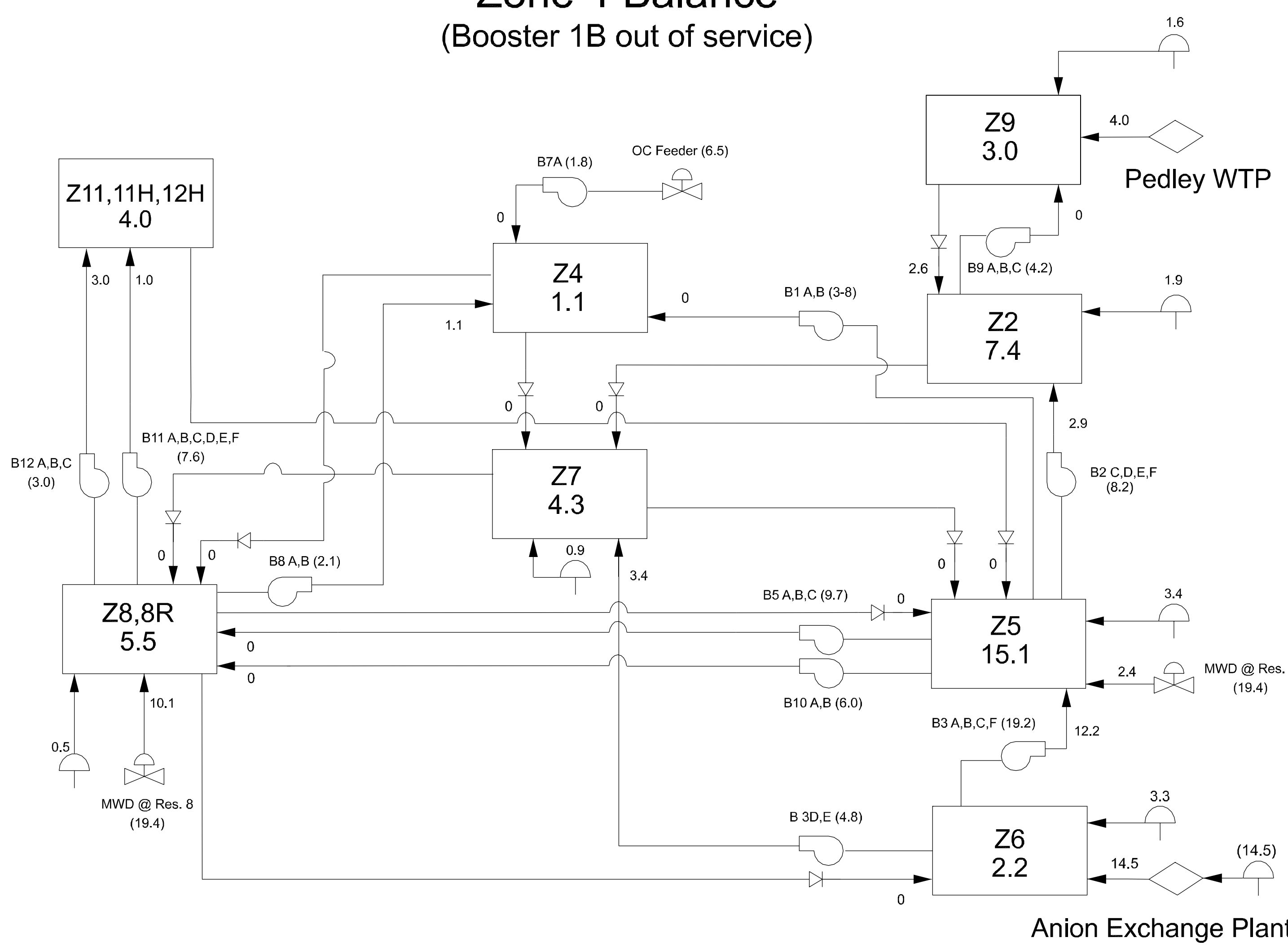
Booster Stations

PRV

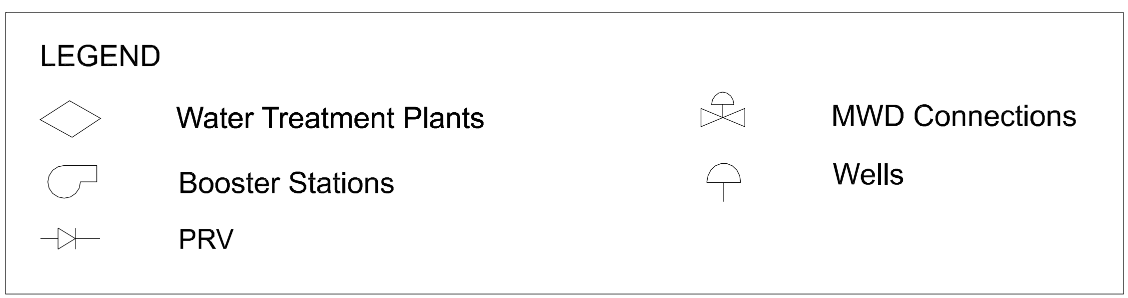
MWD Connections

Wells

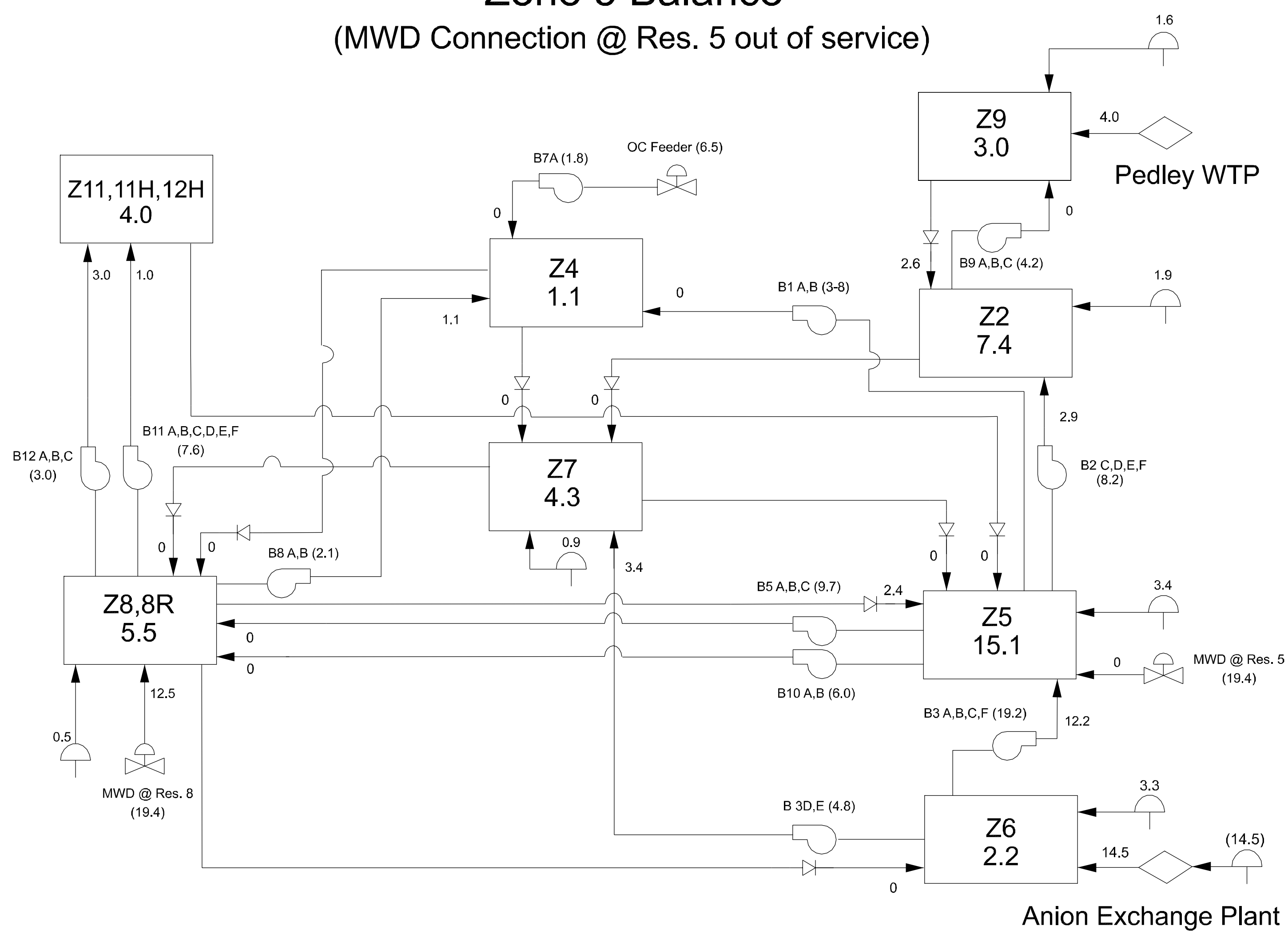
EXISTING SYSTEM SCHEMATIC
MAXIMUM DAY DEMAND CONDITIONS
Zone 4 Balance
(Booster 1B out of service)



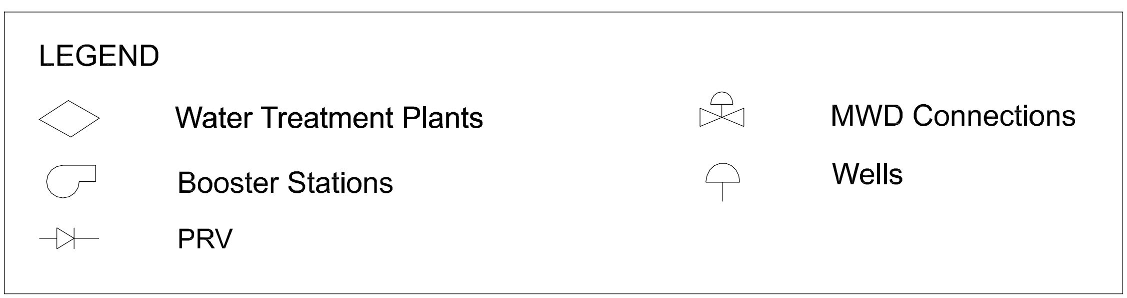
NOTE: ALL DEMANDS IN MGD



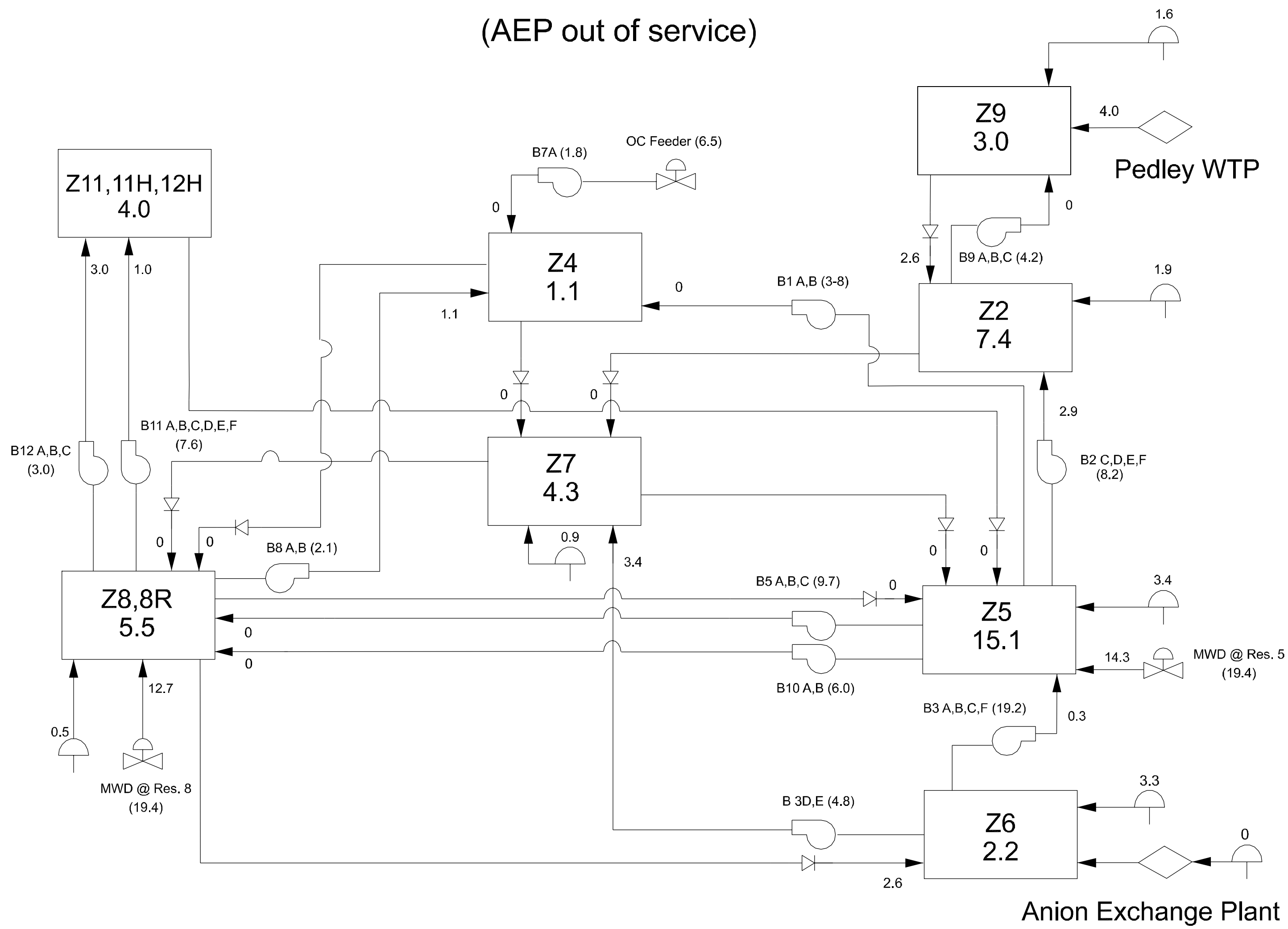
EXISTING SYSTEM SCHEMATIC
MAXIMUM DAY DEMAND CONDITIONS
Zone 5 Balance
(MWD Connection @ Res. 5 out of service)



NOTE: ALL DEMANDS IN MGD



EXISTING SYSTEM SCHEMATIC
MAXIMUM DAY DEMAND CONDITIONS
Zone 6 Balance
(AEP out of service)

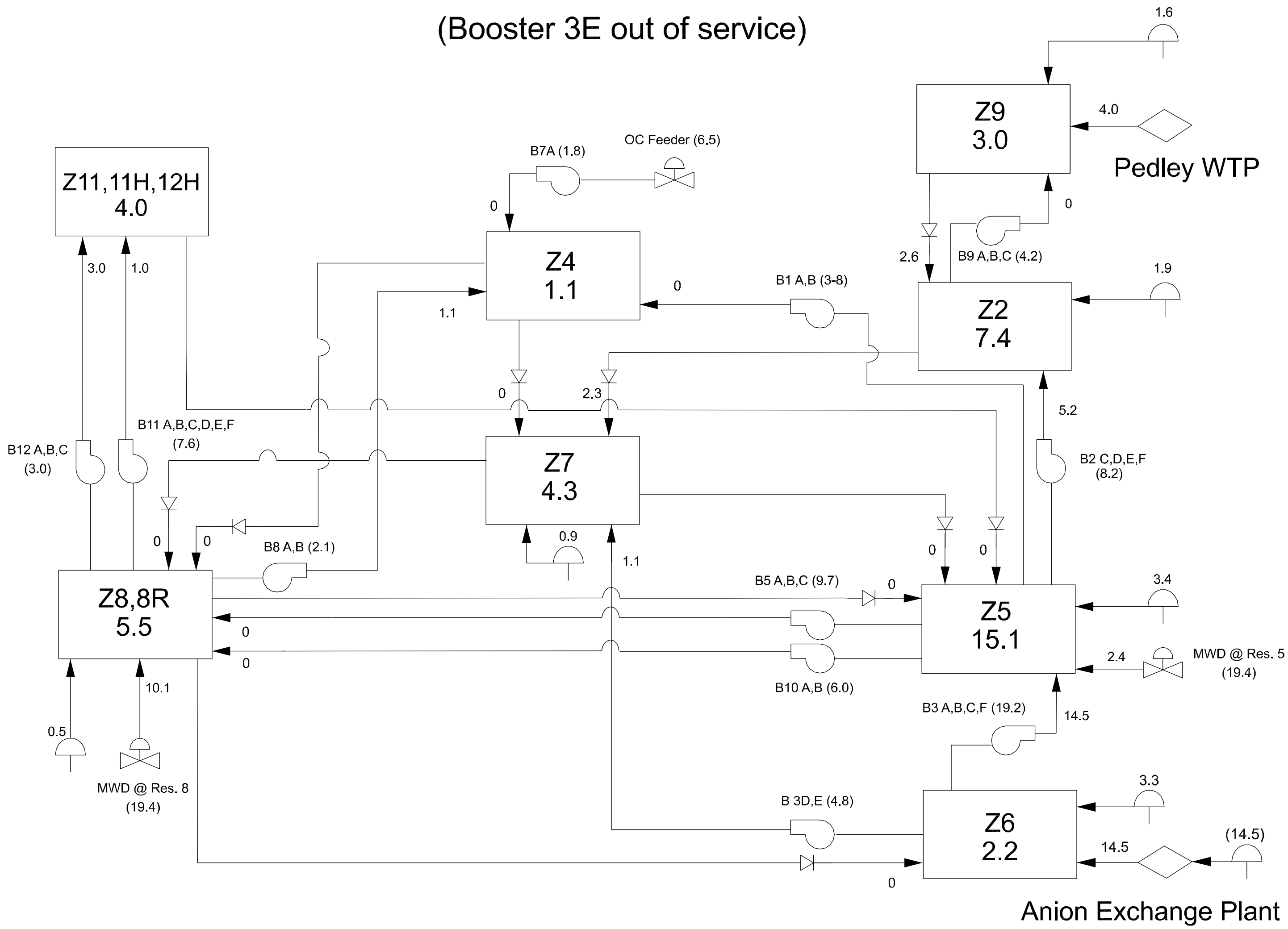


NOTE: ALL DEMANDS IN MGD

LEGEND

(diamond)	Water Treatment Plants	(valve)	MWD Connections
(pump)	Booster Stations	(well)	Wells
(PRV)	PRV		

EXISTING SYSTEM SCHEMATIC
MAXIMUM DAY DEMAND CONDITIONS
Zone 7 Balance
(Booster 3E out of service)

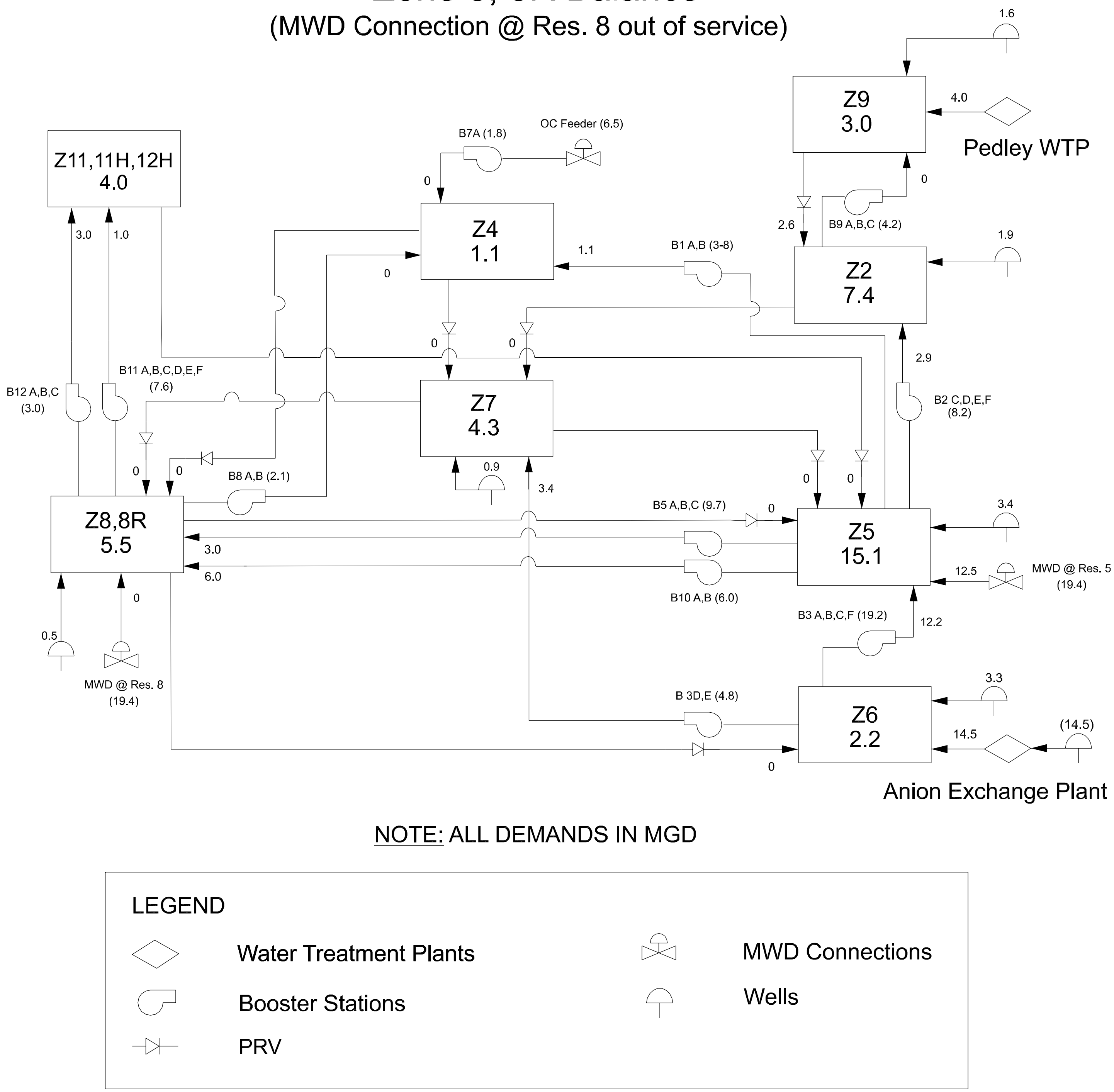


NOTE: ALL DEMANDS IN MGD

LEGEND

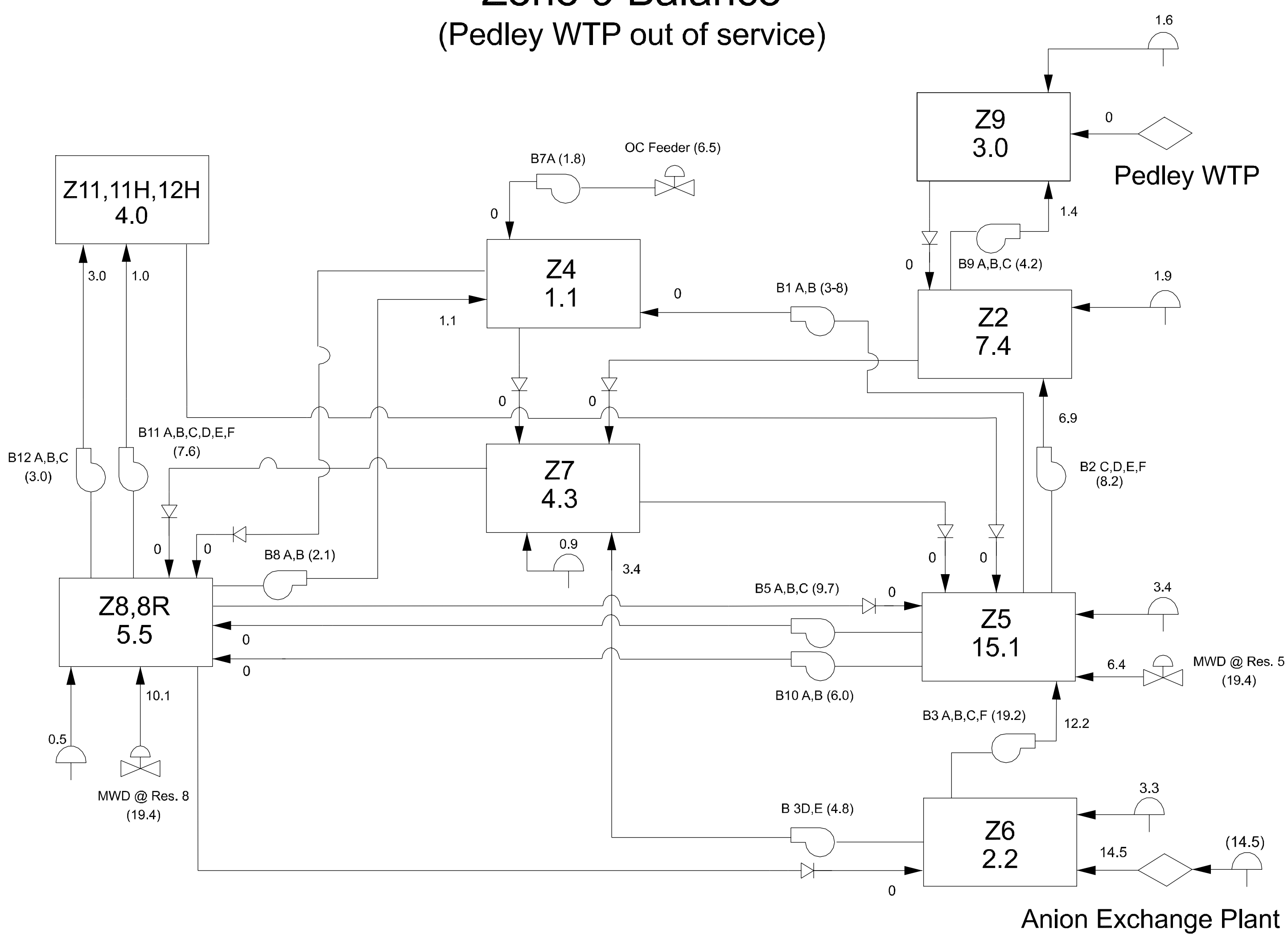
Water Treatment Plants	MWD Connections
Booster Stations	Wells
PRV	

EXISTING SYSTEM SCHEMATIC
MAXIMUM DAY DEMAND CONDITIONS
Zone 8, 8R Balance
(MWD Connection @ Res. 8 out of service)



NOTE: ALL DEMANDS IN MGD

EXISTING SYSTEM SCHEMATIC
MAXIMUM DAY DEMAND CONDITIONS
Zone 9 Balance
(Pedley WTP out of service)

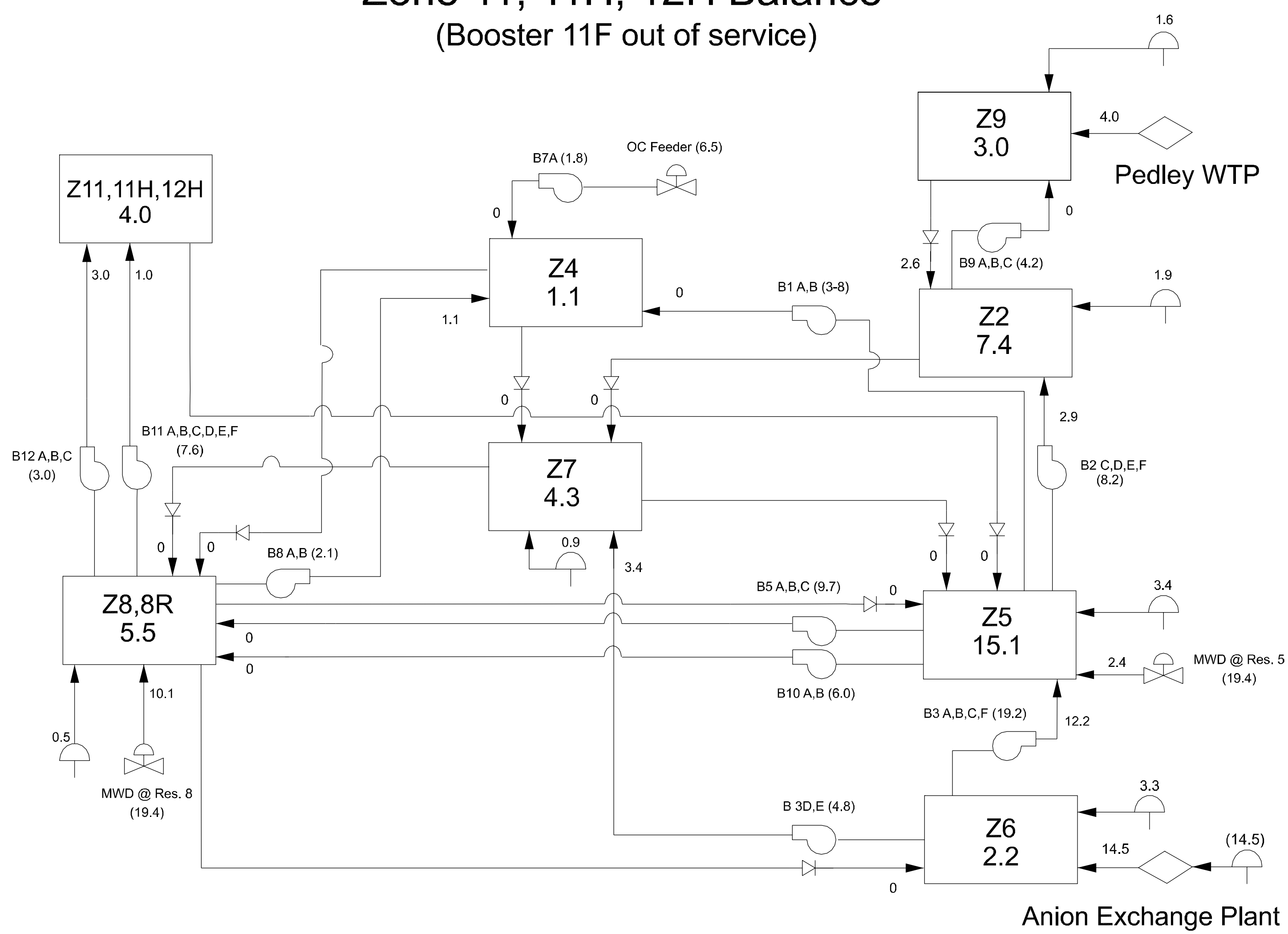


NOTE: ALL DEMANDS IN MGD

LEGEND

- Water Treatment Plants
- Booster Stations
- PRV
- MWD Connections
- Wells

EXISTING SYSTEM SCHEMATIC
MAXIMUM DAY DEMAND CONDITIONS
Zone 11, 11H, 12H Balance
(Booster 11F out of service)

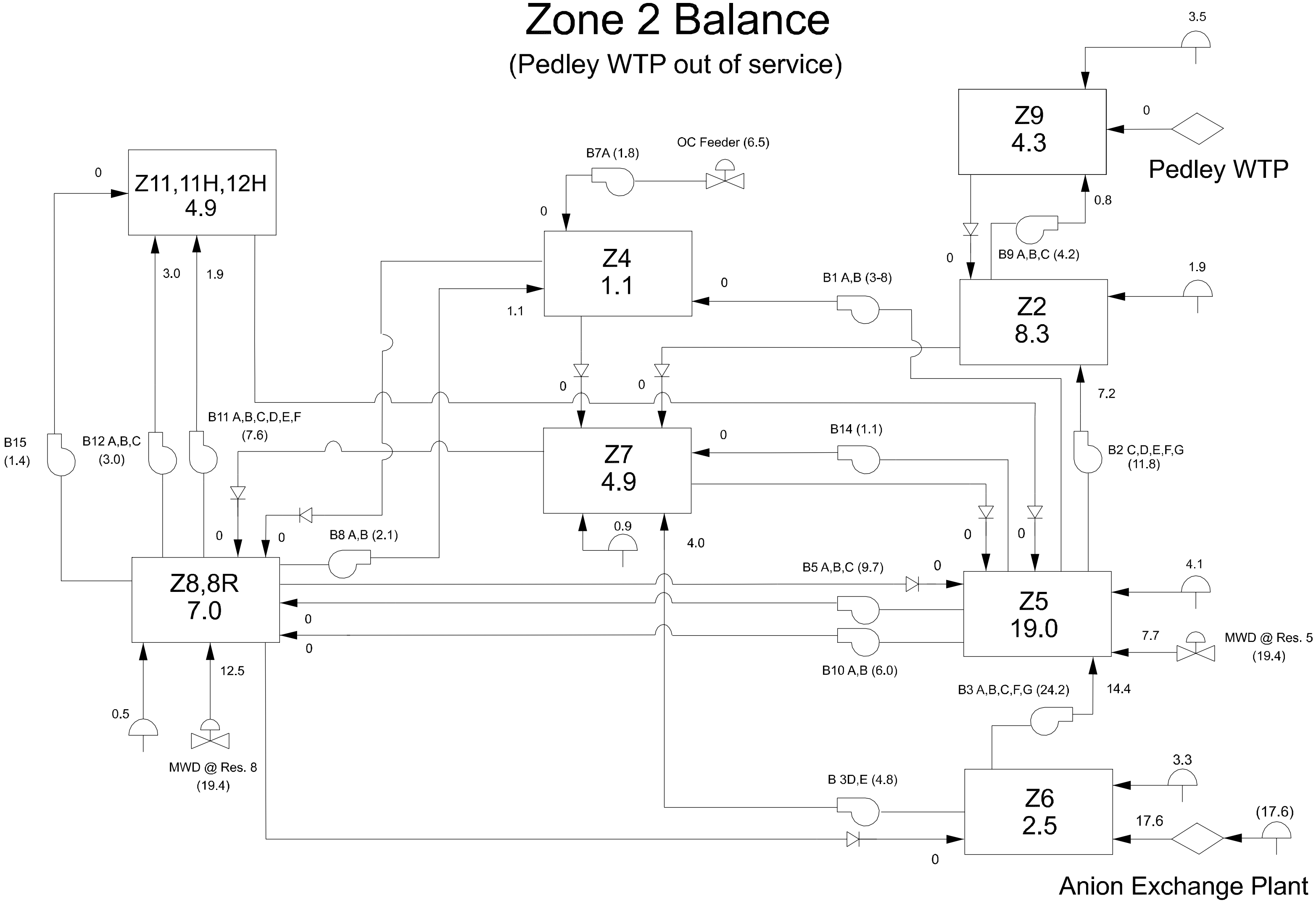


NOTE: ALL DEMANDS IN MGD

LEGEND

◇	Water Treatment Plants		MWD Connections
	Booster Stations		Wells
	PRV		

FUTURE SYSTEM SCHEMATIC
MAXIMUM DAY DEMAND CONDITIONS
Zone 2 Balance
(Pedley WTP out of service)

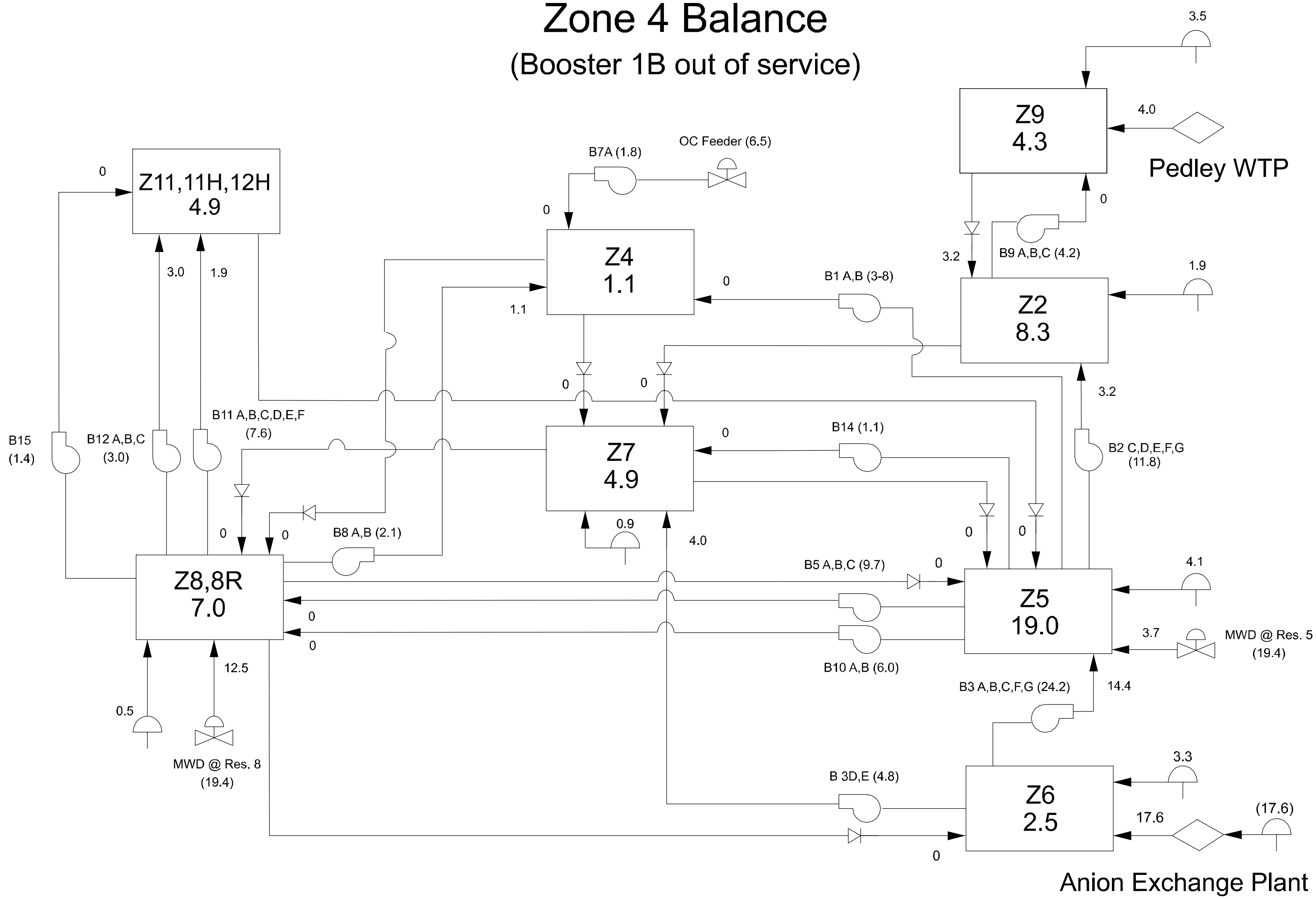


NOTE: ALL DEMANDS IN MGD

LEGEND

◇	Water Treatment Plants		MWD Connections
	Booster Stations		Wells
	PRV		

FUTURE SYSTEM SCHEMATIC
MAXIMUM DAY DEMAND CONDITIONS
Zone 4 Balance
(Booster 1B out of service)

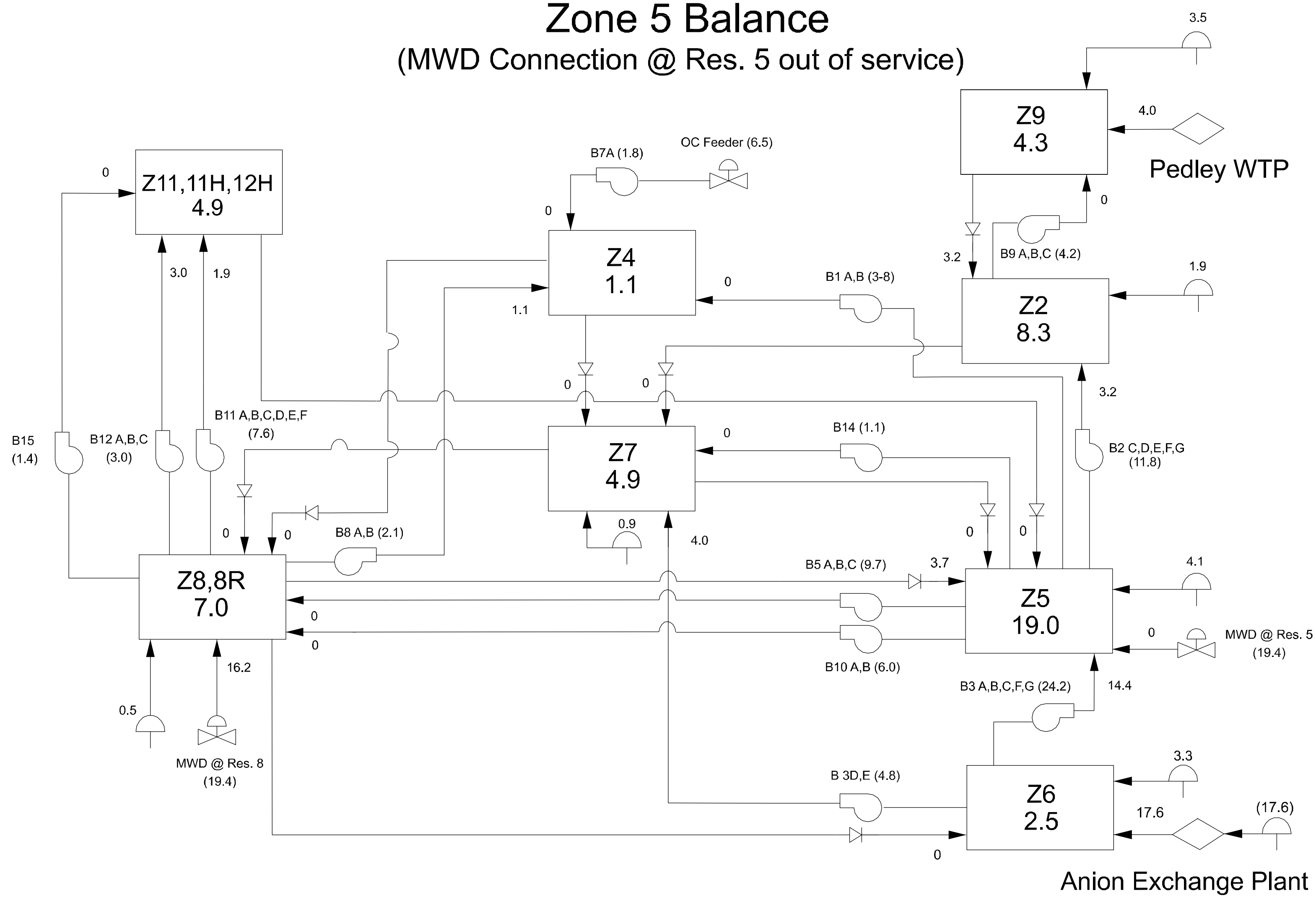


NOTE: ALL DEMANDS IN MGD

LEGEND

◇	Water Treatment Plants		MWD Connections
	Booster Stations		Wells
	PRV		

FUTURE SYSTEM SCHEMATIC
MAXIMUM DAY DEMAND CONDITIONS
Zone 5 Balance
(MWD Connection @ Res. 5 out of service)



NOTE: ALL DEMANDS IN MGD

LEGEND

Water Treatment Plants

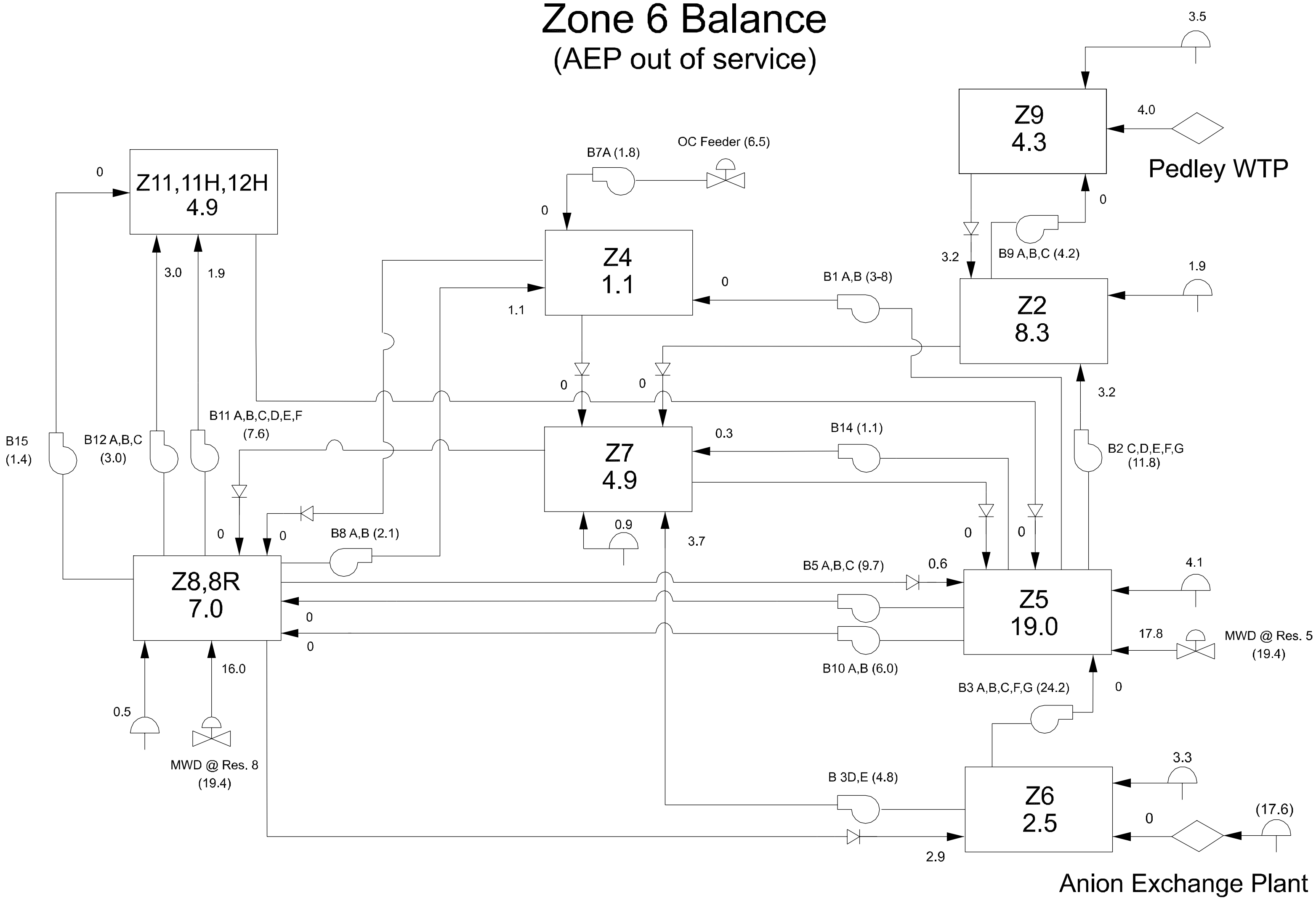
Booster Stations

PRV

MWD Connections

Wells

FUTURE SYSTEM SCHEMATIC
MAXIMUM DAY DEMAND CONDITIONS
Zone 6 Balance
(AEP out of service)

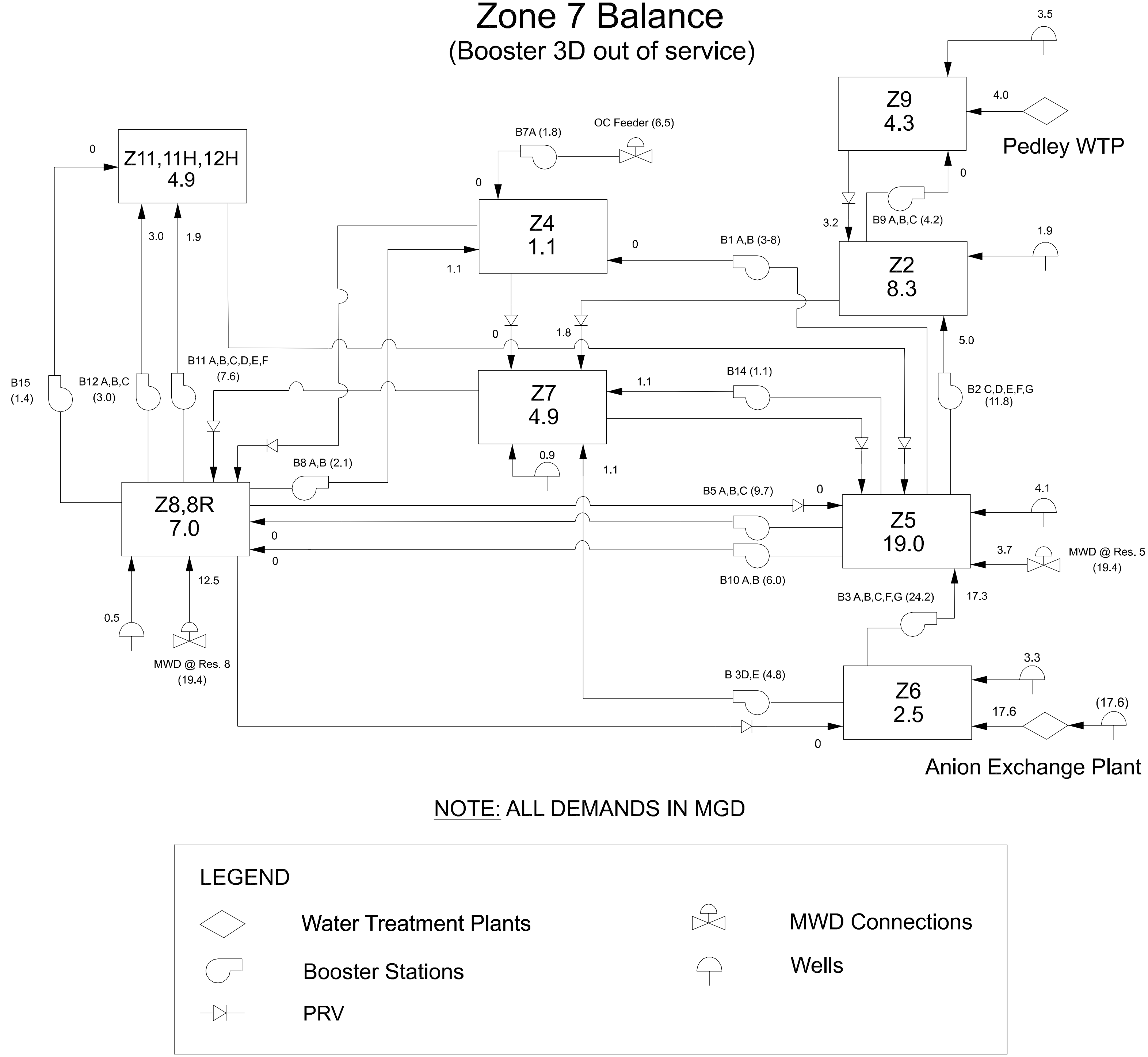


NOTE: ALL DEMANDS IN MGD

LEGEND

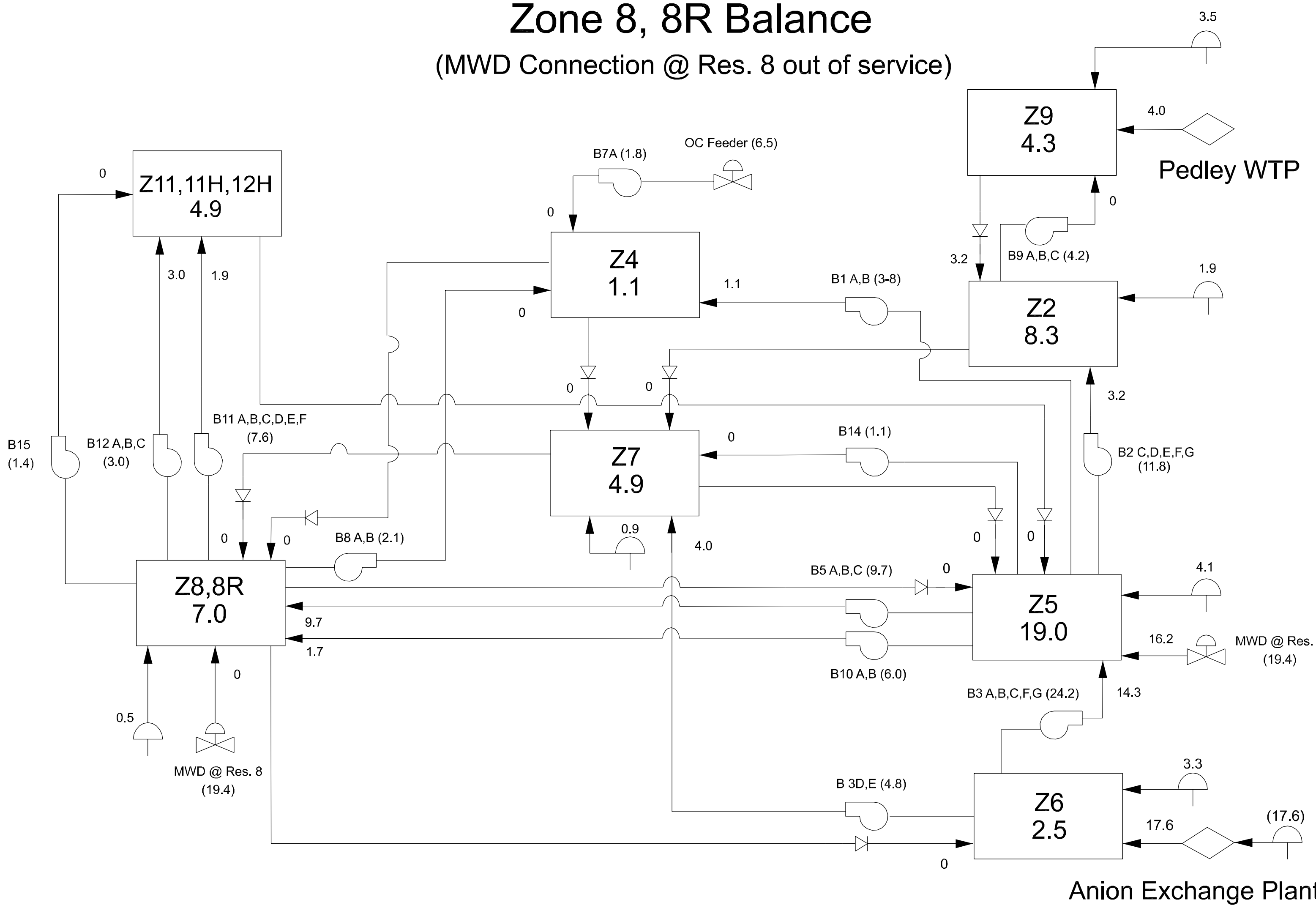
◇	Water Treatment Plants		MWD Connections
	Booster Stations		Wells
	PRV		

FUTURE SYSTEM SCHEMATIC
MAXIMUM DAY DEMAND CONDITIONS
Zone 7 Balance
(Booster 3D out of service)



NOTE: ALL DEMANDS IN MGD

FUTURE SYSTEM SCHEMATIC
MAXIMUM DAY DEMAND CONDITIONS
Zone 8, 8R Balance
(MWD Connection @ Res. 8 out of service)

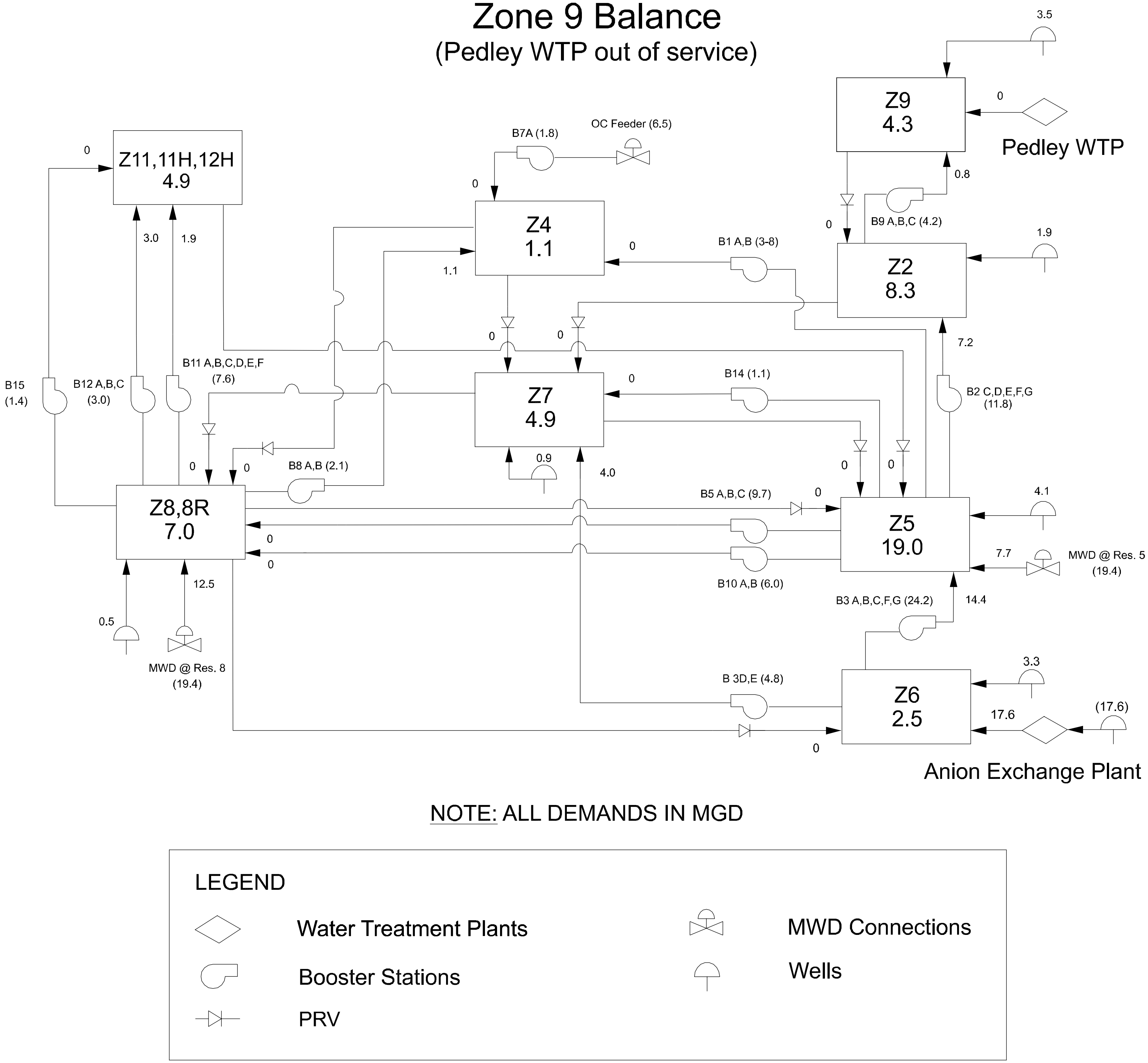


NOTE: ALL DEMANDS IN MGD

LEGEND

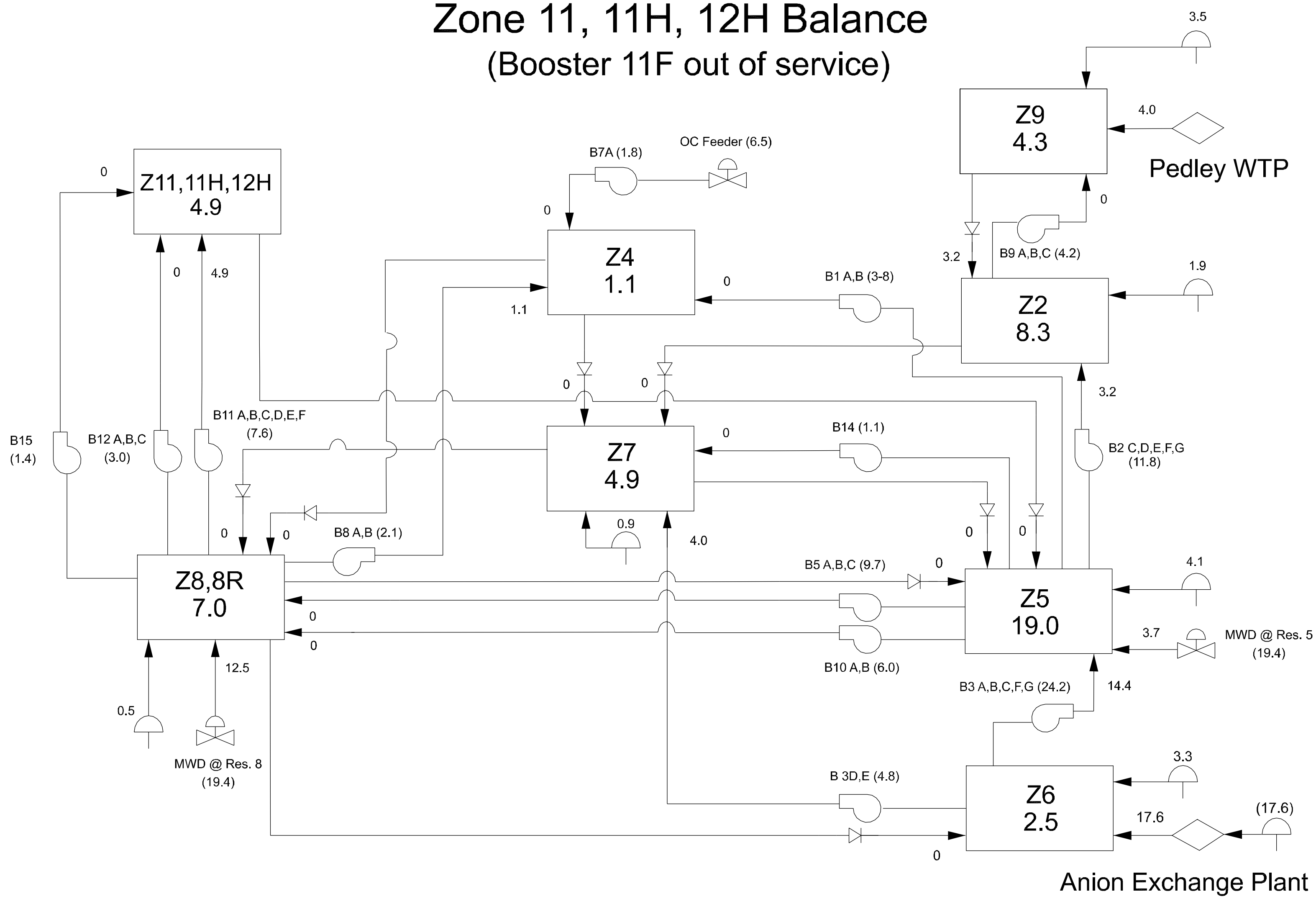
◇	Water Treatment Plants		MWD Connections
	Booster Stations		Wells
	PRV		

FUTURE SYSTEM SCHEMATIC
MAXIMUM DAY DEMAND CONDITIONS
Zone 9 Balance
(Pedley WTP out of service)



NOTE: ALL DEMANDS IN MGD

FUTURE SYSTEM SCHEMATIC
MAXIMUM DAY DEMAND CONDITIONS
Zone 11, 11H, 12H Balance
(Booster 11F out of service)



NOTE: ALL DEMANDS IN MGD