West Valley Water District

FINAL

July 2020

Water Facilities Master Plan

AKEL
ENGINEERING GROUP, INC.

West Valley Water District

WEST VALLEY WATER DISTRICT

2020

WATER FACILITIES MASTER PLAN

Final

July 2020

AKEL
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ADOPTION RESOLUTION

AKEL
ENGINEERING GROUP, INC.

RESOLUTION NO. 2020-11

RESOLUTION OF THE BOARD OF DIRECTORS
OF
WEST VALLEY WATER DISTRICT
ADOPTING THE 2020 WATER FACILITIES MASTER PLAN

WHEREAS, the Board of Directors ("Board") of West Valley Water District ("District"), located in San Bernardino County, California adopted a Water Master Plan in 2012 to (1) determine the future water demand requirements for the District and (2) identify the water facilities needed to produce, deliver, store and transport the water supply to its customers; and

WHEREAS, the Board of the District desires to adopt the 2020 Water Facilities Master Plan and 5-year Capital Improvement Program to (1) determine the future water demand requirements for the District and (2) identify the water facilities needed to produce, deliver, store and transport the water supply to its customers in such form and content presented to the Board at this Board; and

WHEREAS, the Board desires to make the necessary finding to approve the 2020 Water Facilities Master Plan and 5-year Capital Improvement Program, all as authorized and required by law;

NOW, THEREFORE, the Board of Directors of the West Valley Water District hereby finds, determines, resolves and orders as follows:

SECTION 1. Each of the above recitals is true and correct, as is each of the recitals, findings and determinations as adopted by the Board of the District.

SECTION 2. The form of the 2020 Water Facilities Master Plan and 5-year Capital Improvement Program presented at this meeting is hereby approved. The general manager of the District is hereby authorized to implement or cause the implementation of the 2020 Water Facilities Master Plan and 5-year Capital Improvement Program in accordance with the terms thereof.

ADOPTED, SIGNED AND APPROVED THIS 16th DAY OF JULY, 2020.

Channing Hawkins, President of the Board
of Directors of West Valley Water District

ATTEST:

Executive Assistant
West Valley Water District

AKEL
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Smart Planning Our Water Resources

July 16, 2020

West Valley Water District
855 W. Base Line Road
Rialto, CA 92377

Attention: Linda Jadeski
Engineering Services Manager

Subject: 2020 Water Facilities Master Plan – Final Report

Dear Linda:

We are pleased to submit this report for the West Valley Water District Water Facilities Master Plan. This master plan is a standalone document intended to plan the orderly and phased growth of the water system. The master plan documents the following:

- Existing distribution system facilities, acceptable hydraulic performance criteria, and projected water demands
- Development and calibration of the District's GIS-based hydraulic water model.
- Capacity evaluation of the existing water system with improvements to mitigate existing deficiencies and to accommodate future growth.
- Capital Improvement Program (CIP) with an opinion of probable construction costs and suggestions for cost allocations to meet AB 1600.
- Potable water supply and regulations completed by Kleinfelder, Inc.

We extend our thanks to you, and other District staff whose courtesy and cooperation were valuable components in completing this study.

Sincerely,

AKEL ENGINEERING GROUP, INC.

Tony Akel, P.E.
Principal

Enclosure: Report

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Acknowledgements

Board of Directors

Mr. Channing Hawkins, President

Mr. Kyle Crowther, Vice President

Dr. Michael Taylor

Dr. Clifford O. Young, Sr.

Mr. Greg Young

District Staff

Mr. Clarence Mansell, Jr, General Manager

Ms. Linda Jadeski, Engineering Services Manager

Ms. Joanne Chan, Operations Manager

Mr. Joe Schaack, Production Supervisor

Other District Engineering and Operations Staff

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EXECUTIVE SUMMARY

The purpose of this Water Facilities Master Plan is to determine the future water demands and supply requirements for West Valley Water District (District) and to identify the water facilities needed to produce, deliver, store and transport this supply to its customers. The facilities are based on the projected highest water usage day, when the District is fully developed.

This executive summary presents a brief background of the District's water distribution system, the planning area characteristics, the system performance and design criteria, the hydraulic model, and a capital improvement program. A hydraulic model of the District's existing water distribution system was created and used to evaluate the capacity adequacy of the existing distribution system and to recommend improvements to mitigate existing deficiencies, as well as servicing future growth.

The highlights of this Water Facilities Master Plan are listed as follows:

1. The water demand projections used for ultimate build-out of the District are based on land uses from the latest General Plan Land Use maps from the Cities of Rialto, Fontana, Colton and Counties of San Bernardino and Riverside. Actual consumption data for the various land uses were extracted from District billing information and used to project future water demands. As a result, future water demands are lower than those projected in the previous Water Master Plan.
2. The calculated water use rate per Equivalent Dwelling Unit (EDU) is 670 gallons per day (gpd). This usage reflects a decrease in consumption from the previous Water Master Plan, which utilized 750 gpd per EDU. Future demands are expected to decrease based upon water conservation programs employed by the District, by regional incentive programs, water conserving fixtures/appliances, Green Building Codes, new ordinances/laws, and general education of the public.
3. The projected development within the District will require a large investment in new infrastructure. This study analyzes this future development and identifies the facilities needed to serve it. Residential lands are currently built to 59 percent of the proposed land use capacity, while non-residential lands are developed to 75 percent of the proposed capacity. Thus, approximately 66 percent of the overall land use plan is built out.
4. Future water supplies will include additional groundwater, State Water Project (SWP) water and purchased groundwater. This will require the District to drill additional wells, expand treatment capabilities at the Oliver P. Roemer Water Filtration Facility (WFF), install wellhead treatment, and enter into additional agreements for purchased groundwater supplies.

5. To meet the ultimate peak day water demands, the District will have to expand treatment capabilities at the Oliver P. Roemer Water Filtration Facility (WFF) to maximize the use of State Water Project (SWP) water, drill new wells in the Bunker Hill groundwater basin and construct the reservoirs and pump stations needed to support these wells. The following 5-year Capital Improvement Projects are recommended:
    - Construct the expansion of the Oliver P. Roemer Water Filtration Facility.
    - Drilling four new wells in the Bunker Hill Basin.
    - Install wellhead treatment or create blending plans for existing wells.
    - Construct Reservoir R8-3.
    - Construct Booster Pump Station 4-3, 7-2 and a new Bunker Hill pump station.
    - Construct new transmission pipelines and replace aging pipelines.
    - Acquire property for needed facilities.

ES.1 STUDY OBJECTIVES

The District recognizes the importance of planning, developing, and financing the District's water system infrastructure. As such, District staff initiated an update to the Water Facilities Master Plan, most recently completed in 2012. This master plan included the following tasks:

- Summarizing the District's existing domestic water system facilities
- Documenting growth planning assumptions and known future developments
- Updating the domestic water system performance criteria
- Projecting future domestic water demands
- Creating and calibrating a new hydraulic model using Geographic Information Systems (GIS) data
- Evaluating the domestic water facilities to meet existing and projected demand requirements and fire flows
- Evaluating the existing groundwater conditions
- Performing a capacity analysis for major distribution mains
- Performing a fire flow analysis
- Recommending a capital improvement program (CIP) with an opinion of probable costs for 5-year and buildout growth
- Performing a capacity allocation analysis for cost sharing purposes

ES.2 STUDY AREA

The District provides domestic water service to customers throughout southwestern San Bernardino County and a small portion of northern Riverside County, as part of the greater San Bernardino-Riverside-Ontario metropolitan area. The service area, approximately 50 miles east of downtown Los Angeles, is generally bounded by U.S. Forest Service land to the north and Riverside County to the south, with the cities of San Bernardino and Colton serving as the eastern boundaries and the City of Fontana as the western boundary (**Figure ES.1**). The District Sphere of Influence encompass 18,076 acres, serving over 80,000 residents.

ES.3 SYSTEM PERFORMANCE AND DESIGN CRITERIA

This report documents the District's performance and design criteria that were used for evaluating the domestic water system. The system performance and design criteria are used to establish guidelines for determining future water demands, evaluating existing domestic water facilities, and for sizing future facilities. Chapter 3 discusses the system performance and design criteria for the domestic water system.

ES.4 EXISTING WATER SYSTEM OVERVIEW

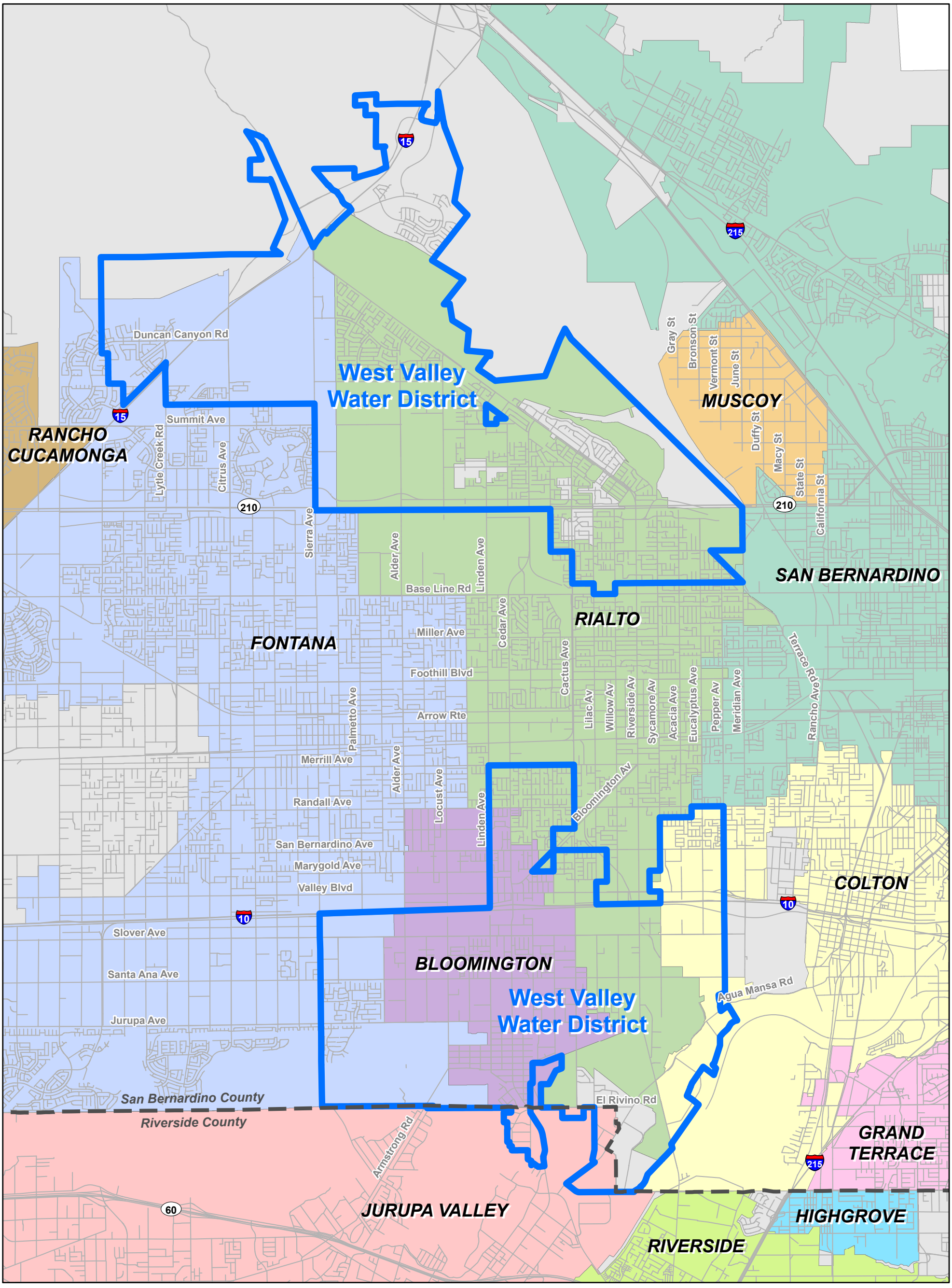
The District utilizes multiple sources of drinking water supply to serve its existing customers. The water distribution system is generally divided into two sections, commonly referred to as the North System and the South System. The existing water distribution is shown graphically on **Figure ES.2**, with a general color coding for the distribution mains as well as labeling the existing booster stations, valve stations, storage reservoirs, and supply facilities. Booster stations and valve stations are used to convey water between the District's multiple pressure zones, with storage tanks providing additional water supply for operational and emergency purposes.

ES.5 EXISTING AND FUTURE DOMESTIC WATER DEMANDS

The existing water demands used for this master plan were based on the District's water billing consumption records and adjusted to match the annual production records and account for system loss. Additionally, future demands were developed based on known development expected to occur within the next five years as well as the expected buildout development identified by the counties of San Bernardino and Riverside.

ES.6 WATER SUPPLY PLANNING

In order to meet the existing domestic water demands the District utilizes several sources of supply, including groundwater and treated surface water. The District's existing wells extract groundwater from one of the following groundwater basins: Lytle Creek Basin, Bunker Hill Basin, Rialto-Colton Basin, Chino Basin, and Riverside-Arlington Basin. The District also treats the following two sources of surface water at the Oliver P. Roemer Water Filtration Facility (Roemer Water Filtration Facility): Lytle Creek and State Water Project.



Legend

- WVWD Service Area
- **City Boundaries**
  - Bloomington
  - Colton
  - Fontana
  - Grand Terrace
  - Highgrove
  - Jurupa Valley
  - Muscoy
  - Rancho Cucamonga
  - Rialto
  - Riverside
  - San Bernardino
  - Unincorporated Area
- County Boundaries
- Street Centerlines

N
W GIS E
S

0 0.25 0.5 1 Mile

Updated: September 29, 2017

AKEL ENGINEERING GROUP, INC.

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ES.1
WVWD Service Area and Surrounding Cities

Water Facilities Master Plan
West Valley Water District

West Valley Water District

ES.2
Existing Water Distribution System

Water Facilities Master Plan
West Valley Water District

Legend

Existing System

- WTP
- Tanks
- Inactive Tanks
- Active Wells
- Inactive Wells
- Pumps
- Valves

Pipes by Diameter

- 8" and Smaller
- 10" - 12"
- 16" - 20"
- 24" - 48"
- Street Centerlines

Updated: March 13, 2019

0 0.25 0.5 1 Mile

N W E S

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West Valley Water District

In order to meet the growing demand requirements of the District service area and provide additional water supply reliability, the existing water supply capacity will require expansion; this expansion is planned to include the rehabilitation of existing groundwater wells, the construction of new groundwater wells, and the expansion of the Roemer Water Filtration Facility.

ES.7 HYDRAULIC MODEL DEVELOPMENT

Hydraulic network analysis has become an effective and powerful tool in many aspects of water distribution planning, design, operation, management, emergency response planning, system reliability analysis, fire flow analysis, and water quality evaluations. As a part of this master plan a new hydraulic model was developed for the District's water distribution system, combining information on the physical characteristics of the water system (pipelines, groundwater wells, valves, booster stations, and storage reservoirs) and operational characteristics (how they operate). The hydraulic model development process included a thorough verification and calibration process with District staff to ensure the water model was consistent with the existing water distribution system and provided results consistent with real-world conditions.

ES.8 EXISTING SYSTEM EVALUATION

The District's master plan included a hydraulic evaluation of the District's existing water distribution system. This hydraulic evaluation included analyzing the system-wide pressures under various demand conditions comparing the existing storage capacity, booster station capacity, and supply capacity to the required amounts based on the master plan performance criteria. The District's existing system is generally able to meet the system performance criteria under existing conditions. Improvements will be recommended to mitigate the deficiencies identified as part of the evaluation.

ES.9 CAPITAL IMPROVEMENT PROGRAM

The Capital Improvement Program includes improvements consistent with ongoing projects planned by the District as well as improvements recommended for mitigating existing system deficiencies and servicing future growth. **Figure ES.3** through **Figure ES.6** document the recommended improvements. For budgeting purposes, the District included a 5-year improvement prioritization plan, and which is summarized in **Table ES.1**. A more detailed cost summary for the 5-year plan, as well as the buildout improvements, are documented in Chapter 8. As shown on **Table ES.1**, the total cost over the 5-year horizon is approximately 159.1 million dollars.

ES.4

ES.5

ES.6

Duncan Canyon Rd
Summit Ave
Lytle Creek Rd
Citrus Ave
Sierra Ave
Alder Ave
Linden Ave
Base Line Rd
Miller Ave
Cedar Ave
Foothill Blvd
Cactus Ave
Lilac Av
Willow Av
Riverside Av
Sycamore Av
Acacia Ave
Eucalyptus Ave
Meridian Ave
Pepper Av
Terrace Rd
Rancho Ave
Gray St
Bronson St
Vermont St
June St
Duffy St
Macy St
State St
California St
Arrow Rte
Merrill Ave
Palmetto Ave
Alder Ave
Locust Ave
Linden Ave
Bloomington Av
Randall Ave
San Bernardino Ave
Marygold Ave
Valley Blvd
Slover Ave
Santa Ana Ave
Jurupa Ave
8th St
Agua Mansa Rd
El Rivino Rd
Armstrong Rd
Wilson St
15
10
210
215

Legend

System Improvements
- Tanks
- Wells
- Pumps
- Valves
- Pipes

Existing System
- WTP
- Tanks
- Wells
- Pumps
- Valves
- Pipes

- Inactive Tanks
- Abandoned Pipes
- Street Centerlines

Updated: March 18, 2019

0 0.25 0.5 1 Mile

N W GIS E S

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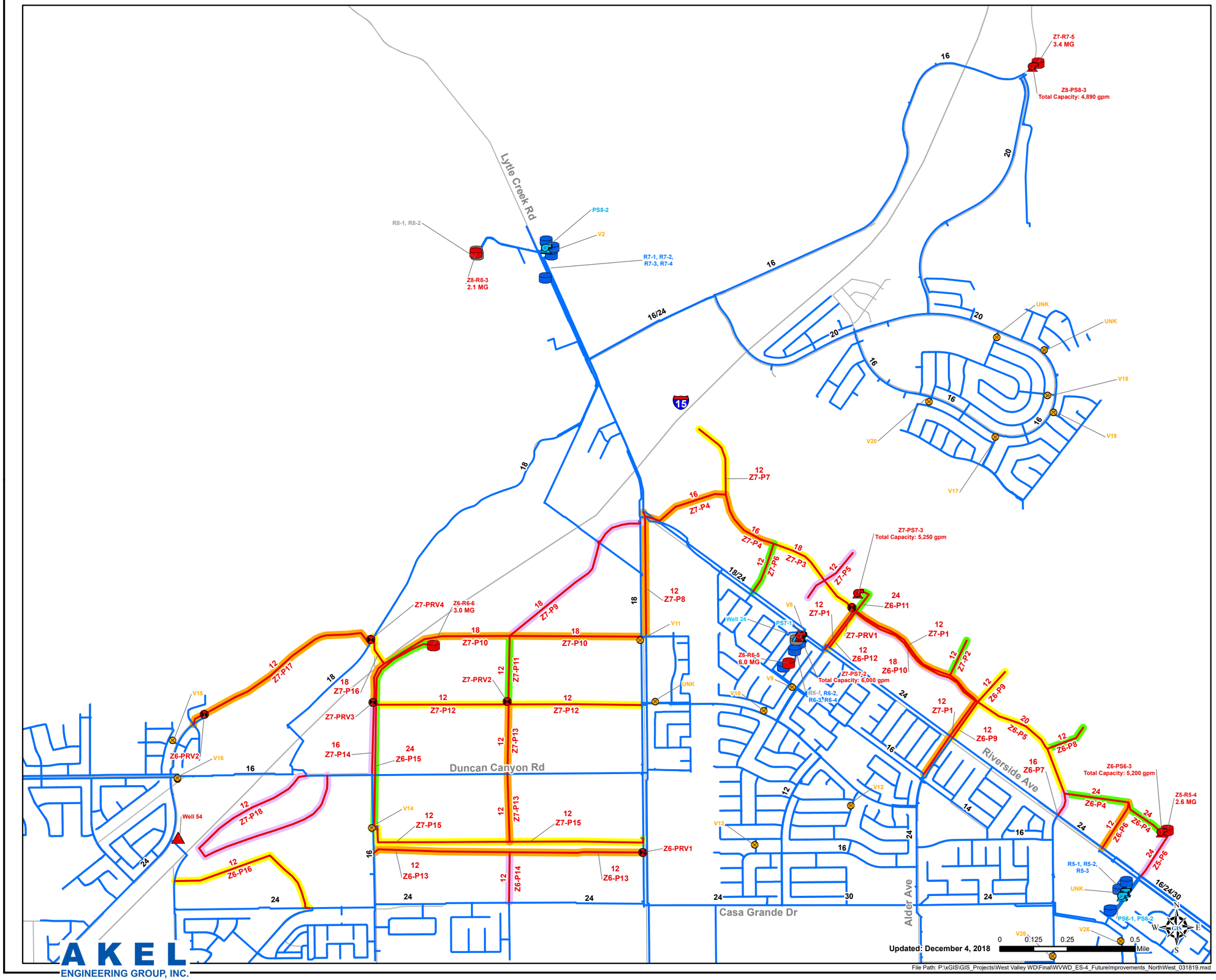
ES.3
Future Improvements Keymap

Water Facilities Master Plan
West Valley Water District

West Valley Water District



Legend

System Improvements

- Tanks
- Wells
- Pumps
- Valves
- Pipes

Existing System

- WTP
- Tanks
- Wells
- Pumps
- Valves
- Pipes
- Inactive Tanks
- Abandoned Pipes
- Street Centerlines

Note:
Pipe highlighting indicates limits of individual segments as identified in the CIP table.

ES.4
Future Improvements

Water Facilities Master Plan
West Valley Water District

West Valley Water District

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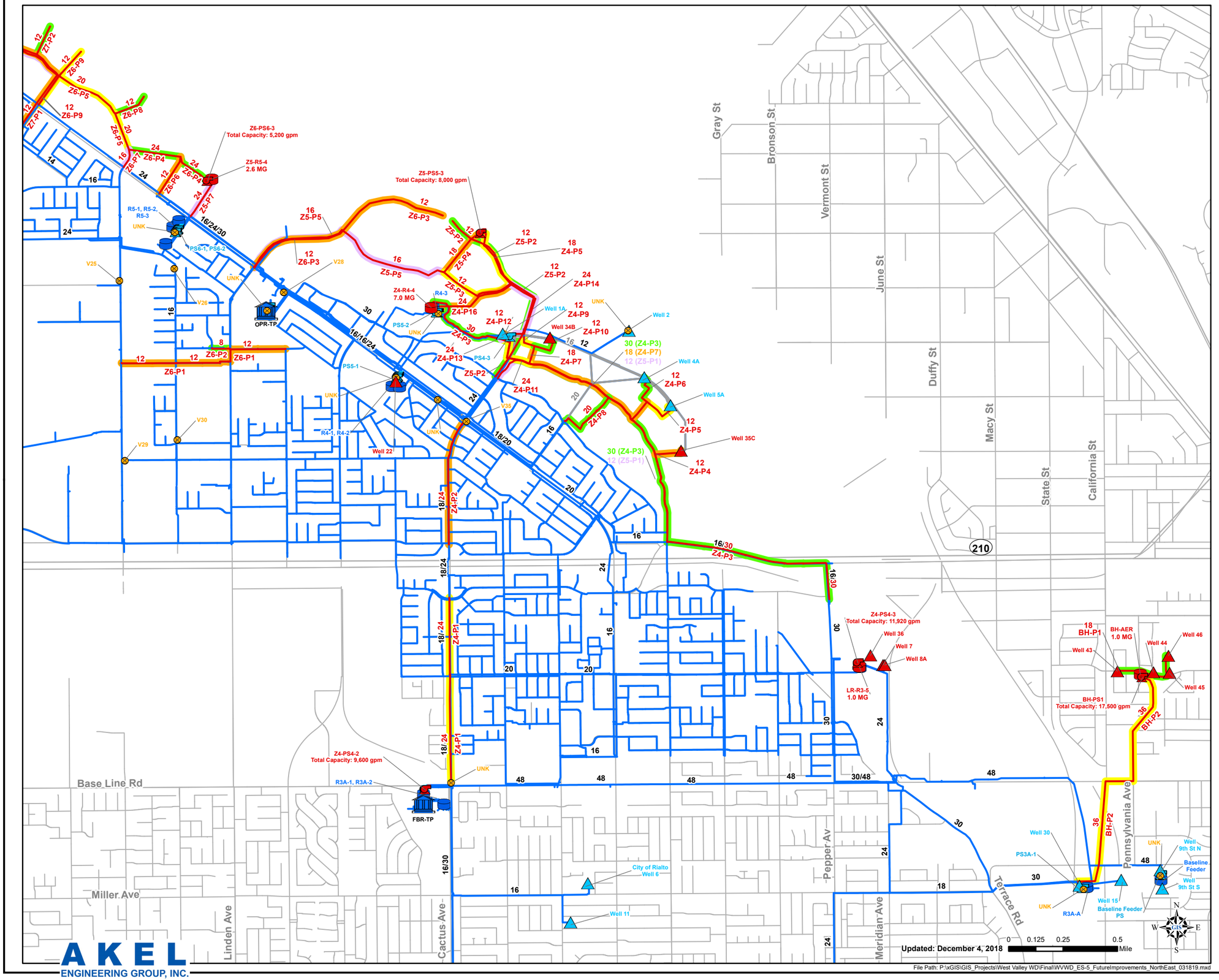


Legend

System Improvements

- Tanks
- Wells
- Pumps
- Valves
- Pipes

Existing System

- WTP
- Tanks
- Wells
- Pumps
- Valves
- Pipes
- Inactive Tanks
- Abandoned Pipes
- Street Centerlines

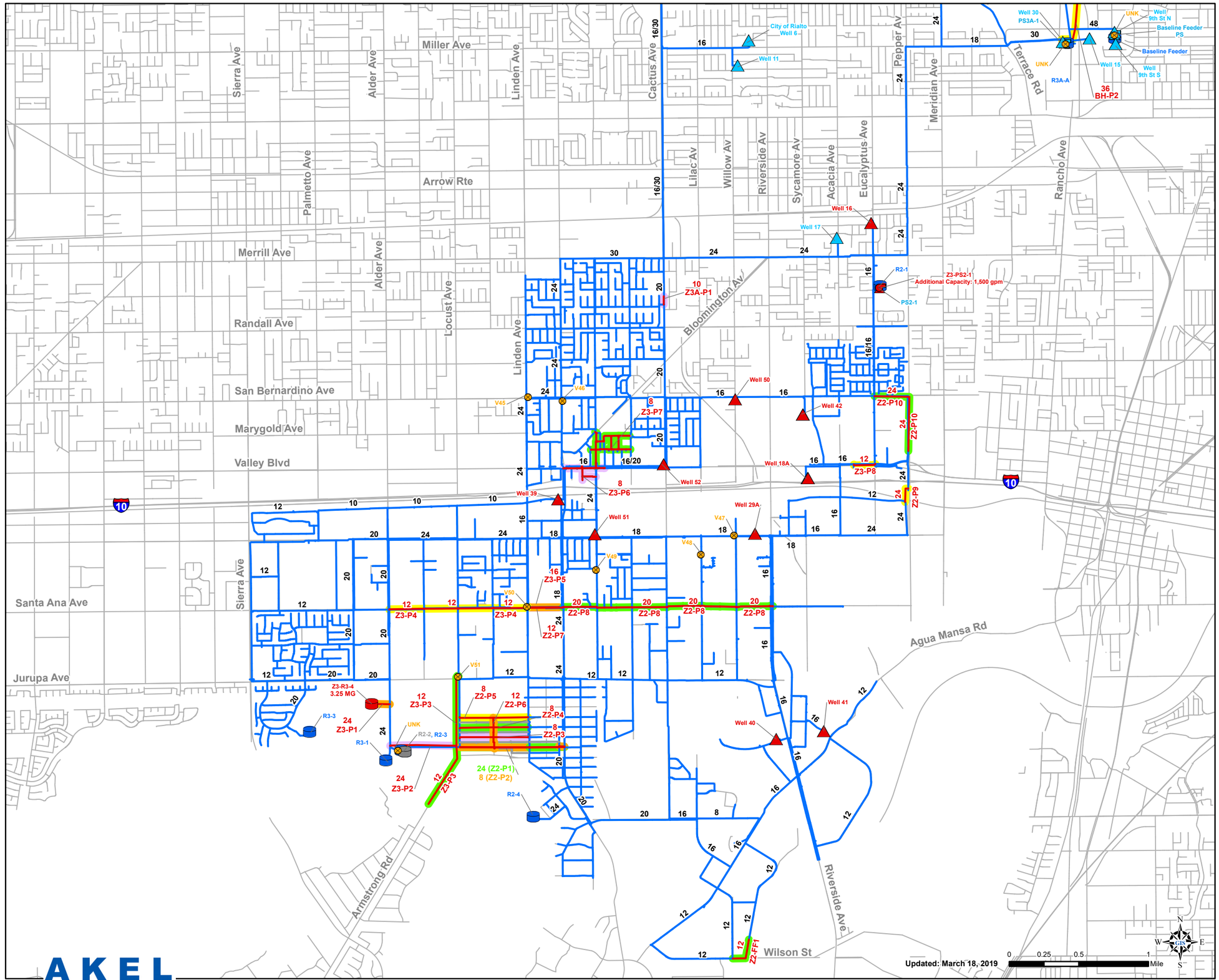
Note:
Pipe highlighting indicates limits of individual segments as identified in the CIP table.

ES.5
Future Improvements

Water Facilities Master Plan
West Valley Water District

West Valley Water District

AKEL ENGINEERING GROUP, INC.



File Path: P:\xGIS\GIS_Projects\West Valley WD\Final\WVWD_ES-6_FutureImprovements_South_031819.mxd

Legend

System Improvements

- Tanks
- Wells
- Pumps
- Valves
- Pipes

Existing System

- WTP
- Tanks
- Wells
- Pumps
- Valves
- Pipes
- Inactive Tanks
- Abandoned Pipes
- Street Centerlines

Note:
Pipe highlighting indicates limits of individual segments as identified in the CIP table.

ES.6
Future Improvements

Water Facilities Master Plan
West Valley Water District

West Valley Water District

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Table ES.5 5-Year CIP Summary

Water Facilities Master Plan
West Valley Water District

Fiscal Year	Existing Users		Future Users		Combined Project Costs	
	Fiscal Year Total ($)	Cumulative Total ($)	Fiscal Year Total ($)	Cumulative Total ($)	Fiscal Year Total ($)	Cumulative Total ($)
2019/20	$14,163,200	$14,163,200	$80,106,920	$80,106,920	$94,270,120	$94,270,120
2020/21	$1,766,000	$15,929,200	$25,858,000	$105,964,920	$27,624,000	$121,894,120
2021/22	$5,364,500	$21,293,700	$3,523,000	$109,487,920	$8,887,500	$130,781,620
2022/23	$6,001,000	$27,294,700	$7,073,000	$116,560,920	$13,074,000	$143,855,620
2023/24	$0	$27,294,700	$6,469,000	$123,029,920	$6,469,000	$150,324,620
Total Improvement Cost		**$27,294,700**		**$123,029,920**		**$150,324,620**

AKEL ENGINEERING GROUP, INC.

4/30/2020

CHAPTER 1 - INTRODUCTION

This chapter provides a brief background of the District's domestic water system, the need for this master plan, and the objectives of the study. Abbreviations and definitions are also provided in this chapter.

1.1 BACKGROUND

The West Valley Water District (District) provides domestic water service to customers throughout southwestern San Bernardino County and a small portion of northern Riverside County, as part of the greater San Bernardino-Riverside-Ontario metropolitan area. The service area, approximately 50 miles east of downtown Los Angeles, generally includes the cities of Fontana, Rialto, Colton, Jurupa Valley, Bloomington, and other unincorporated areas of San Bernardino County (**Figure 1.1**). The District provides potable water service to more than 80,000 residents, as well as a myriad of commercial, industrial, and institutional establishments. The District operates a domestic water distribution system that consists of 21 groundwater wells, 25 separate storage reservoirs across eight pressure zones, for a total storage over 72 million gallons (MG), and over 375 miles of transmission and distribution pipelines.

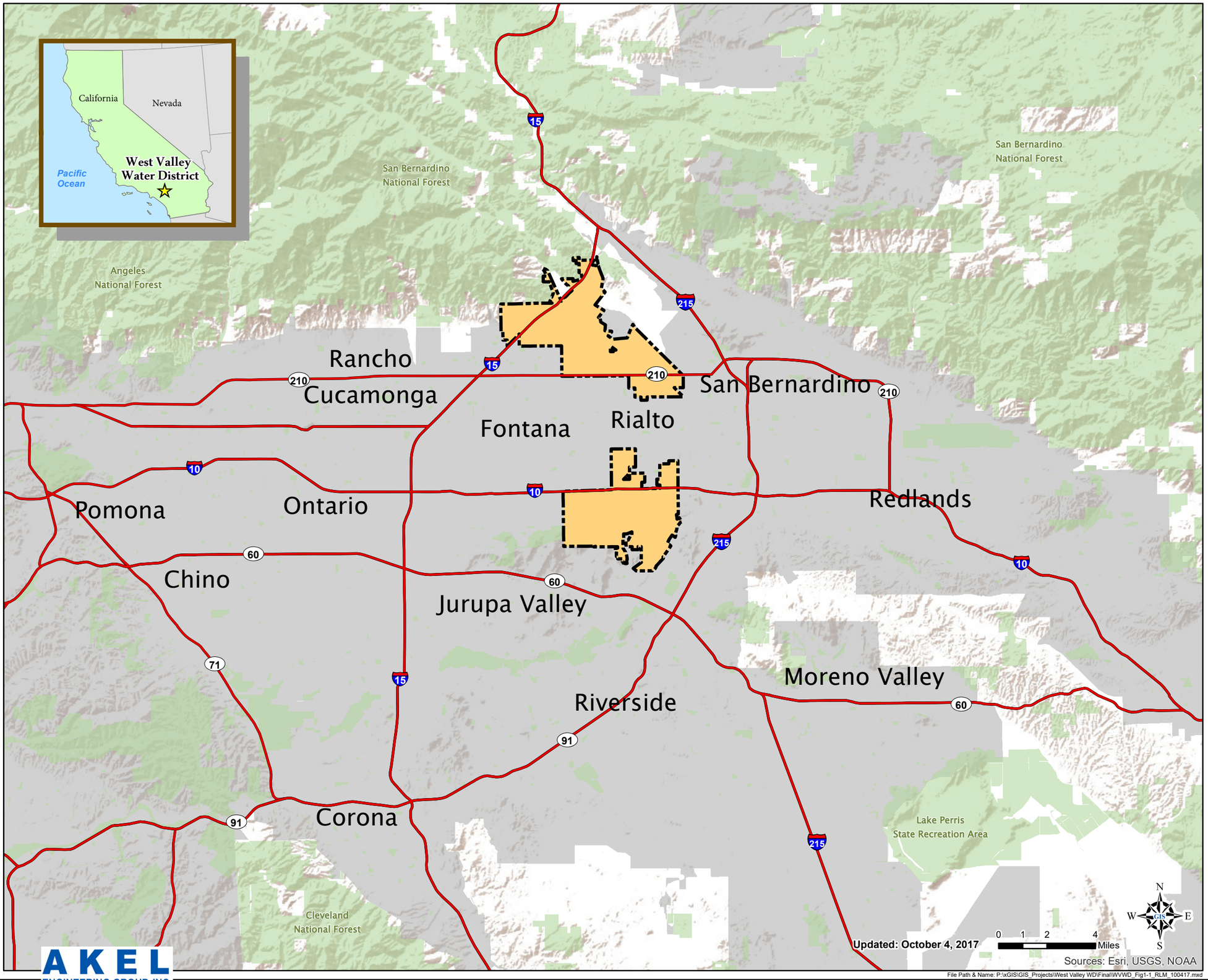
In 2012, the District developed a Water System Master Plan that identified capacity deficiencies in the existing water system and recommended improvements to alleviate existing deficiencies and serve future developments inside the District's service area. Recognizing the importance of planning, developing, and financing system facilities to provide reliable water service to existing customers and for servicing anticipated growth within the service area, the District initiated updating elements of the 2012 Water System Master Plan, to reflect current land use conditions.

1.2 SCOPE OF WORK

The District approved Akel Engineering Group Inc. to prepare this 2020 Water Facilities Master Plan (WFMP) in May of 2017. This 2020 WFMP is intended to serve as a tool for planning and phasing the construction of future domestic water system infrastructure for the projected buildout of the service area. The 2020 WFMP evaluates the District's water system and recommends capacity improvements necessary to service the needs of existing users and for servicing the future growth of the District.

The service area and horizon for the master plan are reflective of the cumulative growth associated with the differing municipalities serviced by the District. Should planning conditions change, and depending on their magnitude, adjustments to the master plan recommendations might be necessary.

This master plan included the following tasks:



Legend

- Major Highways
- West Valley Water District
- Urbanized Area
- Protected Open Space

Figure 1.1
Regional Location Map

Water Facilities Master Plan
West Valley Water District

West Valley Water District

AKEL ENGINEERING GROUP, INC.

- Summarizing the District's existing domestic water system facilities
- Documenting growth planning assumptions and known future developments
- Updating the domestic water system performance criteria
- Projecting future domestic water demands
- Creating and calibrating a new hydraulic model using Geographic Information Systems (GIS) data
- Evaluating the domestic water facilities to meet existing and projected demand requirements and fire flows
- Evaluating the existing groundwater conditions
- Performing a capacity analysis and fire flow analysis for distribution mains
- Recommending a capital improvement program (CIP) with an opinion of probable costs for 5-year and buildout growth
- Performing a capacity allocation analysis for cost sharing purposes

1.3 PREVIOUS MASTER PLANS

The District's most recent water master plan was completed in 2012. This master plan included an evaluation of servicing growth throughout the Sphere of Influence, evaluated existing demands and projected future demands, recommended phased improvements as part of a 5 year capital improvement program, and identified pumping and storage requirements for the buildout of the Sphere of Influence.

1.4 RELEVANT REPORTS

The District has completed several special studies intended to evaluate localized growth. These reports were referenced and used during the preparation of 2020 WFMP. The following lists relevant reports that were used in the completion of this master plan, as well as a brief description of each document:

- 2012 Water Master Plan, August 2012. (2012 WMP). This report documents the water demand projection and provides an update to the Capital Improvement Program, through the evaluation of the existing water system.
- 2015 San Bernardino Valley Regional Urban Water Management Plan. The District participated in the 2015 San Bernardino Valley Regional Urban Water Management Plan (RUWMP), which established a benchmark per capita water usage and targets in order to achieve higher levels of water conservation for the sustainability of water supply sources. This included adopting an updated water shortage contingency plan, defining supply sources, addressing supply reliability, and projecting sustainable supply yields and future demands.

- Draft 2017 Lytle Creek Ranch Water Facilities Feasibility Study. This report documents the preliminary water facility requirements for the buildout of the Lytle Creek Ranch Specific Plan. This report includes demand projections for the buildout of the Lytle Creek Ranch development and documents preliminary pipeline alignments as well as pump station and storage reservoir sizes and locations. Additionally, preliminary project costs are documented for the required water facility improvements.

1.5 REPORT ORGANIZATION

The water system master plan report contains the following chapters:

Chapter 1 - Introduction. This chapter provides a brief background of the District's domestic water system, the need for this master plan, and the objectives of the study. Abbreviations and definitions are also provided in this chapter.

Chapter 2 - Planning Areas Characteristics. This chapter presents a discussion of the planning area characteristics for this master plan and defines the land use classifications. The planning area is divided into several planning sub-areas, as established by the various city and county general plans.

Chapter 3 - System Performance and Design Criteria. This chapter presents the District's performance and design criteria, which was used in this analysis for identifying current system capacity deficiencies and for sizing proposed distribution mains, storage reservoirs, pump stations and wells.

Chapter 4 - Existing Domestic Water Facilities. This chapter provides a description of the District's existing domestic water system facilities including the distribution mains, storage reservoir, booster pump stations and the existing wells.

Chapter 5 - Water Demands and Supply Characteristics. This chapter summarizes existing domestic water demands, discussed available supply characteristics, and projects the future domestic water demands.

Chapter 6 - Hydraulic Model Development. This chapter describes the development and calibration of the District's domestic water distribution system hydraulic model. The hydraulic model was used to evaluate the capacity adequacy of the existing system and to plan its expansion to service anticipated future growth.

Chapter 7 - Evaluation and Proposed Improvements. This section presents a summary of the domestic water system evaluation and identifies improvements needed to mitigate existing deficiencies, as well as improvements needed to expand the system and service growth.

Chapter 8 - Capital Improvement Program. This chapter provides a summary of the recommended domestic water system improvements to mitigate existing capacity deficiencies and to accommodate anticipated future growth. The chapter also presents the cost criteria and

methodologies for developing the capital improvement program. Finally, a capacity allocation analysis, usually used for cost sharing purposes, is also included.

1.6 ACKNOWLEDGEMENTS

Obtaining the necessary information to successfully complete the analysis presented in this report, and developing the long term strategy for mitigating the existing system deficiencies and for accommodating future growth, was accomplished with the strong commitment and very active input from dedicated team members including:

- Ms. Linda Jadeski, Engineering Services Manager
- Ms. Joanne Chan, Operations Manager
- Mr. Joe Schaack, Production Supervisor

1.7 UNIT CONVERSIONS AND ABBREVIATIONS

Engineering units were used in reporting flow rates and volumes pertaining to the design and operation of various components of the domestic water distribution system. Where it was necessary to report values in smaller or larger quantities, different sets of units were used to describe the same parameter. Values reported in one set of units can be converted to another set of units by applying a multiplication factor. A list of multiplication factors for units used in this report is shown on **Table 1.1**.

Various abbreviations and acronyms were also used in this report to represent relevant water system terminologies and engineering units. A list of abbreviations and acronyms is included in **Table 1.2**.

1.8 GEOGRAPHIC INFORMATION SYSTEMS

This master planning effort made extensive use of Geographic Information Systems (GIS) technology, for completing the following tasks:

- Developing the physical characteristics of the hydraulic model (pipes and junctions, wells, and storage reservoirs)
- Allocating existing water demands, as extracted from the water billing records, and based on each user's physical address.
- Calculating and allocating future water demands, based on future developments water use.
- Extracting ground elevations along the distribution mains from available digital elevation information.
- Generating maps and exhibits used in this master plan.

Table 1.1 Unit Conversions

Water Facilities Master Plan

West Valley Water District

Volume Unit Calculations		
To Convert From:	**To:**	**Multiply by:**
acre feet	gallons	325,851
acre feet	cubic feet	43,560
acre feet	million gallons	0.3259
cubic feet	gallons	7.481
cubic feet	acre feet	2.296×10^{-5}
cubic feet	million gallons	7.481×10^{-6}
gallons	cubic feet	0.1337
gallons	acre feet	3.069×10^{-6}
gallons	million gallons	1,000,000
million gallons	gallons	1×10^{-6}
million gallons	cubic feet	133,672
million gallons	acre feet	3.069
Flow Rate Calculations		
To Convert From:	**To:**	**Multiply By:**
ac-ft/yr	mgd	8.93×10^{-4}
ac-ft/yr	cfs	1.381×10^{-3}
ac-ft/yr	gpm	0.621
ac-ft/yr	gpd	892.7
cfs	mgd	0.646
cfs	gpm	448.8
cfs	ac-ft/yr	724
cfs	gpd	646300
gpd	mgd	1×10^{-6}
gpd	cfs	1.547×10^{-6}
gpd	gpm	6.944×10^{-4}
gpd	ac-ft/yr	1.12×10^{-3}
gpm	mgd	1.44×10^{-3}
gpm	cfs	2.228×10^{-3}
gpm	ac-ft/yr	1.61
gpm	gpd	1,440
mgd	cfs	1.547
mgd	gpm	694.4
mgd	ac-ft/yr	1,120
mgd	gpd	1,000,000

Table 1.2 Abbreviations and Acronyms

Water Facilities Master Plan
West Valley Water District

Abbreviation	Expansion	Abbreviation	Expansion
2012 WSMP	2012 Water System Master Plan	gpm	gallons per minute
AACE International	Association for the Advancement of Cost Engineering	hp	horsepower
AC	acre	HGL	hydraulic grade line
ACP	Asbestos Cement Pipe	HWL	high water level
ADD	average day demand	in	inch
AF	Acre Feet	LF	linear feet
Akel	Akel Engineering Group, Inc.	MG	million gallons
CCI	Construction Cost Index	MGD	million gallons per day
CDPH	California Department of Public Health	MMD	maximum month demand
cfs	cubic feet per second	NFPA	National Fire Protection Association
CI	cast iron pipe	PDD	peak day demand
CIB	Capital Improvement Budget	PHD	peak hour demand
CIP	Capital Improvement Program	PRV	pressure reducing valve
DIP	Ductile Iron Pipe	psi	pounds per square inch
District	West Valley Water District	ROW	Right of Way
DU	dwelling unit	SBVMWD	San Bernardino Valley Municipal Water District
EDU	equivalent dwelling unit	SCADA	Supervisory Control and Data Acquisition
ENR	Engineering News Record	SCAG	Southern California Association of Governments
EPA	Environmental Protection Agency	SHGL	Static Hydraulic Gradient Line
EPS	Extended Period Simulation	SS	Steady-State
FBR	Fluidized Bed Reactor	SOI	Sphere of Influence
ft	feet	TBD	to be determined
fps	feet per second	ULL	Urban Limit Line
FY	Fiscal Year	WFF	Oliver P. Roemer Water Filtration Facility
GIS	Geographic Information Systems	WFMP	Water Facilities Master Plan
gpd	gallons per day	WTP	Water Treatment Plant
gpdc	gallons per day per capita		

CHAPTER 2 - PLANNING AREA CHARACTERISTICS

This chapter presents a discussion of the planning area characteristics for this master plan and defines the land use classifications. The planning area is divided into several planning sub-areas, as established by the various city and county general plans.

2.1 STUDY AREA DESCRIPTION

The West Valley Water District provides domestic water service to customers throughout southwestern San Bernardino County and a small portion of northern Riverside County, as part of the greater San Bernardino-Riverside-Ontario metropolitan area. The service area, approximately 50 miles east of downtown Los Angeles, is generally bounded by U.S. Forest Service land to the north and Riverside County to the south, with the cities of San Bernardino and Colton serving as the eastern boundaries and the City of Fontana as the western boundary (**Figure 2.1**). The central portion of the City of Rialto divides the District's service area into a northern system and southern system and is served by the City of Rialto. The additional water agencies serving the areas adjacent to the District service area are summarized on **Figure 2.2**. The District Sphere of Influence encompass 18,076 acres, serving over 80,000 residents.

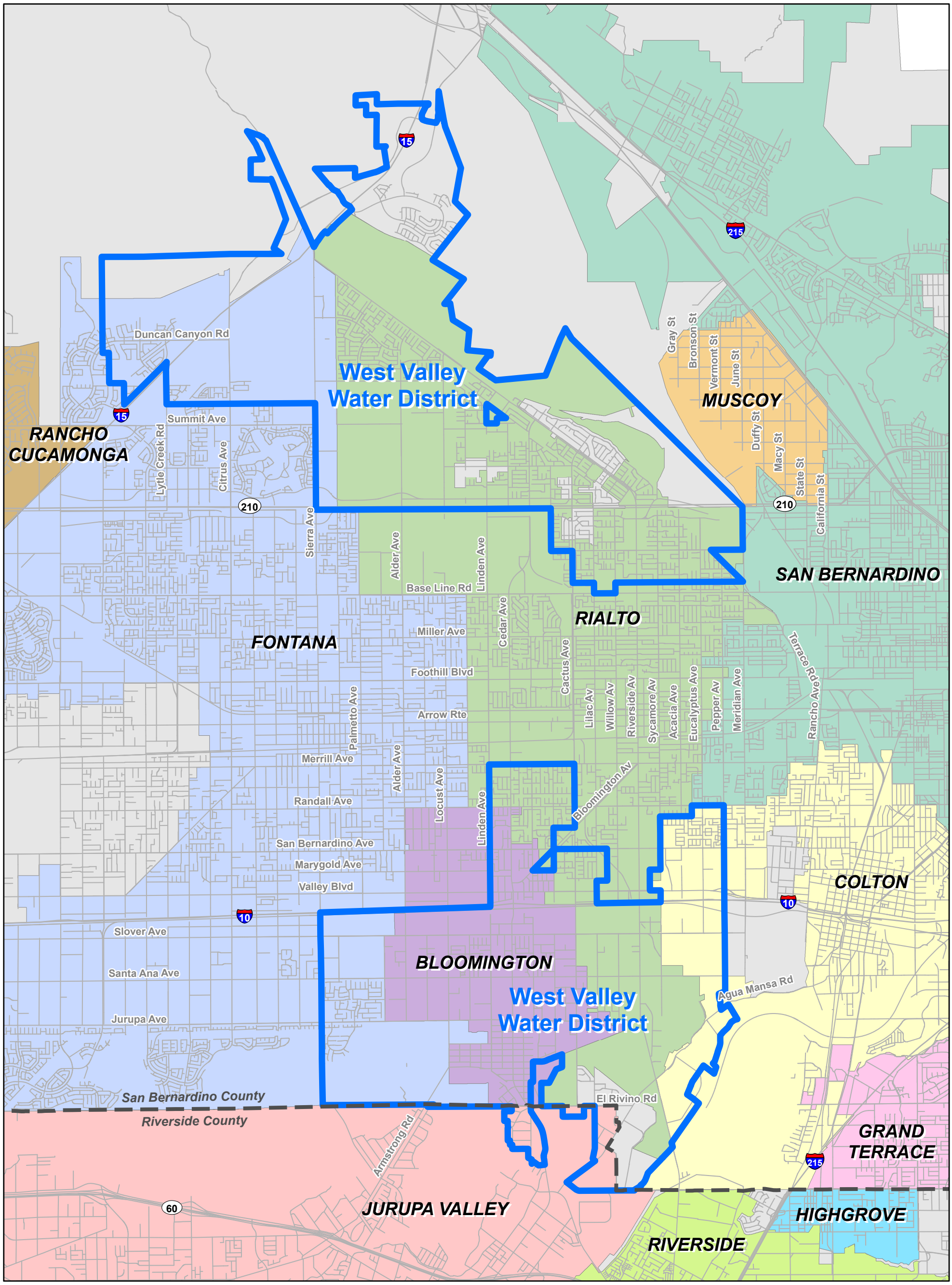
The topography of the service area generally slopes upward from south to north, with service elevations approximately ranging between 900 ft and 2,300 ft. Due to the varying terrain, the service area is divided into eight pressure zones to account for the changes in elevation. Currently, the water demands are met from a combination of groundwater wells and treated surface water. Booster stations and pressure reducing valves (PRVs) convey water from supply sources throughout the individual pressure zones.

2.2 WATER SERVICE AREA AND LAND USE

The existing service area is comprised of approximately 11,500 acres of developed lands and 6,300 acres of undeveloped land that is slated for growth. For planning purposes, this master plan evaluated the existing land use, 5-year growth projections, and buildout of the service area.

2.2.1 Existing Land Use

The existing land use within the District's service area is comprised of a relatively even split between residential and non-residential uses. Residential land uses comprise approximately 5,200 acres and non-residential uses totaling approximately 4,600 acres. Other land uses, including utilities, right of way, landscape irrigation, open space, and undeveloped land, make up the remainder of the service area. The existing land use is documented on **Figure 2.3** and included on **Table 2.1**.



Legend

- WVWD Service Area
- **City Boundaries**
  - Bloomington
  - Colton
  - Fontana
  - Grand Terrace
  - Highgrove
  - Jurupa Valley
  - Muscoy
  - Rancho Cucamonga
  - Rialto
  - Riverside
  - San Bernardino
  - Unincorporated Area
- County Boundaries
- Street Centerlines

N
W GIS E
S

0 0.25 0.5 1 Mile

Updated: September 29, 2017

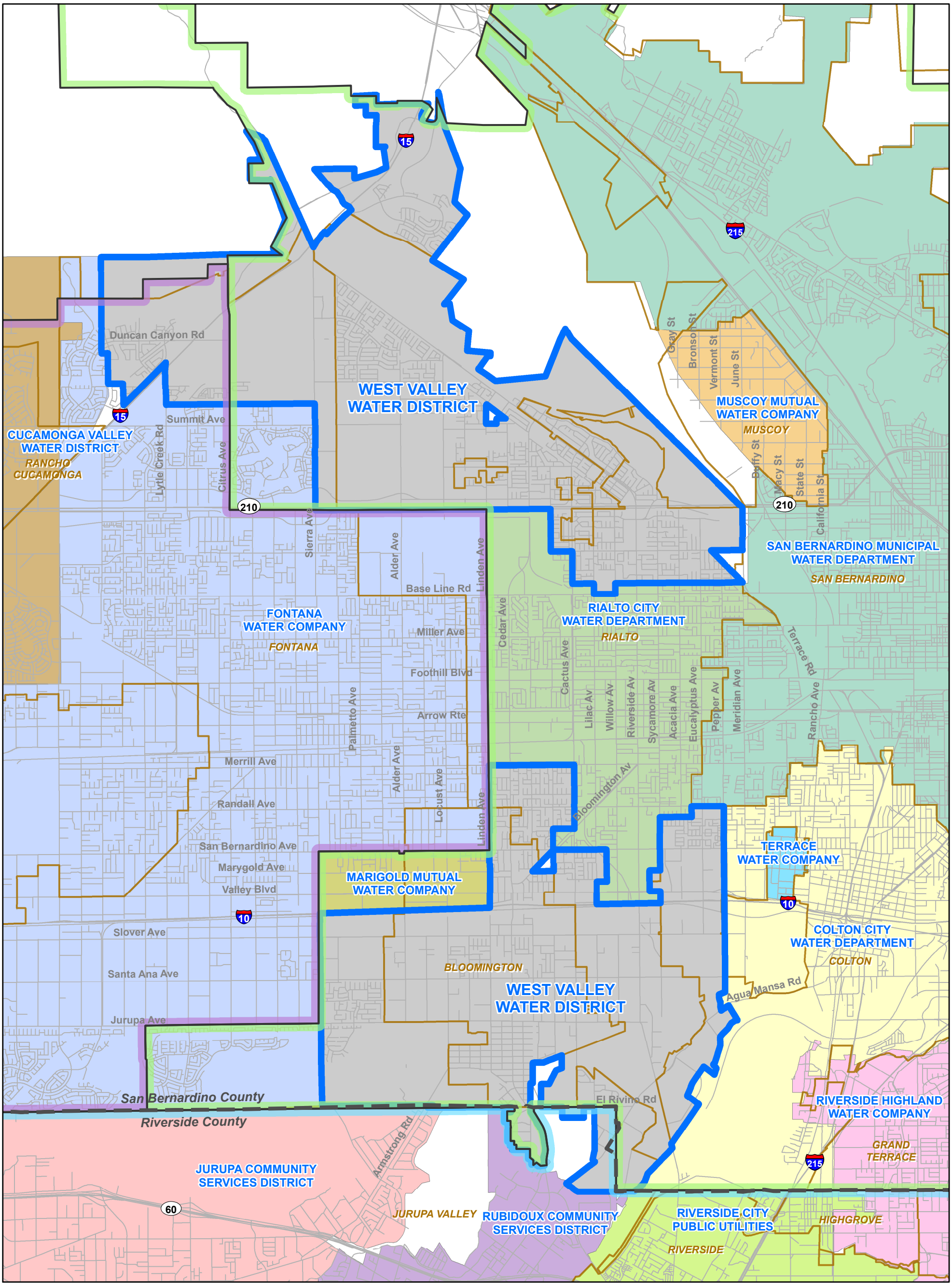
AKEL ENGINEERING GROUP, INC.

File Path: P:\xGIS\GIS_Projects\West Valley WD\Final\WVWD_Fig2-1_SA-Cities_092917.mxd

Figure 2.1
WVWD Service Area and Surrounding Cities

Water Facilities Master Plan
West Valley Water District

West Valley Water District



Legend

Regional Water Agencies

- Inland Empire Utilities Agency
- San Bernardino Valley Municipal Water District
- Western Municipal Water District

Local Water Agencies

- West Valley Water District
- Colton City Water Department
- Riverside City Public Utilities
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Marigold Mutual Water Company
- Muscoy Mutual Water Company
- Rialto City Water Department
- Riverside Highland Water Company
- Rubidoux Community Services District
- San Bernardino Municipal Water Department
- Terrace Water Company
- City Boundaries
- County Boundaries
- Street Centerlines

N, W GIS E, S

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Updated: October 3, 2017

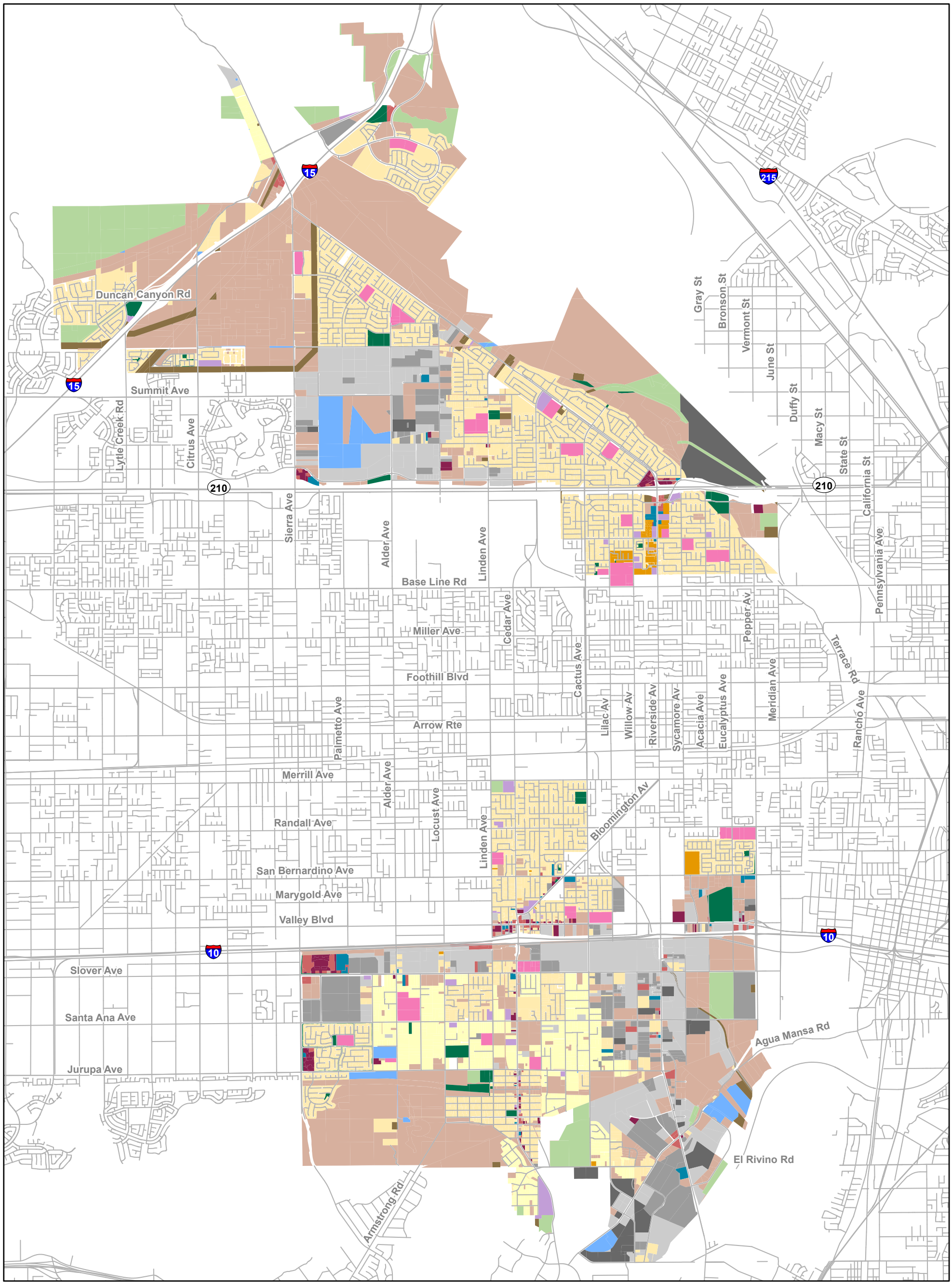
AKEL ENGINEERING GROUP, INC.

File Path: P:\xGIS\GIS_Projects\West Valley WD\Final\WVWD_Fig2-2_WaterAgencies_100317.mxd

Figure 2.2
WVWD Service Area and Surrounding Water Agencies

Water Facilities Master Plan
West Valley Water District

West Valley Water District



Legend

Existing Land Use

- Very Low Density Residential
- Low Density Residential
- Medium Density Residential
- High Density Residential
- Commercial
- Retail
- Educational
- Institutional
- Public Facility
- Industrial
- Light Industrial
- Heavy Industrial
- Utilities
- Office
- Open Space
- Landscape Irrigation
- Vacant
- Street Centerlines

N W GIS E S

0 0.25 0.5 1 Mile

Updated: September 27, 2017

File Path: P:\xGIS\GIS_Projects\West Valley WD\Final\WVWD_Fig2-3_ExistingLandUse_092717.mxd

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Figure 2.3
Existing Land Use

Water Facilities Master Plan
West Valley Water District

West Valley Water District

Table 2.1 Existing Service Area Land Use

Water Facilities Master Plan
West Valley Water District

Land Use Designation	Existing Land Use within District's Service Area (acres)
Residential	
Residential 2	1,080
Residential 6	4,026
Residential 12	4
Residential 21	87
Subtotal- Residential	**5,196**
Non-Residential	
Commercial	123
Retail	121
Office	72
Educational	373
Institutional	129
Public Facility	324
Light Industrial	1,022
Heavy Industrial	510
Industrial	1,983
Subtotal-Non Residential	**4,657**
Other	
Utilities	293
ROW	110
Landscape Irrigation	238
Open Space	1,755
Vacant-Undeveloped	5,538
Subtotal- Other	**7,934**
Total	
	17,787

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10/4/2017

2.2.2 Five Year Growth Projections

As part of this master plan evaluation, 5-year growth is evaluated for the purpose of identifying improvements necessary to serve development occurring in the near future. District staff have identified areas of development expected to occur within the next five years, which are summarized on **Table 2.2** and shown graphically on **Figure 2.4**, and include the following large development projects:

- **Lytle Creek Ranch.** This development is located along the northeast side of the District service area. The 5-year growth projection for Lytle Creek Ranch includes approximately 1,390 equivalent dwelling units across three pressure zones.

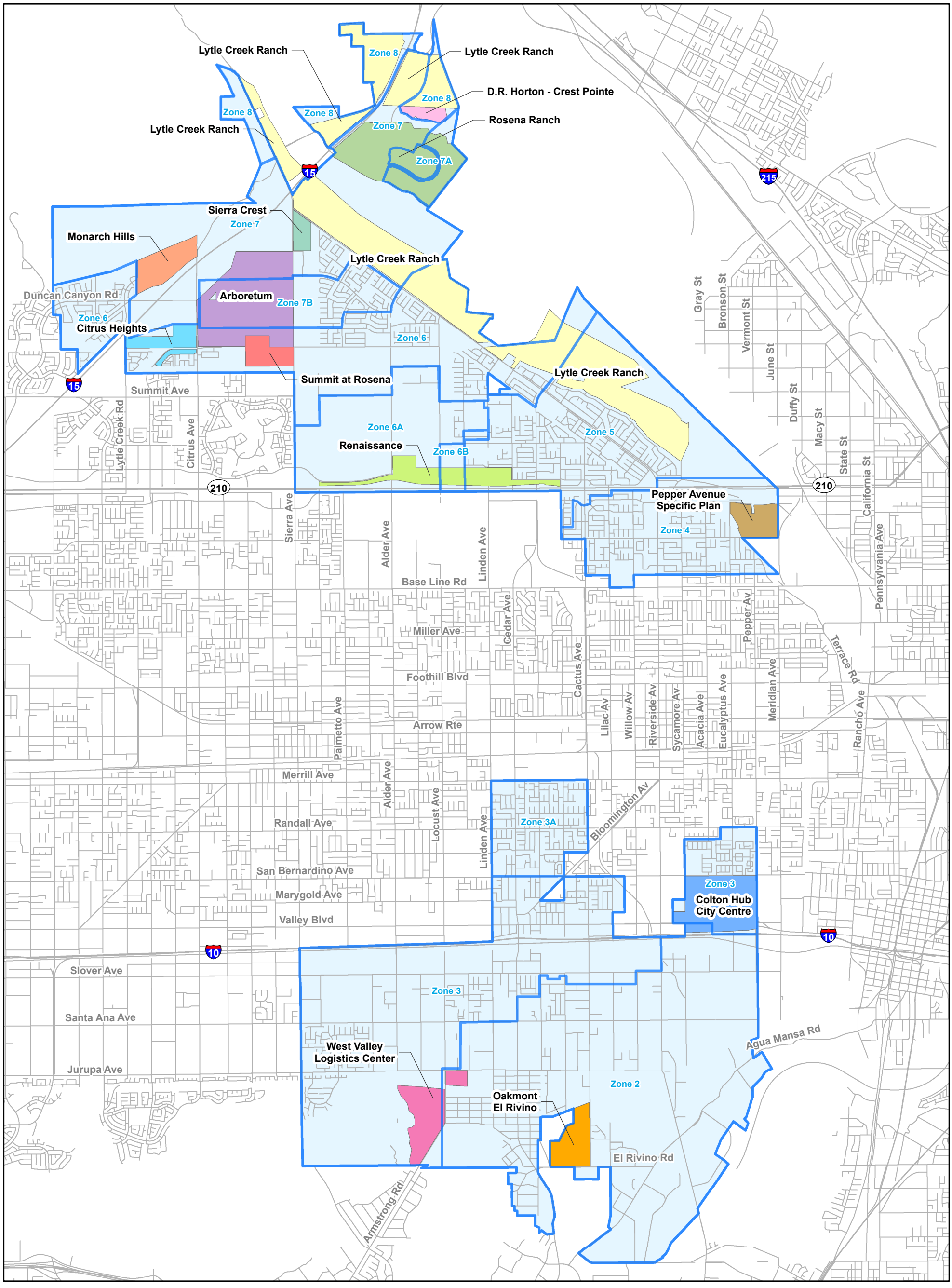
- **Arboretum.** This development is generally located north of Casa Grande Avenue between Sierra Avenue and Citrus Avenue, and south of Segovia Lane. 5-year growth estimates for Arboretum include approximately 1,990 equivalent dwelling units (EDU) in Pressure Zones 6 and 7.

2.2.3 Buildout Growth Projections

Buildout land use of the District service area is documented on **Figure 2.5** and inventoried on **Table 2.3**. The existing and future land use acreages are broken down in the the following categories:

- **Existing Development:** These acreages represent existing developed lands.
- **Existing Lands - Redeveloped:** These acreages represent existing developed lands expected to redevelop into other land use types within the buildout horizon of the master plan.
- **Existing Development - Unchanged:** These acreages represent the total existing acreages expected to remain within the buildout horizon of the master plan.
- **New Lands - Redevelopment:** These acreages represent lands that have redeveloped from a prior use and into a new respective category.
- **New Development:** These acreages represent gains from the development of existing vacant lands.

This table includes existing lands, lands planned for redevelopment, and undeveloped lands planned for development. The buildout land use projections include approximately 8,800 acres of residential and 5,900 acres of non-residential uses. These acreages were extracted from shapefiles provided by District staff, which consolidated local general plan land uses. For the purposes of this master plan, land use categories with similar densities were consolidated further for ease of reference.



Legend

Future Major Developments

- Arboretum
- Shady Trails
- Colton Hub City Centre
- D.R. Horton - Crest Pointe
- Lytle Creek Ranch
- Monarch Hills
- Oakmont El Rivino
- Pepper Avenue Specific Plan
- Renaissance
- Rosena Ranch
- Sierra Crest
- Summit at Rosena
- West Valley Logistics Center

- Pressure Zones
- Roads

Updated: April 2, 2018

0 0.25 0.5 1 Mile

N W GIS E S

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Figure 2.4
Future Major Developments

Water Facilities Master Plan
West Valley Water District

West Valley Water District

Duncan Canyon Rd
Summit Ave
Lytle Creek Rd
Citrus Ave
Sierra Ave
Alder Ave
Linden Ave
Base Line Rd
Cedar Ave
Miller Ave
Foothill Blvd
Cactus Ave
Palmetto Ave
Arrow Rte
Lilac Av
Willow Av
Riverside Av
Sycamore Av
Acacia Ave
Eucalyptus Ave
Pepper Av
Meridian Ave
Terrace Rd
Rancho Ave
Merrill Ave
Locust Ave
Bloomington Av
Randall Ave
San Bernardino Ave
Marygold Ave
Valley Blvd
Slover Ave
Santa Ana Ave
Jurupa Ave
Armstrong Rd
Agua Mansa Rd
El Rivino Rd
Gray St
Bronson St
Vermont St
June St
Duffy St
Macy St
State St
California St
Pennsylvania Ave
15
215
210
10

Legend

Future Land Use

- Renaissance Specific Plan
- Very Low Density Residential
- Low Density Residential
- Medium Density Residential
- High Density Residential
- Commercial
- Retail
- Educational
- Institutional
- Public Facility
- Industrial
- Light Industrial
- Heavy Industrial
- Utilities
- Office
- Open Space
- Landscape Irrigation
- Street Centerlines

0 0.25 0.5 1 Mile

N W GIS E S

Updated: December 3, 2018

Figure 2.5
Future Land Use

Water Facilities Master Plan
West Valley Water District

West Valley Water District

AKEL ENGINEERING GROUP, INC.

File Path: P:\xGIS\GIS_Projects\West Valley WD\Final\WVWD_Fig2-5_FutureLandUse_120318.mxd

Table 2.2 5 Year Growth Assumptions

Water Facilities Master Plan
West Valley Water District

Presssure Zone ID	Development Designation	Projected EDUs
South System		
Zone 2		
	Miscellaneous Infill	200
	Subtotal	200
Zone 3		
	Wildrose Village- Phase 1	110
	Wildrose Village - Phase 2	64
	Miscellaneous Infill	230
	Subtotal	404
Zone 3A		
	Crestwood Communities	50
	Subtotal	50
North System		
Zone 4		
	Pepper Avenue Specific Plan	50
	Miscellaneous Infill	10
	Subtotal	60
Zone 5		
	Renaissance	50
	Lytle Creek Ranch	900
	Miscellaneous Infill	50
	Subtotal	1,000
Zone 6		
	Renaissance	50
	Arboretum - Meadow	200
	Arboretum - Garden	700
	Shady Trails - Phase 1	100
	Shady Trails - Phase 2	137
	Miscellaneous Infill	50
	Summit at Rosena Development	480

Table 2.2 5 Year Growth Assumptions

Water Facilities Master Plan
West Valley Water District

Presssure Zone ID	Development Designation	Projected EDUs
	Tract 18944	90
	Subtotal	1,807
Zone 7		
	Arboretum - Meadow	390
	Arboretum - Garden	700
	Sierra Crest II	180
	Monarch Hills	472
	Lytle Creek Ranch	100
	Rosena Ranch	400
	D.R. Horton	80
	Tract 18944	90
	Subtotal	2,412
Zone 8		
	Lytle Creek Ranch	390
	Subtotal	390
	Grand Total	**6,323**

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3/13/2018

Source: Development information provided by WVWD staff.

Table 2.3 Existing and Future Service Area Land Use

Water Facilities Master Plan
West Valley Water District

Land Use Classification	Existing Service Area			Inside Sphere of Influence			
	Existing Development	Existing Lands - Redeveloped	Subtotal Existing Lands - Unchanged	New Lands - Redevelopment	New Development		Total
					Inside Existing Service Area	Outside Existing Service Area	
	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)
Residential							
Residential 2	1,080	5	1,074	200	721	6	2,002
Residential 6	4,026	412	3,614	231	1,905	5	5,756
Residential 12	4	4	0	147	409	27	583
Residential 21	87	4	83	42	503	57	685
Subtotal- Residential	5,196	425	4,772	621	3,538	95	9,025
Non-Residential							
Commercial	123	65	58	604	323	18	1,004
Retail	121	117	4	96	84	0	184
Office	72	63	9	13	42	0	64
Educational	373	75	299	35	48	0	382
Institutional	129	121	8	283	192	0	482
Public Facility	324	271	53	32	99	0	184
Light Industrial	1,022	698	324	318	104	0	746
Heavy Industrial	510	348	162	178	302	0	643
Industrial	1,983	822	1,161	702	370	0	2,233
Subtotal-Non Residential	4,657	2,579	2,077	2,260	1,565	18	5,921
Other							
Utilities	293	70	223	46	316	0	585
ROW	110	75	35	15	60	0	110
Landscape Irrigation	238	161	77	10	114	25	226
Open Space	0	0	0	327	1,688	195	2,210
Vacant-Undeveloped	5,538	0	0	0	0	0	0
Subtotal- Other	6,179	306	335	397	2,178	219	3,130
Total							
	16,032	**3,310**	**7,184**	**3,278**	**7,281**	**333**	**18,076**

2.3 HISTORICAL AND FUTURE POPULATION

The historical population (**Table 2.4**) was extracted from the District's 2015 Urban Water Management Plan (UWMP), which utilized population estimates prepared by the Southern California Association of Governments (SCAG). The methodologies for calculating the projected population varied and are briefly summarized as follows:

- 2018-2022: Linearly interpolated between 2017 and 2023 based on the 5-year projected growth.
- 2023: Based on 5-year projected growth assuming 3.5 people per EDU.
- 2024-2046: Calculated assuming 1.5% annual population growth, consistent with 2015 UWMP growth rate.

Though historical populations were used in understanding the domestic water consumption behaviors and trends, population forecasts are presented for informational purposes only. Estimates of future domestic water demands were not based on population, but rather on net acreage for residential and non-residential land uses. Future population and EDUs were used as a means for estimating the planning horizon of the water system and phasing improvements.

2.4 CLIMATE

This section documents the existing climate for the District service area, as well as the potential effects of climate change.

2.4.1 Existing Climate

The climate for the West Valley Water District is generally characterized by hot, dry summers and cool winters with intermittent rainfall. The bulk of the rainfall generally occurs in the months from November to April, with approximately 18.81 inches of rainfall typical to the area. The average high temperature in July and August ranges at approximately 95 degrees Fahrenheit, with the average low in December and February at approximately 42 degrees Fahrenheit. It should be noted that the San Gabriel Mountains border the northern extent of the service area, and form the Lytle Creek catchment. Rainfall amounts can rise significantly closer to the mountains due to orographic lifting.

2.4.2 Climate Change

The 2015 San Bernardino Valley Regional Urban Water Management Plan (SBVR-UWMP) included the West Valley Water District, and documents the potential effects of climate change on the region. This document sources information from the Upper Santa Ana River Watershed Integrated Regional Water Management Plan and the Climate Change Vulnerability Assessment Checklist.

The recent climate modeling documented in the SBVR-UWMP indicates that temperatures are expected to rise. The City of Riverside is expected to experience almost double the days exceeding 95 degrees Fahrenheit by 2070 than what were historically recorded. Big Bear, which historically has had no days of 95 degree heat, is expected to have 4 days exceeding this

Table 2.4 Historical and Projected Population

Water Facilities Master Plan

West Valley Water District

Year	Population [1,2]	Annual Growth (%)	Average Annual Demand[3,4] (AF)	(mgd)	Per Capita Consumption[5] (gpdc)
Historical Population[1]					
2005	66,442	-	19,796	17.7	266
2006	67,821	2.1%	22,347	20.0	294
2007	69,228	2.1%	23,167	20.7	299
2008	70,665	2.1%	23,638	21.1	299
2009	72,131	2.1%	20,444	18.3	253
2010	73,469	1.9%	19,556	17.5	238
2011	74,807	1.8%	19,479	17.4	232
2012	76,145	1.8%	21,243	19.0	249
2013	77,483	1.8%	20,535	18.3	237
2014	78,821	1.7%	20,229	18.1	229
2015	80,161	1.7%	17,006	15.2	189
2016	82,013	2.3%	16,301	14.6	177
2017	83,902	2.3%	18,778	16.8	200
Projected Population[2]					
2018	87,590	4.4%	19,656	17.6	200
2019	91,279	4.2%	20,538	18.3	201
2020	94,967	4.0%	21,424	19.1	201
2021	98,656	3.9%	22,315	19.9	202
2022	102,344	3.7%	23,210	20.7	202
2023	106,033	3.6%	24,109	21.5	203
2024	107,623	1.5%	24,535	21.9	204
2025	109,237	1.5%	24,968	22.3	204
2026	110,876	1.5%	25,408	22.7	205
2027	112,539	1.5%	25,856	23.1	205
2028	114,227	1.5%	26,312	23.5	206
2029	115,941	1.5%	26,776	23.9	206
2030	117,680	1.5%	27,247	24.3	207
2031	119,445	1.5%	27,727	24.8	207
2032	121,236	1.5%	28,215	25.2	208
2033	123,055	1.5%	28,711	25.6	208
2034	124,901	1.5%	29,216	26.1	209
2035	126,774	1.5%	29,730	26.5	209
2036	128,676	1.5%	30,252	27.0	210
2037	130,606	1.5%	30,784	27.5	210
2038	132,565	1.5%	31,324	28.0	211
2039	134,554	1.5%	31,874	28.5	212
2040	136,572	1.5%	32,427	29.0	212
2041	138,621	1.5%	32,920	29.4	212
2042	140,700	1.5%	33,414	29.8	212

Table 2.4 Historical and Projected Population

Water Facilities Master Plan

West Valley Water District

Year	Population [1,2]	Annual Growth (%)	Average Annual Demand[3,4] (AF)	(mgd)	Per Capita Consumption[5] (gpdc)
2043	142,810	1.5%	33,915	30.3	212
2044	144,953	1.5%	34,424	30.7	212
2045	147,127	1.5%	34,940	31.2	212
2046	149,334	1.5%	**35,464**	**31.7**	**212**

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4/17/2020

Notes :

1. Unless noted otherwise, historical population extracted from 2015 UWMP.

   Year 2005 - 2009, 2015: Extracted from 2015 UWMP WVWD SBX7-7 Table 5

   Year 2010 - 2014: Straight line linear interpolation between 2009 and 2015

   Year 2016: Extracted from 2016 Year End Report received June 15, 2017

   Year 2017: Extracted from "Population Estimates 2017" spreadsheet received June 15, 2017

2. Population Projection Source:

   Years 2018 - 2022: Linearly interpolated between 2017 and 2023

   Year 2023: Population growth based on 5-Year Growth Assumptions provided by District staff

   Years 2024 - 2046: Assuming a 1.5% annual growth rate

3. Historical demand extracted from production statistics received from WVWD staff October 30, 2017. Historical demands exclude water produced for wholesale delivery to other agencies.

4. Demand Projection Source.

   Years 2018 - 2022: Demand linearly interpolated between 2017 and 2023

   Year 2023: Additional demand due to 5 year growth, assuming 670 gpd/EDU, and accounting for conservation.

   Year 2024 - 2039: Demand linearly interpolated between 2023 and 2040

   Years 2040: 2015 Urban Water Management Plan

   Years 2041 - 2046: Calculated assuming per capita demand factor of 212 gpdc, consistent with 2015 UWMP demand projection methodology.

5. The 2015 UWMP calculated a 2020 Per Capita Water Use Target of 232 gpcd and a 2015 actual per capita water use of 190 gpcd. For demand planning purposes the UWMP used a per capita water use of 209 gpcd (10% increase over 2015). Accounting for water losses and occupancy vacancies the 2019 WFMP uses a per capita water use of 212 gpcd.

threshold by 2070. The causal effects of the increasing climate temperatures are the reduction in alpine and sub-alpine forestation, and increasing storm intensities with decreasing frequency. The reduction in forest matter with increasing storm intensities are expected to exacerbate flooding concerns. Furthermore, the increase in temperature is expected to elevate mean snow levels, and thus reduce snowpack and yearly groundwater recharge.

The two methods for addressing the changing climate are documented as mitigation and adaptation. Mitigation efforts involve programs and policies intended to reduce carbon emissions, while adaptation efforts involve adjusting to the outcomes of climate change (risk of flooding, temperature increase, etc). It is recommended that as scientific advancements in climate change occur, and the impacts to water infrastructure are documented, that the District plan for efforts in both adaptation and mitigation.

CHAPTER 3 - SYSTEM PERFORMANCE AND DESIGN CRITERIA

This chapter presents the District's performance and design criteria, which was used in this analysis for identifying current system capacity deficiencies and for sizing proposed distribution mains, storage reservoirs, pump stations and wells.

3.1 HISTORICAL WATER USE TRENDS

The historical domestic water consumption per capita was calculated to determine the average water use per capita per day. This was accomplished by dividing the District's historical water production by the historical population for the respective year.

The District's historical per capita consumption factors, for the period 2005-2016, are listed in **Table 3.1**. The per capita consumption has generally decreased since 2005, being reduced by approximately 20%. This trend is largely attributed to the District's effort of implementing water conservation measures. **Table 3.2** lists the last four years of monthly water production for the District from 2013 to 2016.

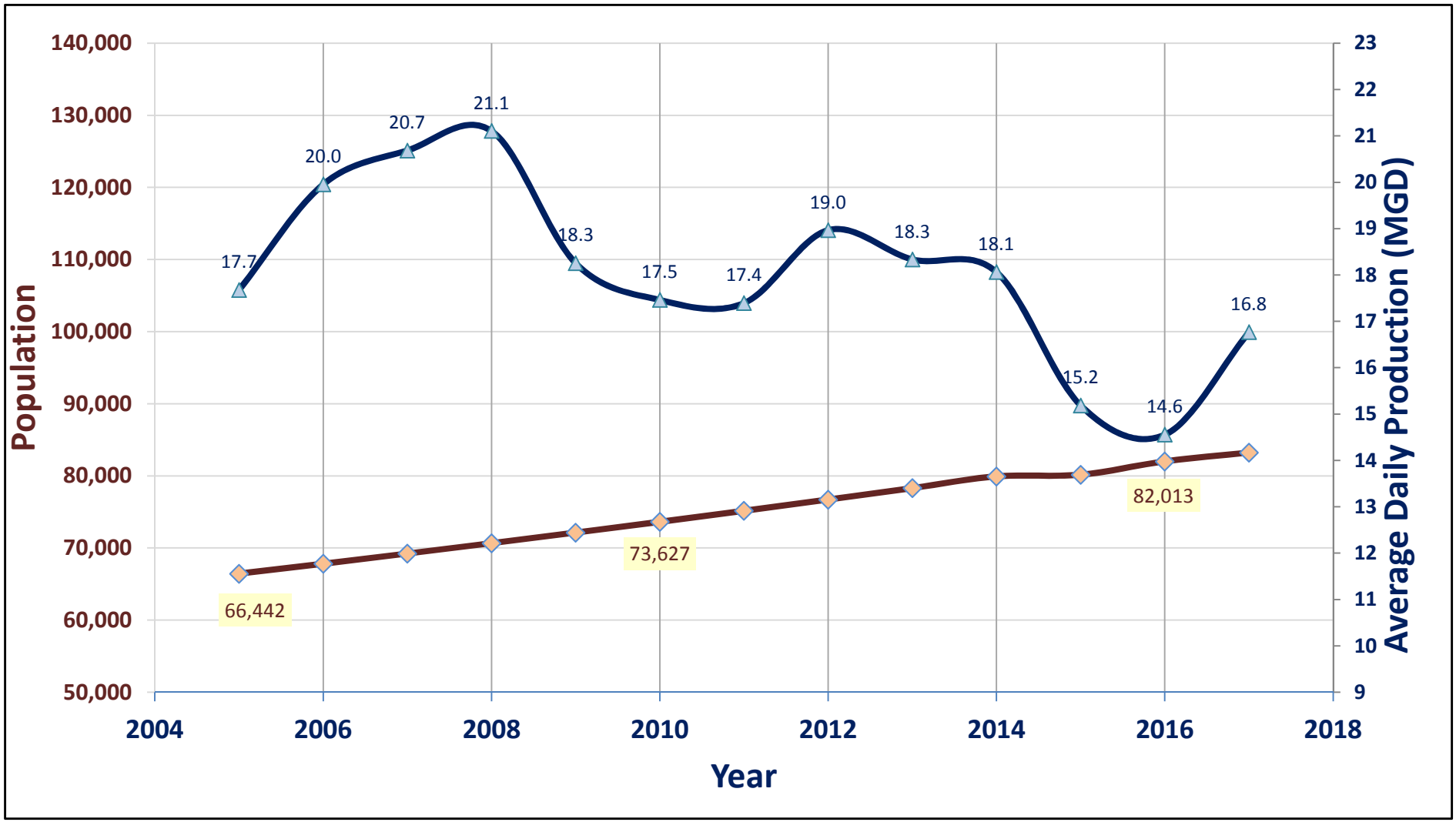
The ultimate demand forecasts included in this master plan for residential and non-residential land uses is based on net acreages. However, to generalize trends in the District's water use, per capita water use was documented. **Figure 3.1** displays the historical population in relation to average daily water production. **Figure 3.2** displays a comparison in the per capita water use and average daily water production. The remainder of the District's criteria are summarized in the following sections and on **Table 3.3**.

3.2 SUPPLY CRITERIA

In determining the adequacy of the domestic water supply facilities, the source must be large enough to meet the varying water demand conditions, as well as provide sufficient water during potential emergencies such as power outages and natural or created disasters.

Ideally, a water distribution system should be operated at a constant water supply rate with consistent supply from the water source. On the day of peak day demand it is desirable to maintain a water supply rate equal to the peak day rate. Water required for peak hour demands or for fire flows would come from storage.

The District currently uses a combination of groundwater wells, State Water Project (SWP) water and treated surface water from Lytle Creek to meet the varying demand conditions of the existing customers. The minimum reliable supply to the surface water treatment facility is estimated to be approximately 4,000 afy, or 3.6 mgd. For supply planning purposes it is assumed that the total required groundwater supply shall be adequate to supply peak day demands less 4,000 afy, which is summarized on the following page.



LEGEND

Population

Average Daily Production (MGD)

PRELIMINARY

September 25, 2018

Figure 3.1

Historical Population vs. Average Daily Production

Water Facilities Master Plan

West Valley Water District

AKEL ENGINEERING GROUP, INC.

LEGEND

Per Capita Consumption (gpdc)

Average Daily Production (MGD)

PRELIMINARY

September 25, 2018

Figure 3.2

Water Use Per Capita vs. Average Daily Production

Water Facilities Master Plan

West Valley Water District

AKEL ENGINEERING GROUP, INC.

Table 3.1 Historical Annual Water Production and Peak Day Peaking Factors (2005-2017)

Water Facilities Master Plan
West Valley Water District

Year	Population[1,2,3,4]	% Increase	Historical Water Production										Average Daily Water Use per Capita
			Total Annual Production[5]					Monthly Production[6]			Daily Production[6]		
			Consumption by WVWD	Delivered to Others	Total		Percent Increase	Maximum	Month of Occur.	Max-to-Avg Ratio	Average	Max-to-Avg Ratio	
			(AF)	(AF)	(AF)	(gpm)		(mgd)			(MGD)		(gpdc)
2005	66,442	-	19,796	1,355	21,151	13,114	-	27.49	July	1.46	17.7	-	266
2006	67,821	2.1%	22,347	1,970	24,317	15,078	15%	30.58	August	1.41	20.0	-	295
2007	69,228	2.1%	23,167	171	23,338	14,471	-4%	28.58	August	1.37	20.7	-	299
2008	70,665	2.1%	23,638	429	24,068	14,923	3%	28.38	August	1.32	21.1	-	299
2009	72,131	2.1%	20,444	1,137	21,581	13,381	-10%	24.97	August	1.30	18.3	-	253
2010	73,469	1.9%	19,556	1,210	20,766	12,876	-4%	25.19	August	1.36	17.5	-	238
2011	74,807	1.8%	19,479	1,146	20,624	12,788	-1%	27.25	July	1.48	17.4	-	233
2012	76,145	1.8%	21,243	1,294	22,537	13,974	9%	26.08	August	1.30	19.0	-	249
2013	77,483	1.8%	20,535	1,065	21,600	13,393	-4%	23.13	July	1.20	18.3	-	237
2014	78,821	1.7%	20,229	931	21,160	13,120	-2%	23.63	July	1.25	18.1	-	230
2015	80,161	1.7%	17,006	1,191	18,197	11,283	-14%	18.62	August	1.15	15.2	-	190
2016	82,013	2.3%	16,301	2,070	18,371	11,391	1%	20.08	August	1.22	14.6	-	178
2017	83,902	2.3%	18,778	1,243	20,021	12,414	9%	22.47	July	1.26	16.8	-	200
Historical Maximum Peaking Factors													
7-Year Maximum (2011-2017)					22,537	13,974	9%	27		1.48	19.0	-	249
5-Year Maximum (2013-2017)					21,600	13,393	9%	24		1.26	18.3	-	237
3-Year Maximum (2015-2017)					20,021	12,414	9%	22		1.26	16.8	-	200
2017 Maximum					20,021	12,414	9%	22		1.26	16.8	-	200
Recommended Peaking Factors													
2012 Water System Master Plan Criteria												1.70	
2019 Water System Master Plan										**1.40**		**1.70**	

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9/12/2019

Notes:

1. Historical Population from 2005 to 2014 extracted from the District's Public Water System Statistics provided by District staff September 12, 2019
2. 2015 population extracted from 2015 Urban Water Management Plan
3. 2016 population extracted from "2016 Year End Report", provided by District Staff on June 17, 2017
4. 2017 population extracted from "2017 Year End Report", provided by District Staff on September 25, 2018
5. Annual production statistics received September 25, 2018 (including distinction between actual WVWD consumption and water delivered to others (WVWD customers versus Water Wholesale to other agencies).
6. Source : Public Water System Statistics received from District staff June 15, 2017. "Year end report" for year 2016, received June 15, 2017. Monthly and Daily Production Statistics not including water wholesale to other agencie

Table 3.2 Historical Monthly Water Production (2015-2017)

Water Facilities Master Plan

West Valley Water District

Month	2015			2016			2017		
	Monthly[1]		Peaking Factor	Monthly[2]		Peaking Factor	Monthly[3]		Peaking Factor
	Production (mgd)	Percent of Annual (%)	Month to Avg Factor	Production (mgd)	Percent of Annual (%)	Month to Avg Factor	Production (mgd)	Percent of Annual (%)	Month to Avg Factor
January	12.6	7%	0.83	9.0	5%	0.62	8.22	4%	0.49
February	12.4	7%	0.82	11.0	6%	0.75	8.34	4%	0.50
March	14.5	8%	0.96	11.8	7%	0.81	12.63	6%	0.76
April	17.2	9%	1.14	12.1	7%	0.83	16.39	8%	0.98
May	15.2	8%	1.00	14.2	8%	0.98	17.27	9%	1.03
June	18.5	10%	1.22	17.8	10%	1.22	20.41	10%	1.22
July	17.0	9%	1.12	20.0	11%	1.38	22.47	11%	**1.34**
August	18.6	10%	**1.23**	20.1	12%	**1.38**	20.72	10%	1.24
September	16.5	9%	1.09	17.5	10%	1.20	19.16	10%	1.15
October	14.1	8%	0.93	15.6	9%	1.07	19.56	10%	1.17
November	13.3	7%	0.88	14.0	8%	0.96	18.08	9%	1.08
December	12.1	7%	0.80	11.4	7%	0.78	17.32	9%	1.04
Total	**182.1**			**174.4**			**200.6**		
Average Value	**15.2**			**14.5**			**16.7**		
Maximum Value	**18.6**		**1.23**	**20.1**		**1.38**	**22.5**		**1.34**

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9/25/2018

Notes:

1. PWSS Statistics received from District Staff, not including water deliveries to customers outside the District Service Area (wholesale to other agencies)
2. Monthly Production extracted from " 2016 Year End Report", received from District Staff 06/15/2017. Does not include wholesale to other agencies.
3. Monthly Production extracted from " 2017 Year End Report", received from District Staff 09/25/2018. Does not include wholesale to other agencies.

Table 3.3 Planning and Design Criteria

Water Facilities Master Plan
West Valley Water District

Design Parameter	Criteria
Supply Requirement	Supply to meet Peak Day Demand with firm capacity only Peak day pumping shall be based on 16 hour of pumping/ day
Storage Requirement	Total Required Storage = Operational + Fire (For Zone 2, 3, 3A, 8) Total Required Storage = Operational + Fire + Pumping (For Zone 4, 5, 6, & 7) Operational Storage: 100% of Peak Day Demand Fire Storage: Low Density Residential: 0.18 MG (1,500 gpm for 2 hours) High Density Residential: 0.54 MG (3,000 gpm for 3 hours) Schools/Commercial: 0.54 MG (3,000 gpm for 3 hours) Office/Light Industrial: 0.54 MG (3,000 gpm for 3 hours) Heavy Industrial: 0.96 MG (4,000 gpm for 4 hours) Pumping Storage: 100% Average Day Demand for Supply Dependent Pumping Zones
Pump Stations[1]	Pump Stations shall meet Peak Day Demand with respective firm capacity of Pressure Zone (on a 16-hour per day pumping schedule). Firm capacity of Pressure Zone is defined as the sum of the total capacity of each pump station pumping into the pressure zone, with each pump station operating without their largest unit.
Pressure Reducing Valves[1]	PRV should be designed to meet the greater of: Peak Hour Demand, or Peak Day Demand + Fire Flow
Pipelines	Pipelines should be designed to meet the greater of: 1) Peak Hour Demand, or 2) Peak Day Demand + Fire Flow Criteria for existing and future pipelines include Maximum Velocity: 5 ft/s during Peak Day Demand 10 ft/s during Peak Day Demand + Fire Flow Maximum Headloss: 5 ft/1,000 ft during Peak Day Demand (assuming a C-Factor of 120) Dead-end pipelines shall not exceed 660 feet in length
Service Pressures	Maximum Pressure In Pipelines: 130 psi At Service Connections: 80 psi Minimum Pressure Peak Hour Demand: 40 psi Peak Day Demand + Fire Flow: 20 psi
Demand Peaking Factors	Peak Month Demand: 1.40 x Average Day Demand Peak Day Demand: 1.70 x Average Day Demand Peak Hour Demand: 1.70 x Peak Day Demand
Water Demand Factors[2]	2015 UWMP Water Use Rate: 212 gallons per capita per day (gpcd) EDU Water Use: 670 gpd/EDU
Fire Flows	Low Density Residential: 1,500 gpm for 2 hours High Density Residential: 3,000 gpm for 3 hours Schools/Commercial: 3,000 gpm for 3 hours Office/Light Industrial: 3,000 gpm for 3 hours Heavy Industrial: 4,000 gpm for 4 hours

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2/9/2018

Notes:

1. Criteria not included in District 2012 Water Master Plan. Criteria shown recommended by Akel Engineering Group.
2. Water use rate consistent with 2020 per capita water use target per District 2015 Urban Water Management Plan.

- Total Required Groundwater Supply = Peak Day Demands – 4,000 afy (3.6 mgd)

3.3 STORAGE CRITERIA

The intent of domestic water storage is to provide supply for operational equalization, fire protection, and other emergencies, such as power outages or supply outages. Operational or equalization storage provides the difference in quantity between the customer's peak hour demands and the system's available reliable supply. The District storage criteria varies depending on what pressure zone is being served.

3.3.1 Typical Storage Criteria

The District's storage criteria consists of three main elements: operational, fire flow, and pumping.

Operational Storage

Operational or equalization storage capacity is necessary to reduce the variations imposed on the supply system by daily demand fluctuations. Peak hour demands may require up to 2 times the amount of maximum day supply capacity. With storage in place, this increase in demand can be met by the operational storage rather than by increasing production from the supply sources. The District criteria for all pressure zones is to maintain an operational storage amount equal to 100 percent of peak day demand.

- Operational Storage = 100% x PDD

Fire Storage

Fire storage is also needed to mitigate potential emergencies that may occur in the pressure zone, and in compliance with relevant fire codes. The recommended fire storage capacity varies by pressure zone and land use type, and is usually higher for commercial and industrial areas. Fire flow provisions for each pressure zone were calculated based on the governing (highest) land use type within a reservoir service area as follows:

- Low Density Residential: 1,500 gpm for 2 hours = 0.18 MG
- High Density Residential: 3,000 gpm for 3 hours = 0.54 MG
- Schools/Commercial: 3,000 gpm for 3 hours = 0.54 MG
- Office/Light Industrial: 3,000 gpm for 3 hours = 0.54 MG
- Heavy Industrial: 4,000 gpm for 4 hours = 0.96 MG

Pumping Storage

The majority of the District's existing and planned groundwater wells with pump stations convey through the North System. In order to ensure a sufficient volume of water is available for pumping

to meet the demands of the North System the District requires an additional amount of water to be stored in the water storage reservoirs. Therefore, Pressure Zones 4, 5, 6 and 7 carry additional pumping storage volumes for the respective higher zones, less the 4.0 mgd capacity of the WFF.

- Pumping Storage = 100% x ADD of Supply Dependent Pressure Zones - 4.0 mgd

Total Storage Requirement

The total storage (Qs) is the summation of operational (equalization), fire, and pumping storage requirements as follows:

For Pressure Zones 2, 3, 3A, 8:

- Qs =Peak Day Demand + fire flow (varies)

For Pressure Zones 4, 5, 6, 7:

- Qs =Peak Day Demand + fire flow (varies) + Pumping (varies)

3.4 PRESSURE CRITERIA

Acceptable service pressures within distribution systems vary depending on District criteria and pressure zone topography. It is essential that the water pressure in a consumer's residence or place of business be maintained within an acceptable range. Low pressures below 30 psi can cause undesirable flow reductions when multiple faucets or water using appliances are used at once.

Excessively high pressures can cause faucets to leak and valve seats to wear out prematurely. Additionally, high service pressures can cause unnecessarily high flow rates, which can result in wasted water and high utility bills. The criteria for pressures in the domestic water system include the following:

- Maximum pressure, usually experienced during low demands and winter months
- Minimum pressure, usually experienced during peak hour demands and summer months
- Minimum pressure during simultaneous peak day demand and fire flow

The American Water Works Association Manual on Computer Modeling and Water Distribution System (AWWA M-32) indicates that maximum pressures are usually in the range of 90-110 pounds per square inch (psi). In some communities, the maximum pressure may be limited to 80 psi to mitigate the impact on internal plumbing. In this case, the distribution system is usually sized for the higher pressures, and individual pressure-reducing valves are installed on service lines where the pressure may be exceeded.

The minimum acceptable pressure is usually in the range of 40-50 psi, which generally provides for sufficient pressures for second story fixtures. When backflow preventers are required, they may reduce the pressures by approximately 5-15 psi. The recommended minimum pressure during fire flows is 20 psi, as established by the National Fire Protection Association (NFPA).

The District's pressure criteria are summarized as follows:

- Maximum pressure (pipelines): 130 psi
- Maximum pressure (service connections): 80 psi
- Minimum pressure (PHD): 40 psi
- Minimum pressure (PDD + Fire Flow): 20 psi

3.5 UNIT FACTORS

Domestic water demand unit factors are coefficients commonly used in planning level analysis to estimate future average daily demands for areas with predetermined land uses. The unit factors are multiplied by net acreages to yield the average daily demand projections.

The total domestic water demand was extracted from consumption data maintained by the District. The demand was adjusted to balance with current production records, and to account for transmission main losses and vacancies in existing land uses. For planning purposes, the production used to develop the water demand unit factors was based on 2014 production data minus ten percent to account for current water conservation trends. The demand unit factor was then calculated using the calculated water production and total number of residential and non-residential land use acreages.

This analysis generally indicates that existing residential land uses have higher consumptive use factors than that of non-residential land uses. The existing unit factor analysis is shown on **Table 3.4**. It should be noted that extensive water conservation efforts have reduced water demands beyond the required "20x2020" target water use. The water production target of 2014 minus 10 percent is below the "20x2020" target, but is considered reasonable and conservative based on 2015 and 2016 production records. The water demand unit factors are summarized on **Table 3.5**. It should be noted that the existing industrial factors are low compared to industry standards, and were adjusted to reflect more conservative planning assumptions.

It should be noted that the water demand unit factors utilized in this WFMP are generally lower for all land use types as compared to the 2012 WMP. A comparison of the water demand unit factors is included in **Appendix A**. The water demand unit factors prepared as part of this master plan reflect changes in water use due to recent drought conditions, as well as a revised land use analysis.

Table 3.4 Water Demand Unit Factor Analysis

Water Facilities Master Plan

West Valley Water District

Land Use Classification	Existing Development within Service Area	Existing Average Daily Water Demand Unit factors									
		Consumption[1]			Production[2]		Production at 100% Occupancy			Recommended Water Unit Factor	
		Unadjusted Water Unit Factors	Annual Consumption		Unadjusted Water Unit Factors	Production (w/o Vacancy rate)	Vacancy Rate[3,4]	Projected Production at 100% Occupancy		Recommended Factor	Balance Using Recommended Unit Factor
	(net acres)	(gpd/net acres)	(gpd)	(gpm)	(gpd/net acres)	(gpd)	(%)	(gpd/net acres)	(gpd)	(gpd/net acres)	(gpd)
Residential[5]											
Residential 2	1,080	734	792,487	550	926	1,000,047	5.9%	984	1,062,750	990	1,068,792
Residential 6	4,026	1,974	7,945,858	5,518	2,491	10,026,958	5.9%	2,647	10,655,641	2,650	10,667,777
Residential 12	4	3,414	12,569	9	4,308	15,861	5.9%	4,578	16,856	4,580	16,864
Residential 21	87	4,196	367,009	255	5,295	463,133	5.9%	5,627	492,171	5,630	492,419
Subtotal Residential	5,196		9,117,923	6,332		11,505,999			12,227,417		12,245,852
Non-Residential											
Commercial	123	1,249	154,053	107	1,576		12.1%	1,794	221,254	1,800	221,977
Retail	121	1,311	158,092	110	1,655	199,498	12.1%	1,884	227,055	1,890	227,828
Office	72	981	70,462	49	1,238	88,916	12.1%	1,409	101,198	1,410	101,302
Educational	373	1,415	528,135	367	1,786	666,459	0.0%	1,786	666,459	1,790	667,905
Institutional	129	1,112	142,911	99	1,403	180,341	0.0%	1,403	180,341	1,410	181,224
Public Facility	324	191	61,965	43	241	78,194	0.0%	241	78,194	250	81,009
Light Industrial	1,022	380	388,224	270	479	489,904	4.6%	502	513,508	500	511,143
Industrial	1,983	332	657,527	457	418	829,740	4.6%	439	869,718	1,000	1,983,076
Heavy Industrial	510	1,149	586,004	407	1,451	739,484	4.6%	1,520	775,113	1,530	780,002
Subtotal - Non-Residential	4,657		2,747,373	1,908		3,466,938			3,632,842		4,755,466
Other											
Landscape Irrigation[6]	450	2,125	956,577	664	2,681	1,207,114	0.0%	2,681	1,207,114	2,690	1,210,981
Marygold Mutual Water Company[7]			652,512			652,212			652,212		652,212
ROW	110	0	0	0	0	0	0.0%	0	0	0	0
Utilities	293	2	445	0	2	561	0.0%	2	561	10	2,931
Open Space	1,755	0	0	0	0	0	0.0%	0	0	0	0
Subtotal - Other	2,820		1,609,534	1,118		1,859,888			1,859,888		1,866,124
	12,673		**13,474,831**	9,358		**16,832,825**			17,720,146		**18,867,442**

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10/5/2017

Note:

1. Consumption extracted from the 2016 water meter shapefile database, provided by District Staff July 5, 2017.
2. Meters consumption was normalized to 2014 production records minus 10 percent (90% of 2014 Production Records).
3. Residential vacancy rate extracted from California Department of Finance Sheet E-5 published 2016.
4. Non-residential vacancy rates extracted from Inland Empire 2013 market report prepared by Voit Real Estate Services, downloaded September 11, 2017. Vacancy rates shown are average of rates for the cities of Fontana, Rialto, and Colton.
5. Residential Landuse categories extracted from the 2010 General Plan Landuse, published by the City of Rialto.
6. Landscape irrigation acres include estimated acres for irrigated parkways, which were assumed at 1 acre per meter.
7. Marygold Mutual Water Company demand extracted from wholesale water sale information included in water billing records received from District staff July 5, 2017. Meter located south of the intersection of Randall Avenue and Cedar Avenue.

Table 3.5 Recommended Water Unit Factors

Water Facilities Master Plan
West Valley Water District

Land Use Designation	Recommended Water Factor (gpd/ acre)	Recommended Water Factor (gpm/acre)
Residential		
Residential 2	990	0.69
Residential 6	2,650	1.84
Residential 12	4,580	3.18
Residential 21	5,630	3.91
Non-Residential		
Commercial	1,800	1.25
Retail	1,890	1.31
Office	1,410	0.98
Educational	1,790	1.24
Institutional	1,410	0.98
Public Facility	230	0.16
Light Industrial	500	0.35
Industrial	1,000	0.69
Heavy Industrial	1,530	1.06
Other		
Landscape Irrigation	2,690	1.87
ROW	0	0
Utilities	10	0.01

3.6 SEASONAL DEMANDS AND PEAKING FACTORS

Domestic water demands within municipal water systems vary with the time of day and month of the year. It is necessary to quantify this variability in demand so that the water distribution system can be evaluated and designed to provide reliable water service under these variable demand conditions.

Water use conditions that are of particular importance to water distribution systems include the average day demand (ADD), the peak month demand (PMD), the peak day demand (PDD), the peak hour demand (PHD), and the winter demand.

The average day demand represents the annual water demand, divided by 365 days, since it is expressed in daily units. The winter demand typically represents the low month water demands and is used for simulating water quality analysis.

3.6.1 Peak Month Demand

The peak month demand (PMD) is the highest demand that occurs within a calendar month during a year. The District's PMD usually occurs in the summer months, in either July or August. The PMD is used primarily in the evaluation of supply capabilities.

Historical monthly water production records, obtained for the period between 2005 and 2015 (Table 3.1), indicate the maximum month to average month ratio ranging between 1.25 and 1.52. Over the reviewed period, this ratio showed increasing or decreasing trends. Therefore, a PMD factor of 1.40 was deemed representative of trends in the District service area. The following equation is recommended for estimating the maximum month demand, given the average day demand:

Peak Month Demand = **1.40** x Average Day Demand

3.6.2 Peak Day Demand

The peak day demand is the highest demand that occurs within a 24 hour day during a year. The District's PDD, which usually occurs during the summer months, is typically used for the evaluation and design of storage facilities, distribution mains, pump stations, and pressure reducing valves. The PDD, when combined with fire flows, is one of the highest demands that these facilities should be able to service while maintaining acceptable pressures within the system.

The peak day demands were obtained from the District's water production records. Production records indicate the date of occurrence and magnitude of the peak day demand for each calendar year, as listed in Table 3.1. Monthly data was provided by the District for review of water demand trends and peaking factor evaluation. For the purposes of this Master Plan, the peak day demand factor is assumed at 1.7 times the average day demand and consistent with the previous master

plan. The following equation is then used to estimate the peak day demand, given the average day demand:

Peak Day Demand = **1.70** x Average Day Demand

3.6.3 Peak Hour Demand

The peak hour demand is another high demand condition that is used in the evaluation and design of water distribution systems. The peak hour demand is the highest demand that occurs within a one-hour period during a year. The peak hour demand is considered to be the largest single measure of the maximum demand placed on the distribution system. The PHD is often compared to the MDD plus fire flow to determine the largest demand imposed on the system for the purpose of evaluating distribution mains.

A peak hour to peak day ratio of 1.7 was applied to the peak day demand to yield the peak hour demand ratio of 2.9, consistent with the District design standards. The peak hour demand can then be calculated using the average day demand and the following equation:

Peak Hour Demand = **1.70** x Peak Day Demand

3.7 FIRE FLOWS

Fire flows are typically based on land use, with the potential for increased fire flow based on the building type. The following are the criteria for fire flows:

- **Low Density Residential.** Fire flows for low density residential land use types were calculated at 1,500 gpm for two hours.
- **High Density Residential.** Fire flows for high density residential land use types were calculated at 3,000 gpm for three hours.
- **Schools/ Commercial.** Fire flows for schools and commercial land use types were calculated at 3,000 gpm for three hours.
- **Office/ Light Industrial.** Fire flows for office and light industrial land use types was calculated at 3,000 gpm for three hours.
- **Heavy Industrial.** Fire flows for heavy industrial land use types were calculated at 4,000 gpm for four hours.

3.8 TRANSMISSION AND DISTRIBUTION MAIN CRITERIA

Transmission and distribution mains are usually designed to convey the maximum expected flow condition. In municipal water systems, this condition is usually the greater of either the peak hour demand or the peak day demand plus fire flow. The hydrodynamics of pipe flow create two additional parameters that are taken into consideration when evaluating or sizing water mains: head loss and velocity.

Head loss is a loss of energy within pipes that is caused by the frictional effects of the inside surface of the pipe and friction within the moving fluid itself. Head loss creates a loss in pressure which is undesirable in water distribution systems. Head loss, by itself, is not a critical factor as long as the pressure criterion has not been violated. However, high head loss may be an indicator that the pipe is nearing the limit of its carrying capacity and may not have sufficient capacity to perform under stringent conditions. The District criterion for maximum pipeline head loss is summarized as follows:

- Peak Day Demand: 5 feet per 1,000 feet of pipe

Since high flow velocities can cause damage to pipes and lead to high head loss, it is desirable to keep the velocity below a predetermined limit. The District criteria for maximum pipeline velocity are summarized as follows:

- Peak Day Demand: 5 feet per second
- Peak Day Demand + Fire Flow: 10 feet per second

These velocity criteria also ensure that the head loss is kept below an acceptable limit, as the head loss in a pipe is a function of the flow velocity. Flow velocities in transmission mains 14 inches and larger are governed by the head loss criteria.

A summary of the criteria pertaining to transmission and distribution mains is included in **Table 3.3**. The pipe roughness coefficient used for calculating head loss was based on the District criterion of 120.

It should be noted that the headloss criteria in transmission mains may be relaxed, where feasible, to account for transmission main redundancy and reliability. Relaxing of the criteria requires the review and approval of the District.

3.9 TIME OF USE

Southern California Edison (SCE) has defined peak use times of the year where a tiered system of energy rates are implemented to encourage decreased energy consumption. Time of use is implemented from June 1 through September 30, which coincides with the maximum day and peak hour demands in the water system. There are three stages of energy rates during summer time of use:

- **Off Peak:** This category is typically associated with the lowest energy costs and occurs from 9:00 PM to 4:00 PM.
- **Partial Peak:** This category has medium energy costs and is intended to minimize energy use when possible. It occurs from 4:00 PM to 9:00 PM on weekends and holidays.
- **On Peak:** This is the highest cost category, and is intended to encourage users to avoid energy consumption whenever possible. It occurs from 4:00 PM to 9:00 PM.

District staff have been implementing time of use pumping, when possible, throughout their system to reduce operational costs. It should be noted that time of use pumping may impact the sizing of pipelines within pressure zones during nighttime replenishment pumping. This high pumping period is accounted for in this master plan analysis, and modeling scenarios reflect the time of use periods.

CHAPTER 4 - EXISTING DOMESTIC WATER FACILITIES

This chapter provides a description of the District's existing domestic water system facilities including the distribution mains, storage reservoir, booster pump stations and the existing wells.

4.1 EXISTING WATER SYSTEM OVERVIEW

The District operates a domestic water distribution system that consists of 21 groundwater wells, 25 separate storage reservoirs across eight pressure zones shown in **Figure 4.1**, for a total storage over 72 million gallons (MG), and over 375 miles of transmission and distribution pipelines.

The District's existing domestic water distribution system is shown in **Figure 4.2**, which displays the existing system by pipe size. This figure provides a general color coding for the distribution mains, as well as labeling the existing wells, booster stations, pressure reducing valves, and the storage reservoirs. Additionally, **Figure 4.3** summarizes the existing system with pipelines colored based on pressure zone. A hydraulic profile based on the existing operations of the District's water system is provided on **Figure 4.4**. The District is generally divided into two sections, commonly referred to as the North System and South System, which are briefly summarized in the following sections.

4.1.1 North System

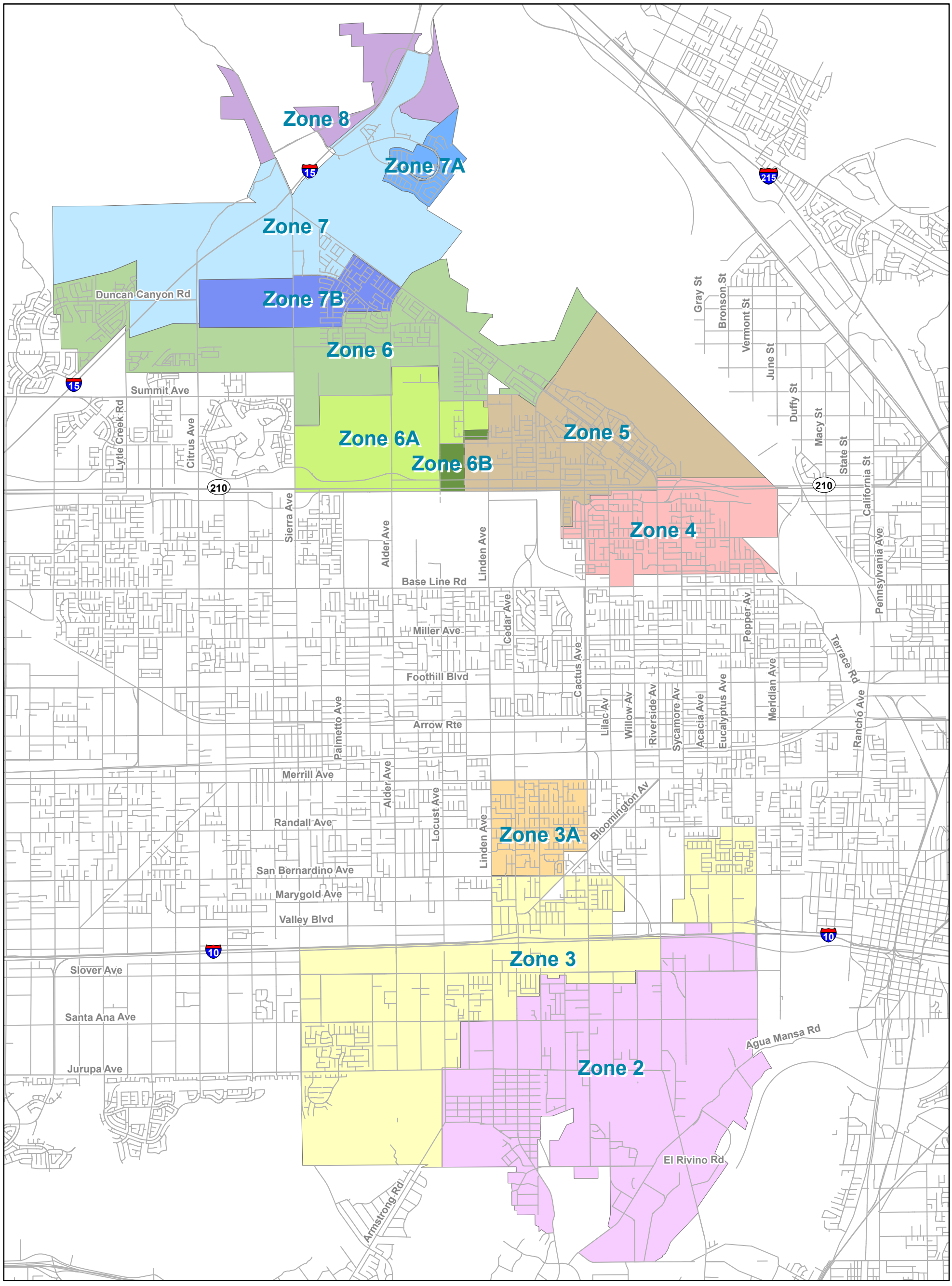
The District's North System, comprised of Pressure Zones 4, 5, 6, 7 and 8, provides domestic water service to the District's customers north of Baseline Road. Supply for this system is provided by multiple groundwater wells, the Roemer WFF in Pressure Zone 5, and water boosted from the Baseline Feeder to Pressure Zone 4 at the Lord Ranch Facility.

4.1.2 South System

The District's South System, comprised of Pressure Zones 3A, 3, and 2, provides domestic water service to the District's customers generally located south of Merrill Avenue. Supply for this system is provided by multiple groundwater wells and the FBR treatment facility in Pressure Zone 3A.

4.2 SOURCE OF SUPPLY

In order to meet existing domestic water demands, the District utilizes several sources of supply, including groundwater and treated surface water. The following section provides a brief summary of these sources, with a more detailed discussion provided in the Water Demands and Supply Characteristics chapter.



Legend

Pressure Zones

- Zone 2
- Zone 3
- Zone 3A
- Zone 4
- Zone 5
- Zone 6
- Zone 6A
- Zone 6B
- Zone 7
- Zone 7A
- Zone 7B
- Zone 8

Street Centerlines

Updated: October 9, 2017

0 0.25 0.5 1 Mile

N W GIS E S

File Path: P:\xGIS\GIS_Projects\West Valley WD\Final\WVWD_Fig4-1_PressureZones_100917.mxd

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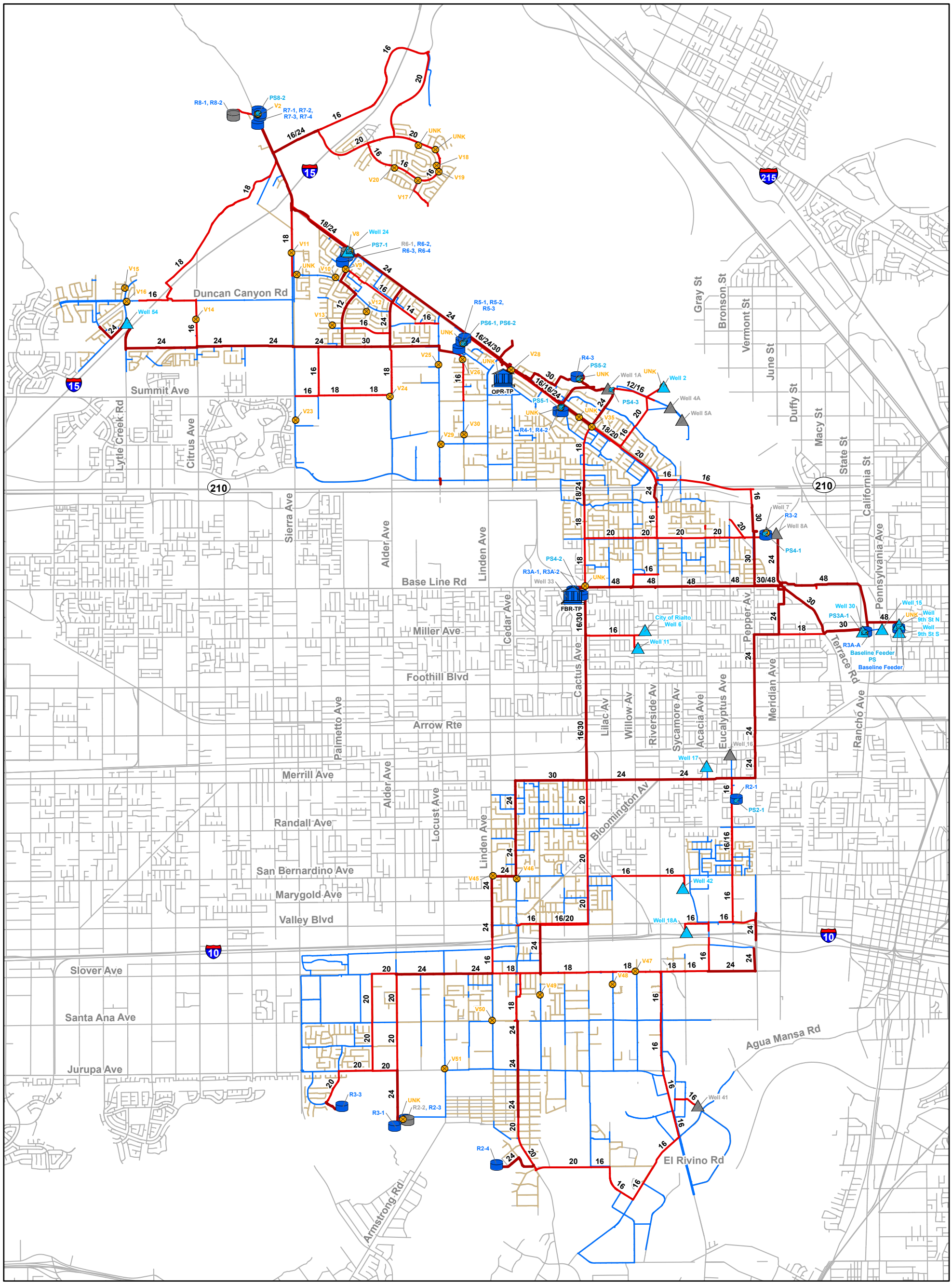
Figure 4.1
Existing Pressure Zones

Water Facilities Master Plan
West Valley Water District

West Valley Water District



Legend

Existing System

- WTP
- Tanks
- Inactive Tanks
- Active Wells
- Inactive Wells
- Pumps
- Valves

Pipes by Diameter

- 8" and Smaller
- 10" - 12"
- 16" - 20"
- 24" - 48"
- Street Centerlines

N, W, GIS, E, S

0 0.25 0.5 1 Mile

Updated: March 13, 2019

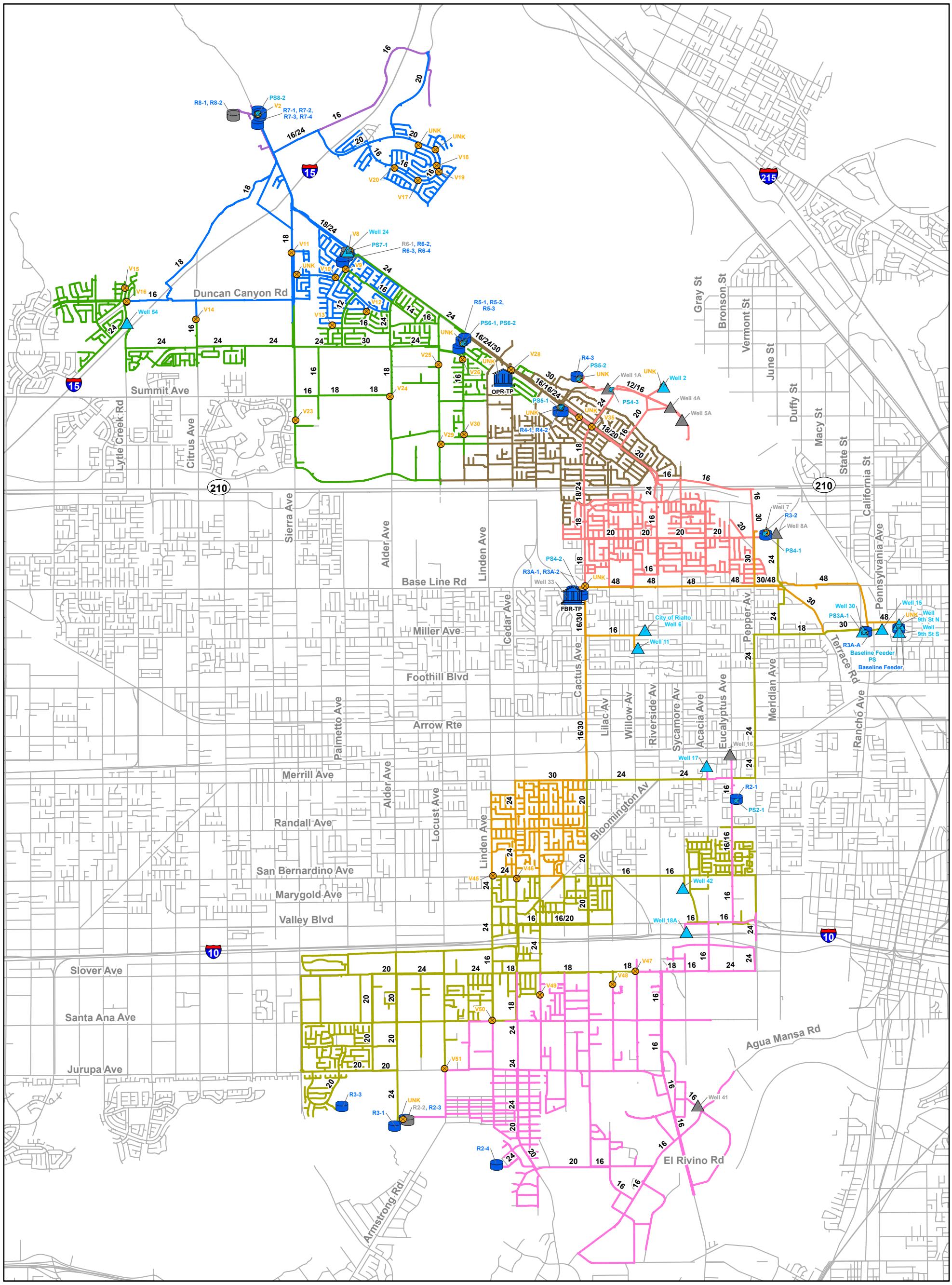
Figure 4.2
Existing Water Distribution System

Water Facilities Master Plan
West Valley Water District

AKEL ENGINEERING GROUP, INC.

West Valley Water District

File Path: P:\xGIS\GIS_Projects\West Valley WD\Final\WVWD_Fig4-2_ExistingSystem_031319.mxd



Legend

Existing System

- WTP
- Tanks
- Inactive Tanks
- Active Wells
- Inactive Wells
- Pumps
- Valves

Pipes by Pressure Zone

- Zone 2
- Zone 3
- Zone 3A
- Zone 4
- Zone 5
- Zone 6
- Zone 7
- Zone 8
- Street Centerlines

0 0.25 0.5 1 Mile

Updated: March 13, 2019

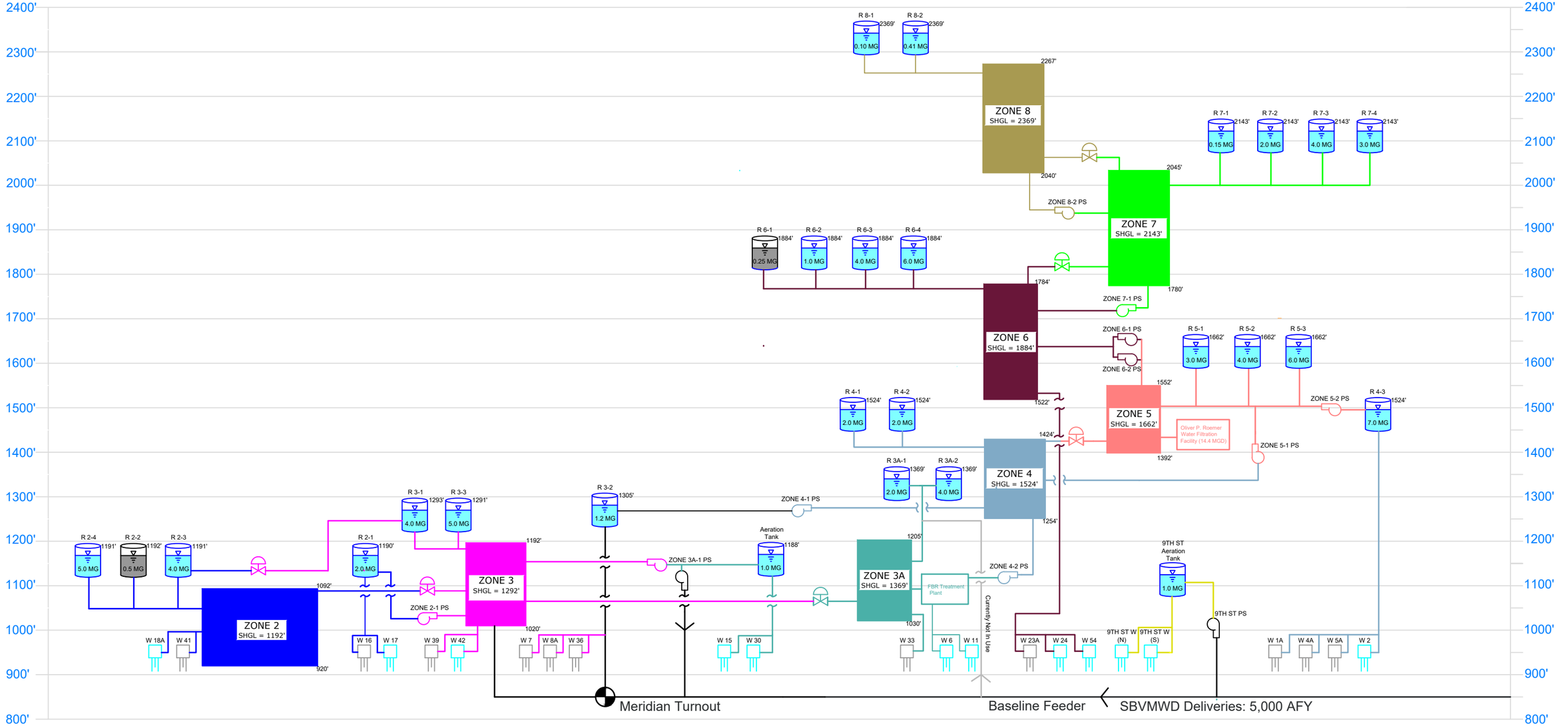
File Path: P:\xGIS\GIS_Projects\West Valley WD\Final\WVWD_Fig4-3_PipesPZ_031319.mxd

Figure 4.3
Existing System Pipes by Pressure Zone

Water Facilities Master Plan
West Valley Water District

AKEL ENGINEERING GROUP, INC.

West Valley Water District



LEGEND

HWL
LOW
MG
RESERVOIR
HWL: HIGH WATER LEVEL
MG: RESERVOIR CAPACITY
LOW: BOTTOM ELEVATION

RESERVOIR OFFLINE
HWL: HIGH WATER LEVEL
MG: RESERVOIR CAPACITY
LOW: BOTTOM ELEVATION

BOOSTER PUMPING STATION

PRESSURE REGULATING VALVE

TRANSMISSION MAIN

ZONE # SHGL
HIGH'
LOW'
PRESSURE ZONE
SHGL: STATIC HYDRAULIC GRADE LINE
HIGH': HIGHEST SERVICE ELEVATION
LOW': LOWEST SERVICE ELEVATION

WELL ACTIVE

WELL INACTIVE

Figure 4.4

Existing Hydraulic Profile Schematic

WATER FACILITIES MASTER PLAN

WEST VALLEY WATER DISTRICT

AKEL ENGINEERING GROUP, INC.

Last Updated: 07/21/2020

4.2.1 Groundwater Supply and Treatment Facilities

The District has 21 existing production wells, which are summarized on **Table 4.1**; this includes 12 active and nine inactive groundwater wells. As shown on **Table 4.1**; the firm capacity of the District's active groundwater wells is approximately 13,600 gpm. Rehabilitation, including water treatment, is needed to bring the remaining eight non-operational wells into production. The Kleinfelder firm was included as part of this team to evaluate the water supply and quality of the District's production wells.

Some wells are adversely impacted by contaminants, both human-caused and naturally occurring, which may limit the ability to use them as a source for consumption. The following documents the wells and their limiting water quality contaminant:

- **Arsenic:** Wells W-8A, W-36 and W-2
- **Perchlorate:** Wells W-16, W-17, W-18A, W-33, W-41 and W-42
- **Nitrate:** Wells W-16, W-18A, W-22A, W-39, and W-42

The District monitors groundwater quality and the movement of the groundwater contaminants, and in response to water quality concerns, groundwater treatment at the wellhead have been installed by the District on some wells. For example, well W-2 has Arsenic treatment and coagulation, and well W-11 has Perchlorate treatment.

A fluidized bed reactor (FBR) facility was constructed at the District's headquarters to remove perchlorate and nitrates. The FBR facility currently is used for perchlorate removal from the groundwater produced by wells W-11 and W-6. The process involves pumping groundwater from the two wells to the FBR, and additional downstream treatment facilities are utilized prior to discharge into the system, including: post-aeration tanks for treated water oxygenation, media filtration for solids removal, and a filtered water tank with a chlorination system for disinfection.

4.2.2 Surface Water Supply

The Oliver P. Roemer Water Filtration Facility (Roemer WFF) treats raw water from Lytle Creek, and is supplemented with State Water Project (SWP) water from Silverwood Lake. The facility is designed to treat local Lytle Creek water, imported SWP water, and a blend of the two. Kleinfelder, included on the Master Plan team, evaluated the Roemer WFF and provided discussion and recommendations.

The current capacity of the Roemer WFF is 14.4 mgd. This treatment facility has a current maximum treatment capacity of 14.4 mgd with plans to expand to 20.4 mgd. The planned expansion assumes the construction of a 6.0 mgd membrane filtration plant. Two additional lead-lag granular activated carbon (GAC) vessel systems were installed in 2017. **Appendix B** documents figures from the previous master plan that include a flow schematic of the Roemer WFF and a plant site diagram of the Roemer WFF.

Table 4.1 Existing Groundwater Wells

Water Facilities Master Plan
West Valley Water District

Supply Well	Zone	Groundwater Basin	Location	Pump Test Capacity[1]				Production Capacity[2]	Operational Controls[3]			
				Flow Rate		Total Dynamic Head	Test Year		Low Demand		High Demand	
				(gpm)	(mgd)	(ft)		(mgd)	On (ft)	Off (ft)	On (ft)	Off (ft)
Active Groundwater Wells												
W-2	4	Lytle Creek	19973 Country Club Drive, Rialto	1,532	2.2	519	2017	1.47	18	20	18	20
W-4A	4	Lytle Creek	5914 N. Sycamore Avenue, Rialto	2,318	3.3	512	2017	2.23	9	11	12	14
W-5A	4	Lytle Creek	5914 N. Sycamore Avenue, Rialto	1,085	1.6	532	2017	1.04	8	10	10	12
W-11[4]	3A	Rialto	238 W. Victoria St., Rialto	1,346	1.9	465	2017	1.29	VFD			
W-15	2,3,3A	Bunker Hill	1950 W. 9th St. San Bernardino	1,380	2.0	380	2016	1.32	24	26	24	26
W-17	2	Rialto	404 S. Acacia Avenue, Rialto	1,000	1.4		2010	0.96	10	18	10	18
W-18A	2	North Riverside	1783 S. Sycamore Avenue, Colton	2,170	3.1		2010	2.08	16	18	20	22
W-24	6	Rialto	4334 Riverside Avenue, Rialto	475	0.7	145	2017	0.46				
W-30	2,3,3A	Bunker Hill	2015 W. 9th St. San Bernardino	1,520	2.2	375	2016	1.46	22	24.5	22	24.5
W-42	3	North Riverside	295 E. San Bernardino Avenue, Rialto	1,625	2.3	578	2017	1.56	20	22	24	26
W-54	6	Rialto	Duncan Canyon Road, Fontana	920	1.3	930	2017	0.88	16	18	26	28
Rialto W-6[4]	3A	Rialto	204 W. Etiwanda Ave.	1,870	2.7	451	2017	1.80	VFD			
			Total Well Capacity[4]	15,895	22.9			**15.26**				
			Firm Well Capacity[4] (largest unit out of service)	13,577	19.6			**13.03**				
Inactive Groundwater Wells												
W-1A	4	Lytle Creek	19523 Country Club Drive, Rialto	822	1.2	367.1	2017	0.79				
W-7	3,4	Lytle Creek	6871 Martin PMP, San Bernardino	1,100	1.6		2010	1.06				
W-8A	3,4	Lytle Creek	6871 Martin Road, San Bernardino	1,700	2.4		2010	1.63				
W-41	2	North Riverside	3353 Industrial, Rialto	2,104	3.0	376.4	2016	2.02				
W-16		Rialto	296 S. Eucalyptus Avenue, Rialto	1,550	2.2		2010	1.49				
W-33	3A	Rialto	855 W Baseline Road, Rialto	2,517	3.6	425.3	2017	2.42				
W-23A	6	Rialto	4334 Riverside Avenue, Rialto	200	0.3		2010	0.19				
W-36	3,4	Lytle Creek	20600 Walnut Avenue, San Bernardino									
W-39	3	Chino	10272 Cedar Place, San Bernardino County					0.89				

AKEL ENGINEERING GROUP, INC.

1/11/2019

Notes:

1. Source: Pump tests received from District staff August 2, 2017.
2. Production capacity assumes operating time of 16 hours per day.
3. Source: Operational control document received from District staff August 31, 2017.
4. Well 11 and Rialto Well 6 both feed the District's Groundwater Wellhead Treatment System (FBR); only one well operates at any given time.

The current Roemer WFF consists of influent water blending ponds, rapid mixing/coagulation, flocculation, sedimentation and dual-media filtration. Filtered water is treated with GAC to remove volatile organic compounds (VOCs) and odor and taste contaminants; the filtered water ultimately is disinfected with ultraviolent (UV) light. The finished product water is chlorinated using free chlorine for further virus deactivation and to provide residual disinfectant in the distribution system.

The Roemer WFF also integrates auxiliary facilities including two filter backwash water ponds, three sludge disposal and drying ponds, multiple flow controlling/splitting structures, chemical storage building, Lytle Creek pump station, water distribution pump station, multiple intermediate pumping systems, electrical/power supply and instrumentation and control installations.

It should be noted that the City of Rialto owns 1.5 mgd of the Lytle Creek treated flows. Currently, the District delivers these flows through a connection with the City of Rialto at their Cedar Reservoir site, along Cedar Avenue south of Persimmon Avenue. The District delivers approximately 1.2 mgd, which can increase to the City of Rialto's owned capacity of 1.5 mgd depending on Lytle Creek flows.

4.2.3 Baseline Feeder Pipeline

Beginning in 1998, the District began receiving water through what is known as the Baseline Feeder (BLF) pipeline. This pipeline was constructed in a joint venture with the City of Rialto and San Bernardino Valley Municipal Water District (SBVWMD). The current agreement with SBVWMD allows the District to receive up to 5,000 afy of supply through this 48-inch transmission pipeline.

In 2012, two new groundwater wells, along with an aeration tank and pump station, were constructed as part of the Baseline Feeder Well Replacement and Improvement project, which was implemented to provide adequate supply to meet the District's 5,000 afy allotment. Before this time the District received an average of 2,700 afy due to diminishing operational capacity of the original SBVWMD BLF supply wells.

Water is currently delivered to the existing system through the following two facilities.

4.2.3.1 Meridian Turnout

The District receives water delivered through the BLF pipeline using a control structure at the intersection of Baseline Road and Meridian Avenue. This control structure, known as the Meridian Turnout, currently regulates the delivery of water to the District at the following locations:

- North from Baseline Road to the Lord Ranch Facility via a 24-inch pipeline
- South from Baseline Road to Pressure Zone 3 via a 24-inch pipeline

Based on current operating conditions, the Meridian Turnout prioritizes maintaining the level of the water storage reservoir 3-2, which serves as a forebay reservoir for pump station 4-1. Excess water in the BLF not required to maintain the tank level is transferred south to Pressure Zone 3.

4.2.3.2 Lord Ranch Facility

The District currently relies on pump stations to transfer supply delivered via the BLF to Pressure Zone 4 and the higher North System pressure zones. Pump Station 4-1 is currently utilized as the primary pump station to convey BLF deliveries to Pressure Zone 4, and is referred to as the Lord Ranch Facility. This facility is currently comprised of a forebay water storage reservoir (Reservoir 3-2), and Pump Station 4-1. Water is delivered to the forebay reservoir via a 24-inch pipeline from the Meridian Turnout. A new pump station planned for this facility will be the primary pump station to transfer future water extracted from the Bunker Hill groundwater basin to Pressure Zone 4.

4.3 PRESSURE ZONES

The District's service area generally slopes upward from south to north, with service elevations ranging between 900 ft and 2,300 ft. Due to the varying terrain, the service area is divided into eight pressure zones to account for the changes in elevation.

4.3.1 Zone 2 (SHGL = 1,192 feet)

Zone 2 is the southernmost zone in the District's southern system. It is generally bounded by the Santa Ana River and Riverside/San Bernardino County Line to the south, Locust, Maple and Cedar Avenues to the west, Interstate 10 to the north and Pepper Avenue to the east.

Elevations served in this pressure zone range from approximately 920 feet to 1,092 feet. This zone is supplied from one groundwater well (Well 18A) as well as PRVs from Zone 3; this zone has 3 active ground level storage reservoirs for a total storage capacity of 11.0 MG.

4.3.2 Zone 3 (SHGL = 1,292 feet)

Zone 3, located within the District's southern system, is separated into two distinct areas that are divided by the City of Rialto. The first area is generally bounded by Sierra Avenue to the west and Zone 2 to the east, with San Bernardino Avenue and the Riverside/San Bernardino County Line serving as the northern and southern boundaries respectively. The second area is generally bounded by Sycamore Avenue to the west and Pepper Avenue to the east, with Randall Avenue and Interstate 10 serving as the northern and southern boundaries respectively.

Elevations served in this pressure zone range from approximately 1,020 feet to 1,192 feet. This zone can be supplied from multiple locations, which are summarized as follows:

- Baseline feeder pipeline through the Meridian Turnout
- Well 17 supply, which first enters Reservoir 2-1, before being boosted into the Pressure Zone by the 2-1 Booster Station.

- Direct supply from Well 42
- Wells 15 and 30 supply, which first enters Aeration Tank 3A-1, before being boosted into the Pressure Zone by the 3A-1 Booster Station.
- PRVs from Zone 3A

This zone has three storage reservoirs for a total storage capacity of 10.2 MG.

4.3.3 Zone 3A (SHGL = 1,369 feet)

Zone 3A is the northernmost zone in the District' southern system. It is generally bound by Merrill Avenue to the north and San Bernardino Avenue to the south, with Linden Avenue and Cactus Avenue serving as the western and eastern boundaries respectively.

Elevations served in this pressure zone range from approximately 1,030 feet to 1,205 feet. This zone can be supplied from multiple locations, which are summarized as follows:

- The Fluidized Bed Reactor (FBR) treatment plant, which treats groundwater from well 11 and the City of Rialto well 6,
- Baseline feeder pipeline through the Meridian Turnout

This zone has two storage reservoirs for a total storage capacity of 6.0 MG.

4.3.4 Zone 4 (SHGL = 1,524 feet)

Zone 4 is the southernmost zone of the District's northern system. It is generally bound by Highland Avenue to the north and Baseline Road to the south, with Cactus Avenue and the Southern Pacific Railroad serving as the western and eastern boundaries respectively

Elevations served in this pressure zone range from approximately 1,254 feet to 1,424 feet. This zone is currently supplied by pump station 4-1 and pump station 4-2 as well as PRVs from Zone 5. This zone has three storage reservoirs for a total storage capacity of 11.0 MG, which includes pumping storage for Zones 5, 6, 7, and 8.

4.3.5 Zone 5 (SHGL = 1,662 feet)

Zone 5 is located within the District's northern system and generally bound by Summit Avenue to the north and Highland Avenue in the south. Maple Avenue and Linden Avenue serve as the western boundary while the Lytle Creek wash serves as the eastern boundary.

Elevations served in this pressure zone range from approximately 1,392 feet to 1,552 feet. This zone is supplied by the Roemer WFF as well as booster stations 5-1 and 5-2, which draw water from Zone 4. This zone has three storage reservoirs for a total storage capacity of 13.0 MG, which includes pump storage for Zones 6, 7, and 8.

4.3.6 Zone 6 (SHGL = 1,884 feet)

Zone 6, located within the District's northern system, is generally bound by Duncan Canyon Road and Casa Grande Drive to the north and Highland Avenue to the south; Sierra Avenue and Brookside Avenue generally serve as the western boundaries while the Lytle Creek wash serves as the eastern boundary.

Elevations served in this pressure zone range from approximately 1,522 feet to 1,784 feet. This zone is supplied from booster stations 6-1 and 6-2, which draw water from Zone 5, as well as PRVs from Zone 6; this zone has 3 active storage reservoirs for a total storage capacity of 11.0 MG, which includes pumping storage for Zones 7 and 8.

Zone 6 includes two subzones: Zone 6A, and Zone 6B. Zone 6A includes the developed area bound to the north by Summit Avenue and Lowell Street, Locust Avenue to the east, Foothill Freeway to the south and Sierra Avenue to the west. Zone 6B is bound to the north and west by Zone 6A, with Maple Avenue and Highland Avenue generally serving as the eastern and southern boundaries respectively.

4.3.7 Zone 7 (SHGL = 2,143 feet)

Zone 7, located within the District's northern system, is bounded to the south by pressure zone 6, and bounded north by the San Bernardino National Forest, then along the Interstate 15 to Glen Helen Regional Park. Elevations served in this pressure zone range from approximately 1,780 feet to 2,045 feet. This zone is supplied from booster station 7-1, which draws water from Zone 6, as well as PRVs from Zone 8; this zone has 4 storage reservoirs for a total storage capacity of 9.2 MG, which includes pumping storage for Zone 8.

Pressure Zone 7 includes two subzones: Zone 7A, and Zone 7B. Zone 7A serves the residential development along Sycamore Creek Loop. Zone 7B is generally south of Terra Vista Drive, between Riverside Avenue and Citrus Avenue.

4.3.8 Zone 8 (SHGL = 2,369 feet)

Pressure Zone 8 is the northernmost zone in the District's northern system and is generally north of Glen Helen Parkway, with Sierra Avenue and Clearwater Parkway serving as the western and eastern boundaries respectively.

Elevations in this pressure zone range from approximately 2,040 feet to 2,267 feet. This zone is supplied from booster stations 8-1 and 8-2, which draw water from Zone 7; this zone has two storage reservoirs for a total storage capacity of 0.51 MG.

4.4 TRANSMISSION AND DISTRIBUTION PIPELINES

Supply is pumped directly into the District's distribution system via 375 miles of pipeline, with diameters ranging from pipelines less than 6-inches in diameter to 48-inch pipelines. The District

maintains a robust transmission system, with approximately 60 miles of pipeline greater than or equal to 18-inches in diameter. The existing system pipelines are documented on **Figure 4.2**, and color-coded by pipe size. Similarly, **Figure 4.3** documents the existing system, and color-coded by pressure zone serviced.

An inventory of existing pipes, extracted from the GIS-based hydraulic model and used in this analysis, is included in **Table 4.2**. For each pipe diameter, the inventory lists the length in feet, as well as the total length in units of miles. Additionally, standard pipe roughness coefficients used for various materials are included for reference on **Table 4.3**.

4.5 STORAGE RESERVOIR

Storage reservoirs are typically incorporated in the water system to provide water supply for operation during periods of high demand, for meeting fire flow requirements, and for other emergencies, as defined in the District's planning criteria.

The District's existing storage reservoirs are summarized on **Table 4.4**, along with their capacity, high water level, tank height, and construction type. These reservoirs are also shown on the hydraulic profile schematic (**Figure 4.4**), the high water level and bottom tank elevations. The District maintains a robust system storage capacity, in excess of 71 million gallons.

4.6 BOOSTER STATIONS

Water is conveyed from the lower pressure zones to the higher pressure zones via a series of booster pump stations (**Table 4.5**). Water is extracted from various sources, including surface water from Lytle Creek and purchased State Water Project water treated at the Oliver P. Roemer Water Filtration Facility, the Bunker Hill Basin water delivered through the Baseline Feeder, and groundwater wells. This water is then boosted throughout the water system by an interconnected transmission network.

Table 4.5 lists the location, design capacity, and individual pump information at each pump station. Operational controls for the booster pumps are controlled to turn "on" or "off" depending on their assigned storage reservoirs, as listed in this table.

4.7 PRESSURE REDUCING VALVES

There are several sub-pressure zones that are pressure reducing valve (PRV) dependent within the existing system. Other PRVs act as emergency connections between pressure zones in case of a catastrophic failure. An inventory of the PRVs, their size, location, pressure zone serviced and settings are included on **Table 4.6**.

Table 4.2 Existing Modeled Pipe Inventory

Water Facilities Master Plan
West Valley Water District

Pipe Diameter	Pipe Length By Material								
	Steel	Asbestos Cement	Cast Iron	Ductile Iron	PVC	HDPE	Unknown	Total	
(in)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(mile)
Existing Distribution System									
2	3,186	0	255	23	20	0	464	3,948	0.7
3	586	0	167	0	0	0	43	796	0.2
4	33,969	12,833	6,186	0	81	0	5,421	58,489	11.1
6	133,232	155,210	8,011	453	26,841	0	5,953	329,700	
8	57,416	293,451	6,076	1,858	300,829	0	10,721	670,350	127.0
10	36,799	79,143	122	30	9,752	0	1,543	127,390	24.1
12	160,537	115,728	0	431	104,318	0	25,357	406,370	77.0
14	2,709	0	0	0	0	0	0	2,709	0.5
16	93,109	11,983	0	19,812	2,163	0	4,315	131,383	24.9
18	46,114	12,562	0	136	16	0	154	58,981	11.2
20	50,480	7,864	0	10,040	13	0	287	68,684	13.0
22	0	0	0	0	0	0	47	47	0.0
24	94,076	24,214	2,174	16,787	31	279	3,393	140,956	26.7
30	33,615	14,545	0	1,059	0	0	1,732	50,951	9.6
36	2,568	0	0	0	0	0	117	2,685	0.5
Total	**748,396**	**727,534**	**22,991**	**50,629**	**444,064**	**279**	**59,547**	**2,053,440**	**326.5**
Baseline Feeder Pipeline									
Total	**19,735**	**0**	**0**	**0**	**0**	**0**	**286**	**20,021**	**3.8**

AKEL ENGINEERING GROUP, INC.

10/3/2017

Note:

1. Pipeline length and material based on GIS data provided by District Staff, as included in the 2017 Water System Hydraulic Model.

Table 4.3 Pipe Roughness Coefficients

Water Facilities Master Plan

West Valley Water District

Pipe Material	Age (years)					
	0	10	20	30	40	50
Asbestos Cement	125	125	125	125	125	125
Cast Iron	120	110	100	90	85	80
Ductile Iron	130	125	120	115	110	105
Plastic (PVC)	145	145	140	140	135	135
Steel	130	120	110	100	90	80

AKEL ENGINEERING GROUP, INC.

9/29/2017

Notes:

1. At age=0, the roughness coefficients are commonly used values for new pipes. Roughness coefficients decrease with age at a rate that depends on pipe material.
2. Pipes with an unknown material or age were assigned a roughness coefficient of 110.

Table 4.4 Existing Storage Facilities

Water Facilities Master Plan
West Valley Water District

Designation	Capacity (MG)	High Water Level (ft)	Tank Height (ft)	Type of Construction
Zone 2				
R2-1	2.00	1,190	29.0	Reinforced Concrete
R2-2 (Inactive)	0.50	1,192	30.0[2]	Welded Steel
R2-3	4.00	1,191	31.0	Welded Steel
R2-4	5.00	1,191	31.0	Welded Steel
Subtotal (Active Facilities)	**11.00**			
Zone 3A				
R3A-1	2.00	1,369	18.0	Reinforced Concrete
R3A-2	4.00	1,369	23.0	Welded Steel
Subtotal	**6.00**			
Zone 3				
R3-1	4.00	1,293	33.0	Welded Steel
R3-2	1.20	1,305	32.0	Welded Steel
R3-3	5.00	1,292	31.0	Welded Steel
Subtotal	**10.20**			
Zone 4				
R4-1	2.00	1,524	24.0	Reinforced Concrete
R4-2	2.00	1,524	19.0	Reinforced Concrete
R4-3	7.00	1,524	24.0	Welded Steel
Subtotal	**11.00**			
Zone 5				
R5-1	3.00	1,662	24.0	Reinforced Concrete
R5-2	4.00	1,662	23.5	Welded Steel
R5-3	6.00	1,662	24.0	Reinforced Concrete
Subtotal	**13.00**			

Table 4.4 Existing Storage Facilities

Water Facilities Master Plan

West Valley Water District

Designation	Capacity (MG)	High Water Level (ft)	Tank Height (ft)	Type of Construction
Zone 6				
R6-1 (Inactive)	0.25	1,885	24.0	Welded Steel
R6-2	1.00	1,884	24.0	Welded Steel
R6-3	4.00	1,884	31.0	Welded Steel
R6-4	6.00	1,884	31.0	Welded Steel
Subtotal (Active Facilities)	**11.00**			
Zone 7				
R7-1	0.15	2,143	23.5	Welded Steel
R7-2	2.00	2,143	23.0	Welded Steel
R7-3	4.00	2,143	23.5	Welded Steel
R7-4	3.00	2,143	23.5	Welded Steel
Subtotal	**9.15**			
Zone 8				
R8-1	0.10	2,369	24.0	Welded Steel
R8-2	0.41	2,363	18.0	Welded Steel
Subtotal	**0.51**			
Total Storage Capacity				
	71.86			

AKEL ENGINEERING GROUP, INC.

5/19/2017

Notes:

1. Unless noted otherwise, storage facility information extracted from West Valley Water District 2012 Water System Master Plan
2. Source: Tank information received from district staff October 30, 2017.

Table 4.5 Existing Booster Pump Stations

Water Facilities Master Plan
West Valley Water District

Designation No.	Location	Source Pressure Zone	Destination Pressure Zone	Design Capacity[1]	Operational Capacity[2]			Operational Controls[4]			
					Total (mgd)	Hours or operation	Firm[3] (mgd)	Low Demand On	Low Demand Off	High Demand On (ft)	High Demand Off (ft)
Zone 2 to Zone 3 Transfer PS	Zone 2-1 Reservoir	2	3	1,500 gpm (1 pump)	1.4	16.0	0.0	19.0	21.0	23.0	25.0
FBR Treatment Facility		-	3A	2,000 gpm	2.9	24.0	2.9				
Zone 3A-1 PS[3]	2015 9th St	3, 3A	3, 3A	3,500 gpm @ 210' (2 pumps, Z3A) 3,400 gpm @ 150' (2 pumps, Z3)	20.0	16.0	16.6	18.0	20.0	22.0	24.0
Zone 4-1 PS	6871 Martin Rd	3	4	2,000 gpm @ 240' (2 pumps) 1,100 gpm @ 240' (1 pump)	4.9	16.0	3.0	10.0	12.0	13.0	15.0
Zone 4-2 PS	855 Baseline Rd	3A	4	2,400 gpm @ 170' (3 pumps)	6.9	16.0	4.6	7.0	9.0	9.0	11.0
Zone 4 Transfer PS	Zone 4-3 Reservoir	4	4	5,000 gpm (1 pump)		As Needed					
Zone 5-1 PS[4]	5700 Riverside Ave	4	5	3,000 gpm @ 170' (4 pumps)	11.5	16.0	8.6	9.0	11.0	13.0	15.0
Zone 5-2 PS	At Reservoir R4-3	4	5	3,200 gpm @ 181' (6 pumps)	18.4	16.0	15.4	10.0	12.0	14.0	16.0
Oliver P. Roemer WFF Effluent Pumps	3010 Cedar Ave	-	5	1,800 gpm @ 130' (4 pumps)	10.4	24.0	7.8				
Zone 6-1 PS[4]	5210 Riverside Ave	5	6	2,200 gpm @ 230' (3 pumps) 1,850 gpm @ 235' (1 pump) 850 gpm @ 220' (1 pump)	8.9	16.0	6.8	14.0	16.0	24.0	26.0
Zone 6-2 PS	5210 Riverside Ave	5	6	2,590 gpm @ 265' (6 pumps)	14.9	16.0	12.4	15.0	17.0	25.0	27.0
Zone 7-1 PS	4334 Riverside Ave	6	7	2,200 gpm @ 280' (3 pumps) 1,300 gpm @ 280' (1 pump)	7.6	16.0	5.5	16.0	18.0	20.0	22.0
Zone 8-1 PS	3434 Lytle Creek Rd	7	8	280 gpm @ 225' (1 pump) 175 gpm @ 225' (1 pump)		As Needed					
Zone 8-2 PS	3296 Lytle Creek Rd	7	8	1,630 gpm @ 252' (4 pumps)	6.3	16.0	4.7	10.0	16.5	10.0	16.5

AKEL ENGINEERING GROUP, INC.

9/25/2017

Notes:

1. Source : West Valley Water District 2012 Water Master Plan
2. Excluding the Roemer WFF and FBR Treatment plant, production capacity assumes operating time of 16 hours per day.
3. Firm capacity defined as total pump capacity excluding largest pump.
4. Source: Operational control document received from District staff August 31, 2017.

Table 4.6 Existing Pressure Reducing Valves

Water Facilities Master Plan
West Valley Water District

Valve ID	Location	Size	Pressure Zone		Settings	
		(in)	Upstream	Downstream	Upstream	Downstream
Zone 8						
V2	8-2 Pump Station	10	8	7	111	N/A
Zone 7						
V8	Riverside (By Zone 7-1 PS)	12	7	7B	120	80
V9	Live Oak & Via Bello	8	7	7B	-	-
V10	Dove Tree & Terra Vista	8	7	7B	-	-
V11	North Sierra, across from school	8	7	7B	Not in Use	
V12	Terra Vista & Tamarind	8	7	6	95	60
V13	Goldenrod & Sunrise	8	7	6	-	-
V14	Citrus 1/4 mile south of Duncan Canyon	8	7	6	-	-
V15	Six M Ranch Ln & Cloudcrest Way	8	7	6	Not in Use	
V16	Duncan Canyon & Coyote Canyon South side	8	7	6	190	80
V17	Sweet bay and Sycamore Creek	8	7	7A	140	73
V18	Kimberlite & Sycamore Creek	8	7	7A	140	80
V19	Black Cottonwood & Sycamore Creek	8	7	7A	140	92
V20	Eve Primrose Ln & Sycamore Creek	8	7	7A	140	80
Zone 6						
V23	South Sierra, Sierra & Summit	8	6	6A	-	-
V24	End of Alder (by Target warehouse)	12	6	6A	105	75
V25	Locust (by fireworks factory)	12	6	6A	115	75
V26	Maple (top near bend)	8	6	6A	114	70
V27	Linden South of Riverside	8	6	6A	-	-
V28	Riverside and Cedar	6	6	6A	140	75
V29	Locust and Bohnert	8	6A	6B	112	82
V30	Maple and Banyon	6	6A	6B	120	70
Zone 5						
V35	Riverside and Cactus	8	5	4	-	-
Zone 3						
V44	San Bernardino and Linden	16	3A	3	-	-
V45	San Bernardino and Linden	12	3A	3	-	-
V46	San Bernardino and Cedar	12	3A	3	-	-
V47	Slover near Willow	12	3	2	-	-
V48	Lilac below Slover	8	3	2	-	-
V49	Larch and Buckskin	8	3	2	-	-
V50	Santa Ana and Linden	10	3	2	-	-
V51	Locust and Jurupa	12	3	2	-	-

Note:
1. Source: Control valve inventory received from District staff August 3, 2017.

CHAPTER 5 – WATER DEMANDS AND SUPPLY CHARACTERISTICS

This chapter summarizes existing domestic water demands, discussed available supply characteristics, and projects the future domestic water demands.

5.1 EXISTING DOMESTIC WATER DEMANDS

The existing water demands used for this master plan were based on the District's 2016 water billing consumption records as well as total annual production. The existing water demands in this analysis are adjusted to match the annual production records and account for system losses.

The existing demand distribution, by pressure zone, was obtained from the water billing records. Using GIS, each customer account was geocoded to its physical location within its existing pressure zone. The accounts were then sorted by pressure zone and the total demand in each zone was calculated.

The District's existing average day domestic water demands, as extracted from the water billing records, were lower than the total demands listed in the annual production records due to system losses that occurred between the groundwater wells and customer service connections. In 2016 this water loss volume was approximately 6% of the total water produced by the District. For evaluation purposes the total domestic water demands were adjusted to reflect the 2014 production volume less 10%. This adjustment accounts for continuing changes in customer water use in response to State-mandated drought measures. The existing domestic water demands used in the evaluation, for each pressure zone, are summarized by pressure zone on **Table 5.1**.

5.2 FUTURE DOMESTIC WATER DEMANDS

Future demands were projected using the unit factors for residential and non-residential land uses and included the developments within the District service area. **Table 5.2** organizes the future land use categories and their corresponding domestic water demands. It should be noted that the existing domestic water demands in **Table 5.2** were calculated using the recommended water unit factors, which take into account future water conservation practices, and are intended to represent the water use practices of customers at the buildout of the master plan horizon. The total average day domestic water demands from existing and future developments is calculated at 31.6 mgd.

These demands were used in sizing the future infrastructure facilities, including distribution mains, storage reservoirs, and booster stations. Demands were also used for allocating and reserving capacities in the existing or proposed facilities. **Table 5.1** summarizes the buildout water demand for each pressure zone.

Table 5.1 Demands by Pressure Zone

Water Facilities Master Plan
West Valley Water District

Pressure Zone	Demands by Pressure Zone						
	Existing[1]	5-Year Growth[2]		Buildout[3]			
		New Demand (mgd)	Subtotal (mgd)	New Demand (mgd)	Total Average Day Demands (mgd)	Increase from Existing (%)	Total Peak Day Demands[4] (mgd)
South System Pressure Zones							
2	2.7	0.1	2.8	1.8	4.6	72%	7.7
3	3.9	0.3	4.1	2.5	6.6	72%	11.3
3A	1.0	0.0	1.1	0.0	1.1	7%	1.9
Subtotal	**7.6**	**0.4**	**8.0**	**4.3**	**12.3**	**63%**	**20.9**
North System Pressure Zones							
4	2.0	0.0	2.0	0.3		-100%	0.0
5	2.0	0.7	2.6	0.2	2.8	43%	4.8
6	3.2	1.2	4.4	2.4	6.8	114%	11.6
7	2.5	1.6	4.0	2.5	6.5	165%	11.1
8	0.2	0.3	0.5	0.4	0.9	276%	1.5
Subtotal	**9.8**	**3.7**	**13.5**	**5.8**	**17.1**	**74%**	**29.0**
System-Wide Demands							
AKEL ENGINEERING GROUP, INC.	**17.4**	**4.2**	**21.5**	**10.1**	**29.3**	**69%**	**49.9**

9/13/2019

Notes:

1. Average day demands based on 2014 production less 10%, where the demand distribution by pressure zone is based on 2016 water billing records
2. Demands due to 5-Year growth based on development information provided by District Staff.
3. Future demands based on additional growth due to buildout of General Plan Land Use.
4. Peak Day Demand = 1.7 x Average Day Demand
5. The demands shown in this table include system losses.

Table 5.2 Buildout Average Daily Water Demands

Water Facilities Master Plan
West Valley Water District

Land Use Classifications	Buildout Water Demands											
	Existing Development			Future Development to be Serviced within Planned Area Boundary								
	Within Service Area			Within Service Area			Sphere of Influence				Total	
	Existing Development (net acre)	Water Unit Factor (gpd/net acre)	Average Daily Demand (gpd)	New Development (net acre)	Future Water Unit Factor (gpd/net acre)	Average Daily Demand (gpd)	Existing Development (net acre)	New Development (net acre)	Future Water Unit Factor (gpd/net acre)	Average Daily Demand (gpd)	Total Development within SOI (net acre)	Average Daily Demand (gpd)
Residential												
Residential 2	1,074	990	1,063,695	921	990	912,078	0	6	990	5,842	2,002	1,981,614
Residential 6	3,614	2,650	9,577,035	2,136	2,650	5,660,863	0	5	2,650	14,234	5,756	15,252,132
Residential 12	0	4,580	0	556	4,580	2,544,483	0	27	4,580	124,527	583	2,669,010
Residential 21	83	5,630	468,282	545	5,630	3,069,456	0	57	5,630	319,248	685	3,856,986
Subtotal Residential	4,772		11,109,011	4,158		12,186,880	0	95		463,851	9,025	23,759,741
Non-Residential												
Commercial	58	1,800	105,083	927	1,800	1,668,923	0	18	1,800	32,621	1,004	1,806,627
Retail	4	1,890	7,317	180	1,890	339,845	0	0	1,890	0	184	347,162
Office	9	1,410	12,207	55	1,410	77,652	0	0	1,410	0	64	89,859
Educational	299	1,790	534,407	84	1,790	149,565	0	0	1,790	0	382	683,972
Institutional	8	1,410	10,866	475	1,410	669,137	0	0	1,410	0	482	680,003
Public Facility	53	250	13,324	131	250	32,761	0	0	250	0	184	46,085
Light Industrial	324	500	161,978	422	500	210,874	0	0	500	0	746	372,852
Heavy Industrial	162	1,530	248,184	480	1,530	735,142	0	0	1,530	0	643	983,325
Industrial	1,161	1,000	1,160,728	1,072	1,000	1,071,836	0	0	1,000	0	2,233	2,232,564
Subtotal Non-Residential	2,077		2,254,094	3,825		4,955,735	0	18		32,621	5,921	7,242,450
Other												
Utilities	223	10	2,230	362	10	3,618	0	0	10	0	585	5,849
ROW	35	0	0	75	0	0	0	0	0	0	110	0
Landscape Irrigation	77	2,690	207,367	124	2,690	333,334	0	25	2,690	66,291	226	606,992
Open Space	0	0	0	2,015	0	0	0	195	0	0	2,210	0
Subtotal Other	335		209,598	2,576		336,952	0	219		66,291	3,130	612,841
Totals	7,184		**13,572,703**	10,559		17,479,567	0	333		562,763	18,076	**31,615,032**

5.3 REGULATIONS IMPACTING DEMAND

The State of California recently enacted Senate Bill 606 and Assembly Bill 1668, which regulate water demands based on user categories and establish planning targets for indoor and outdoor water use. These laws establish a target of maximum indoor residential water use of 55 gpdc by the year 2025, and a target of 50 gpdc by 2030. The State Water Resources Control Board is also expected to provide guidance on the calculation of indoor and outdoor water use from commercial, industrial and institutional uses, and similar targets, which are expected by 2022. These regulations are likely to establish long term water use reductions, which will impact supply and infrastructure planning.

5.4 DIURNAL DEMAND PATTERNS

Water demands vary with the time of day and by account type according to the land use designation. These fluctuations were accounted for in the modeling effort and evaluation of the water distribution system. The diurnal demand patterns affect the water levels in storage reservoirs and amount of flow through distribution mains.

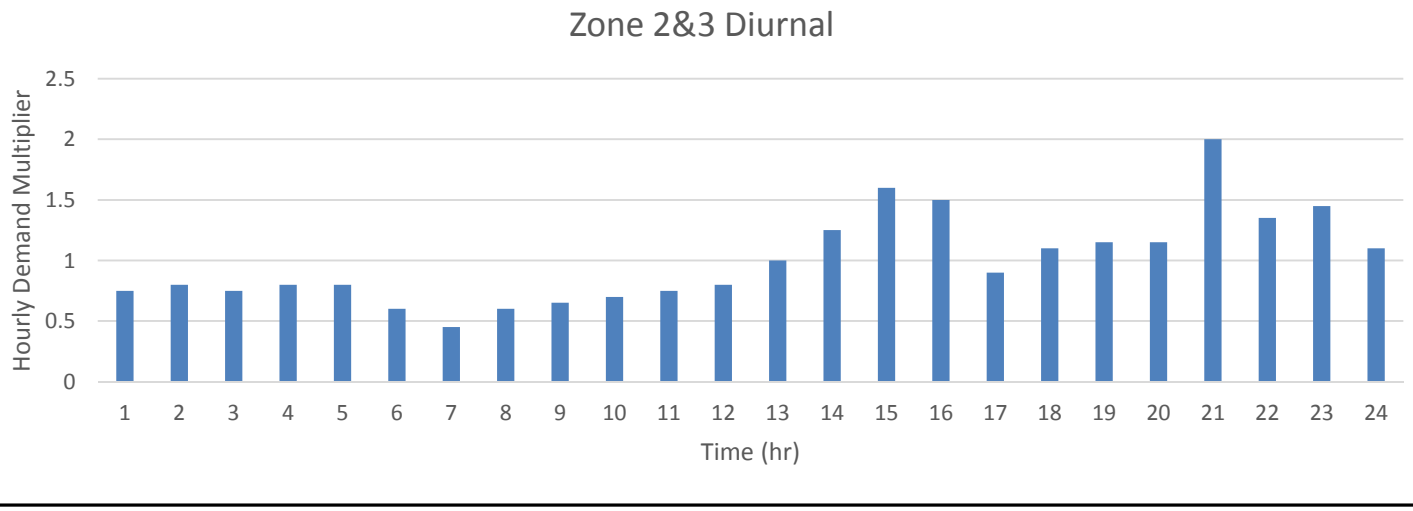
Using available SCADA data provided by District staff, unique diurnal curves were developed for the Pressure Zones 3, 3A, 4, 5, 6, and 7. These patterns were developed using a mass balance method for each pressure zone, using the pump station flow in, pump station flow out, and the change in storage volume to estimate the fluctuation in zone demand. As shown on **Figure 5.1** and **Figure 5.2**, the hourly demand multipliers by pressure zone range from a maximum of 2.3 in Pressure Zone 6 to a minimum of 0.3 in Pressure Zone 5. The diurnal patterns were confirmed during the calibration effort of the District's hydraulic model and corresponding SCADA information.

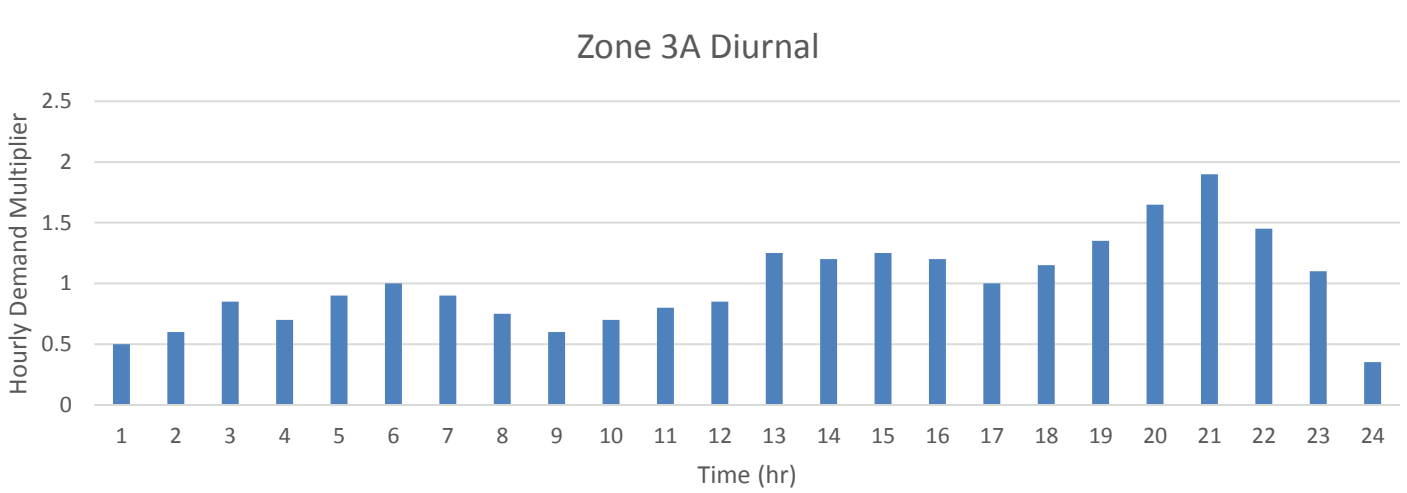
5.5 WATER SUPPLY CHARACTERISTICS

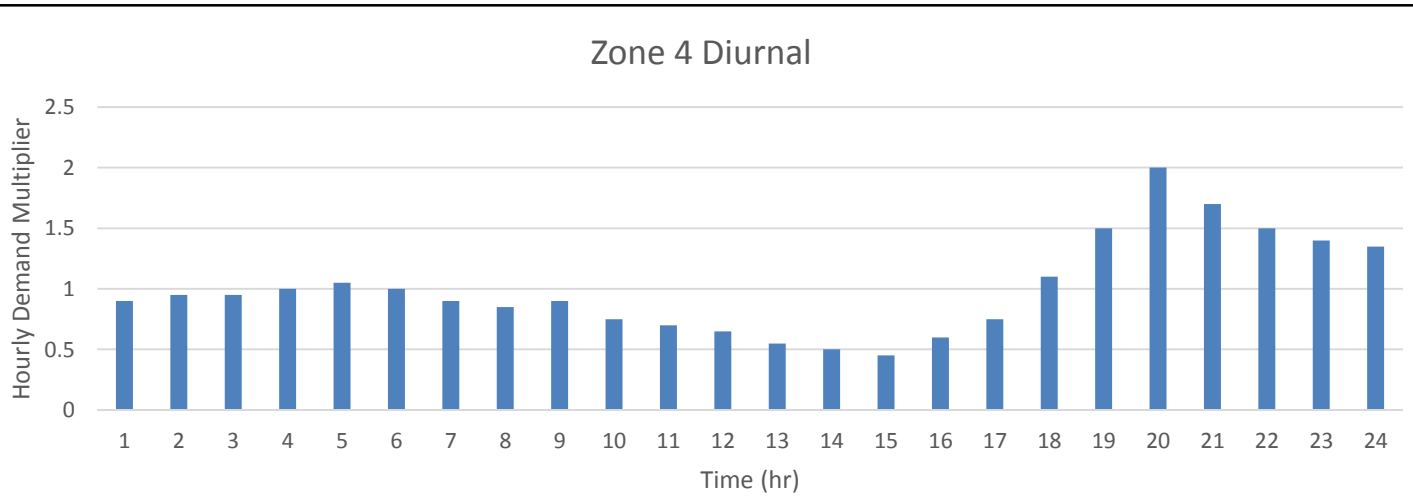
In order to meet the existing domestic water demands, the District utilizes several sources of supply, including groundwater and treated surface water. Some supply sources are subject to constraints that can impact the availability and reliability. The following sections summarize the supply sources and the related constraints, as well as documents the assumptions utilized in planning the supply-related improvements intended to meet future demands at the buildout.

5.5.1 Groundwater Supply Sources and Constraints

As discussed in a previous chapter, the District currently utilizes multiple wells to extract groundwater for delivery to existing water system customers. These groundwater wells extract water from five separate groundwater basins, which are shown graphically on **Figure 5.3** and briefly summarized on the following pages.







LEGEND

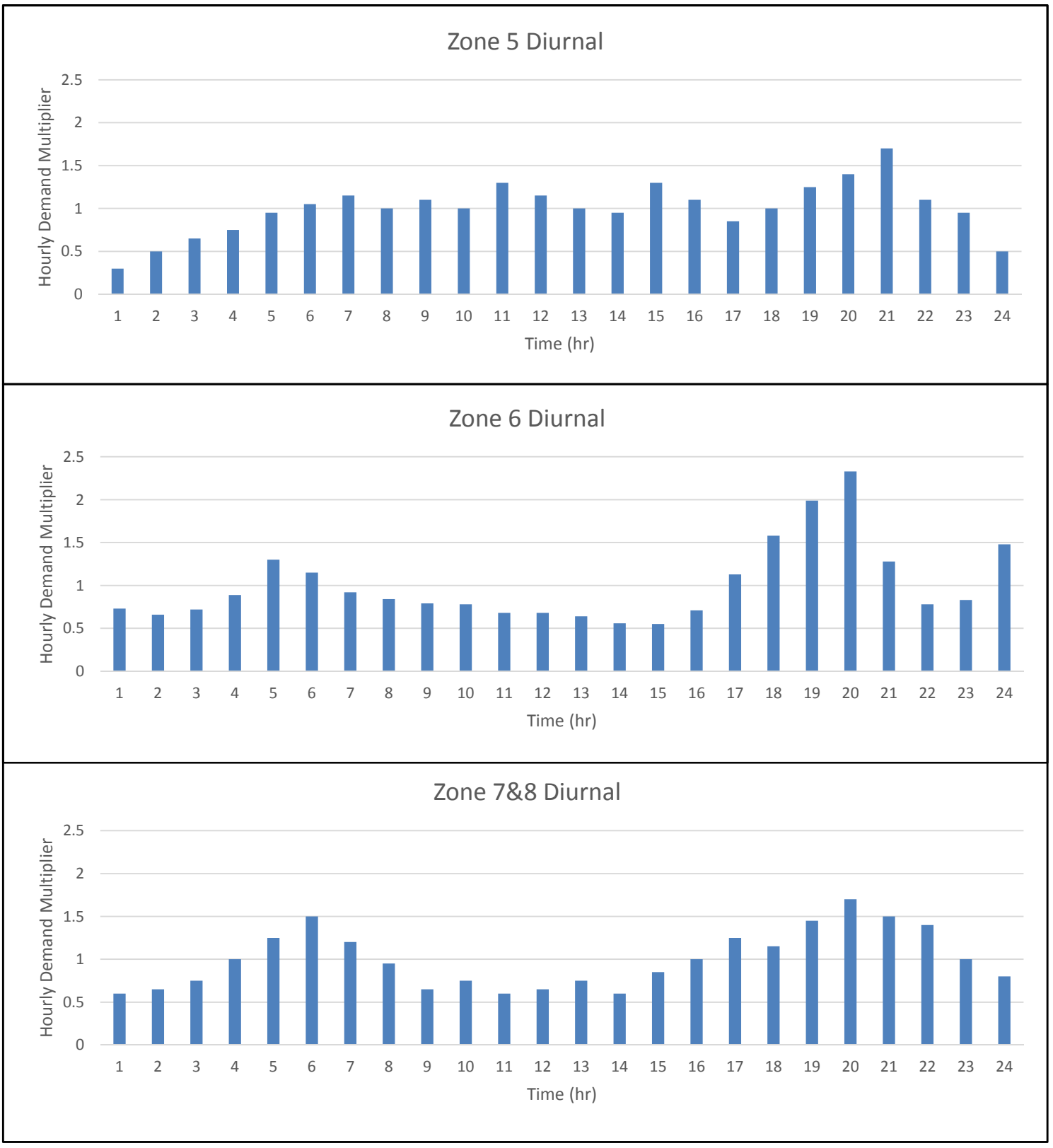
Hourly Demand Multiplier

PRELIMINARY

February 5, 2018

Figure 5.1
Pressure Zone Demand Diurnals
Water Facilities Master Plan
West Valley Water District

AKEL ENGINEERING GROUP, INC.



LEGEND

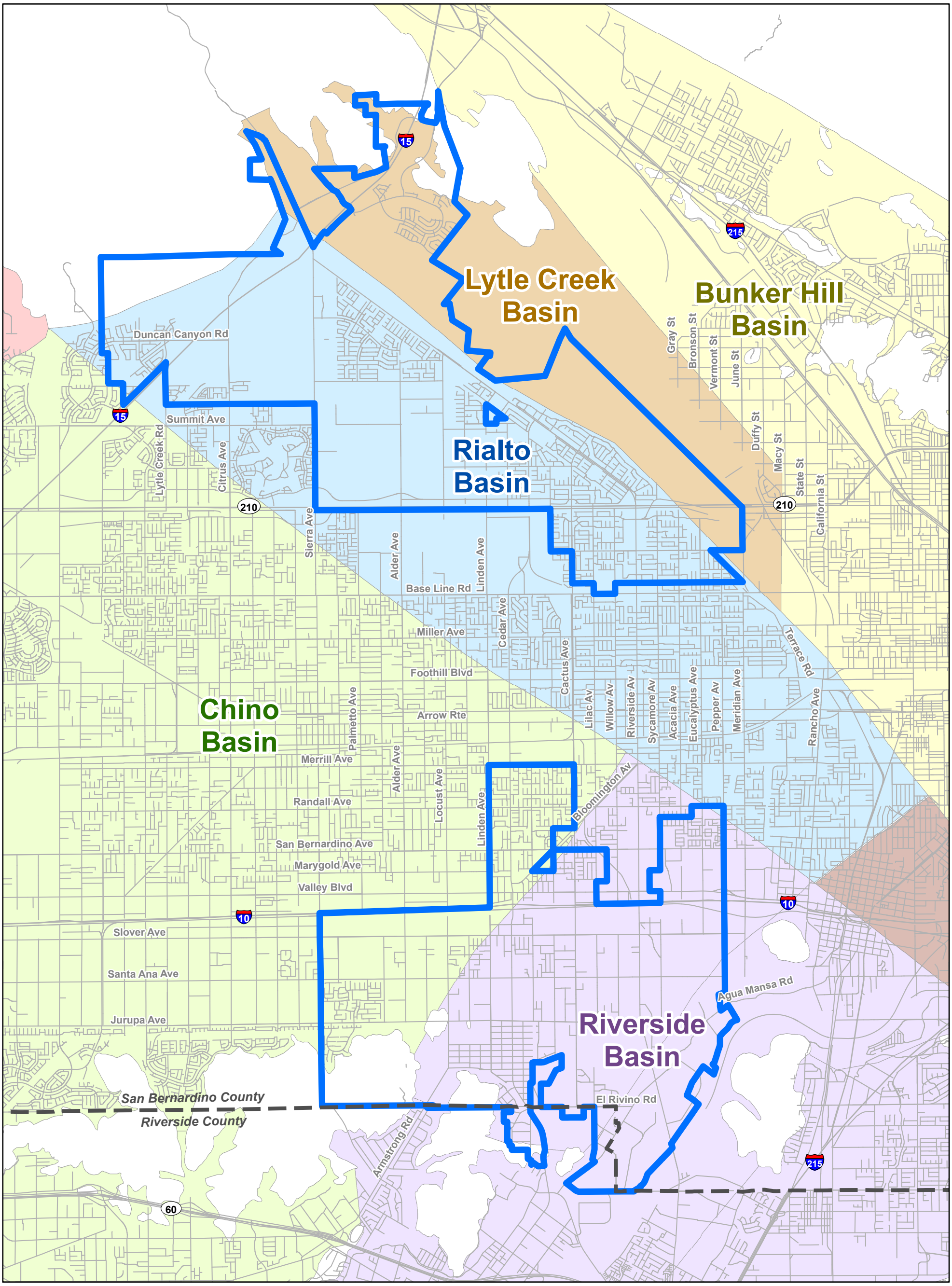
Hourly Demand Multiplier

PRELIMINARY

February 5, 2018

Figure 5.2
Pressure Zone Demand Diurnals
Water Facilities Master Plan
West Valley Water District

AKEL ENGINEERING GROUP, INC.



Legend

- WVWD Service Area
- County Boundaries
- Street Centerlines

Groundwater Subbasins

- Bunker Hill
- Chino
- Colton
- Cucamonga
- Lytle Creek
- Rialto
- Riverside

N W GIS E S

0 0.25 0.5 1 Mile

Updated: January 28, 2019

File Path: P:\xGIS\GIS_Projects\West Valley WD\Final\WVWD_Fig5-3_GWsubbasins_012819.mxd

AKEL ENGINEERING GROUP, INC.

Figure 5.3
Groundwater Subbasins

Water Facilities Master Plan
West Valley Water District

West Valley Water District

5.5.1.1 Lytle Creek Basin

The Lytle Creek groundwater basin is a subbasin of the Bunker Hill groundwater basin, and underlies the northern extent of the District's North System. The subbasin is part of the Upper Santa Ana Valley Groundwater Basin and is generally adjoined to the west by the Rialto-Colton basin along the Lytle Creek fault and along the east and southeast by the remaining portions of the Bunker Hill basin. The San Gabriel Mountains form the northwestern border. It should be noted that DWR Bulletin 118 includes the Lytle Creek subbasin as part of the Bunker Hill basin and does not address it separately. However, the Santa Ana Region Basin Plan identifies this area as a separate management zone, and the District currently refers to it separately in discussions of groundwater quality and quantity from the remaining Bunker Hill basin.

The District's water rights in the Lytle Creek Basin are limited to 12,105 gallons per minute (gpm) if they are diverting their full allotment (2,290 gpm) of surface flow from Lytle Creek. If flows from the Creek are low and the District is receiving a portion of their allotment, they can pump the difference from the wells to a combined maximum of 14,395 gpm from the basin, depending on how much water is available to pump and how much water is available to divert from Lytle Creek. The District has no restrictions on how much is can pump and serve within the Lytle Creek Region.

The basin is an adjudicated groundwater basin and is managed by the Lytle Creek Water Conservation Association. The basin is highly porous and easily replenished during heavy precipitation years. Well production in the basin varies as the basin levels change from year to year.

The quality of groundwater in the Lytle Creek basin is characterized with arsenic contamination, in particular Well No 36 (not currently in use). Currently, only well W-2 has coagulation-based wellhead treatment to remove arsenic before its water is used for water supply.

5.5.1.2 Bunker Hill Basin

The Bunker Hill groundwater basin adjoins the eastern boundary of the District's North System. The basin is part of the San Bernardino Basin Area and is generally adjoined to the west by the Lytle Creek basin and the Rialto-Colton basin

The extractions in the Bunker Hill basin are governed by the Western Judgement. The Western Judgment defined and adjudicated the San Bernardino Basin Area in 1969, and allocates percentages of the safe yield volume to the various agencies capable of extracting water from the basin.

The District has unrestricted water rights in the Bunker Hill basin, but has restrictions on pumping and exporting from certain areas of the basin as is defined in the 1924 Judgment for Lytle Creek Region and as defined in a City of San Bernardino Municipal Water Department's Basin Management Ordinance.

Plumes of various chemical pollutants have been detected in the Bunker Hill groundwater basin requiring installation of treatment to protect basin water quality. Currently, the District has two operational wells producing high quality water for water supply without any regulated contaminants requiring treatment. The Bunker Hill Basin is expected to be a reliable long-term water supply source able to make up shortfalls in water supply that could be caused by long-term droughts.

The District has two existing wells in the Bunker Hill Basin (Wells W-15 and W-30) within the defined area of the 1924 Judgment for the Lytle Creek Region.

In addition to the two existing wells, the District and the City of Rialto by agreement with the SBVMWD, have renewed a contract for a project to pump groundwater from the Bunker Hill Basin through a 48-inch diameter pipeline known as the BLF. The agreement requires that SBVMWD provide a supply up to 5,000 afy to the District (5.76 mgd).

The District owns one third of the BLF from Meridian Avenue to the Cactus Reservoir. This can provide up to 14,000 gpm of capacity in the pipeline. The additional capacity in the pipeline may be utilized for pumping water from the Bunker Hill Basin into the Baseline Reservoirs (R3A-1 and R3A-2). Additional agreements in the future may provide for more purchased water from SBVMWD or the City of San Bernardino or the District could drill additional wells to meet ultimate water demand.

5.5.1.3 Rialto-Colton Basin

The Rialto-Colton basin underlies a majority of the District's North System. The basin is generally bounded to the northwest by the San Gabriel Mountains, the San Jacinto fault to the northeast, and the Rialto-Colton fault to the southwest, with the Santa Ana River traversing the southeastern portion of the basin.

Extractions in the Rialto-Colton basin are governed by the 1961 Rialto Basin Decree. Based on the groundwater elevations for three specific index wells verified between March and May of each year, the extraction entitlement for the District may be limited. Water levels in the Basin have declined in recent years, reducing the amount of groundwater extractions. Steps are being taken to formulate a long term strategy to manage the basin.

When the basin is not subject to restrictions by the adjudication, the District has unlimited extraction rights. During drought conditions, and when the adjudication is in effect, the extraction right ranges from 6,134 afy during drought periods to 3,067 afy in the most severe drought periods.

Since 2002, the Santa Ana River Water Quality Control Board (SARWQCB) has been conducting an investigation of groundwater contamination in the area of the City of Rialto. This site has also been designated as a Superfund site by the US EPA. Water quality of the Rialto Basin is characterized with elevated concentrations of perchlorate and nitrate, thus requiring treatment and

reducing its ability to be a reliable water supply. Currently installed wellhead treatment systems utilize ion exchange (IX) and fluidized bed reactor (FBR) treatment to mitigate perchlorate and nitrate contamination.

During years when the average elevation of the spring-high water levels in the three index wells is below 967.7 feet above mean sea level, the amount of water which the stipulated parties are entitled to pump from the Basin is reduced one percent (1%) for each foot. The average elevations of the spring-high water levels for the October 1, 2017 through the September 30, 2018 water year is 931.3 feet above mean sea level, or 38.4 feet below 969.7 feet mean sea level, thus reducing the District's extractions from the Basin by thirty-eight percent (38%).

5.5.1.4 Chino Basin

The Chino basin underlies a portion of the District's South System. The basin is generally bounded to the east by the Rialto-Colton fault, the San Gabriel Mountains to the north, and the Jurupa Mountains and Puente Hills to the south. The Chino Basin consists of about 235 square miles of the Upper Santa Ana River Watershed, and is an alluvial valley that is mainly flat from east to west, and slopes from the north to the south at a one to two percent grade. This basin is among the largest groundwater basins in southern California, with about 5,000,000 acre-feet of water and an unused storage capacity of about 1,000,000 acre-feet.

The Chino basin is an adjudicated groundwater basin and is managed by the Chino Basin Watermaster, which manages the basin through the Chino Optimum Basin Management Plan. Without incurring replenishment costs, the District is entitled to approximately 1,000 afy of groundwater extraction from this subbasin. The District has two wells (W-37 and W-39) in the Chino Basin which can produce 1.4 mgd and 3.8 mgd, but are not currently in service due to high levels of perchlorate and nitrate. The District will have to install wellhead treatment on these wells to take advantage of their pumping ability and the District's rights in the basin.

5.5.1.5 Riverside-Arlington Basin (North Riverside Groundwater Basin)

The Riverside-Arlington basin underlies a majority of the District's South System. The basin is generally bounded to the north by the Jurupa Mountains, to the northeast by the Rialto-Colton fault, and the Box Springs Mountains and Arlington Mountain to the south, with the Santa Ana River traversing the northern portion of the basin. This groundwater basin is a large alluvial fill basin that is bound by major faults and topographic barriers. Recharge to the basin occurs by the underflow from basins to the north, from the Santa Ana River, and from percolation of surface water runoff from the surrounding uplands.

The extractions in a portion of the North Riverside basin upstream of the Riverside Narrows are governed by the Western Judgement. However, there is no extraction limit for the District's wells in this basin. Water quality of the basin is characterized with elevated concentration of perchlorate and emerging increase of nitrate concentration. The currently installed wellhead treatment system utilize IX to remove perchlorate. The District has identified that some wells located in the basin

present possible contamination with Methyl tert-butyl ether (MTBE). Wells Number 40 and 41 are monitored monthly, however no MTBE has been detected in these wells or any other District wells.

5.5.2 Surface Water Supply

The following sections document the District's existing sources of surface water supply, current water supply constraints, and existing surface water quality.

5.5.2.1 Surface Water Supply Sources

As discussed in a previous chapter, the District currently treats two sources of surface water at the Roemer WFF for delivery to existing water system customers: State Water Project water and flow from Lytle Creek. These sources and the related reliability are briefly summarized in the following sections and shown on **Table 5.3**.

- **Lytle Creek.** The District has 5.09 cubic feet per second (2,290 gpm), water right in Lytle Creek surface water and has entered into an agreement with the City of San Bernardino to purchase the City of San Bernardino's 3.00 cfs (1,350 gpm) water rights for a total of 8.09 cfs (3,640 gpm or 5.2 mgd) of Lytle Creek surface water. The City of San Bernardino, due to infrastructure limitations, is unable to utilize its rights and divert water from the Creek. The District also has a court settlement agreement with Fontana Union Water Company for approximately one percent (1%) of Fontana Union Water Company's annual water production to be taken at the District's WFF. This is approximately 320 acre feet per year, or 200 gpm. The City of Rialto has 2.3 cfs water rights. The District, the City of Rialto, and the City of San Bernardino, have a combined capacity of 10.39 cfs (6.7 mgd) of Lytle Creek surface water rights.

  In 1993, the District and the City of Rialto jointly constructed the Oliver P. Roemer WFF, a 7.2 mgd water treatment plant, in Pressure Zone 5, to treat 6.7 mgd of Lytle Creek surface water. The facility produced approximately 5.2 mgd annual average daily flow of supply to the District and approximately 1.5 mgd for the City of Rialto from Lytle Creek.

  Lytle Creek surface water flows fluctuate seasonally and the District and City of Rialto's water right could be prorated whenever the Lytle Creek water flow is below 800 miner inches (16 cfs). When the Lytle Creek surface water flow drops below 16 cfs, the water right of both the District and the City of Rialto are subject to proration. In addition to the flow fluctuation, the turbidity of Lytle Creek surface water flow also varies seasonally.

- **State Water Project.** The District currently imports SWP water from SBVMWD through the Lytle Turnout off of the San Gabriel Feeder Pipeline. This SWP water is delivered to the Roemer WFF and treated in addition to the Lytle Creek flows. Recently constructed

Table 5.3 Water Supply Portfolio

Water Facilities Master Plan
West Valley Water District

Source	Maximum Water When Available[1] (AFY)	Imported Water[1] (AFY)	Historical Water Use[2] 2011 (AFY)	2012 (AFY)	2013 (AFY)	2014 (AFY)	2015 (AFY)	2016 (AFY)	2017 (AFY)
Surface Water									
Imported SWP[3]		No Limit	400	849	1,194	1,643	2,244	2,839	2,653
Lytle Creek	5,870[4]		4,203	4,700	3,110	2,363	2,271	2,026	4,540
Other Surface Water									
Groundwater Basins[5]									
Lytle Creek Basin	19,500[6]		2,983	4,002	3,776	3,262	2,159	1,850	2,365
Bunker Hill Basin	No Restrictions		1,335	1,682	1,885	1,478	1,520	1,351	
Chino Basin	1000[7]		0	0	0	0	0	0	0
Rialto-Colton	No Restrictions[8]		4,883	4,093	4,005	3,916	2,505	2,123	3,923
Riverside-Arlington	No Restrictions		3,144	3,932	3,389	2,992	2,065	2,745	1,089
Total Groundwater Use			12,345	13,709	13,055	11,648	8,249	8,069	7,377
Other Water Sources									
Purchased GW through Baseline Feeder Pipeline		5,000	3,020	1,990	3,350	4,819	4,367	3,380	3,151
Total Historical Water Use									
Total			**19,968**	**21,248**	**20,709**	**20,473**	**17,131**	**16,314**	**17,722**

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1/28/2019

Note:

1. Source: WVWD 2012 Water System Master Plan.
2. Unless noted otherwise, historical water use extracted from Water System Statistics provided by WVWD Staff on September 25. 2018.
3. Water imported from the SWP is purchased from San Bernardino Valley Municipal Water District.
4. The District has a 3,700 AFY water right to Lytle Creek and has entered into an agreement with the City of San Bernardino to purchase the City's 2,170 AFY water right for a total of 5,870 AFY water right to Lytle Creek
5. Historical water use by groundwater basin extracted from the following:
   Years 2011-2015: WVWD 2015 Urban Water Management Plan, Table 11-10.
   Year 2016: Basin data provided by WVWD staff on January 28, 2019.
   Year 2017: Groundwater basin production report provided by WVWD staff on September 24, 2018.
6. During extended periods of drought well production in Lytle Creek Basin is projected to be reduced. However, there is no maximum amount of water that that can be pumped and served within the Lytle Creek Basin region.
7. The District's water rights are limited to approximately 1000 AFY without incurring replenishment costs.
8. When the basin adjudication is in effect the extractions rights range from 6,134 AFY to 3,067 AFY depending on the severity of the drought.

metering and transmission facilities will enable the District to import and treat up to 20 mgd upon the completion of the Roemer WFF capacity expansion. It should be noted that the SWP water is considered an interruptible water supply, and while historically reliable, the potential disruption of SWP water deliveries are accounted for when planning future water infrastructure facilities.

5.5.3 Water Supply Planning

In order to meet the growing demand requirements of the District service area and provide additional water supply reliability, the existing water supply capacity will require expansion. This expansion will include the rehabilitation of existing groundwater wells, the construction of new groundwater wells, and the expansion of the Roemer WFF treatment plant, which are generally described in the following sections.

5.5.3.1 Rehabilitate Existing Wells

The District currently has multiple groundwater wells that are inactive due to water quality constraints or other operational issues. The rehabilitation of these existing wells will increase the District's supply capacity and multiple sites have infrastructure in place to facilitate the delivery of water to the existing water distribution system. The rehabilitation of these existing wells is considered the first priority for planning water supply improvements, which is reflected in the supply capacity analysis and recommended improvements discussed in a later chapter.

5.5.3.2 Construct New Wells

New groundwater wells are required to meet the expanded needs of the planning area boundary. The well locations shown in this WFMP are preliminary and are intended as placeholders for planning purposes. The location of future groundwater wells will be determined based on site feasibility studies completed as part of the design process. The general assumptions for the recommendation of new wells are documented as follows:

- Due to the availability of water supply in the Bunker Hill groundwater basin the development of future wells is recommended. However, as an alternative to constructing new groundwater wells the District could also enter into contract to receive deliveries of Bunker Hill water through the Baseline Feeder pipeline.

- As discussed in a previous section, Pressure Zone 2 receives a majority of its supply by PRV from Pressure Zone 3. To limit this supply dependency, new wells are recommended to meet the buildout development demand requirements within Pressure Zone 2.

5.5.3.3 Roemer WFF Treatment Expansion

The Roemer WFF has a current treatment capacity of 14.4 mgd. The District has plans to expand the capacity by an additional 6.0 mgd, which will increase the total treatment capacity to 20.4 mgd. Based on the 4,000 afy (3.6 mgd) of projected Lytle Creek flows, it is estimated that

approximately 16.8 mgd total of SWP water could be purchased to utilize the full treatment capacity of the Roemer WFF.

5.5.4 Surface Water Quality

Lytle Creek and State Water Project are the two sources of surface water currently used for the District's surface water supply. Lytle Creek, which is a perennial stream in the upper watershed, is a local surface water that is treated for domestic water use. During the summer for short periods, Lytle Creek surface water flow will drop below 16 cfs, which causes the District's water rights to be subject to proration. Turbidity, microbiological contaminants and other surface water-typical constituents characterize the quality of the water from Lytle Creek.

The District has been utilizing water from the State Water Project since 1999. The current metering and transmission facilities allow the District to import 20 mgd (23,000 afy) of the SWP water. Quality of the SWP water is characterized with elevated concentration of total organic carbon (TOC). Traditionally, the District imports and treats the SWP water for potable water supply at the Roemer WFF.

5.5.5 Other Water Sources

This section documents other sources of water supply, both existing and potential, that are available to the District. This section was completed by Kleinfelder.

5.5.5.1 Baseline Feeder

The water supply of the Baseline feeder comes from SBVMWD-owned wells in the Bunker Hill Basin. The current agreement with SBVMWD allows the District to receive up to 5,000 afy of supply. The District could investigate additional supply through the BLF.

5.5.5.2 Alternative Water Sources

No other water source is currently being utilized by the District. However, due to climate change and severe droughts, the District is considering the feasibility of developing alternative source of water supplies including but not limited to water banking, storm water run-off collection and recyclable water. Capacity and water quality of these alternative sources are not defined at this point in time. Further study of potential yields and treatment methodologies will need to be completed prior to implementing new water sources. Treatments may include removal of turbidity, oil, heavy metals, microbiological contaminants, and other regulated water quality constituents may be necessary. As opportunities arise and technology advances, it is recommended that the District continue to explore the possibility of expanding its water supply portfolio and developing new sources of water supply.

5.5.6 Current and Future Regulations

The US EPA has set mandatory water quality standards in the National Primary Drinking Water Regulations (NPDWRs) for inorganics, organic chemicals, disinfectant and disinfection by-products, and microbiological contaminants. The US EPA recommends secondary non-enforceable National Secondary Drinking Water Standards (NSDWSs) for 15 contaminants that may cause aesthetic effects on potable water. The quality of the District's potable water is in full compliance with local, state and federal regulatory requirements.

The pending regulations that may be of importance for the District and its water supply system include:

- California DDW's recommendations to establish a lower perchlorate detection limit for purposes of reporting. If proved technically and economically feasible and beneficial to the public health, the current perchlorate MCL of 6 parts per billion (PBB) may be revised.
- The Lead and Copper Rule will be updated in 2018 to incorporate EPA changes and lessons learned from the water crisis in Flint, Michigan.
- Development of a new unregulated contaminant monitoring regulation. DDW is in the process of gathering information on the presence and concentration of contaminants of concern in potable water systems. If deemed necessary, the DDW may choose to regulate, or increase regulation, of some of these contaminants in the future.

Although not currently utilized by the District, the pending new regulation for water reuse, including recycled water and water for potable reuse, may be important for the District's future water supply.

CHAPTER 6 - HYDRAULIC MODEL DEVELOPMENT

This chapter describes the development and calibration of the District's domestic water distribution system hydraulic model. The hydraulic model was used to evaluate the capacity adequacy of the existing system and to plan its expansion to service anticipated future growth.

6.1 OVERVIEW

Hydraulic network analysis has become an effectively powerful tool in many aspects of water distribution planning, design, operation, management, emergency response planning, system reliability analysis, fire flow analysis, and water quality evaluations. The District's hydraulic model was used to evaluate the capacity adequacy of the existing system and to plan its expansion to service anticipated future growth.

6.2 MODEL SELECTION

The District's hydraulic model combines information on the physical characteristics of the water system (pipelines, groundwater wells, and storage reservoir) and operational characteristics (how they operate). The hydraulic model then performs calculations and solves a series of equations to simulate flows in pipes and calculate pressures at nodes or junctions.

There are several network analysis software products that are released by different manufacturers, which can equally perform the hydraulic analysis satisfactorily. The selection of a particular software depends on user preferences, the distribution system's unique requirements, and the costs for purchasing and maintaining the software.

The District's previous model was developed using the Innovyze (formerly known as MWHSoft) H2ONet, which allows for steady-state and extended period simulations within an AutoCAD user interface. As part of this master plan, the hydraulic model was redeveloped into the GIS-based hydraulic model InfoWater by Innovyze. The model has an intuitive graphical interface and is directly integrated with ESRI's ArcGIS (GIS), providing a useful modeling tool linked to the newly developed District GIS.

6.3 HYDRAULIC MODEL DEVELOPMENT

Developing the hydraulic model included skeletonization, digitizing and quality control, developing pipe and node databases, and water demand allocation.

6.3.1 Skeletonization

Skeletonizing the model refers to the process where pipes not essential to the hydraulic analysis of the system are stripped from the model. Skeletonizing the model is useful in creating a system that accurately reflects the hydraulics of the pipes within the system, while reducing complexities

of large systems, which will reduce the time of analysis while maintaining accuracy, but will also comply with limitations imposed by the computer program. For the purposes of this master plan, skeletonizing was kept to a minimum due to the integrity of the GIS.

6.3.2 Pipes and Nodes

Computer modeling requires the compilation of large numerical databases that enable data input into the model. Detailed physical aspects, such as pipe size, pipe elevation, and pipe lengths, contribute to the accuracy of the model.

Pipes and nodes represent the physical aspect of the system within the model. A node is a computer representation of a place where demand may be allocated into the hydraulic system, while a pipe represents the distribution and transmission aspect of the water demand. In addition, reservoir dimensions and capacities, and groundwater well capacity and design head, were also included in the hydraulic model.

6.3.3 Digitizing and Quality Control

The District's existing domestic water distribution system was digitized in GIS using several sources of data and various levels of quality control. The data sources included the District's existing system as maintained by staff in GIS, as well as conversation with District staff and record drawings.

After reviewing the available data sources, the hydraulic model was updated and verified by District staff. Resolving discrepancies in data sources was accomplished by graphically identifying each discrepancy and submitting it to engineering and GIS staff for review and comments. District comments were incorporated in the verified model.

6.3.4 Demand Allocation

Demand allocation consists of assigning water demand values to the appropriate nodes in the model. The goal is to distribute the demands throughout the model to best represent actual system response.

Allocating demands to nodes within the hydraulic model required multiple steps, incorporating the efficiency and capabilities of GIS and hydraulic modeling software. Existing land use water demand factors were used in conjunction with the existing land use map. Each demand factor was applied to the appropriate land use and then multiplied by the acreage. In the absence of complete water billing records, this methodology was considered the best approach for accurately allocating the existing water demands.

Domestic water demands from each anticipated future development, as presented in a previous chapter, were also allocated to the model for the purpose of sizing the required future facilities. The demands from the greater Planning Area were allocated based on proposed land use and the land use acreages. As many of the areas were very large in size, demands were allocated evenly

to the demand nodes within each area. Infill areas, redevelopment areas, and vacant lands were also included in the future demand allocation.

6.4 MODEL CALIBRATION

Calibration is intended to instill a level of confidence in the pressures and flows that are simulated. Calibration generally consists of comparing model predictions to field measured results and making necessary adjustments.

6.4.1 Calibration Plan and SCADA

The District relies on multiple sources of supply, including groundwater wells, treated water supply, and water deliveries through the Baseline Feeder. The District maintains SCADA at its tank sites, booster stations, and the Oliver P Roemer Water Filtration Facility. As such, this SCADA information was considered adequate for calibrating the hydraulic model. **Figure 6.1** documents each point used in the calibration of the hydraulic model.

District staff provided hourly flow data for each well and booster station, as well as tank levels for each pressure zone for July 2017. This data was further consolidated and compared with daily demand data to best calibrate to peak day conditions.

6.4.2 Steady State Calibration

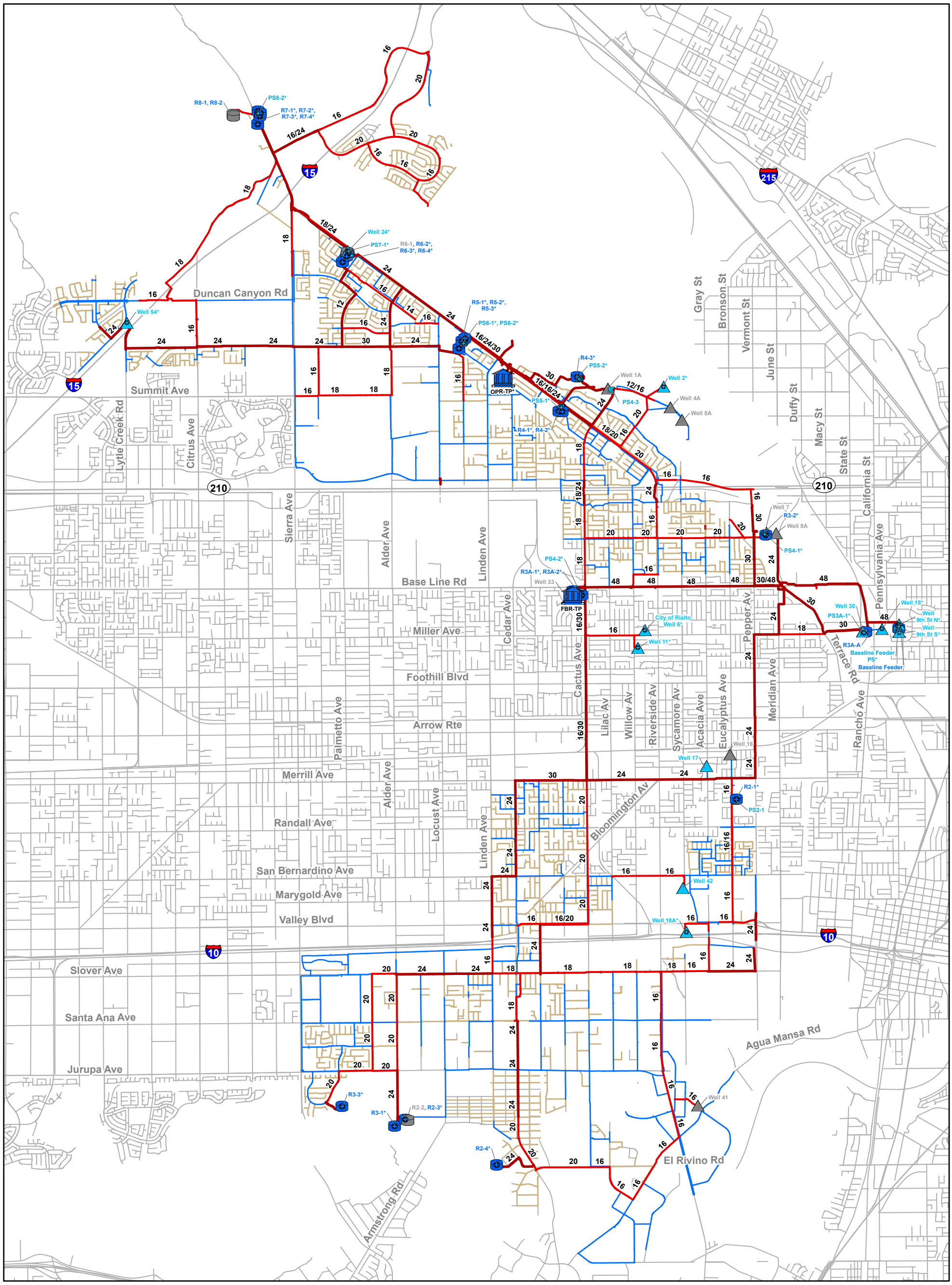
As part of this master plan, a steady-state calibration was performed on the existing system. Steady-state model runs consist of “snapshot” model run where the system is evaluated for a single specified hour. Typically, steady-state model runs are calibrated to fire flow tests, where a static pressure and residual pressure are provided. The model is then simulated for that specific hour and fire flow, and a pressure comparison is completed. The modeled Hazen Williams C-Factor and connectivity are adjusted based on the calibration results.

The steady-state calibration results are documented on **Table 6.1**. The results generally indicate that the system is in good health. There are robust looped-pipe networks and transmission main connectivity within the existing system, which help to mitigate the negative effects of fire flows.

6.4.3 EPS Calibration

The model was also calibrated for extended period simulation (EPS), which typically involved comparing the hydraulic model to field conditions over at least 24 hours. EPS calibration consists of comparing model predictions to diurnal operational changes in the water system. The intent of an extended period simulation

The calibration process was iterative and resulted in satisfactory comparisons between the field measurements and the hydraulic model predictions at each well site. It should be noted that some of the SCADA information at the well sites and the booster station sites were found to be



Legend

- *Model Calibration Point
- Pumps

Existing System

- WTP
- Tanks
- Inactive Tanks
- Active Wells
- Inactive Wells

Pipes by Diameter

- 8" and Smaller
- 10" - 12"
- 16" - 20"
- 24" - 48"
- Street Centerlines

Updated: February 7, 2018

0 0.25 0.5 1 Mile

N W GIS E S

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Figure 6.1
Hydraulic Model Calibration Program

Water Facilities Master Plan
West Valley Water District

West Valley Water District

Table 6.1 Steady State Calibration Results

Water Facilities Master Plan

West Valley Water District

Location Number	Pressure Zone	Date	Time	Address of Gauging Hydrant	Static Pressure			Residual Pressure		
					Observed (psi)	Simulated (psi)	Percent Difference	Observed (psi)	Simulated (psi)	Percent Difference
560	2	3/30/16		1350 Brown Ave., Riverside, CA	113	114	1.3%	107	109.63	2.5%
569	4	7/25/16		1571 N Sycamore Avenue, Rialto, CA	71	70	-1.9%	68	65.44	-3.8%
568	3A	8/8/16		654 S. Cactus Avenue, Rialto, CA	73	72	-1.3%	66	65.32	-1.0%
570	2	8/8/16		2755 S Willow Avenue, Bloomington, CA	82	87	6.5%	75	82.48	10.0%
573	5	11/2/16		5891 N Sycamore Avenue, Rialto, CA	80	85	6.0%	74	80.35	8.6%
576	6	11/2/16		2010 W Stonehurst Dr., Rialto, CA	85	86	1.5%	80	79.05	-1.2%
578	5	1/10/17		2092 Spruce Avenue, Rialto, CA	85	83	-1.9%	72	77.17	7.2%
580	3	3/16/17		17132 Slover Avenue, Fontana, CA	75	84	11.5%	74	78.64	6.3%
581	3A	3/16/17		884 S Church Street, Rialto, CA	80	78	-2.0%	76	70.35	-7.4%

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9/11/2017

Notes:

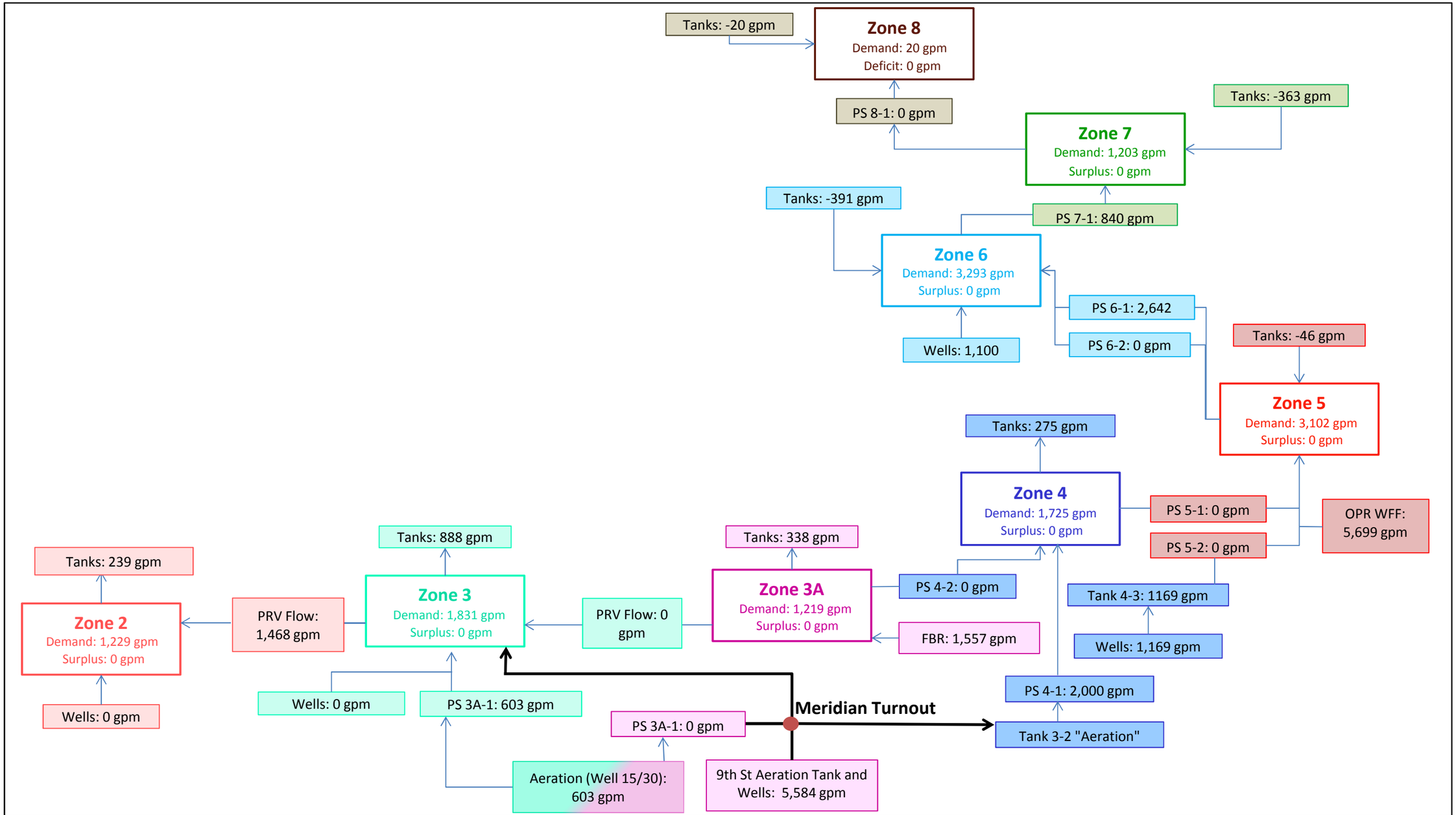
1. Fire flow locations and results based of historical fire flow tests received from District staff.

erroneous. As such, a mass balance of the existing water system by pressure zone was completed and submitted to District staff for review (**Figure 6.2**). Calibration information for the wells and the booster stations relied heavily on District staff knowledge of the system, and interpretation of trendlines observed in the SCADA. The calibration results were graphically summarized for each site and included in **Appendix C**.

Representative extracts from **Appendix C** are shown on **Figure 6.3** for calibration points at the Zone 5, 6, and 7 storage reservoirs.

6.4.4 Use of the Calibrated Model

The calibrated hydraulic model was used as an established benchmark in the capacity evaluation of the existing water distribution system. The model was also used to identify improvements necessary for mitigating existing system deficiencies and for accommodating future growth. This valuable investment will continue to prove its value to the District as future planning issues or other operational conditions surface. It is recommended that the model be maintained and updated with recent construction to preserve its integrity.



NOTES

1. Flow information shown based on SCADA data for July 9, 2017 and additional adjustments based on information provuded by WVWD staff.
2. Zone 8 Tank flow based on modeling results in absence of SCADA data.
3. Zone demands based on SCADA flows provided by WVWD staff.
4. Combined Zone 2 and Zone 3 demand assumed to be equal to water supplied to Zone 3. Distribution of Zone 2 and 3 demand based on 2016 production records.
5. Positive tank flow reflects filling; negative tank flow reflects emptying.

PRELIMINARY

January 30, 2018

Figure 6.2
SCADA Mass Balance
Water Facilities Master Plan
West Valley Water District

West Valley Water District

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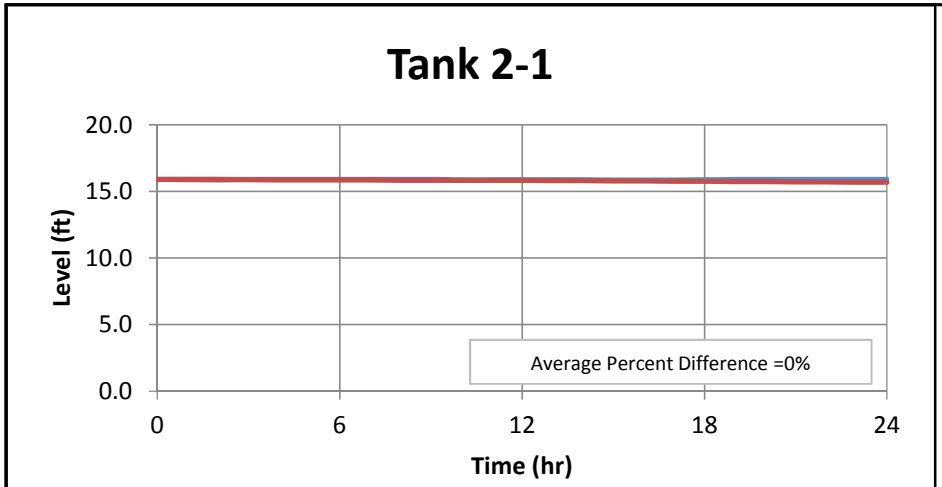

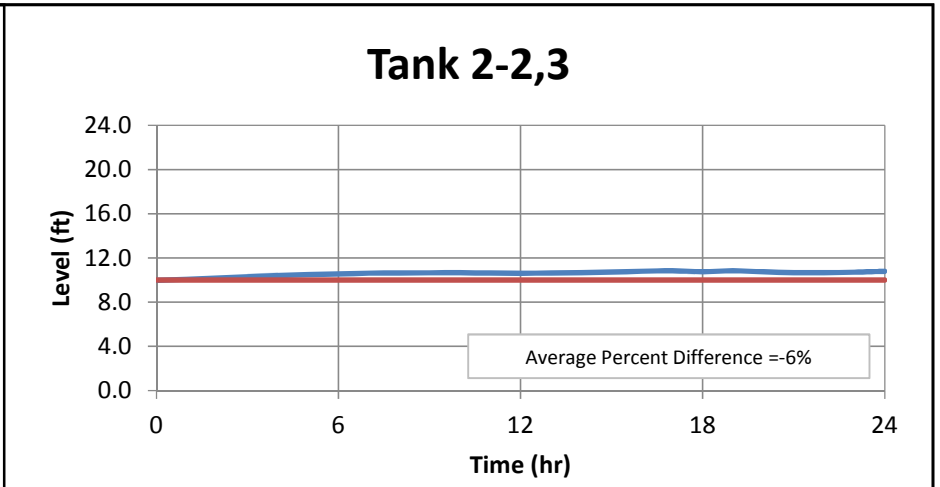

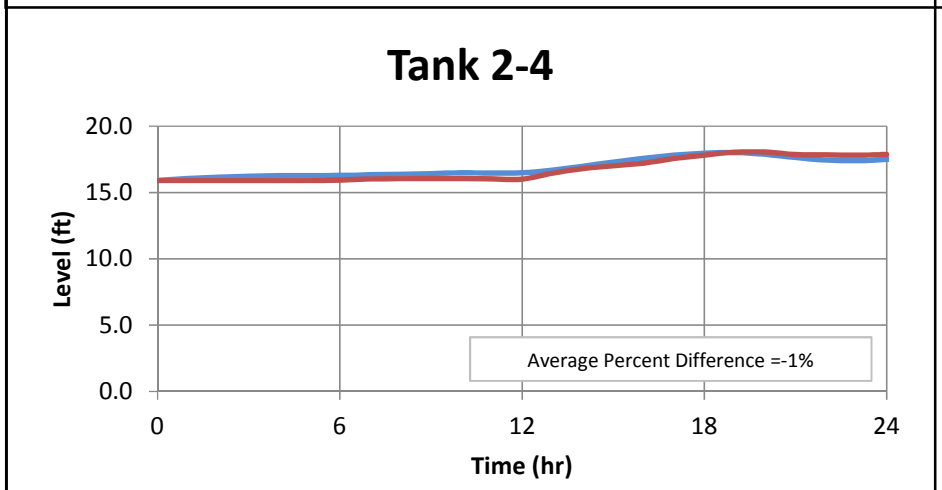

LEGEND

SCADA (July 9, 2017)

Hydraulic Model

PRELIMINARY

January 23, 2018

Figure 6.3
Hydraulic Model Calibration

Water Facilities Master Plan
West Valley Water District

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CHAPTER 7 - EVALUATION AND PROPOSED IMPROVEMENTS

This section presents a summary of the domestic water system evaluation and identifies improvements needed to mitigate existing deficiencies, as well as improvements needed to expand the system and service growth.

7.1 OVERVIEW

The calibrated hydraulic model was used for evaluating the distribution system for capacity deficiencies during peak hour demand and during peak day demands in conjunction with fire flows. Since the hydraulic model was calibrated for extended period simulations, the analysis duration was established at 24 hours for analysis.

The criteria used for evaluating the capacity adequacy of the domestic water distribution system summarized in the System Performance and Design Criteria chapter.

7.2 FIRE FLOW ANALYSIS

The fire flow analysis consisted of using the peak day demand in the hydraulic model and applying hypothetical fire flows. The magnitude and duration of each fire flow was based on the governing land use type within proximity to the fire location. The criterion for fire flows was also summarized in the System Performance and Design Criteria chapter.

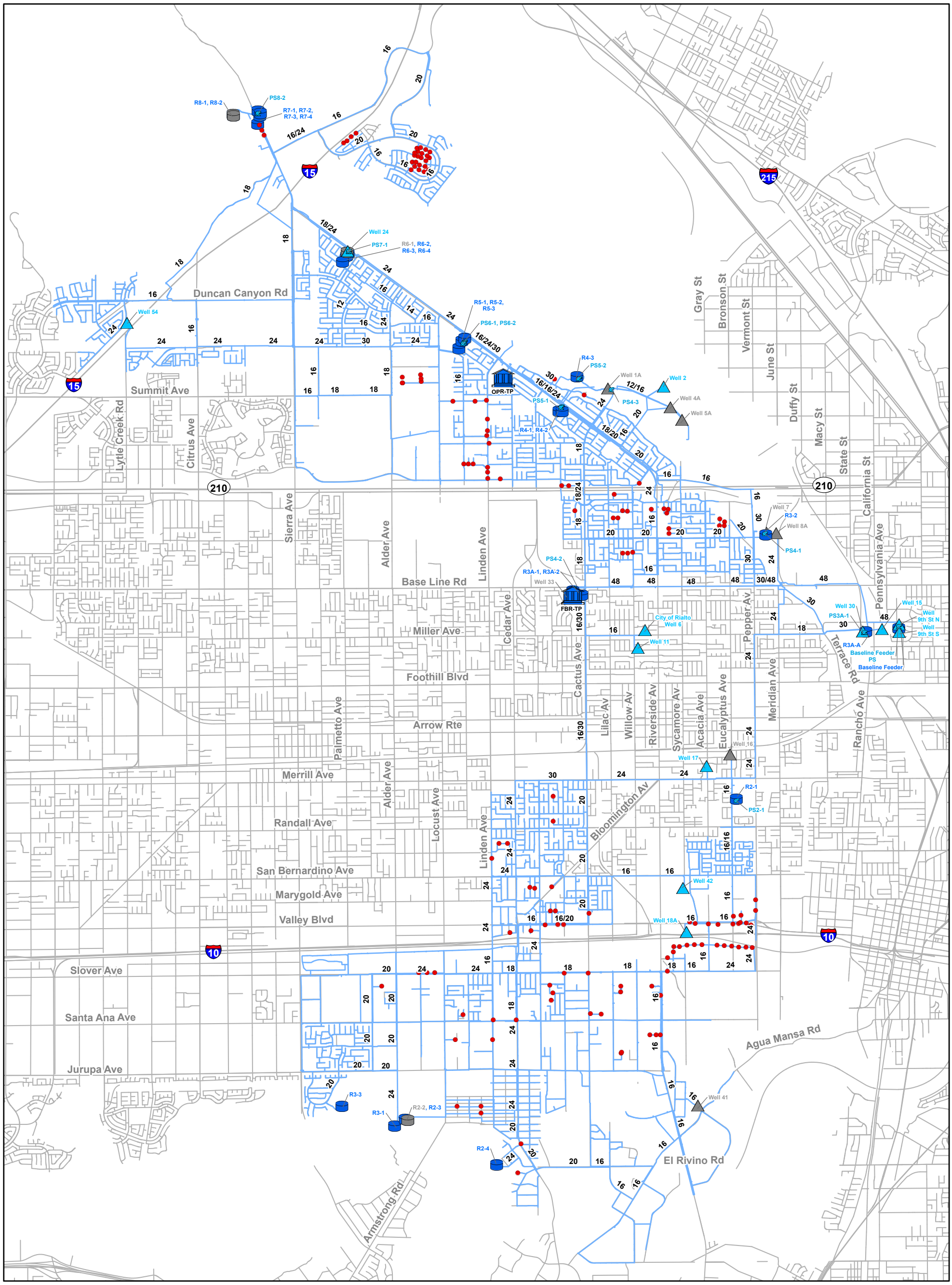
The hydraulic model indicates that the District's existing distribution system performed adequately during the fire flow analysis. **Figure 7.1** documents the hydraulically simulated pressure deficiencies within the existing distribution system. As discussed in the system performance and design criteria chapter, pressures within the water main must be above 20 psi to provide adequate pressure for firefighting purposes. **Figure 7.2** documents the fire flow availability based on the nearby infrastructure and hydraulically available head pressure.

7.2.1 Fire Flow Improvements

Improvements recommended to support fire flow delivery are shown with the 5-year improvements on **Figure 7.3**.

7.2.2 Other Potential Improvements

It should be noted that there are areas of the system that have vulnerabilities when assessed against the Master Plan fire flow criteria. However, it was determined that some of these areas may have reduced fire flow requirements, per the California Fire Code, or other potential fire fighting capabilities, and thus, improvements are not included in this Master Plan. As future development occurs, it is recommended that a development specific fire flow analysis be completed to document any potential deficiencies and appropriate mitigation be completed.



Legend

- Node Pressures < 20 psi

Existing System

- WTP
- Tanks
- Inactive Tanks
- Active Wells
- Inactive Wells
- Pumps
- Pipes
- Street Centerlines

0 0.25 0.5 1 Mile

Updated: February 13, 2018

Figure 7.1
Fire Flow Analysis

Water Facilities Master Plan
West Valley Water District

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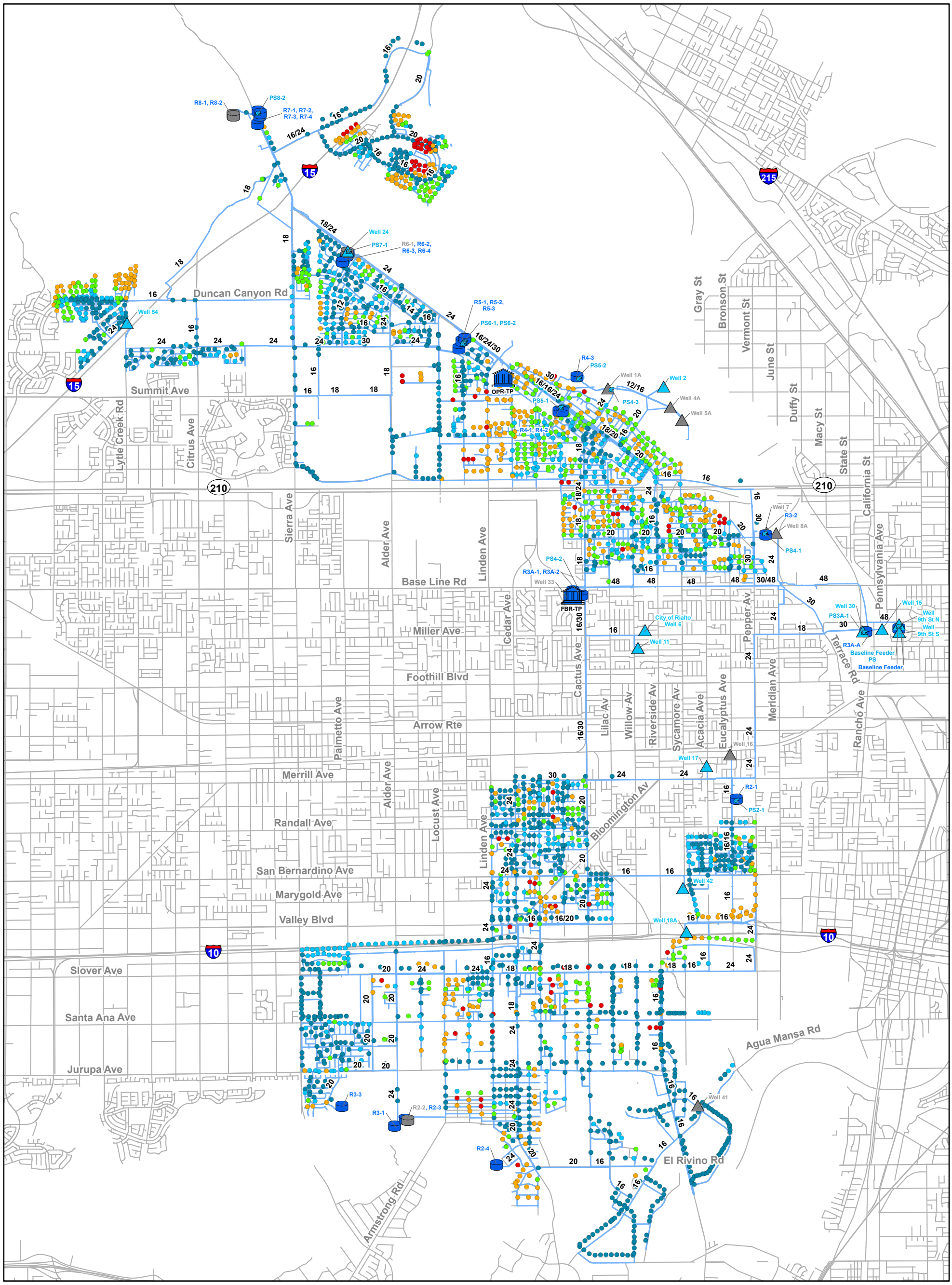

Legend

Available Fire Flow
- ≤ 1,500
- 1,500 - 3,000
- 3,000 - 4,000
- 4,000 - 5,000
- > 5,000

Existing System
- WTP
- Tanks
- Inactive Tanks
- Active Wells
- Inactive Wells
- Pumps
- Pipes
- Street Centerlines

Updated: February 13, 2018

0 0.25 0.5 1 Mile

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File Path: P:\xGIS\GIS_Projects\West Valley WD\Final\WVWD_Fig7-2_AvailableFireFlow_021318.mxd

Figure 7.2
Available Fire Flow

Water Facilities Master Plan
West Valley Water District

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West Valley Water District

R8-1, R8-2
R8-3
2.1 MG
PS8-2
V2
R7-1, R7-2, R7-3, R7-4
PS7-2
Total Capacity: 6,000 gpm
V8
Well 24
R6-1, R6-2, R6-3, R6-4
V9
V10
V11
UNK
V12
V13
V14
V15
V16
Well: 54
V17
V18
V19
V20
R5-1, R5-2, R5-3
PS6-1, PS6-2
V23
V24
V25
V26
V28
OPR-TP
R4-3
PS5-2
Well 1A
Well 2
Well 4A
Well 5A
PS4-3
PS5-1
R4-1, R4-2
V30
V35
PS4-2
R3A-1, R3A-2
Well 33
FBR-1
R3-5
1.0 MG
Well: 36
Well: 8A
Well: 7
Well: 43
BH-AER
1.0 MG
Well: 46
Well: 45
Well: 44
PS4-3
Total Capacity: 11,920 gpm
BH-PS1
Total Capacity: 17,500 gpm
Well 30
PS3A-1
Well 15
Well 9th St N
Well 9th St S
R3A-A
Baseline Feeder PS
Baseline Feeder
City of Rialto Well 6
Well 11
V29
V45
V46
Well 42
Well: 18A
Well: 39
V47
V48
V49
V50
V51
R3-3
R3-1
R2-2, R2-3
R2-4
Well: 41
Well 16
Well 17
R2-1
PS2-1
Duncan Canyon Rd
Summit Ave
Lytle Creek Rd
Citrus Ave
Sierra Ave
Alder Ave
Linden Ave
Base Line Rd
Cedar Ave
Miller Ave
Foothill Blvd
Cactus Ave
Arrow Rte
Palmetto Ave
Merrill Ave
Locust Ave
Randall Ave
San Bernardino Ave
Marygold Ave
Valley Blvd
Slover Ave
Santa Ana Ave
Jurupa Ave
Armstrong Rd
8th St
Lilac Av
Willow Av
Riverside Av
Sycamore Av
Acacia Ave
Eucalyptus Ave
Pepper Av
Meridian Ave
Bloomington Av
Terrace Rd
Rancho Ave
El Rivino Rd
Agua Mansa Rd
Wilson St
Gray St
Bronson St
Vermont St
June St
Duffy St
Macy St
State St
California St
Pennsylvania Ave
15
215
210
10

Legend

System Improvements
- Tanks
- Wells
- Pumps
- Valves
- Pipes

Existing System
- WTP
- Tanks
- Active Wells
- Pumps
- Valves
- Pipes

- Inactive Tanks
- Inactive Wells
- Abandoned Pipes
- Street Centerlines

Updated: March 13, 2019

0 0.25 0.5 1 Mile

N W GIS E S

Figure 7.3
5 Year Improvements

Water Facilities Master Plan
West Valley Water District

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7.3 LOW PRESSURES ANALYSIS

The existing domestic water distribution system was evaluated to determine the minimum pressure adequacy during peak day demand conditions. During peak day demands, the minimum pressure requirement is 40 psi, while during the peak hour demand, the minimum pressure requirement is 35 psi. The hydraulic analysis indicated the existing system is able to provide minimum pressures reasonably well. Minimum pressures during peak day demand conditions are summarized graphically on **Figure 7.4**. Areas of low pressure are briefly described as follows:

- Zone 4, approaching Highway 210
- Zone 5, approaching Roemer WFF

7.4 HIGH PRESSURES ANALYSIS

The hydraulic model was also used to determine if the existing domestic water distribution system meets the District's System Performance and Design Criteria for maximum pressures. Under typical operating conditions the maximum allowable pressure in a pipeline is 130 psi, while the maximum service connection pressure is 80 psi. It is recommended that any new service connections made in areas identified as experiencing high pressure implement a pressure reducing device as part of the service connection. The hydraulic analysis indicated the existing system is able to provide minimum pressures reasonably well. Maximum pressures during peak day demand conditions are summarized graphically on **Figure 7.5**. Areas of maximum pressure are briefly summarized as follows:

- Zone 2, southeast of Agua Mansa Road
- Zone 8, Glen Helen Parkway
- Zone 6, southwest of I15 and Duncan Canyon Rd
- Zone 6, north of the existing Zone 5 tanks

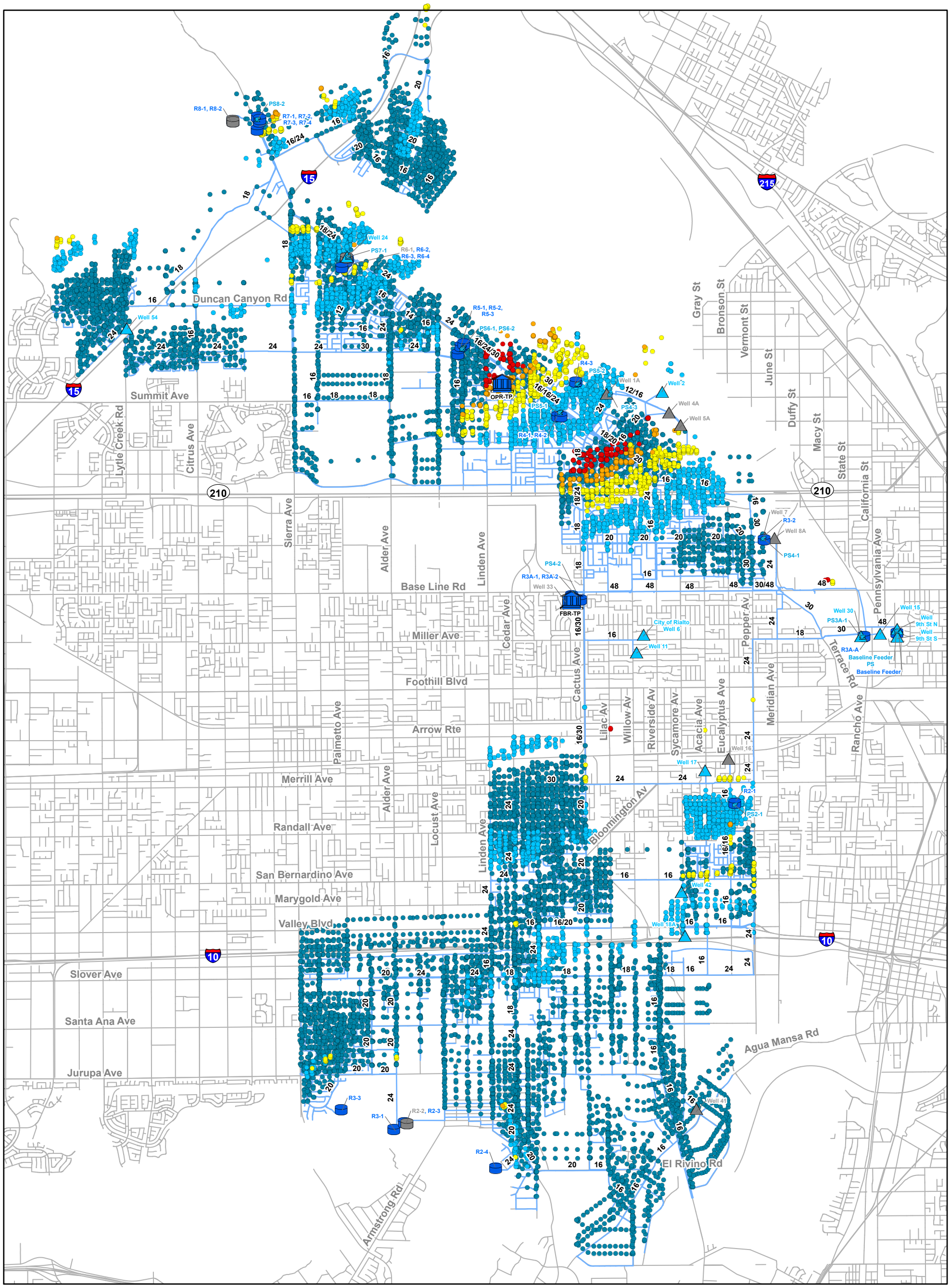
7.5 WATER SUPPLY REQUIREMENTS

The District's existing water supply capacity is identified in this section. Additionally, this section documents the additional supply capacity recommended to meet the requirements of the 5-year and buildout development horizons.

7.5.1 Water Supply Scenarios

As discussed in previous chapters the District's existing supply capacity is comprised of both groundwater and treated surface water. For planning purposes, the supply capacity analysis considered two supply alternatives, which are summarized as follows:

- **Supply Scenario 1:** This supply scenario assumes Roemer WFF is operating at maximum



Legend

Minimum Pressures
- ≤ 35
- 35 - 40
- 40 - 50
- 50 - 65
- > 65

Existing System
- WTP
- Tanks
- Inactive Tanks
- Active Wells
- Inactive Wells
- Pumps
- Pipes
- Street Centerlines

Updated: February 7, 2018

0 0.25 0.5 1 Mile

N W GIS E S

File Path: P:\xGIS\GIS_Projects\West Valley WD\Final\WVWD_Fig7-4_MinPressure_020718.mxd

Figure 7.4
Minimum Pressures
Peak Day Demand

Water Facilities Master Plan
West Valley Water District

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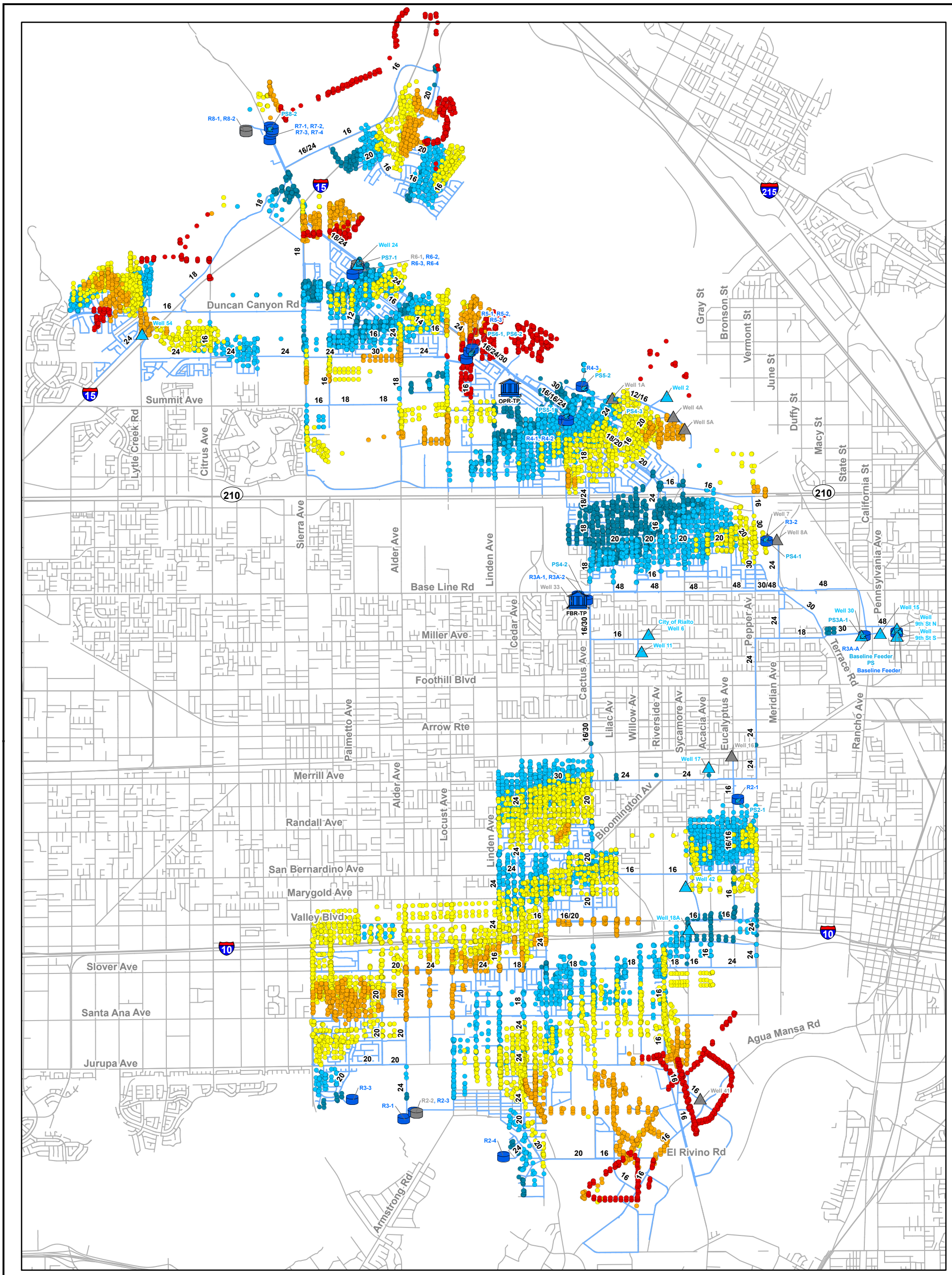
West Valley Water District



Legend

Maximum Pressures

- ≤ 60
- 60 - 80
- 80 - 100
- 100 - 120
- > 120

Existing System

- WTP
- Tanks
- Inactive Tanks
- Active Wells
- Inactive Wells
- Pumps
- Pipes
- Street Centerlines

N, W, GIS, E, S

0 0.25 0.5 1 Mile

Updated: February 7, 2018

File Path: P:\xGIS\GIS_Projects\West Valley WD\Final\WVWD_Fig7-5_MaxPressure_020718.mxd

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Figure 7.5
Maximum Pressures
Peak Day Demand

Water Facilities Master Plan
West Valley Water District

West Valley Water District

treatment capacity, with groundwater wells providing the remaining supply requirements.

- **Supply Scenario 2:** This supply scenario assumes an interruption in SWP water availability and Roemer WFF is assumed to be treating Lytle Creek flows, which are estimated at 4,000 afy (3.6 mgd).

Thus, supply recommendations are based on the ability of the water facilities meeting each of the aforementioned supply scenarios.

7.5.2 System-Wide Water Supply Analysis

The system-wide water supply capacity analysis for existing and buildout conditions is summarized on **Table 7.1**, which includes the supply requirements and available supply volumes under both Supply Scenario 1 and Supply Scenario 2. **Table 7.1** also documents the phased supply improvements, which includes the rehabilitation of existing wells and the construction of new wells. In addition to a system-wide supply capacity analysis.

As documented on **Table 7.1**, the District's supply facilities are capable of meeting the existing supply requirements. Under the conservative Supply Scenario 2, the District has a supply deficiency of approximately the District has an existing supply capacity surplus the District

7.5.3 Pressure Zone Supply Analysis

In addition to a system-wide water supply capacity analysis, the existing pressure zones were evaluated to determine the feasibility of reducing the interzonal supply dependencies with the construction and rehabilitation of new wells. Pressure Zones 2, 3, and 3A were evaluated independently to identify supply improvements to mitigate existing supply dependencies while Pressure Zones 4-8 were evaluated together, with future pump stations planned to convey the existing and future supplies to the higher zones. The pressure zone supply analyses are summarized in the following sections.

7.5.3.1 Pressure Zone 2

Under existing conditions Pressure Zone 2 relies on groundwater wells and PRVs from Pressure Zone 3 to meet existing supply requirements. As documented on **Table 7.2**, three new wells are recommended for equipping and construction to mitigate this existing supply dependency. Additionally, one new well will be required within the buildout development horizon to meet additional demands.

7.5.3.2 Pressure Zone 3

Under existing conditions Pressure Zone 3 utilizes groundwater wells and water delivered through the Meridian Turnout to meet existing supply requirements. As documented on **Table 7.3**, three wells are recommended for rehabilitation and construction to mitigate a portion of this supply dependency. It should be noted that the potential future wells in this pressure zone are located

Table 7.1 Phased Supply Planning
Water Facilities Master Plan
West Valley Water District

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
Population Forecasting																													
Projected Annual Growth Rate	4.4%	4.2%	4.0%	3.9%	3.7%	3.6%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
Projected Population	87,590	91,279	94,967	98,656	102,344	106,033	107,623	109,237	110,876	112,539	114,227	115,941	117,680	119,445	121,236	123,055	124,901	126,774	128,676	130,606	132,565	134,554	136,572	138,621	140,700	142,810	144,953	147,127	149,334
Projected Demands																													
Average Day Demands, mgd	17.6	18.3	19.1	19.9	20.7	21.5	21.9	22.3	22.7	23.1	23.5	23.9	24.3	24.8	25.2	25.6	26.1	26.5	27.0	27.5	28.0	28.5	29.0	29.4	29.8	30.3	30.7	31.2	31.7
Peak Day Demands[1], mgd	29.8	31.2	32.5	33.9	35.2	36.6	37.2	37.9	38.6	39.2	39.9	40.6	41.4	42.1	42.8	43.6	44.3	45.1	45.9	46.7	47.5	48.4	49.2	50.0	50.7	51.5	52.3	53.0	53.8
Buildout Supply Analysis																													
Required Supply (PDD)	29.8	31.2	32.5	33.9	35.2	36.6	37.2	37.9	38.6	39.2	39.9	40.6	41.4	42.1	42.8	43.6	44.3	45.1	45.9	46.7	47.5	48.4	49.2	50.0	50.7	51.5	52.3	53.0	53.8
Available Supply				OPR Expansion Online																									
Supply Scenario 1 (Maximum Surface Water Treatment)				↓																									
Surface Water[2]	12.9	12.9	12.9	12.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9
Groundwater[3,4]	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Firm Available Supply	32.9	32.9	32.9	32.9	38.9	38.9	38.9	38.9	38.9	38.9	38.9	38.9	38.9	38.9	38.9	38.9	38.9	38.9	38.9	38.9	38.9	38.9	38.9	38.9	38.9	38.9	38.9	38.9	38.9
Supply Scenario 2 (Minimum Surface Water Treatment)																													
Surface Water[2]	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Groundwater[3,4]	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
Total Available Supply	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6
Recommended New Wells																													
Well ID		39	41, 50	16, 52	29A	43, 44	45, 46					7, 8A	36						51				34B, 35C		22A				
Estimated Production Capacity[5,6]			2.1, 1.4	1.4, 1.9	1.4	3.4, 3.4	3.4, 3.4					2, 2.3	2.6						2.9				1.9, 1.9		1.4				
Supplied Zone			2, 3	3, 3	2	3A, 3A	3A, 3A					4, 4	4						2				4, 4		4				
New Firm Well Capacity	20.0	21.8	25.3	28.6	31.8	38.6	45.4	45.4	45.4	45.4	45.4	47.0	49.6	49.6	49.6	49.6	49.6	49.6	52.5	52.5	52.5	52.5	56.3	56.3	57.7	57.7	57.7	57.7	57.7
Supply Capacity Analysis																													
Scenario 1 (Maximum Surface Water Supplies)	- Treat maximum Lytle Creek and State Water Project water at OPR WFF, with 1,680 afy delivery to City of Rialto - Includes additional 4,000 AFY SWP water delivery for 15 years (2022-2036) - Rehabilitate existing offline wells - Construct new wells to offset surface water treatment - OPR WFF treatment capacity expansion online 2022																												
	3.1	3.5	5.7	7.6	15.5	20.9	27.0	26.4	25.7	25.0	24.3	25.3	27.1	26.4	25.7	24.9	24.2	23.4	25.5	24.7	23.9	23.0	26.0	25.2	25.9	25.1	24.4	23.6	22.8
Scenario 2 (Conservative Surface Water Supplies)	- Treat 4,000 AFY of Lytle Creek water at OPR WFF, with 1,680 afy delivery to City of Rialto. - Existing Lytle Creek wells considered non-reliable and not included in existing supply totals - Rehabilitate existing offline wells - Construct new wells as needed																												
	-13.3	-12.8	-10.7	-8.7	-6.9	-1.5	4.7	4.0	3.4	2.7	2.0	2.9	4.8	4.1	3.3	2.6	1.8	1.0	3.1	2.3	1.5	0.7	3.6	2.9	3.5	2.8	2.0	1.2	0.4

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4/17/2020

Notes

1. Peak Day Demand = 1.7 x Average Day Demand
2. Available Surface Water supply excludes City of Rialto capacity ownership (1.5 mgd)
3. Existing groundwater capacity based on historical pump tests provided by WVWD staff August 2, 2017 and assumes 16-hour daily runtime
4. Groundwater supply shown equal to firm supply, which reflects total supply with largest unit out of service
5. Estimated production capacities extracted from WVWD 2012 WMP.
6. Well 39 capacity based on the following Chino Groundwater Basin Water Rights:
   - 2019-2021: 1,000 AFY WVWD rights + 1,000 AFY leased rights
   - 2022-2028: 1,000 AFY WVWD rights + 3,000 AFY leased rights
   - 2029-Buildout: 1,000 AFY WVWD Rights

WVWD may renegotiate additional lease rights following 10-year lease term. However, for conservative planning purposes Well 39 currently planned to extract only WVWD right after 2028.

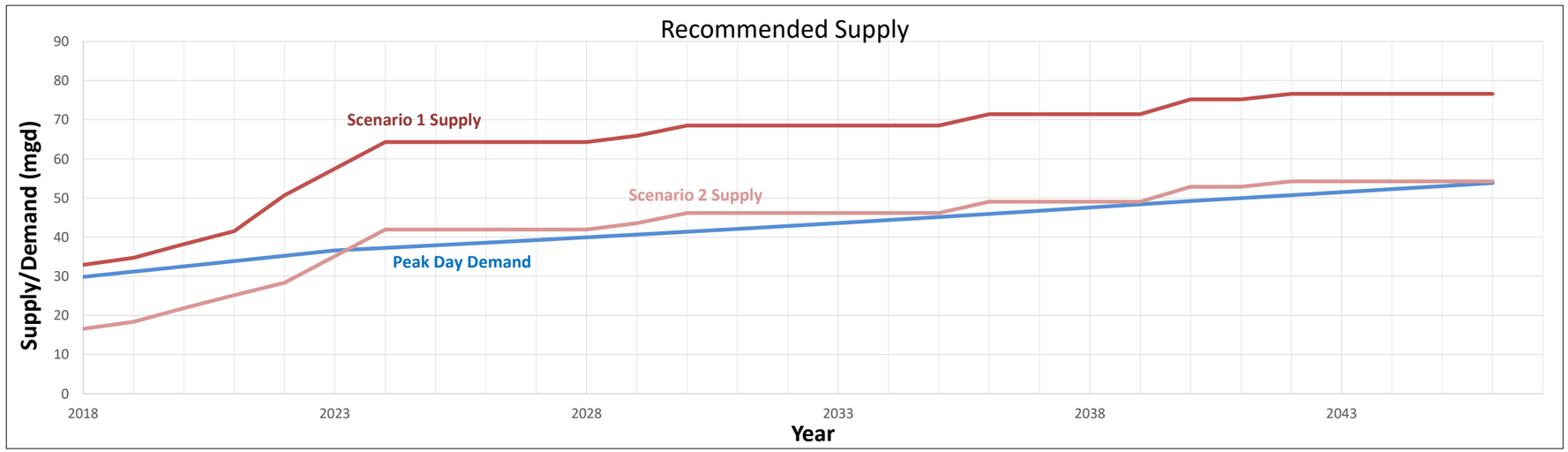

Table 7.2 Pressure Zone 2 Supply Analysis

Water Facilities Master Plan

West Valley Water District

Year	ADD[1]	PDD[2]	Supply Sources[3,4,5]		Groundwater Supply[6]		Surplus/Deficit	
			Well	Source	Total	Firm	Total	Firm
	(mgd)	(mgd)		(mgd)	(mgd)	(mgd)	(mgd)	(mgd)
2018/19	2.65	4.51	Existing W-17	0.96				
			Existing W-18A	2.08	3.04	0.96	-1.47	-3.55
2019/20	2.68	4.56	Equip W-41 (Treatment)	2.10	5.14	3.04	0.59	-1.51
2020/21	2.71	4.60	Equip W-16 (Pump Shaft)	1.40	6.54	4.44	1.94	-0.16
2021/22	2.73	4.65	Construct W-29A	1.40	7.94	5.84	3.30	1.20
2022/23	2.76	4.69			7.94	5.84	3.25	1.15
2023/24	2.79	4.74			7.94	5.84	3.21	1.11
Buildout	4.55	7.74	Construct W-51	2.90	10.84	7.94	3.10	**0.20**

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2/4/2019

Notes:

1. Demands are based on the following:
   - 2018/19: Estimated existing demand
   - 2019/19-2022/23: Linear interpolation between 2018/19 and 2023/24
   - 2023/24: Additional demand based on projected 5-year growth.
2. PDD = 1.7 x ADD
3. Existing well capacities based on pump tests received from District staff August 2, 2017 and assume 16-hour daily operations.
4. Future well capacities based on 2012 Water Master Plan and assume 16-hour daily operations.
5. Firm capacity excludes largest groundwater supply.

Table 7.3 Pressure Zone 3 Supply Analysis

Water Facilities Master Plan

West Valley Water District

Year	ADD[1]	PDD[2]	Supply Sources[3,4,5]		Groundwater Supply[6]		Surplus/Deficit	
			Well	Source	Total	Firm	Total	Firm
	(mgd)	(mgd)		(mgd)	(mgd)	(mgd)	(mgd)	(mgd)
2018/19	3.87	6.57	Existing W-15	1.32				
			Existing W-30	1.46				
			Existing W-42	1.56	4.34	2.78	-2.23	-3.79
2019/20	3.92	6.66	Construct W-50	1.40				
			Rehabilitate W-39	3.80	9.54	5.74	2.88	-0.92
2020/21	3.97	6.75	Construct W-52	1.90	11.44	7.64	4.69	0.89
2021/22	4.02	6.84			11.44	7.64	4.60	0.80
2022/23	4.08	6.93			11.44	7.64	4.51	
2023/24	4.13	7.02			11.44	7.64	4.42	0.62
Buildout	6.63	11.28	Meridian Turnout Delivery	3.63	15.07	11.27	3.80	**0.00**

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2/4/2019

Notes:

1. Demands are based on the following:
   - 2018/19: Estimated existing demand
   - 2019/19-2022/23: Linear interpolation between 2018/19 and 2023/24
   - 2023/24: Additional demand based on projected 5-year growth.
2. PDD = 1.7 x ADD
3. Existing well capacities based on pump tests received from District staff August 2, 2017 and assume 16-hour daily operations.
4. Future well capacities based on 2012 Water Master Plan and assume 16-hour daily operations.
5. Under buildout development PDD conditions Pressure Zone 3 will require approximately 2,500 gpm supply deliveries through the District's Meridian Turnout facility.
6. Firm capacity excludes largest groundwater supply.

within the Chino Groundwater Basin. Based on the existing water rights limitations within the Chino Groundwater Basin, the District currently plans to extract its allowed amount utilizing Well 39 and no additional wells are planned for construction. Therefore, under the buildout development horizon Pressure Zone 3 will require continued supply deliveries through the Meridian Turnout.

7.5.3.3 Pressure Zone 3A

Under existing conditions Pressure Zone 3A utilizes the FBR treatment facility to meet existing supply requirements. As documented on **Table 7.4**, under existing and buildout conditions, this facility is anticipated to be sufficient to meet the zone's supply requirements. However, it should be noted that in the event the FBR treatment facility supply is interrupted this pressure zone can receive deliveries through both the Baseline Feeder Pipeline and Pump Station 3A.

7.5.3.4 Pressure Zone 4-8 (North System Pressure Zones)

Under existing conditions Pressure Zones 4, 5, 6, 7, and 8 are supplied by both groundwater wells and the OPR treatment facility. As summarized on **Table 7.5**, under Supply Scenario 1 the existing water supply facilities are capable of meeting the supply requirements of the pressure zones. However, under the conservative Supply Scenario 2, the available groundwater supply capacity is unable to offset the reduction in surface water available for treatment. In order to mitigate this deficiency the new wells are recommended for construction and equipping; this includes the development of the Bunker Hill well field, comprised of future wells 43, 44, 45, and 46, which is recommended for immediate design and construction. Additionally, to continue to maximize the treatment of surface water supplies, the OPR WFF 6.0 mgd expansion is planned for immediate design and construction. This capacity expansion will enable the District to take advantage of available surface water supplies and minimize groundwater pumping when possible.

7.5.4 Recommended Supply Improvements

The following sections summarize the recommended supply improvements intended to mitigate existing supply deficiencies and accommodate future growth under the five-year and buildout development horizon.

7.5.4.1 Five-Year Supply Improvements

The following section summarizes the supply improvements recommended for implementation within the five-year development horizon, which are briefly on the following pages.

- **Well 16:** This well has a design capacity of 1,500 gpm and discharges into water storage reservoir 2-1. This well has existing treatment for perchlorate and additional treatment is required for nitrate before being activated.

Table 7.4 Pressure Zone 3A Supply Analysis

Water Facilities Master Plan

West Valley Water District

Year	ADD[1]	PDD[2]	Supply Sources[3,4]		Groundwater Supply[5]		Surplus/Deficit	
			Well	Source	Total	Firm	Total	Firm
	(mgd)	(mgd)		(mgd)	(mgd)	(mgd)	(mgd)	(mgd)
2018/19	1.04	1.77	FBR	2.88	2.88	2.88	1.11	1.11
2019/20	1.05	1.78			2.88	2.88	1.10	1.10
2020/21	1.05	1.79			2.88	2.88	1.09	1.09
2021/22	1.06	1.80			2.88	2.88	1.08	1.08
2022/23	1.07	1.81			2.88	2.88	1.07	1.07
2023/24	1.07	1.82			2.88	2.88	1.06	1.06
Buildout	1.11	1.89			2.88	2.88	0.99	**0.99**

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2/4/2019

Notes:

1. Demands are based on the following:
   - 2018/19: Estimated existing demand
   - 2019/19-2022/23: Linear interpolation between 2018/19 and 2023/24
   - 2023/24: Additional demand based on projected 5-year growth.
2. PDD = 1.7 x ADD
3. Existing well capacities based on pump tests received from District staff August 2, 2017 and assume 16-hour daily operations.
4. Future well capacities based on 2012 Water Master Plan and assume 16-hour daily operations.
5. The FBR treatment facility is planned to provide supplies to Pressure Zone 3A under existing and buildout conditions. However, the District can provide supplemental supplies to this zone through the Baseline Feeder Pipeline as well as Pump Station 3A.

Table 7.5 North System Pressure Zone Supply Analysis

Water Facilities Master Plan

West Valley Water District

Year	ADD[1]	PDD[2]	Groundwater Supply				Surface Water		Surplus/Deficit			
			Supply Source[3,4,5]		Supply Capacity[6]		Scenario 1[7,8] (Maximum Surface Water)	Scenario 2[9] (Minimum Surface Water)	Scenario 1 (Maximum Surface Water)		Scenario 2 (Minimum Surface Water)	
			Well	Capacity	Total	Firm			Total	Firm	Total	Firm
	(mgd)	(mgd)		(mgd)	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)
2018/19	9.81	16.67	Existing W-24	0.46								
			Existing W-54	0.88								
			Existing W-9th St (North)	2.88								
			Existing W-9th St (South)	3.36	7.58	4.22	12.90	2.10	3.81	0.45	-8.65	-10.35
2019/20	10.55	17.94			7.58	4.22	12.90	2.10	2.54	-0.82	-8.26	-11.62
2020/21	11.30	19.21			7.58	4.22	12.90	2.10	1.27	-2.09	-9.53	-12.89
2021/22	12.05	20.48			7.58	4.22	12.90		0.00	-3.36	-12.90	-16.26
2022/23	12.79	21.75	Construct W-43	3.40			*OPR WFF Expansion Online*					
			Construct W-44	3.40	14.38	10.98	18.90	2.10	11.53	8.13	-5.27	-8.67
2023/24	13.54	23.02	Construct W-45	3.40								
			Construct W-46	3.40	21.18	17.78	18.90	2.10	17.06	13.66	0.26	-3.14
Buildout	17.05	28.99	Equip W-7 (Blind Flanged)	2.00								
			Equip W-8A (Treatment)	2.30								
			Equip W-22A (Treatment)	1.40								
			Construct W-34B	1.90								
			Construct W-35C	1.90								
			Equip W-36 (Treatment)	2.60	33.28	29.88	18.90	2.10	23.19	**19.79**	6.39	**2.99**

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2/4/2019

Notes:

1. Demands are based on the following:
   - 2018/19: Estimated existing demand
   - 2019/19-2022/23: Linear interpolation between 2018/19 and 2023/24
   - 2023/24: Additional demand based on projected 5-year growth.
2. PDD = 1.7 x ADD
3. Existing well capacities based on pump tests received from District staff August 2, 2017 and assume 16-hour daily operations.
4. Future well capacities based on 2012 Water Master Plan and assume 16-hour daily operations.
5. For conservative supply planning purposes existing Lytle Creek groundwater basin wells (W-1, W-2, W-4A, W-5A) are considered non-reliable and excluded from the supply analysis.
6. Firm capacity excludes largest groundwater supply.
7. Scenario 1 assumes OPR WFF operating at maximum treatment capacity, with 1.5 mgd of treated water delivered to the City of Rialto.
8. The OPR WFF treatment capacity expansion is assumed to come online in the year 2022/23.
9. Scenario 2 assumes OPR WFF treating minimum reliable Lytle Creek supply of 4,000 AFY, with 1.5 mgd of treated water delivered to the City of Rialto.

- **Well 29A:** This well has a design capacity of 1,500 gpm and is planned to discharge directly into Pressure Zone 2. Treatment for perchlorate and nitrate is required before being activated.

- **Well 39:** This well has a capacity of up to 4,000 gpm and is planned to discharge directly into Pressure Zone 3. Once drilled, water quality sampling indicated nitrate exceeding regulatory limits. As such, the well was never equipped, and requires treatment and equipping prior to production.

- **Well 41:** This well has a design capacity of 2,000 gpm and directly discharges into Pressure Zone 2. Currently, this well experiences levels of perchlorate above the regulated maximum contaminant levels and wellhead treatment is required to bring online. Existing treatment vessels located at the reservoir 2-1 site are currently unused and may potentially be relocated to this well site. Feasibility of the relocation of these vessels is dependent on the site constraints. Additional land purchase may be required, should the site not accommodate the vessels. It should be noted that the rehabilitation of this well is expected to reduce the required PRV flow from Pressure Zone 3.

7.5.5 Recommended Supply Improvements

- **Wells 43, 44, 45, and 46:** These wells each have a planned design capacity of 3,400 gpm and are planned as part of the Bunker Hill wellfield development. These wells are planned to discharge into a new aeration tank, which will act as a forebay to a new pump station discharging into a transmission pipeline that will ultimately connect to an existing 30-inch transmission main near the Pump Station 3A site before being conveyed to the Lord Ranch Facility.

- **Well 50:** This well has a design capacity of 1,500 gpm and is planned to discharge directly into Pressure Zone 3. Once drilled, water quality sampling indicated perchlorate exceeding regulatory limits. Treatment for perchlorate and nitrate is required before being activated.

- **Well 52:** This well has a design capacity of 2,000 gpm and is planned to discharge directly into Pressure Zone 3. Treatment for perchlorate and nitrate is required before being activated.

7.5.5.1 Buildout Supply Improvements

The following section summarizes the supply improvements recommended for implementation within the buildout development horizon, which are briefly summarized as follows:

- **Well 7:** This well has a design capacity of 2,100 gpm and is planned to discharge directly into water storage reservoir 3-2. According to District records this well is currently blind flanged.

- **Well 8A:** This well has a design capacity of 2,400 gpm and discharges directly into water storage reservoir 3-2. Currently this well experiences high levels of arsenic and wellhead treatment is required prior to activation.

- **Well 22A:** This well has a design capacity of 1,500 gpm and discharges directly into Pressure Zone 4. Currently, this well experiences high levels of nitrate and wellhead treatment is recommended to bring online. This well will require further study to determine the best methodology to mitigate the ongoing nitrate contamination.

- **Well 34B:** This well has a planned design capacity of 2,000 gpm and discharges directly into Pressure Zone 4. This well is replacing a previously destroyed well and will require re-drilling and equipping. It is also assumed that this well will require wellhead treatment for arsenic levels required prior to activation.

- **Well 35C:** This well has a planned design capacity of 2,000 gpm and discharges directly into Pressure Zone 4. A casing currently exists at this well location and a new study is recommended to confirm the construction and water quality requirements of this well. It is also assumed that this well will require wellhead treatment for arsenic levels required prior to activation.

- **Well 36:** This well has a design capacity of 2,700 gpm and discharges directly into water storage reservoir 3-2. Currently, this well experiences high levels of arsenic and wellhead treatment is required prior to activation.

- **Well 51:** This well has a design capacity of 2,000 gpm and is planned to discharge directly into Pressure Zone 2. The specific location of this well has not been determined and well site investigations should include a water quality study to determine the need for treatment. It should be noted that the construction of this well will reduce the required PRV flow from Pressure Zone 3.

7.5.6 Water Supply Treatment Evaluation

This section documents the groundwater and surface water treatment options for the District, as recommended by Kleinfelder.

7.5.6.1 Groundwater Treatment

Table 7.6 documents the existing conditions of the District's groundwater wells. There are currently 12 active production wells. Some of the production wells are contaminated with perchlorate, nitrate, arsenic, or have issues with air entrapment producing milky water and inducing customer complaints. The District has been proactive in its efforts to install wellhead treatment to maintain the operational status of these wells, and provide high quality drinking water.

Table 7.6 Well Production Capacity and Water Quality Issues

Water Facilities Master Plan

West Valley Water District

Well	Zone	Basin	Location	Five Year Projections, 2022				Ultimate Buildout, 2055				Current Condition of Use	Water Quality Issues
				Pump Capacity (gpm)	Product. Capacity 16h/d Ops (mgd)	Severe Drought Capacity (mgd)	Water Demand (afy)	Pump Capacity 2055 (gpm)	Product. Capacity 16h/d Ops (mgd)	Severe Drought Capacity 2055 (mgd)	Water Demand (afy)		
Lytle Creek Basin													
W-7	3, 4	LC	6871 Martin Road, San Bernardino	2,100	2.0	1.0		2,100	2.0	1.0		Not in operation, Blind flanged	
W-8A	3, 4	LC	6871 Martin Road, San Bernardino	2,400	2.3	0.9		2,400	2.3	0.9		Not currently used, arsenic issue	Low level arsenic
W-36	3,4	LC	20600 Walnut Avenue, San Bernardino					2,700	2.6	0.9		Not currently used	Arsenic removal required
W-1A	4	LC	19523 Country Club Drive, Rialto					760	0.7	0.6		Not currently used due to declining water level	
W-2	4	LC	19973 Country Club Drive, Rialto	2,800	2.7	1.6		2,800	2.7	1.6		Has arsenic treatment, coagulation line	Arsenic
W-4A	4	LC	5914 N. Sycamore Avenue, Rialto					2,600	2.5	0.9		Not currently used due to declining water level	
W-5A	4	LC	5914 N. Sycamore Avenue, Rialto					2,200	2.1	1.0		Not currently used due to declining water level	
W-34B	4	LC	19655 Country Club Drive, Rialto (Future)					2,000	1.9	0.8		Not constructed, replacement for Well 34B	Assumed As removal
W-35C	4	LC	5855 N. Sycamore Avenue, Rialto (Future)					2,000	1.9	0.8		Not constructed, replacement for capped Well 35C	Assumed As removal
			TOTAL LC Current	7,300	7.0	3.5		12,860	12.3	6.0			
			TOTAL LC FUTURE	0	0.0	0.0		6,700	6.4	2.5			
			TOTAL LC Basin	**7,300**	**7.0**	**3.5**		**19,560**	**18.7**	**8.5**			
Rialto-Colton Basin													
W-16	2	R	296 S. Eucalyptus Avenue, Rialto	1,500	1.4	0.8		1,500	1.4	0.8		Current IX for perchlorate, Not used-pump shaft	Perchlorate, Now nitrate
W-17	2	R	404 S. Acacia Avenue, Rialto	1,250	1.2	0.6		1,250	1.2	0.6		Current IX for perchlorate, Operational	Perchlorate
W-49	2	R	Eucalyptus Avenue, Rialto (Future)					1,500	1.4	0.7		Not constructed	
W-11	3A	R	238 W. Victoria Street, Rialto	1,800	1.7	0.9		1,800	1.7	0.9		Current perchlorate FBR, runs when Well 6 is off	
W-33	3A	R	855 W. Baseline Road, Rialto	2,600	2.5	1.3		2,600	2.5	1.3		Not in use, FBR has no capacity, Need to add IX	Perchlorate
W-22A	4	R	5700 N. Riverside Avenue, Rialto (Future)					1,500	1.4	0.7		Well constructed & deactivated, needs treatment	Nitrate >MCL
W-23A	6	R	4334 N. Riverside Avenue, Rialto	200	0.2	0.0		200	0.2	0.0		Not regularly used. Serve as standby for zone 3	
W-24	6	R	4334 N. Riverside Avenue, Rialto	600	0.6	0.3		600	0.6	0.3		OK, Operational	

Table 7.6 Well Production Capacity and Water Quality Issues

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West Valley Water District

Well	Zone	Basin	Location	Five Year Projections, 2022				Ultimate Buildout, 2055				Current Condition of Use	Water Quality Issues
				Pump Capacity (gpm)	Product. Capacity 16h/d Ops (mgd)	Severe Drought Capacity (mgd)	Water Demand (afy)	Pump Capacity 2055 (gpm)	Product. Capacity 16h/d Ops (mgd)	Severe Drought Capacity 2055 (mgd)	Water Demand (afy)		
W-54	6	R	Duncan Canyon Road, Fontana	1,000	1.0	0.6		1,000	1.0	0.6		Air in water, customer complaints, Operational	
			TOTAL RC Current	8,950	8.6	4.4		8,950	8.6	4.4			
			TOTAL RC FUTURE	0	0.0	0.0		3,000	2.8	1.4			
			TOTAL RC Basin	**8,950**	**8.6**	**4.4**		**11,950**	**11.4**	**5.8**			
Bunker Hill Basin													
W-15	3, 3A, 2	BH	1915 W. 9th Street, San Bernardino	2,700	2.6	0.6		2,700	2.6	0.6		OK, Operational	
W-30	3, 3A, 2	BH	2015 W. 9th Street, San Bernardino	3,100	3.0	3.0		3,100	3.0	3.0		OK, Operational	
W-43	3, 3A, 4	BH	Along Baseline Feeder (Future)		0.0			3,500	3.4	3.4		Not constructed, Options: BH or through Baseline Feeder	
W-44	3, 3A, 4	BH	Along Baseline Feeder (Future)		0.0			3,500	3.4	3.4		Not constructed, Options: BH or through Baseline Feeder	
W-45	3, 3A, 4	BH	Along Baseline Feeder (Future)		0.0			3,500	3.4	3.4		Not constructed, Options: BH or through Baseline Feeder	
W-46	3A	BH	Along Baseline Feeder (Future)		0.0			3,500	3.4	3.4		Not constructed, Options: BH or through Baseline Feeder	
W-47	3A	BH	Along Baseline Feeder (Future)		0.0			3,500	3.4	3.4		Not constructed, Options: BH or through Baseline Feeder	
W-48	3A	BH	Along Baseline Feeder (Future)		0.0			3,500	3.4	3.4		Not constructed, Options: BH or through Baseline Feeder	
			TOTAL BH Current	5,800	5.6	5.6		5,800	5.6	3.6			
			TOTAL BH FUTURE	0	0.0	0.0		21,000	20.4	20.4			
			TOTAL BH Basin	**5,800**	**5.6**	**5.6**		**26,800**	**26.0**	**24.0**			
North Riverside Basin													
W-18A	2	NR	1783 S. Sycamore Avenue, Colton	2,700	2.6	1.3		2,700	2.6	1.3		Current IX perchlorate	Perchlorate, Now nitrate, Oil
W-41	2	NR	3353 S. Industrial, Rialto	2,200	2.1	1.1		2,200	2.1	1.1		Currently off	Now perchlorate
W-42	3	NR	295 E. San Bernardino, Rialto	2,200	2.1	1.1		2,200	2.1	1.1		Current IX for perchlorate. OK, Operational	Perchlorate, Now nitrate = 6ppm
W-19A	2	NR	TBD (Future)		0.0			2,100	1.5	0.7		Not constructed	
W-29A	2	NR	180 W. Slover Avenue, Rialto (Future)		0.0			1,500	1.0	0.5		Not constructed	
W-38	2	NR	TBD (Future)		0.0			1,900	1.4	0.7		Not constructed	
W-40	2	NR	157 W. Resource Drive, Rialto (Future)		0.0			1,500	1.0	0.5		Drilled but not equipped	
W-53	2	NR	TBD (Future)		0.0			2,100	1.7	0.9		Not constructed	

Table 7.6 Well Production Capacity and Water Quality Issues

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West Valley Water District

Well	Zone	Basin	Location	Five Year Projections, 2022				Ultimate Buildout, 2055				Current Condition of Use	Water Quality Issues
				Pump Capacity (gpm)	Product. Capacity 16h/d Ops (mgd)	Severe Drought Capacity (mgd)	Water Demand (afy)	Pump Capacity 2055 (gpm)	Product. Capacity 16h/d Ops (mgd)	Severe Drought Capacity 2055 (mgd)	Water Demand (afy)		
W-51	2	NR	TBD (Future)		0.0			3,000	2.2	1.1		Not constructed	
W-52	3	NR	TBD (Future)		0.0			2,000	2.2	1.1		Not constructed	
W-50	3	NR	Willow Ave. and San Bernardino Ave. (Future)		0.0			1,500	1.0	0.5		Not constructed	
			TOTAL NR Current	7,100	6.8	3.4		7,100	6.8	3.4			
			TOTAL NR FUTURE	0	0.0			15,600	12.0	6.0			
			TOTAL NR Basin	**7,100**	**6.8**	**3.4**		**22,700**	**18.8**	**9.4**			
Chino Basin													
W-39	3	C	10272 Cedar Place, San Bernardino Co (Future)		0.0			4,000	3.8	2.0		High levels of nitrate Drilled but not equipped	
			TOTAL C Current	0	0.0	0.0		0	0.0	0.0			
			TOTAL C FUTURE	0	0.0	0.0		4,000	3.8	2.0			
			TOTAL C Basin	**0**	**0.0**	**0.0**		**4,000**	**3.8**	**2.0**			
			TOTAL Ground Water Current	29,150	28.0	16.8		34,710	33.3	17.3			
			TOTAL Ground Water FUTURE	0	0.0	0.0		50,300	45.4	32.3			
			TOTAL Ground Water	**29,150**	**28.0**	**16.8**		**85,010**	**78.7**	**49.6**			

Notes: 2/8/2018

1. Table prepared by Kleinfelder, Inc staff February 2018.
2. Annual average and maximum water demand for intermediate water supply conditions by year 2022 can be satisfied by utilizing all existing wells. This assumes all currently running wells shall be operable which will requires regular and preventive maintenance.
3. To satisfy intermediate water supply demand, capital improvements by implementing wellhead treatments will be required to bring the currently constructed but not running wells in operation by 2022
4. Capacity of the current and the identified additional ground water wells has potential for production of 84.8 MGD which exceeds the average and daily maximum demands of 30.55 MG and 58.68 MGD, respectively.
5. Under sever drought conditions, Baseline Feeder and/or SWP shall be utilized to provide supplemental water supply during peak day demands for intermediate condition of 2022 and for built out conditions of 2055.
6. The OPR WFF with its current capacity of 14.4 MG provides supplemental water supply to the proposed wellhead supply for the intermediate water supply conditions through 2022. The planned 6 MGD expansion shall be realized to satisfy ultimate buildout water demand

The District owns seven non-operating wells that have been inactivated due to mechanical failure of the equipment, or due to contamination such as perchlorate, nitrate, arsenic. For example, W-16, which already has an ionic exchange; wellhead treatment for perchlorates, has a malfunction of the shaft of the pump, W-8A is contaminated with arsenic; and W-33 and W-41 have perchlorate levels that exceed the current MCL. Each of these wells will require treatment or rehabilitation prior to activation.

7.5.6.2 Surface Water Treatment

The Roemer WFF uses raw water from Lytle Creek, and supplemental water from the SWP to treat and deliver high quality drinking water to the existing District customers. The Roemer WFF is operated up to the design capacity and, with regular and planned maintenance, is producing drinking water in compliance with current water quality standards, including TOC reduction to above regulated 35 percent.

7.6 STORAGE ANALYSIS

The section documents the District's existing domestic water storage capacity. Additionally, this section identifies the existing and future storage requirements to meet the storage capacity criteria by pressure zone.

7.6.1 Storage Requirements

The following sections summarize the storage requirements under existing, 5-year, and buildout development conditions. The storage requirements for each development condition are calculated based on criteria discussed in the System Performance and Design Criteria chapter and are summarized on **Table 7.7**.

7.6.1.1 Existing Development

Existing storage requirements were identified for each pressure zone and are summarized in **Table 7.7**. The table lists the existing domestic water demands and operational, pumping, and fire storage for each pressure zone. As summarized on this table the total required storage for existing domestic water demands is 51.8 MG. The current usable storage capacity is 71.86 MG. There are two inactive reservoirs: R6-1 (0.25 MG) and R2-2 (0.5 MG). Reservoir R2-2 is tar lined and R6-6 needs interior recoating. The cost to rehabilitate these two older reservoirs is quite substantial compared to their limited storage capacity.

7.6.1.2 5-Year Development

The storage requirements due to 5-year development were identified based on the planned five year growth and are summarized by pressure zone on **Table 7.7**. The table lists the additional domestic water demands due to 5-year development and identifies the operational, pumping, and fire storage for each pressure zone. As summarized on this table the total required storage for

Table 7.7 Storage Requirements

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Pressure Zone	Water Demands		Water Storage Requirements			
	Average Day Demand[1]	Peak Day Demand[2]	Operational at 100%	Fire Protection[3]	Pumping Storage[4,5]	Total, By Pressure Zone
	(mgd)	(mgd)	(MG)	(MG)	(MG)	(MG)
Exsiting Storage Requirements						
South System Pressure Zones						
2	2.65	4.51	4.51	0.96	-	5.47
3	3.87	6.57	6.57	0.96	-	7.53
3A	1.04	1.77	1.77	0.54	-	2.31
Subtotal	**7.56**	**12.85**	**12.85**	**2.46**	**0.00**	**15.31**
North System Pressure Zones						
4	1.96	3.32	3.32	0.54	7.85	11.72
5	1.98	3.36	3.36	0.54	5.87	9.78
6	3.18	5.40	5.40	0.96	2.70	9.06
7	2.46	4.18	4.18	0.54	0.24	4.96
8	0.24	0.41	0.41	0.54	-	0.95
Subtotal	**9.81**	**16.67**	**16.67**	**3.12**	**16.66**	**36.46**
Existing Storage Requirements						
	17.37	**29.52**	**29.52**	**5.58**	**16.66**	**51.77**
New Storage Requirements (Near-Term 5-Year Planning)						
South System Pressure Zones						
2	0.13	0.22	0.22	0.96	-	1.18
3	0.27	0.45	0.45	0.96	-	1.41
3A	0.03	0.06	0.06	0.54	-	0.60
Subtotal	**0.43**	**0.73**	**0.73**	**2.46**	**0.00**	**3.19**
North System Pressure Zones						
4	0.04	0.07	0.07	0.54	3.69	4.30
5	0.66	1.12	1.12	0.54	3.03	4.69
6	1.19	2.02	2.02	0.96	1.84	4.83
7	1.59	2.70	2.70	0.54	0.26	3.49
8	0.26	0.44	0.44	0.54	-	0.98
Subtotal	**3.73**	**6.34**	**6.34**	**3.12**	**8.82**	**18.29**
New Storage Requirements						
	4.16	**7.07**	**7.07**	**5.58**	**8.82**	**21.48**

Table 7.7 Storage Requirements

Water Facilities Master Plan
West Valley Water District

Pressure Zone	Water Demands		Water Storage Requirements			
	Average Day Demand[1]	Peak Day Demand[2]	Operational at 100%	Fire Protection[3]	Pumping Storage[4,5]	Total, By Pressure Zone
	(mgd)	(mgd)	(MG)	(MG)	(MG)	(MG)
New Storage Requirements (Year 6 through Buildout Planning)						
South System Pressure Zones						
2	1.77	3.00	3.00	0.96	-	3.96
3	2.50	4.26	4.26	0.96	-	5.22
3A	0.04	0.07	0.07	0.54	-	0.61
Subtotal	**4.31**	**7.32**	**7.32**	**2.46**	**0.00**	**9.78**
North System Pressure Zones						
4	0.27	0.46	0.46	0.54	5.51	6.51
5	0.19	0.33	0.33	0.54	5.31	6.18
6	2.44	4.16	4.16	0.96	2.87	7.98
7	2.47	4.19	4.19	0.54	0.40	5.14
8	0.40	0.68	0.68	0.54	-	1.22
Subtotal	**5.78**	**9.83**	**9.83**	**3.12**	**14.09**	**27.04**
New Storage Requirements						
	10.09	**17.15**	**17.15**	**5.58**	**14.09**	**36.82**
Total Storage Requirements at Buildout						
South System Pressure Zones						
2	4.55	7.74	7.74	0.96	-	8.70
3	6.63	11.28	11.28	0.96	-	12.24
3A	1.11	1.89	1.89	0.54	-	2.43
Subtotal	**12.30**	**20.90**	**20.90**	**2.46**	**0.00**	**23.36**
North System Pressure Zones						
4	2.27	3.85	3.85	0.54	17.05	17.44
5	2.83	4.81	4.81	0.54	14.22	15.57
6	6.81	11.58	11.58	0.96	7.41	19.95
7	6.51	11.07	11.07	0.54	0.90	12.51
8	0.90	1.53	1.53	0.54	-	2.07
Subtotal	**19.32**	**32.84**	**32.84**	**3.12**	**39.58**	**67.54**
Total Storage Requirements						
	31.62	**53.75**	**53.75**	**5.58**	**39.58**	**90.91**

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Notes:

1. Existing average day demands based on 2014 production less 10%, where the demand distribution by pressure zone is based on 2016 water billing records.
2. Peak Day Demand = 1.7 x Average Day Demand
3. Fire Protection requirement represents largest fire requirement for each zone, based on account types listed in water billing records
4. Zones 4-7 include a pumping storage capacity which is equal to 1-day storage of ADD for the higher zones.
5. The pumping storage shown in this table is the maximum pumping storage required and does not take into account the 4.0 MG of pumping storage available at the OPR WFF during emergency conditions.

5-year domestic water demands is 21.5 MG, which excludes the demands due to existing development.

7.6.1.3 Buildout Development Storage Requirements

The storage requirements due to buildout development of the District service area are summarized by pressure zone on **Table 7.7**. The table lists the additional domestic water demands due to buildout development and identifies the operational, pumping, and fire storage for each pressure zone. The table also lists the total required storage for buildout domestic water demands at 36.8 MG, which excludes the demands due to existing and 5-year development.

7.6.2 Storage Analysis and Recommended New Storage Facilities

The existing and future storage requirements, shown on **Table 7.7**, were compared with existing District storage facilities in each pressure zone and the required storage facility improvements for the 5-year (**Table 7.8**) and Buildout (**Table 7.9**) development horizons were identified; these tables list existing storage facilities for each zone, identifies existing storage capacity deficiencies, and identifies future storage capacity requirements to meet the needs from future growth.

7.6.2.1 5-year Development Storage Analysis

Based on the storage analysis shown on **Table 7.8**, the majority of the existing pressures zones have sufficient storage capacity to meet existing and five-five year requirements. The storage improvements recommended for construction within the five-year development horizon include the replacement of the existing Pressure Zone 8 storage reservoirs and the construction of a planned aeration reservoir, which are briefly summarized as follows:

Pressure Zone 8: In order to meet the storage capacity requirements due to the 5-year development within this pressure zone, an additional 0.5 MG of storage capacity is required. However, in order provide additional capacity for buildout development within the pressure zone a total capacity of 2.1 MG is recommended, which will provide surplus storage capacity to meet growing storage requirements as development continues beyond the 5-year development planning horizon. This storage volume also accounts for the demolition of the existing Zone 8 storage reservoirs.

- **Lord Ranch Facility:** The current designs for the Lord Ranch Facility include the construction of one new aeration reservoir. This reservoir is not intended to float on the District's distribution system and will serve as a forebay to the Lord Ranch Facility pump station expansion.

The proposed storage reservoir improvements for the 5-year development horizon are included on **Table 7.10** and graphically shown on **Figure 7.3**, and described as follows:

- **Z8-R8-3:** Replace the existing 0.10 MG and 0.41 MG Zone 8 water storage reservoirs with a 2.1 MG storage reservoir at the existing Zone 8 Tank site.

Table 7.8 Storage Capacity Analysis - 5 Year Growth

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Pressure Zone	Demands				Operational + Emergency Storage		Pumping Storage[1,2,3,4]		Fire Protection	Total Existing and Future Storage Requirement[5]	Existing Storage Reservoirs									Storage Balance for Existing Demands	Proposed New Storage Reservoirs									Total Storage	Storage Balance for Existing and 5-Year Demands
	Existing Average Day Demand	Existing Peak Day Demand	5-Year Average Day Demand	5-Year Peak Day Demand	Existing	5-Year Growth	Existing	5-Year Growth			Zone 2	Zone 3	Zone 3A	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Total		Zone 2	Zone 3	Zone 3A	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8[6]	Total		
	(MGD)	(MGD)	(MGD)	(MGD)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)
South System																														
Pressure Zone 2	2.65	4.51	0.13	0.22	4.51	0.22	0.00	0.00	0.96	5.70	11.00								11.00	5.53									0.00	11.00	5.30
Pressure Zone 3	3.87	6.57	0.27	0.45	6.57	0.45	0.00	0.00	0.96	7.98		9.00							9.00	1.47									0.00	9.00	1.02
Pressure Zone 3A	1.04	1.77	0.033	0.06	1.77	0.06	0.00	0.00	0.54	2.36			6.00						6.00	3.69									0.00	6.00	3.64
Subtotal	7.56	12.85	0.43	0.73	12.85	0.73	0.00	0.00	2.46	16.04									26.00	9.96									0.00	26.00	9.96
North System																														
Pressure Zone 4	1.96	3.32	0.04	0.07	3.32	0.07	7.85	3.69	0.54	11.47				11.00					11.00	3.28									0.00	11.00	-0.47
Pressure Zone 5	1.98	3.36	0.66	1.12		1.12	5.87	3.03	0.54	6.57					13.00				13.00	10.59									0.00	13.00	6.43
Pressure Zone 6	3.18	5.40	1.19	2.02	5.40	2.02	2.70	1.84	0.96	12.92						11.00			11.00	1.94									0.00	11.00	-1.92
Pressure Zone 7	2.46	4.18	1.59	2.70	4.18	2.70	0.24	0.26	0.54	7.91							9.15		9.15	4.19									0.00	9.15	1.24
Pressure Zone 8[6]	0.24	0.41	0.26	0.44	0.41	0.44	0.00	0.00	0.54	1.38								0.51	0.51	-0.44								2.10	2.10	2.10	0.72
Subtotal	9.81	16.67	3.73	6.34	13.31	6.34	16.66	8.82	3.12	40.26									44.66	4.40									2.10	46.76	5.99
Total	**17.37**	**29.52**	**4.16**	**7.07**	**26.16**	**7.07**	**16.66**	**8.82**	**5.58**	**56.30**									**70.66**	**14.36**									2.10	**72.76**	16.46

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Notes:

1. Total Required Storage for Pressure Zone 2, 3, 3A, 8 : Operational + Fire
2. Total Required Storage for Pressure Zone 4, 5, 6, 7 : Operational + Fire + Pumping Storage
3. Pumping Storage defined as 100% Average Day Demand (ADD) for supply dependent pumping zone.
4. The pumping storage shown in this column is the maximum pumping storage required and does not take into account the 4.0 MG of pumping storage available and the OPR WFF.
5. The total pumping requirement for Zone 4 and Zone 5 reflects a 4.0 MG reduction in pumping storage due to supply available at the OPR WFF under emergency operational conditions.
6. Proposed new Zone 8 storage tank volume based on buildout land use demand requirements, which exceed the storage requirements due to 5 year growth.

Table 7.9 Storage Capacity Analysis - Buildout

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West Valley Water District

Pressure Zone	Demands				Operational + Emergency Storage		Pumping Storage[1,2]		Fire Protection[3]	Total Existing and Future Storage Requirement[4]	Existing Storage Reservoirs									Storage Balance for Existing and Buildout Demands	Proposed New Storage Reservoirs									Total Storage	Storage Balance for Existing and Buildout Demands
	Existing Average Day Demand	Existing Peak Day Demand	Future Average Day Demand	Future Peak Day Demand	Existing	Future	Existing	Future			Zone 2	Zone 3	Zone 3A	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Total		Zone 2	Zone 3	Zone 3A	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Total		
	(MGD)	(MGD)	(MGD)	(MGD)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)
South System																														
Pressure Zone 2	2.65	4.51	1.90	3.23	4.51	3.23	0.00	0.00	0.96	8.70	11.00								11.00	2.30									0.00	11.00	2.30
Pressure Zone 3	3.87	6.57	2.77	4.71	6.57	4.71	0.00	0.00	0.96	12.24		9.00							9.00	-3.24	3.25								3.25	12.25	0.01
Pressure Zone 3A	1.04	1.77	0.07	0.12	1.77	0.12	0.00	0.00	0.54	2.43			6.00						6.00	3.57									0.00	6.00	3.57
Subtotal	7.56	12.85	4.74	8.06	12.85	8.06	0.00	0.00	2.46	23.36									26.00	2.64									3.25	29.25	5.89
North System																														
Pressure Zone 4	1.96	3.32	0.31	0.53	3.32	0.53	7.85	9.20	0.54	17.44				11.00					11.00	-6.44	7.00								7.00	18.00	0.56
Pressure Zone 5	1.98	3.36	0.85	1.45		1.45	5.87	8.35	0.54	12.21					13.00				13.00	0.79			2.60						2.60	15.60	3.39
Pressure Zone 6	3.18	5.40	3.63	6.18	5.40	6.18	2.70	4.71	0.96	19.95						11.00			11.00	-8.95				9.00					9.00	20.00	0.05
Pressure Zone 7	2.46	4.18	4.05	6.89	4.18	6.89	0.24	0.66	0.54	12.51							9.15		9.15	-3.36					3.40				3.40	12.55	0.04
Pressure Zone 8	0.24	0.41	0.66	1.12	0.41	1.12	0.00	0.00	0.54	2.07								0.51	0.51	-1.56						2.10			2.10	2.10	0.03
Subtotal	9.81	16.67	9.51	16.17	13.31	16.17	16.66	22.92	3.12	64.18									44.66	-19.52									24.10	68.76	4.58
Total	**17.37**	**29.52**	**14.25**	**24.22**	**26.16**	**24.22**	**16.66**	**22.92**	**5.58**	**87.54**									**70.66**	**-16.88**									27.35	**98.01**	10.47

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Notes:

1. Pumping Storage defined as 100% Average Day Demand (ADD) for supply dependent pumping zone.
2. The pumping storage shown in this column is the maximum pumping storage required and does not take into account the 4.0 MG of pumping storage available and the OPR WFF.
3. Fire storage requirement is the greatest fire flow volume of existing and future customers for each pressure zone.
4. The total pumping requirement for Zone 4 and Zone 5 reflects a 4.0 MG reduction in pumping storage due to supply available at the OPR WFF under emergency operational conditions.

Table 7.10 Proposed Storage Reservoirs

Water Facilities Master Plan

West Valley Water District

Tank ID	Pressure Zone	Volume (MG)	Bottom Elevation (ft)
R3-4	3	3.25	1,260
LR-R3-5	3	1.00	1,156
R4-4	4	7.00	1,500
R5-4	5	2.60	1,638
R6-5	6	6.00	1,860
R6-6	6	3.00	1,860
R7-5	7	3.40	2,120
R8-3	8	2.10	2,363
R-BH-AER	-	1.00	2,345
Total		**29.35**	

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1/11/2019

- **LR-R3-5**: Construct a new 1.0 MG water storage reservoir at the existing Lord Ranch Facility.

7.6.2.2 Buildout Development Storage Analysis

Based on the storage analysis shown on **Table 7.9**, the existing storage capacity of multiple pressure zones is unable to meet the storage requirements at buildout of the District service area. In order to mitigate these storage deficiencies multiple storage reservoirs are recommended, as summarized on **Table 7.10** and shown graphically on **Figure 7.6**.

These storage deficiencies and recommended improvements are also briefly summarized below:

- **Pressure Zone 2:** Pressure Zone 2 is expected to have surplus storage capacity at buildout demands, and no improvements are recommended.

- **Pressure Zone 3:** In order to meet the storage capacity requirements at the buildout of the District service area, an additional 3.25 MG of storage capacity is recommended. This additional capacity is planned to be provided by the construction of one new storage reservoir.

- **Pressure Zone 3A:** Pressure Zone 3A is expected to have surplus storage capacity at buildout demands and no improvements are recommended.

- **Pressure Zone 4:** In order to meet the storage capacity requirements at the buildout of the District service area, an additional 7.0 MG of storage capacity is recommended. This additional capacity is planned to be provided by the construction of one new storage reservoir.

- **Pressure Zone 5:** In order to meet the storage capacity requirements at the buildout of the District service area, an additional 2.6 MG of storage capacity is recommended. This additional capacity is planned to be provided by the construction of one new storage reservoir.

- **Pressure Zone 6:** In order to meet the storage capacity requirements at the buildout of the District service area an additional 9.0 MG of storage capacity is recommended. This additional capacity is planned to be provided by the construction of two new storage reservoirs.

- **Pressure Zone 7:** In order to meet the storage capacity requirements at the buildout of the District service area, an additional 3.4 MG of storage capacity is recommended. This additional capacity is planned to be provided by the construction of one new storage reservoir.

- **Pressure Zone 8:** As described in a previous section, the existing Zone 8 storage

R7-5
3.4 MG
PS8-3
Total Capacity: 4,890 gpm
R8-3
2.1 MG
R6-6
3.0 MG
PS7-3
Total Capacity: 5,250 gpm
PS7-2
Total Capacity: 6,000 gpm
R6-5
6.0 MG
PS6-3
Total Capacity: 5,200 gpm
PS5-3
Total Capacity: 8,000 gpm
R5-4
2.6 MG
R4-4
7.0 MG
Well: 54
Well: 34B
Well: 22
Well: 35C
BH-PS
Total Capacity: 17,500 gpm
BH-AER
1.0 MG
R3-5
1.0 MG
Well: 36
Well: 43
Well: 8A
Well: 7
Well: 46
Well: 45
Well: 44
PS4-3
Total Capacity: 11,920 gpm
PS4-2
Total Capacity: 9,600 gpm
Well: 16
PS2-1
Additional Capacity: 1,500 gpm
Well: 50
Well: 42
Well: 18A
Well: 39
Well: 51
Well: 29A
R3-4
3.25 MG
Well: 40
Well: 41
Duncan Canyon Rd
Summit Ave
Lytle Creek Rd
Citrus Ave
Sierra Ave
Alder Ave
Linden Ave
Base Line Rd
Miller Ave
Cedar Ave
Foothill Blvd
Cactus Ave
Lilac Av
Willow Av
Riverside Av
Sycamore Av
Acacia Ave
Eucalyptus Ave
Pepper Av
Meridian Ave
Terrace Rd
Rancho Ave
Arrow Rte
Merrill Ave
Palmetto Ave
Locust Ave
Bloomington Av
Randall Ave
San Bernardino Ave
Marygold Ave
Valley Blvd
Slover Ave
Santa Ana Ave
Jurupa Ave
Armstrong Rd
8th St
El Rivino Rd
Wilson St
Agua Mansa Rd
Gray St
Bronson St
Vermont St
June St
Duffy St
Macy St
State St
California St
15
215
210
10

Legend

5 Year Improvements	Buildout Improvements	Existing System	
Tanks	Tanks	WTP	Inactive Tanks
Wells	Wells	Tanks	Abandoned Pipes
Pumps	Pumps	Wells	Street Centerlines
Valves	Valves	Pumps	
Pipes	Pipes	Valves	
		Pipes	

Updated: March 18, 2019

0 0.25 0.5 1 Mile

N W GIS E S

Figure 7.6
Buildout Improvements

Water Facilities Master Plan
West Valley Water District

West Valley Water District

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File Path: P:\xGIS\GIS_Projects\West Valley WD\Final\WVWD_Fig7-6_BuildoutImprovements_031819.mxd

reservoirs are planned for replacement as part of the 5-year planning horizon. The recommended tank volume is sized to meet the buildout storage need.

- **Bunker Hill Well Field:** Plans for the Bunker Hill supply include the construction of a 1.0 MG aeration tank, which will serve as an equalization reservoir for the discharge of planned groundwater wells 43, 44, 45, and 46.

The proposed storage reservoirs summarized on **Table 7.10** are briefly described as follows:

- **Z3-R3-4:** Construct a new 3.25 MG storage reservoir approximately 1,100 ft southwest of the intersection of Jurupa Avenue and Alder Avenue.
- **Z4-R4-4:** Construct a new 7.0 MG storage reservoir at the existing water storage reservoir 4-3 site.
- **Z5-R5-4:** Construct a new 2.6 MG storage reservoir within the planned Lytle Creek Ranch development approximately 1,000 feet northeast of the existing water storage reservoir 5-1 site.
- **Z6-R6-5:** Construct a new 6.0 MG storage reservoir at the existing water storage reservoir 6-2 site.
- **Z6-R6-6:** Construct a new 3.0 MG storage reservoir approximately 1,100 feet east of the intersection of Citrus Avenue and Segovia Lane.
- **Z7-R7-5:** Construct a new 3.4 MG storage reservoir at the intersection of Clearwater Parkway and Glen Helen Parkway.

7.7 PUMP STATION CAPACITY ANALYSIS

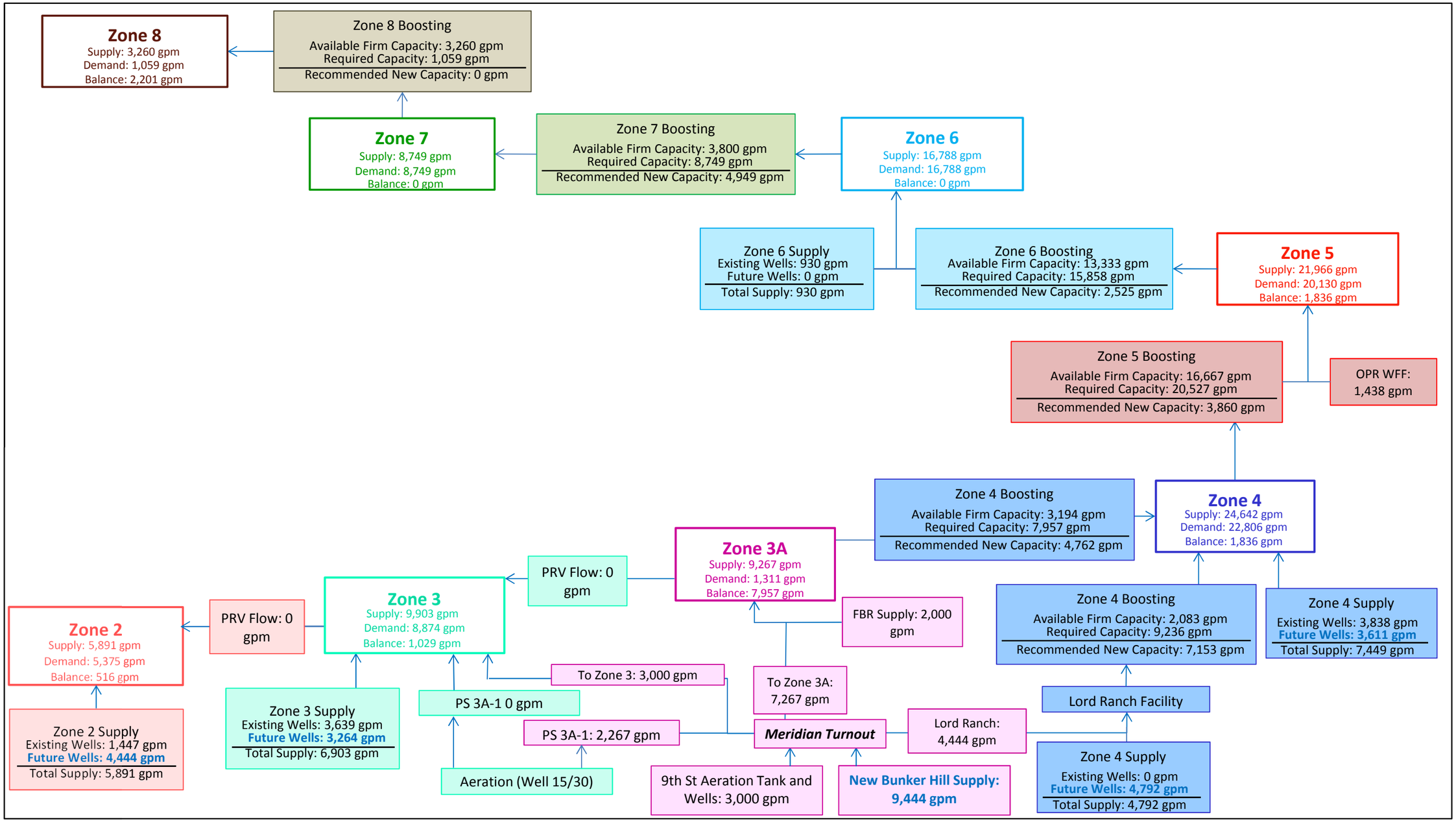
The section documents the existing pump station capacity, as well as the requirements to meet existing and future pumping needs. The pump station capacity evaluation is consolidated by pressure zone, and improvements are documented where necessary.

7.7.1 Existing Pump Station Capacity Requirements

The existing pump station requirements were identified for each station and are summarized on **Table 7.11**. The table lists the existing pump station capacities and identifies the required capacity, based on the District criteria. The existing pump station capacity analysis indicates the District's current pump stations have adequate capacity to service existing customers.

7.7.2 Future Pump Station Capacity Requirements

Future pump station requirements were identified for each pressure zone and are summarized on **Figure 7.7**. Based on the pump station criteria discussed in the System Performance and Design Criteria chapter, the combined firm capacity of each zone pump station is required to meet the Peak Day Demands of each zone in addition to any supply dependent zones. Pump station capacity requirements will vary based on supply scenarios discussed in an earlier section.



NOTES

1. Demands shown based on Buildout Peak Day Demand conditions (1.7 x 31.6 mgd)
2. Total zone demand equal to a sum of the following:
   - Pressure zone demand
   - Total demand of supply dependent boosted zones
   - Any assumed PRV outflow
3. Available pump station firm capacities equal to the sum capacity of each pressure zone pump station operating without its largest unit.
4. Supply and boosting flowrates assume 16-hour a day operations; this excludes FBR and OPR WFF.
5. OPR WFF treating minimum reliable Lytle Creek supply of 4,000 AFY.
6. Recommended new Zone 4 boosting capacity equal to total supply delivered to Lord Ranch Facility less existing PS 4-1 firm capacity.
7. Future wells shown include both the rehabilitation of existing offline wells and the construction of new wells.
8. Zone 5 demands include delivery of 1.5 mgd of treated surface water to the City of Rialto.
9. Recommended new boosting capacity based on 16-hour daily pumping.

PRELIMINARY

March 11, 2019

Figure 7.7
Buildout Supply and Boosting Capacity
Water Facilities Master Plan
West Valley Water District

West Valley Water District

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Table 7.11 Existing Pump Station Analysis

Water Facilities Master Plan
West Valley Water District

Pump Station Name	Pressure Zone		Pressure Zone Demands					Pump Station Capacity Analysis				
	Source	Destination	Destination Zone	Supply Dependent Zones	Average Day Demand			Total Capacity[1]	Firm Capacity[2]	Required Capacity[3]	Credit for Firm Supply[4]	Surplus/ Deficiency
					Destination Zone	Supply Dependent Zones	Total					
			(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)
South System												
Pressure Zone 2												
Wells (W18A)	-	3						1,447	0			
Total			3	-	1,291	0	1,291	1,447	0	2,195	0	-2,195
Pressure Zone 3												
2-1 PS	Wells 16, 17	3						1,000	0			
3A-1 PS	Wells 15, 30	3						1,933	1,933			
9th Street PS	-	3, 4						4,000	1,000			
Wells (W42)	-	3						1,447	0			
Total			3	2	1,903	1,291	3,194	8,380	2,933	5,429	0	-2,496
Pressure Zone 3A												
3A-1 PS	Wells 15, 30	3, 3A						0	0			
FBR	Wells 6, 11							2,000	2,000			
Total			3A	-	709	0	709	2,000	2,000	1,206	0	794
North System												
Pressure Zone 4												
4-1 PS	3	4	4	-				3,400	2,067			
4-2 PS	3A	4	4	-				4,800	3,200			
Total			4	-	1,273	3,733	5,006	8,200	5,267	8,511	0	-3,244
Pressure Zone 5												
5-1 PS	4	5						8,000	6,000			
5-2 PS	4	5						12,800	10,667			
Oliver P. Roemer WFF Effluent Pumps											2,484	
Total			5	6, 7, 8	1,313	2,420	3,733	20,800	16,667	6,346	2,484	12,804

Table 7.11 Existing Pump Station Analysis

Water Facilities Master Plan
West Valley Water District

Pump Station Name	Pressure Zone		Pressure Zone Demands					Pump Station Capacity Analysis				
	Source	Destination	Destination Zone	Supply Dependent Zones	Average Day Demand			Total Capacity[1]	Firm Capacity[2]	Required Capacity[3]	Credit for Firm Supply[4]	Surplus/ Deficiency
					Destination Zone	Supply Dependent Zones	Total					
			(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)
Pressure Zone 6												
6-1 PS	5	6						6,200	4,733			
6-2 PS	5	6						10,360	8,633			
Wells (W24, W54)											317	
Total			6	7, 8	1,443	978	2,420	16,560	13,367	4,115	317	**9,569**
Pressure Zone 7												
7-1 PS	6	7						5,267	3,800			
Total			7	8	938	40	978	5,267	3,800	1,662		**2,138**
Pressure Zone 8												
8-2 PS	7	8						4,375	3,260	0		
Total			8	-	40	0	40	4,375	3,260	68	0	**3,192**

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4/2/2018

Notes:

1. Firm capacity for each pressure zone is defined as the sum of the total capacity of each pump station pumping into the pressure zone, with each pump station operating without their largest unit.
2. Firm and Total capacity based on 16-hour daily pumping times.
3. Pump stations to supply PDD of destination zone and all other supply dependent zones.
4. Total pump station requirement reduced based on firm capacity of wells and treatment plants pumping directly in to destination zone.

Supply Scenario 2 represents the most conservative pump station capacity requirements and improvements recommended are consistent with this scenario. The proposed pump stations are briefly described by pressure zone in the following sections.

Pressure Zone 2: This pressure zone has no existing pump stations and the existing wells, in addition to the planned future wells, will provide sufficient supply capacity to meet the peak day demands of the zone.

Pressure Zone 3: The pump station capacity requirements for this zone are supplied by Pump Station 3A, Pump Station 2-1, and the 9th Street Pump Station through the Meridian Turnout. This zone has no supply dependent demands and a portion of the zone demands are provided by existing and planned future wells. Based on the firm capacity of the existing pump stations, this pressure zone has pumping capacity to meet the peak day demand requirements. However, in order to create firm capacity at the existing Pump Station 2-1, one new pump is recommended.

- **Z3-PS2-1:** Construct one additional 1,500 gpm pump at the existing Pump Station 2-1 site. This will increase the total station capacity to 3,000 gpm and create a firm capacity of 1,500 gpm.

Pressure Zone 3A: The pump station capacity requirements for this zone are supplied by pump station 3A and the 9th Street Pump Station through the Meridian Turnout. This zone has no supply dependent demands and a portion of the zone demands are provided by the FBR and existing and planned future wells. Based on the firm capacity of the existing pump stations, this zone has a pump station capacity surplus and no improvements are recommended.

Pressure Zone 4: The pump station capacity requirements for this zone are supplied by Pump Station 4-1 and Pump Station 4-2. In addition to meeting the peak day demands for Pressure Zone 4, these pump stations must also provide water to Pressure Zones 5, 6, 7 and 8, which are supply dependent pressure zones. Based on these requirements approximately 16,000 gpm of additional pump station capacity is recommended in this zone, which is planned to be met through the construction of two new pump stations.

- **Z4-PS4-2:** Construct a new pump station at the existing Pump Station 4-2 site. This pump station is planned to have four 2,400 gpm pumps, three duty and one standby, for a total station capacity of 9,600 gpm. It should be noted that if space is available the recommended pumps could be incorporated into the existing Pump Station 4-2.

- **Z4-PS4-3:** Construct a new pump station at the existing Lord Ranch Facility. This pump station is planned to have four 2,980 gpm pumps, three duty and one standby.. This pump station is planned to discharge into the existing 30-inch transmission main in Pepper Avenue north to Highland Avenue.

Pressure Zone 5: The pump station capacity requirements for this zone are supplied by Pump Station 5-1 and Pump Station 5-2. In addition to meeting the peak day demands for Pressure

Zone 5 these pump stations must also provide water to Pressure Zone 6, 7, and 8, which are supply dependent pressure zones. A portion of these demands will be met by surface water treatment at Roemer WFF. Based on the existing pumping capacity and planned supply capacity at the Roemer WFF, approximately 6,000 gpm of additional pump station capacity is recommended in this zone, which is planned to be met through the construction of one new pump station.

- **Z5-PS5-3:** Construct a new pump station within the planned Lytle Creek Ranch development approximately 2,200 feet northeast of the existing water storage reservoir 4-3 site. This pump station is planned to have four 2,000 gpm pumps, three duty and one standby, for a total station capacity of 8,000 gpm.

Pressure Zone 6: The pump station capacity requirements for this zone are supplied by Pump Station 6-1 and Pump Station 6-2. In addition to meeting the peak day demands for Pressure Zone 6, these pump stations must also provide water to Pressure Zone 7 and 8, which are supply dependent pressure zones. A portion of these demands are offset by an existing groundwater well. Based on these requirements approximately 3,900 gpm of additional pump station capacity is recommended in this zone, which is planned to be met through the construction of one new pump station.

- **Z6-PS6-3:** Construct a new pump station within the planned Lytle Creek Ranch development approximately 1,000 feet northeast of the existing water storage reservoir 5-1 site. This pump station is planned to have four 1,300 gpm pumps, three duty and one standby, for a total station capacity of 4,200 gpm.

Pressure Zone 7: The pump station capacity requirements for this zone are supplied by Pump Station 7-1. In addition to meeting the peak day demands for Pressure Zone 7, this pump station must also provide water to Pressure Zone 8, which is a supply dependent pressure zone. Based on these requirements approximately 7,500 gpm of additional pump station capacity is recommended in this zone, which is planned to be met through the construction of two new pump stations.

- **Z7-PS7-2:** Construct a new pump station at the existing Pump Station 7-1 location. This pump station is planned to have three 2,000 gpm pumps, two duty and one standby, for a total station capacity of 6,000 gpm.

- **Z7-PS7-3:** Construct a new pump station within the planned Lytle Creek Ranch development approximately 1,500 feet northeast of the existing water storage reservoir 6-2 site. This pump station is planned to have three 1,750 gpm pumps, two duty and one standby, for a total station capacity of 5,250 gpm.

Pressure Zone 8: The pump station capacity requirements for this zone are provided by Pump Station 8-2. The existing pump station is capable of meeting the buildout peak day demands.

However, in order to create hydraulic reliability in this zone one new pump station is recommended with a capacity equal to the existing Pump Station 8-1.

- **Z8-PS8-3:** Construct a new pump station at the intersection of Clearwater Parkway and Glen Helen Parkway. This pump station is planned to have three 1,630 gpm pumps, two duty and one standby, for a total station capacity of 4,890 gpm.

Bunker Hill Well Field: The new Bunker Hill wellfield, comprised of future Wells 43, 44, 45, and 46 as discussed in a previous section, will require a new pump station to transfer the extracted groundwater from the planned aeration tank to the existing 30-inch transmission main at the existing pump station 3A-1 site. This pump station is planned to have a firm capacity of 14,000 gpm, which is equal to the sum of the planned design capacities of the recommended Bunker Hill supply wells.

- **BH-PS:** Construct a new pump station with five 3,500 gpm pumps, four duty and one standby, for a total station capacity of 17,500 gpm.

7.8 PIPELINE IMPROVEMENTS TO SERVE FUTURE GROWTH

The buildout of the District's service area includes development outside of the extent of the existing domestic water distribution system. New pipelines are recommended to serve future growth as well as increase the hydraulic reliability of the domestic water distribution system. Each pipeline improvement is assigned a uniquely coded identifier, which is intended to aid in defining the location of the improvements for mapping purposes. These identifiers reflect the pressure zone and sequence in the improvement schedule. The pipeline improvements are described in detail on the following pages.

7.8.1 Pressure Zone 2

The following section documents pipeline improvements within Pressure Zone 2.

- **Z2-P1:** Construct new parallel 24-inch and 8-inch pipelines in Eighth Street from Locust Avenue to Cedar Avenue.
- **Z2-P2:** Construct a new 8-inch pipeline in Eighth Street from Locust Avenue to Linden Avenue.
- **Z2-P3:** Replace an existing 4-inch and 6-inch pipeline in Ninth Street from Locust Avenue to Linden Avenue with a new 8-inch pipeline.
- **Z2-P4:** Replace an existing 6-inch and 8-inch pipeline in Tenth Street from Locust Avenue to Linden Avenue with a new 8-inch pipeline.
- **Z2-P5:** Construct a new 8-inch pipeline in Eleventh Street from Locust Avenue to Linden Avenue.

- **Z2-P6:** Replace an existing 6-inch pipeline in Maple Street from Eleventh Street to Eighth Street with a new 12-inch pipeline.
- **Z2-P7:** Construct a new 12-inch pipeline in Santa Ana Avenue from Linden Avenue to Cedar Avenue.
- **Z2-P8:** Replace an existing 12-inch pipeline in Santa Ana Avenue with a new 20-inch pipeline from Cedar Avenue to Riverside Avenue.
- **Z2-P9:** Construct a new 24-inch pipeline in Pepper Avenue from approximately 1,200 ft north of Slover Avenue to approximately 300 ft south of I-10. This pipeline includes a casing to cross beneath the South Pacific Railway.
- **Z2-P10:** Construct a new 24-inch pipeline in Pepper Avenue and San Bernardino Avenue from approximately 400 ft north of the intersection of Valley Boulevard and Pepper Avenue to the intersection of San Bernardino Avenue and Eucalyptus Avenue.

7.8.2 Pressure Zone 3

The following section documents pipeline improvements within Pressure Zone 3.

- **Z3-P1:** Construct a new 24-inch pipeline in future right-of-way from planned reservoir 3-4 to Alder Avenue.
- **Z3-P2:** Construct a new 24-inch pipeline in future right-of-way from Alder Avenue to Locust Avenue.
- **Z3-P3:** Construct a new 12-inch pipeline in Locust Avenue and Armstrong Road from Jurupa Avenue to approximately 2,200 ft southwest of Eighth Street.
- **Z3-P4:** Replace existing 4-inch, 6-inch, and 12-inch pipelines in Santa Ana Avenue with a new 12-inch pipeline from Alder Avenue to Linden Avenue.
- **Z3-P5:** Construct a new 16-inch pipeline in Santa Ana Avenue from Linden Avenue to Cedar Avenue.
- **Z3-P6:** Replace existing 2-inch, 4-inch, and 6-inch pipelines in and north of Valley Boulevard generally between Cedar Avenue and larch Avenue.
- **Z3-P7:** Replace existing 4-inch and 6-inch pipelines north of Valley Boulevard generally between Olive Street and Spruce Avenue.
- **Z3-P8:** Construct a new 16-inch pipeline in Valley Boulevard from approximately 850 ft west of Eucalyptus Avenue to Eucalyptus Avenue.

7.8.3 Pressure Zone 3A

The following section documents pipeline improvements within Pressure Zone 3A.

- **Z3A-P1:** Construct a new 10-inch pipeline in Cactus Avenue from James Street to Alru Street.

7.8.4 Pressure Zone 4

The following section documents pipeline improvements within Pressure Zone 4.

- **Z4-P1:** Construct a parallel 24-inch pipeline in Cactus Avenue from Baseline Road to I-210.
- **Z4-P2:** Construct a parallel 24-inch pipeline in Cactus Avenue from Casmalia Street to Riverside Avenue.
- **Z4-P3:** Construct a parallel 30-inch pipeline in Pepper Avenue, Highland Avenue, Oakdale Avenue, and in the planned Lytle Creek Ranch development from the existing Lord Ranch facility to reservoir 4-3.
- **Z4-P4:** Construct a new 12-inch pipeline in the Planned Lytle Creek Ranch development to Well 35C.
- **Z4-P5:** Construct a new 12-inch pipeline in the Planned Lytle Creek Ranch development to Well 5A.
- **Z4-P6:** Construct a new 12-inch pipeline in the Planned Lytle Creek Ranch development to Well 4A.
- **Z4-P7:** Construct a new 18-inch pipeline in the Planned Lytle Creek Ranch development.
- **Z4-P8:** Construct a new 20-inch pipeline in Future ROW from Sycamore Avenue to Planned Lytle Creek Ranch development.
- **Z4-P9:** Construct a new 12-inch pipeline in the Planned Lytle Creek Ranch development.
- **Z4-P10:** Construct a new 12-inch pipeline in the Planned Lytle Creek Ranch development to Well 34B.
- **Z4-P11:** Construct a new 24-inch pipeline in the Planned Lytle Creek Ranch development.
- **Z4-P12:** Construct a new 12-inch pipeline in the Planned Lytle Creek Ranch development.
- **Z4-P13:** Construct a new 24-inch pipeline in the Planned Lytle Creek Ranch development.
- **Z4-P14:** Construct a new 24-inch pipeline in the planned Lytle Creek Ranch development.

- **Z4-P15:** Construct a new 18-inch pipeline in the planned Lytle Creek Ranch development.
- **Z4-P16:** Construct a new 24-inch pipeline in the planned Lytle Creek Ranch development.

7.8.5 Pressure Zone 5

The following section documents pipeline improvements within Pressure Zone 5.

- **Z5-P1:** Construct a new 12-inch pipeline in the planned Lytle Creek Ranch development.
- **Z5-P2:** Construct a new 12-inch pipeline in the planned Lytle Creek Ranch development.
- **Z5-P3:** Construct a new 12-inch pipeline in the planned Lytle Creek Ranch development.
- **Z5-P4:** Construct a new 18-inch pipeline in the planned Lytle Creek Ranch development.
- **Z5-P5:** Construct a new 16-inch pipeline in the planned Lytle Creek Ranch development.
- **Z5-P6:** Construct a new 24-inch pipeline in the planned Lytle Creek Ranch development.

7.8.6 Pressure Zone 6

The following section documents pipeline improvements within Pressure Zone 6.

- **Z6-P1:** Construct a new 12-inch pipeline in Persimmon Street and Summit Avenue generally between Locust Avenue and Cedar Avenue
- **Z6-P2:** Replace existing 4-inch and 6-inch pipelines in Persimmon Street and Summit Avenue with a new 8-inch pipeline generally between Locust Avenue and Cedar Avenue.
- **Z6-P3:** Construct a new 12-inch pipeline in the planned Lytle Creek Ranch development.
- **Z6-P4:** Construct a new 24-inch pipeline in the planned Lytle Creek Ranch development.
- **Z6-P5:** Construct a new 20-inch pipeline in the planned Lytle Creek Ranch development.
- **Z6-P6:** Construct a new 12-inch pipeline in the planned Lytle Creek Ranch development.
- **Z6-P7:** Construct a new 16-inch pipeline in the planned Lytle Creek Ranch development.
- **Z6-P8:** Construct a new 12-inch pipeline in the planned Lytle Creek Ranch development.
- **Z6-P9:** Construct a new 12-inch pipeline in the planned Lytle Creek Ranch development.
- **Z6-P10:** Construct a new 18-inch pipeline in the planned Lytle Creek Ranch development.
- **Z6-P11:** Construct a new 24-inch pipeline in the planned Lytle Creek Ranch development.

- **Z6-P12:** Construct a new 12-inch pipeline in the planned Lytle Creek Ranch development.
- **Z6-P13:** Construct a new 12-inch pipeline in Sunrise Drive from Sierra Avenue to Citrus Avenue.
- **Z6-P14:** Construct a new 12-inch pipeline in Cypress Avenue from Sunrise Avenue to Casa Grande Avenue.
- **Z6-P15:** Construct a new 24-inch pipeline in Citrus Avenue from planned reservoir 6-6 to approximately 1,000 ft south of Duncan Canyon Road.
- **Z6-P16:** Construct a new 12-inch pipeline in future right-of0way from Knox Avenue to Citrus Avenue.

7.8.7 Pressure Zone 7

The following section documents pipeline improvements within Pressure Zone 7.

- **Z7-P1:** Construct a new 12-inch pipeline in Alder Avenue from Via Bello Drive to Lytle Creek Ranch Development.
- **Z7-P2:** Construct a new 12-inch pipeline in the planned Lytle Creek Ranch development
- **Z7-P3:** Construct a new 18-inch pipeline in the planned Lytle Creek Ranch development.
- **Z7-P4:** Construct a new 16-inch pipeline in the planned Lytle Creek Ranch development.
- **Z7-P5:** Construct a new 12-inch pipeline in the planned Lytle Creek Ranch development.
- **Z7-P6:** Construct a new 12-inch pipeline in the planned Lytle Creek Ranch development.
- **Z7-P7:** Construct a new 12-inch pipeline in the planned Lytle Creek Ranch development.
- **Z7-P8:** Construct a new 12-inch pipeline in the planned Lytle Creek Ranch development.
- **Z7-P9:** Construct a new 18-inch pipeline in the planned Lytle Creek Ranch development.
- **Z7-P10:** Construct a new 18-inch pipeline in the planned Lytle Creek Ranch development.
- **Z7-P11:** Construct a new 12-inch pipeline in the planned Lytle Creek Ranch development.
- **Z7-P12:** Construct a new 12-inch pipeline in the planned Lytle Creek Ranch development.
- **Z7-P13:** Construct a new 12-inch pipeline in Cypress Avenue from Terra Vista Drive to Sunrise Drive.
- **Z7-P14:** Construct a new 16-inch pipeline in from Terra Vista Drive to Duncan Canyon Road.

- **Z7-P15:** Construct a new 12-inch pipeline in Sunrise Drive from Sierra Avenue to Citrus Avenue

- **Z7-P16:** Construct a new 18-inch pipeline in future right-of-way from Citrus Avenue to Lytle Creek Road. This pipeline includes a casing to cross beneath I-10.

- **Z7-P17:** Construct a new 12-inch pipeline in Coyote Canyon Road from Lytle Creek Road to Hawk Ridge Road.

- **Z7-P18:** Construct a new 12-inch pipeline in planned future development south of Duncan Canyon Road.

7.8.8 Bunker Hill Supply

The following section documents pipeline improvements to convey future Bunker Hill supply to the existing District transmission system.

- **BH-P1:** Construct new 18-inch pipelines from the planned wells 43, 44, 45, and 46 to the planned in Alder Avenue from Via Bello Drive to Lytle Creek Ranch Development.

- **BH-P1:** Construct new 18-inch pipelines from the planned wells 43, 44, 45, and 46 to the planned in Alder Avenue from Via Bello Drive to Lytle Creek Ranch Development.

- **BH-P2:** Construct a new 36-inch pipeline from the planned Bunker Hill supply to the existing pump station 3A site.

CHAPTER 8 – CAPITAL IMPROVEMENT PROGRAM

This chapter provides a summary of the recommended domestic water system improvements to mitigate existing capacity deficiencies and to accommodate anticipated future growth. The chapter also presents the cost criteria and methodologies for developing the capital improvement program. Finally, a capacity allocation analysis, usually used for cost sharing purposes, is also included.

8.1 COST ESTIMATE ACCURACY

Cost estimates presented in the CIP were prepared for general master planning purposes and, where relevant, for further project evaluation. Final costs of a project will depend on several factors including the final project scope, costs of labor and material, and market conditions during construction.

The Association for the Advancement of Cost Engineering (AACE International), formerly known as the American Association of Cost Engineers has defined three classifications of assessing project costs. These classifications are presented in order of increasing accuracy: Order of Magnitude, Budget, and Definitive.

- **Order of Magnitude Estimate.** This classification is also known as an "original estimate", "study estimate", or "preliminary estimate", and is generally intended for master plans and studies.

  This estimate is not supported with detailed engineering data about the specific project, and its accuracy is dependent on historical data and cost indexes. It is generally expected that this estimate would be accurate within -30 percent to +50 percent.

- **Budget Estimate.** This classification is also known as an "official estimate" and generally intended for predesign studies. This estimate is prepared to include flow sheets and equipment layouts and details. It is generally expected that this estimate would be accurate within -15 percent to +30 percent.

- **Definitive Estimate.** This classification is also known as a "final estimate" and prepared during the time of contract bidding. The data includes complete plot plans and elevations, equipment data sheets, and complete specifications. It is generally expected that this estimate would be accurate within -5 percent to + 15 percent.

Costs developed in this study should be considered "Order of Magnitude" and have an expected accuracy range of **-30 percent** and **+50 percent**.

8.2 COST ESTIMATE METHODOLOGY

Cost estimates presented in this chapter are opinions of probable construction and other relevant costs developed from several sources including cost curves, Akel experience on other master planning projects, and input from District staff. Where appropriate, costs were escalated to reflect the more current Engineering News Records (ENR) Construction Cost Index (CCI).

This section documents the unit costs used in developing the opinion of probable construction costs, the Construction Cost Index, the land acquisition costs, and markups to account for construction contingency and other project related costs.

8.2.1 Unit Costs

The unit cost estimates used in developing the Capital Improvement Program are summarized on **Table 8.1**. Domestic water pipeline unit costs are based on length of pipes, in feet. Storage reservoir unit costs are based on capacity, per million gallons (MG). Pump Station costs are based on an equation that utilizes the total recommended pump station improvement capacity. Well construction costs are preliminary and are intended for planning purposes; a well site investigation is recommended to determine site specific costs involved in new well construction.

The unit costs are intended for developing the Order of Magnitude estimate and do not account for site specific conditions, labor and material costs during the time of construction, final project scope, implementation schedule, detailed utility and topography surveys for reservoir sites, investigation of alternative routings for pipes, and other various factors. The capital improvement program included in this report accounts for construction and project-related contingencies as described in this chapter.

8.2.2 Treatment Costs

Kleinfelder used an analogous cost estimating methodology, which consisted of researching similar facilities and documenting those costs for the purposes of estimating proposed capital improvements costs for the water treatment facilities for the District. Based on water quality data, the best available technology was identified for each specific water source and its associated contaminant (s).

- Microsand based Actiflo coagulation and sedimentation is selected as a practical technology for wellhead treatment to remove arsenic from ground water most commonly occurring in the Lytle Creek Basin water.
- Single pass IX technology is selected for perchlorate removal, a contaminant identified in ground waters of the Rialto Basin and Riverside-Arlington Basin.
- Regenerable IX technology is selected for nitrate removal, the contaminant in the ground water wells of Rialto Basin, Riverside-Arlington Basin and Chino Basin.

Table 8.1 Unit Costs

Water Facilities Master Plan

West Valley Water District

Pipelines[1]	
Pipe Size (in)	**New/Parallel/Replacement** ($/unit length)
6	100
8	133
10	167
12	200
16	267
18	300
20	333
24	400
30	500
36	600
42	700
Pump Station	
Estimated Pumping Station Project Cost= $2.075*10^{(0.7583*\log(Q)+3.1951)}$ where Q is in gpm	
Storage[2]	
$1.38 / gallon	
Land Acquisition Cost[3]	
$7.99 per square foot	
Pipeline Casings	
$24 per inch diameter per linear foot	
Groundwater Wells	
$3,000,000 per well	

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3/7/2019

Notes :

1. Pipeline unit cost based on $15/in.-diameter/foot, consistent with 2014 East Valley Water District Water Master Plan
2. Source: 2014 East Valley Water District Water Master Plan
3. Source: Land appraisal report received from District staff October 12, 2017.
4. Unit costs escalated based on an ENR CCI Index Value of 10,889 (01/2018)

The above water treatment technologies were selected solely for purpose of construction cost estimates for this Water Master Plan, as representatives of reasonable cost technologies.

To estimate costs for the proposed facilities, known cost of similar designed or constructed facilities were prorated proportionally with the flow rates. To accommodate the economy of scale and to come up with cost "*multipliers*", the prorated values are powered with power index varying from 0.5 to 0.65. Finally, the costs were adjusted using an "*Escalation Factor,*" which was calculated for each individual facility assuming 2.5% for annual inflation.

Details of the applied methodology, selected treatment technologies, sources of analogous cost information (Cost basis), calculated *Multipliers* and *Escalation Factors*, and estimated cost for the proposed wellhead treatments are presented in **Table 8.2**.

8.2.3 Construction Cost Index

Costs estimated in this study are adjusted utilizing the Engineering News Record (ENR) Construction Cost Index (CCI), which is widely used in the engineering and construction industries.

The costs in this Water Facilities Master Plan were benchmarked using a 20-City national average ENR CCI of 10,889, reflecting a date of January 2018.

8.2.4 Land Acquisition

Construction of pipelines is generally assumed to be within existing or future street right-of-ways. A land acquisition fee for the construction of storage reservoirs and pump stations was assumed based on recent land acquisitions.

8.2.5 Construction Contingency Allowance

Knowledge about site-specific conditions for each proposed project is limited at the master planning stage; therefore, construction contingencies were used. The estimated construction costs in this master plan include a **20 percent** contingency allowance to account for unforeseen events and unknown field conditions.

8.2.6 Project Related Costs

The capital improvement costs also account for project-related costs, comprising of engineering design, project administration (developer and District staff), construction management and inspection, and legal costs. The project related costs in this master plan were estimated by applying an additional **15 percent** to the estimated construction costs.

Table 8.2 CIP Cost Estimates for Wellhead Treatments

Water Master Plan Update

West Valley Water District

No.	Well	Contaminant	Applicable Technology	Well Capacity, (gpm)	Multiplier	Escalation factor, 2.5% per year	CIP Wellhead Treatment Cost		Comment
							2024	2055	
Lytle Creek Basin									
1	W7	No WQ issues	NA	2,100	NA	NA	50,000	0	Rehab and retest existing well
2	W8A	As	Coagulation	2,400	0.93	NA	3,288,359	0	Construct Arsenic treatment , assumed Actiflo
3	W36	As	Coagulation	2,700	1.00	NA	3,550,000	0	Construct Arsenic treatment , assumed Actiflo
4	W34B	Assumed, As	Coagulation	2,000	0.82	NA	0	2,920,864	Construct Arsenic treatment , assumed Actiflo
5	W35C	Assumed, As	Coagulation	2,000	0.82	NA	0	2,920,864	Construct Arsenic treatment , assumed Actiflo
					Subtotal - Lytle Creek Basin		**6,888,359**	**5,841,728**	
Rialto Basin									
6	W16	ClO4, NO2	IX for nitrate	1,500	1.00	1.22	0	5,716,015	Current ClO4 is OK. Construct IX for NO2 only
7	W17	ClO4	Existing IX is OK	1,250	NA	NA	0	0	Current IX for ClO4 is OK. Regular maintenance, only
8	W22A	NO2	IX for nitrate	1,500	1.00	1.22	0	5,716,015	Construct IX for NO2 only
9	W24	No WQ issue	NA	600	NA	-	0	0	Regular Maintenane, Only
10	W54	Air	Dearation , break tanks	1,000	NA	NA	150,000	0	Install 30 minute RT break tank
					Subtotal - Rialto Basin		**150,000**	**11,432,030**	
Bunker Hill Basin									
11	W15	No WQ issue	NA	2,700	NA	-	0	0	Regular Maintenance, Only
12	W30	No WQ issue	NA	3,100	NA	-	0	0	Regular Maintenance, Only
13	W43	No WQ issue	NA	3,500	NA	-	0	0	Well construction
14	W44	No WQ issue	NA	3,500	NA	-	0	0	Well construction
15	W45	No WQ issue	NA	3,500	NA	-	0	0	Well construction
16	W46	No WQ issue	NA	3,500	NA	-	0	0	Well construction
					Subtotal - Bunker Hill Basin		**0**	**0**	
North Riverside Basin									
17	W18A	ClO4, NO2	IX, FBR	2,700	1.34	1.22	7,668,839	0	Current ClO4 is OK. IX for NO2 is proposed
18	W41	ClO4	IX, FBR	2,200	0.84	1.22	550,000		IX for NO2 only[2]
19	W42	ClO4 and NO2	IX, FBR	2,200	1.28	1.22	0	9,246,213	IX for Nitrate and IX for Perchlorate
20	W29A	ClO4 and NO2	IX, FBR	1,500	1.00	1.22	0	7,208,559	IX for Nitrate and IX for Perchlorate
21	W40	ClO4 and NO2	IX, FBR	1,500	1.00	1.22	0	7,208,559	IX for Nitrate and IX for Perchlorate
22	W51	ClO4 and NO2	IX, FBR	3,000	1.57	1.22	0	11,311,441	IX for Nitrate and IX for Perchlorate
23	W52	ClO4 and NO2	IX, FBR	2,000	1.21	1.22	0	8,690,777	IX for Nitrate and IX for Perchlorate
24	W50	ClO4 and NO2	IX, FBR	1,500	1.00	1.22	0	7,208,559	IX for Nitrate and IX for Perchlorate
					Subtotal - North Riverside Basin		**8,218,839**	**50,874,108**	
Chino Basin									
25	W39	No WQ issue	NA	4,000	NA	-	9,334,214	0	Well drilled but not equipped. Requires treatment.
					Subtotal - Chino Basin		**9,334,214**	**0**	
AKEL ENGINEERING GROUP, INC.				**Subtotal - Total Wellhead Treatments**			**24,591,412**	**68,147,866**	

3/7/2019

Notes:

1. Table prepared by Kleinfelder, Inc staff February 2018.
2. District staff indicated that 2 available treatment vessels are currently unused at the Reservoir 2-1 site. Those vessels may potentially be moved to W41 for treatment purposes. Cost shown accounts for this assumption.
3. Well costs include master planning contingencies provided by Kleinfelder, Inc staff, which include overhead, margin, insurance and bonding, and contingency.

8.3 CAPITAL IMPROVEMENT PROGRAM

This section documents the capital improvement program and the allocation of costs to meet the requirements of AB1600.

8.3.1 Capital Improvement Costs

The Capital Improvement Program costs for the projects identified in this master plan for mitigating existing system deficiencies and for serving anticipated future growth throughout the District are summarized by improvement type on **Table 8.3** through **Table 8.6**.

As summarized in previous chapters the District is currently planning a 6.0 mgd expansion to the OPR WFF; however, in the event additional surface water supplies become available the District may elect to increase this expansion up to 16.0 mgd. Therefore, for conservative planning purposes, this capital improvement program includes the cost of a 16.0 mgd expansion. This cost estimate, prepared by Carollo Engineers, is summarized on **Table 8.4**.

Each improvement was assigned a unique coded identifier associated with the improvement type, and are summarized graphically on **Figure 8.1** through **Figure 8.4**. A hydraulic profile schematic of the buildout of the water distribution system is provided on **Figure 8.5**.

The estimated construction costs include the baseline costs plus **20 percent** contingency allowance to account for unforeseen events and unknown field conditions, as described in a previous section. Capital improvement costs include the estimated construction costs plus **15 percent** project-related costs (engineering design, project administration, construction management and inspection, and legal costs. It should be noted that contingencies for costs associated with well construction and treatment were provided by Kleinfelder Inc and account for margin, overhead, insurance and bonding, or contingencies.

8.3.2 Recommended Cost Allocation Analysis

Cost allocation analysis is needed to identify improvement funding sources, and to establish a nexus between development impact fees and improvements needed to service growth. In compliance with the provisions of Assembly Bill AB 1600, the analysis differentiates between the project needs of servicing existing users and for those required to service anticipated future developments. The cost responsibility is based on model parameters for existing and future land use, and may change depending on the nature of development. **Table 8.3** lists each improvement, and separates the cost by responsibility between existing and future users.

8.3.3 5-Year Capital Improvement Costs and Phasing

The capital improvement program costs and phasing for the next five years are summarized on **Table 8.7**. This plan includes the total costs for pipelines, tanks, booster stations, and valves to be

Figure 8.2

Figure 8.3

Figure 8.4

Duncan Canyon Rd
Summit Ave
Lytle Creek Rd
Citrus Ave
Sierra Ave
Alder Ave
Linden Ave
Base Line Rd
Miller Ave
Cedar Ave
Foothill Blvd
Cactus Ave
Lilac Av
Willow Av
Riverside Av
Sycamore Av
Acacia Ave
Eucalyptus Ave
Meridian Ave
Pepper Av
Terrace Rd
Rancho Ave
Gray St
Bronson St
Vermont St
June St
Duffy St
Macy St
State St
California St
Arrow Rte
Merrill Ave
Palmetto Ave
Alder Ave
Locust Ave
Linden Ave
Bloomington Av
Randall Ave
San Bernardino Ave
Marygold Ave
Valley Blvd
Slover Ave
Santa Ana Ave
Jurupa Ave
Agua Mansa Rd
8th St
El Rivino Rd
Armstrong Rd
Wilson St
15
215
210
10

Legend

System Improvements
- Tanks
- Wells
- Pumps
- Valves
- Pipes

Existing System
- WTP
- Tanks
- Wells
- Pumps
- Valves
- Pipes

- Inactive Tanks
- Abandoned Pipes
- Street Centerlines

Updated: March 18, 2019

0 0.25 0.5 1 Mile

N W GIS E S

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Figure 8.1
Future Improvements Keymap

Water Facilities Master Plan
West Valley Water District

West Valley Water District

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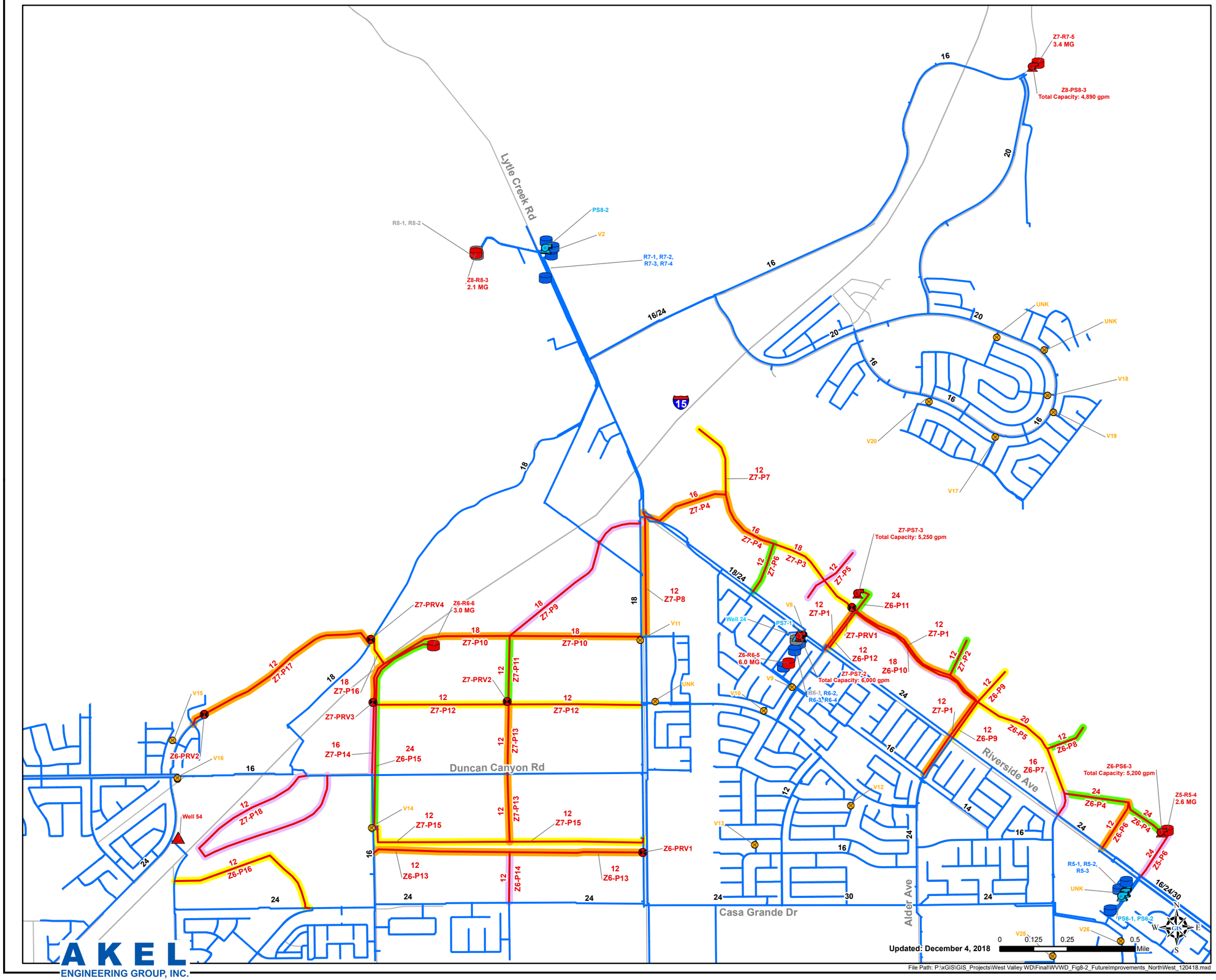

AKEL ENGINEERING GROUP, INC.

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Legend

System Improvements

- Tanks
- Wells
- Pumps
- Valves
- Pipes

Existing System

- WTP
- Tanks
- Wells
- Pumps
- Valves
- Pipes
- Inactive Tanks
- Abandoned Pipes
- Street Centerlines

Note:
Pipe highlighting indicates limits of individual segments as identified in the CIP table.

Figure 8.2
Future Improvements

Water Facilities Master Plan
West Valley Water District

West Valley Water District

Legend

System Improvements

- Tanks
- Wells
- Pumps
- Valves
- Pipes

Existing System

- WTP
- Tanks
- Wells
- Pumps
- Valves
- Pipes
- Inactive Tanks
- Abandoned Pipes
- Street Centerlines

Note:
Pipe highlighting indicates limits of individual segments as identified in the CIP table.

Figure 8.3
Future Improvements

Water Facilities Master Plan
West Valley Water District

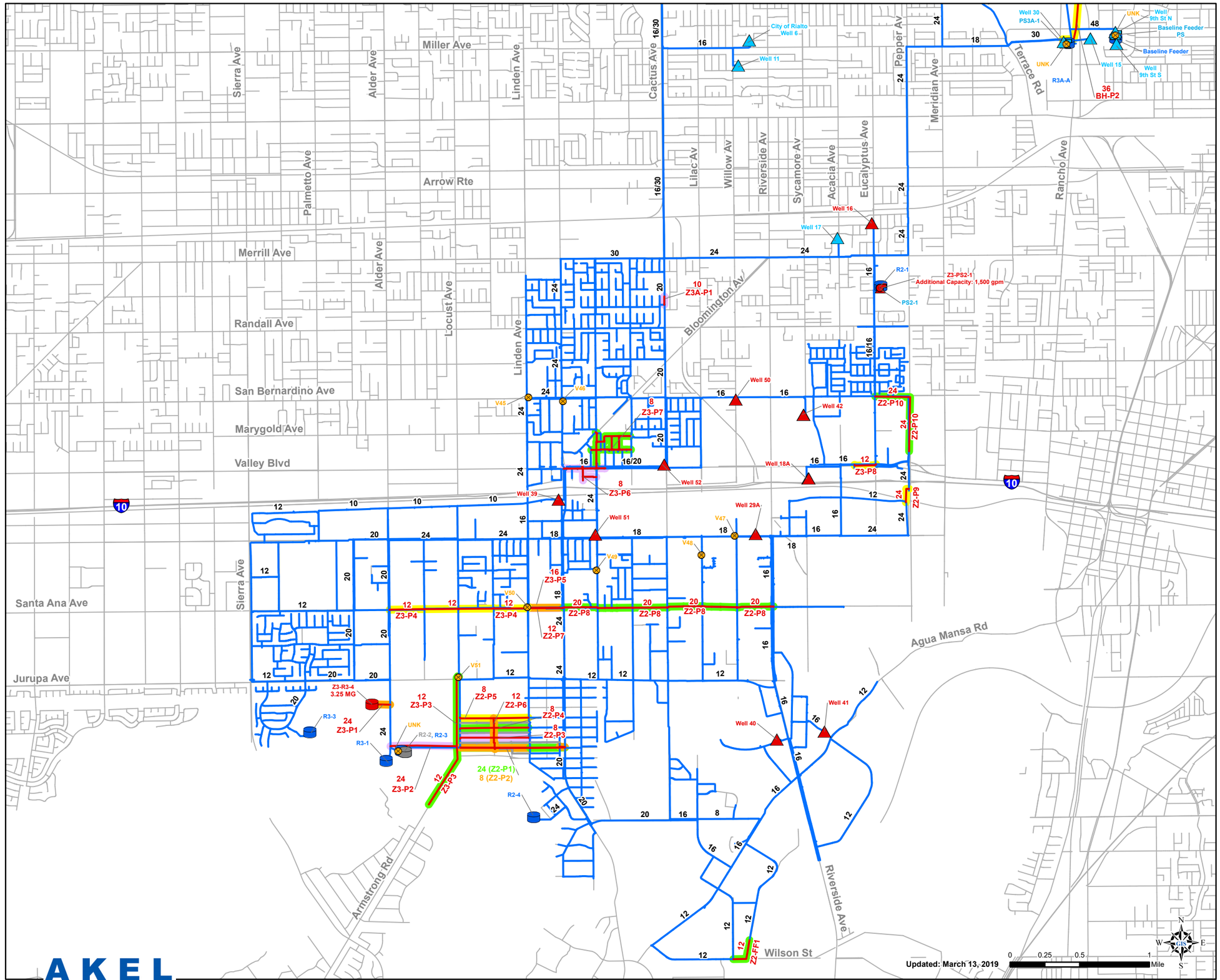
West Valley Water District

AKEL ENGINEERING GROUP, INC.

Updated: December 4, 2018

0 0.125 0.25 0.5 Mile

File Path: P:\xGIS\GIS_Projects\West Valley WD\Final\WVWD_Fig8-3_FutureImprovements_NorthEast_120418.mxd



Legend

System Improvements

- Tanks
- Wells
- Pumps
- Valves
- Pipes

Existing System

- WTP
- Tanks
- Wells
- Pumps
- Valves
- Pipes
- Inactive Tanks
- Abandoned Pipes
- Street Centerlines

Note:
Pipe highlighting indicates limits of individual segments as identified in the CIP table.

Figure 8.4
Future Improvements

Water Facilities Master Plan
West Valley Water District

West Valley Water District

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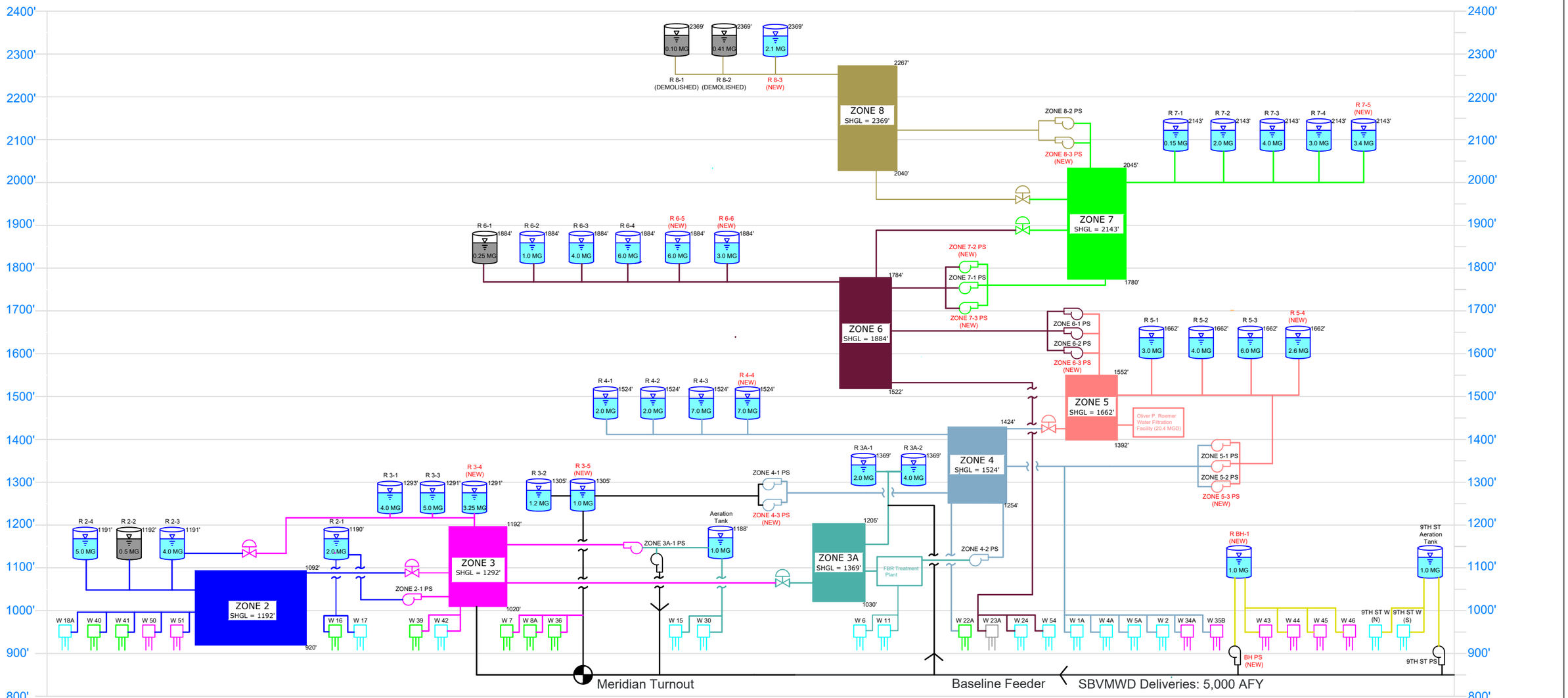
ENGINEERING GROUP, INC.



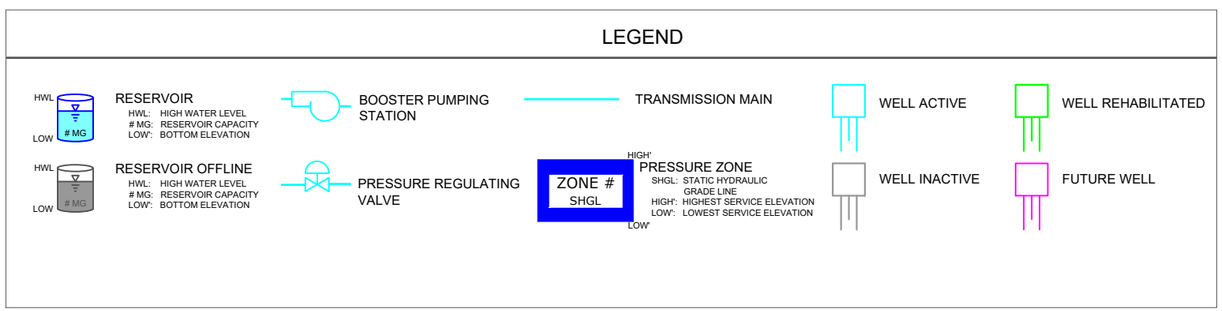


Figure 8.5

Buildout Hydraulic Profile Schematic

WATER FACILITIES MASTER PLAN

WEST VALLEY WATER DISTRICT

AKEL ENGINEERING GROUP, INC.

Last Updated: 07/21/2020

Table 8.3 Capital Improvement Costs - Pipelines

Water Facilities Master Plan
West Valley Water District

Improv. No.	Pressure Zone	Alignment	Limits	Pipeline Improvements		Infrastructure Costs				Baseline Constr. Costs	Estimated Const. Costs[1]	Capital Improv. Costs[2,3]	Improvement Horizon	Construction Trigger	Suggested Cost Allocation		Cost Sharing	
				Existing Diameter (in)	New/Parallel/ Replace	Diameter (in)	Length (ft)	Unit Cost ($)	Infr. Cost ($)	($)	($)	($)			Existing Users	Future Users	Existing Users	Future Users
Pressure Zone 2																		
Z2-P1	2	Bloomington Phase 4	From Locust Ave to Cedar Ave	-	New	24	4,000	-	-	-	-	2,222,000	Five-Year	Immediate	100%	0%	2,222,000	0
Z2-P2	2	Bloomington Phase 4	From Locust Ave to Linden Ave	-	New	8	4,075					850,000	Five-Year	Immediate	100%	0%	850,000	0
Z2-P3	2	Bloomington Phase 5	From Locust Ave to Linden Ave	4, 6	Replace	8	2,625	-	-	-	-	650,000	Five-Year	Immediate	100%	0%	650,000	0
Z2-P4	2	Bloomington Phase 3	From Locust Ave to Linden Ave	4, 8	Replace	8	2,625	-	-	-	-	650,000	Five-Year	Immediate	100%	0%	650,000	0
Z2-P5	2	Bloomington Phase 3	From Locust Ave to Linden Ave	-	New	8	2,625		-	-	-	400,000	Five-Year	Immediate	100%	0%	400,000	0
Z2-P6		Bloomington Phase 3	From Eleventh St to Eighth St	6	Replace	12	1,275	-	-	-	-	650,000	Five-Year	Immediate	100%	0%	650,000	0
Z2-P7	2	Santa Ana Ave	From Linden Ave to Cedar Ave	-	New	12	1,375	200	274,835	275,000	330,000	380,000	Five-Year	Immediate	100%	0%	380,000	0
Z2-P8	2	Santa Ana Ave	From Cedar Ave to Riverside Ave	12	Replace	20	8,250	333	2,748,345	2,749,000	3,299,000	3,794,000	Five-Year	Immediate	100%	0%	3,794,000	0
Z2-P9	2	Pepper Ave	From approx. 1,200 ft n/o Slover Ave to approx. 300 ft s/o I-10	-	New	24	550	400	219,868	220,000	264,000	304,000	Five-Year	Immediate	100%	0%	304,000	0
Z2-P9C	2	Pepper Ave	From approx. 150' s/o railway to 150' n/o railway (Casing)	-	New	-	400	24	422,400	423,000	508,000	585,000	Five-Year	Immediate	100%	0%	585,000	0
Z2-P10		Pepper Ave, San Bernardino Ave	From approx. 400' n/o the intersection of Valley Blvd and Pepper Ave to the intersection of San Bernardino Ave and Eucalyptus Ave	-	New	24	3,375	400	1,349,188	1,350,000	1,620,000	1,863,000	Buildout	As Development Occurs	0%	100%	0	1,863,000
Z2-FF1	2	Holly St and Wilson St	From the intersection of Brown Ave and Wilson St to approx 700' n/o Wilson St	-	New	12	1,225	200	244,853	245,000	294,000	339,000	Five-Year	Immediate	100%	0%	339,000	0
								Subtotal - Pressure Zone 2		**5,262,000**	**6,315,000**	**12,687,000**					**10,824,000**	**1,863,000**
Pressure Zone 3																		
Z3-P1	3	Future ROW	From planned reservoir 3-4 site to Alder Ave	-	New	24	700	400	279,832	280,000	336,000	387,000	Buildout	With Reservoir 3-4	0%	100%	0	387,000
Z3-P2	3	Future ROW	From Alder Ave to Locust Ave	-	New	24	2,525	400	1,009,392	1,010,000	1,212,000	1,394,000	Buildout	As Development Occurs	0%	100%	0	1,394,000
Z3-P3	3	Locust Ave, Armstrong Rd	From Jurupa Ave to approx. 2,200' sw/o Eighth St	-	New	12	5,250	200	1,049,368	1,050,000	1,260,000	1,449,000	Buildout	As Development Occurs	0%	100%	0	1,449,000
Z3-P4	3	Santa Ana Ave	From Alder Ave to Linden Ave	4, 6, 12	Replace	12	5,375	200	1,074,353	1,075,000	1,290,000	1,484,000	Five-Year	Immediate	100%	0%	1,484,000	0
Z3-P5	3	Santa Ana Ave	From Linden Ave to Cedar Ave	-	New	16	1,250	267	333,133	334,000	401,000	462,000	Five-Year	Immediate	100%	0%	462,000	0
Z3-P6	3	Valley Blvd, s/o Valley Blvd	Generally between Cedar Ave and Larch Ave	2, 4, 6	Replace	8	2,800	133	373,109	374,000	449,000	517,000	Five-Year	Immediate	100%	0%	517,000	0
Z3-P7	3	Generally n/o Valley Blvd	Generally Between Olive St and Spruce Ave	4, 6	Replace	8	5,650	133	752,880	753,000	904,000	1,040,000	Five-Year	Immediate	100%	0%	1,040,000	0
Z3-P8	3	Valley Blvd, s/o Valley Blvd	From approx. 850' w/o Eucalyptus Ave to Eucalyptus Ave	2, 4, 6	Replace	12	875	-	-	-	-	210,000	Five-Year	Immediate	100%	0%	210,000	0
								Subtotal - Pressure Zone 3		**4,876,000**	**5,852,000**	**6,943,000**					**3,713,000**	**3,230,000**
Pressure Zone 3A																		
Z3A-P1	3	Cactus Ave	From James St to Alru St	-	New	10	325	-	-	-	-	143,500	Five-Year	Immediate	100%	0%	143,500	0
								Subtotal - Pressure Zone 3A		**0**	**0**	**143,500**					**143,500**	**0**
Pressure Zone 4																		
Z4-P1	4	Cactus Ave	From Baseline Rd to I-210	18	Parallel	24	4,525	400	1,808,911	1,809,000	2,171,000	2,497,000	Buildout	With PS 4-2 Expansion	0%	100%	0	2,497,000
Z4-P2	4	Cactus Ave	From Casmalia St to Riverside Ave	18	Parallel	24	3,125	400	1,249,248	1,250,000	1,500,000	1,725,000	Buildout	With PS 4-2 Expansion	0%	100%	0	1,725,000
Z4-P3	4	Pepper Ave, Highland Ave, Oakdale Ave, Future ROW	From Lord Ranch Facility to reservoir 4-3 site	16	Parallel	30	14,600	500	7,295,608	7,296,000	8,756,000	10,070,000	Buildout	With Reservoir 4-4	0%	100%	0	10,070,000
Z4-P4	4	Future ROW	From Well 35C to Lytle Creek Ranch Development	-	New	12	700	200	139,916	140,000	168,000	194,000	Buildout	With Well 35C	0%	100%	0	194,000
Z4-P5	4	Future ROW	From Well 5A to Lytle Creek Ranch Development	-	New	12	950	200	189,886	190,000	228,000	263,000	Buildout	As Development Occurs	0%	100%	0	263,000
Z4-P6	4	Future ROW	From Well 4A to Lytle Creek Ranch Development	-	New	12	850	200	169,898	170,000	204,000	235,000	Buildout	As Development Occurs	0%	100%	0	235,000
Z4-P7	4	Future ROW	Lytle Creek Ranch Development	-	New	18	3,950	300	1,184,287	1,185,000	1,422,000	1,636,000	Buildout	As Development Occurs	0%	100%	0	1,636,000
Z4-P8	4	Future ROW	From Sycamore Ave to Lytle Creek Ranch Development	-	New	20	1,600	333	533,012	534,000	641,000	738,000	Buildout	As Development Occurs	0%	100%	0	738,000
Z4-P9	4	Future ROW	Lytle Creek Ranch Development	-	New	12	425	200	84,949	85,000	102,000	118,000	Buildout	As Development Occurs	0%	100%	0	118,000
Z4-P10	4	Future ROW	From Well 34B to Lytle Creek Ranch Development	-	New	12	800	200	159,904	160,000	192,000	221,000	Buildout	With Well 34B	0%	100%	0	221,000
Z4-P11	4	Future ROW	Lytle Creek Ranch Development	-	New	24	1,275	400	509,693	510,000	612,000	704,000	Buildout	As Development Occurs	0%	100%	0	704,000
Z4-P12	4	Future ROW	Lytle Creek Ranch Development	-	New	12	75	200	14,991	15,000	18,000	21,000	Buildout	As Development Occurs	0%	100%	0	21,000
Z4-P13	4	Future ROW	Lytle Creek Ranch Development	-	New	24	125	400	49,970	50,000	60,000	69,000	Buildout	As Development Occurs	0%	100%	0	69,000
Z4-P14	4	Future ROW	Lytle Creek Ranch Development	-	New	24	1,800	400	719,567	720,000	864,000	994,000	Buildout	As Development Occurs	0%	100%	0	994,000

Table 8.3 Capital Improvement Costs - Pipelines

Water Facilities Master Plan
West Valley Water District

Improv. No.	Pressure Zone	Alignment	Limits	Pipeline Improvements		Infrastructure Costs				Baseline Constr. Costs	Estimated Const. Costs[1]	Capital Improv. Costs[2,3]	Improvement Horizon	Construction Trigger	Suggested Cost Allocation		Cost Sharing	
				Existing Diameter (in)	New/Parallel/ Replace	Diameter (in)	Length (ft)	Unit Cost ($)	Infr. Cost ($)	($)	($)	($)			Existing Users	Future Users	Existing Users	Future Users
Z4-P15	4	Future ROW	Lytle Creek Ranch Development	-	New	18	1,550	300	464,720	465,000	558,000	642,000	Buildout	As Development Occurs	0%	100%	0	642,000
Z4-P16	4	Future ROW	Lytle Creek Ranch Development	-	New	24	2,125	400	849,489	850,000	1,020,000	1,173,000	Buildout	As Development Occurs	0%	100%	0	1,173,000
							Subtotal - Pressure Zone 4			**15,429,000**	**18,516,000**	**21,300,000**					**0**	**21,300,000**
Pressure Zone 5																		
Z5-P1	5	Future ROW	Lytle Creek Ranch Development	-	New	12	6,900	200	1,379,170	1,380,000	1,656,000	1,905,000	Buildout	As Development Occurs	0%	100%	0	1,905,000
Z5-P2	5	Future ROW	Lytle Creek Ranch Development	-	New	12	4,975	200	994,401	995,000	1,194,000	1,374,000	Buildout	As Development Occurs	0%	100%	0	1,374,000
Z5-P3	5	Future ROW	Lytle Creek Ranch Development	-	New	12	1,925	200	384,768	385,000	462,000	532,000	Buildout	As Development Occurs	0%	100%	0	532,000
Z5-P4	5	Future ROW	Lytle Creek Ranch Development	-	New	18	1,275	300	382,270	383,000	460,000	529,000	Buildout	As Development Occurs	0%	100%	0	529,000
Z5-P5	5	Future ROW	Lytle Creek Ranch Development	-	New	16	5,400	267	1,439,134	1,440,000	1,728,000	1,988,000	Buildout	As Development Occurs	0%	100%	0	1,988,000
Z5-P6	5	Future ROW	Lytle Creek Ranch Development	-	New	24	1,000	400	399,759	400,000	480,000	552,000	Buildout	As Development Occurs	0%	100%	0	552,000
							Subtotal - Pressure Zone 5			**4,983,000**	**5,980,000**	**6,880,000**					**0**	**6,880,000**
Pressure Zone 6																		
Z6-P1	6	Persimmon St and Summit Ave	Generally between Locust Ave and Cedar Ave	-	New	12	4,375	200	874,474	875,000	1,050,000	1,208,000	Buildout	As Funding is Available	100%	0%	1,208,000	0
Z6-P2	6	Persimmon St and Summit Ave	Generally between Locust Ave and Cedar Ave	4, 6	Replace	8	475	133	63,295	64,000	77,000	89,000	Buildout	As Funding is Available	100%	0%	89,000	0
Z6-P3	6	Future ROW	Lytle Creek Ranch Development	-	New	12	5,275	200	1,054,365	1,055,000	1,266,000	1,456,000	Buildout	As Development Occurs	0%	100%	0	1,456,000
Z6-P4	6	Future ROW	Lytle Creek Ranch Development	-	New	24	2,175	400	869,477	870,000	1,044,000	1,201,000	Buildout	As Development Occurs	0%	100%	0	1,201,000
Z6-P5	6	Future ROW	Lytle Creek Ranch Development	-	New	20	2,625	333	874,474	875,000	1,050,000	1,208,000	Buildout	As Development Occurs	0%	100%	0	1,208,000
Z6-P6	6	Future ROW	Lytle Creek Ranch Development	-	New	12	1,050	200	209,874	210,000	252,000	290,000	Buildout	As Development Occurs	0%	100%	0	290,000
Z6-P7	6	Future ROW	Lytle Creek Ranch Development	-	New	16	475	267	126,590	127,000	153,000	176,000	Buildout	As Development Occurs	0%	100%	0	176,000
Z6-P8	6	Future ROW	Lytle Creek Ranch Development	-	New	12	850	200	169,898	170,000	204,000	235,000	Buildout	As Development Occurs	0%	100%	0	235,000
Z6-P9	6	Future ROW	Lytle Creek Ranch Development	-	New	12	1,650	200	329,801	330,000	396,000	456,000	Buildout	As Development Occurs	0%	100%	0	456,000
Z6-P10	6	Future ROW	Lytle Creek Ranch Development	-	New	18	3,025	300	906,954	907,000	1,089,000	1,253,000	Buildout	As Development Occurs	0%	100%	0	1,253,000
Z6-P11	6	Future ROW	Lytle Creek Ranch Development	-	New	24	550	400	219,868	220,000	264,000	304,000	Buildout	As Development Occurs	0%	100%	0	304,000
Z6-P12	6	Future ROW	Lytle Creek Ranch Development	-	New	12	875	200	174,895	175,000	210,000	242,000	Buildout	As Development Occurs	0%	100%	0	242,000
Z6-P13	6	Sunrise Dr	From Sierra Ave to Citrus Ave	-	New	12	5,325	200	1,064,359	1,065,000	1,278,000	1,470,000	Buildout	As Development Occurs	0%	100%	0	1,470,000
Z6-P14	6	Cypress Ave	From Sunrise Ave to Casa Grande Ave	-	New	12	975	200	194,883	195,000	234,000	270,000	Buildout	As Development Occurs	0%	100%	0	270,000
Z6-P15	6	Citrus Ave	From planned reservoir 6-6 site to approx. 1,000' s/o Duncan Canyon Rd	-	New	24	4,350	400	1,738,953	1,739,000	2,087,000	2,401,000	Buildout	With Reservoir 6-6	0%	100%	0	2,401,000
Z6-P16	6	Future ROW	From Knox Ave to Citrus Ave	-	New	12	3,325	200	664,600	665,000	798,000	918,000	Buildout	As Development Occurs	0%	100%	0	918,000
							Subtotal - Pressure Zone 6			**9,542,000**	**11,452,000**	**13,177,000**					**1,297,000**	**11,880,000**
Pressure Zone 7																		
Z7-P1	7	Alder Ave	From Via Bello Dr to Lytle Creek Ranch Development	-	New	12	5,750	200	1,149,308	1,150,000	1,380,000	1,587,000	Buildout	As Development Occurs	0%	100%	0	1,587,000
Z7-P2	7	Future ROW	Lytle Creek Ranch Development	-	New	12	775	200	154,907	155,000	186,000	214,000	Buildout	As Development Occurs	0%	100%	0	214,000
Z7-P3	7	Future ROW	Lytle Creek Ranch Development	-	New	18	1,975	300	592,144	593,000	712,000	819,000	Buildout	As Development Occurs	0%	100%	0	819,000
Z7-P4	7	Future ROW	Lytle Creek Ranch Development	-	New	16	3,275	267	872,808	873,000	1,048,000	1,206,000	Buildout	As Development Occurs	0%	100%	0	1,206,000
Z7-P5	7	Future ROW	Lytle Creek Ranch Development	-	New	12	1,275	200	254,847	255,000	306,000	352,000	Buildout	As Development Occurs	0%	100%	0	352,000
Z7-P6	7	Future ROW	Lytle Creek Ranch Development	-	New	12	1,025	200	204,877	205,000	246,000	283,000	Buildout	As Development Occurs	0%	100%	0	283,000
Z7-P7	7	Future ROW	Lytle Creek Ranch Development	-	New	12	1,500	200	299,819	300,000	360,000	414,000	Buildout	As Development Occurs	0%	100%	0	414,000
Z7-P8	7	Sierra Ave	From Riverside Ave to Segovia Ln	-	New	12	2,250	200	449,729	450,000	540,000	621,000	Five-Year	As Development Occurs	0%	100%	0	621,000
Z7-P9	7	Future ROW	From the intersection of Riverside Ave and Sierra Ave to the intersection of Cypress Ave	-	New	18	3,625	300	1,086,846	1,087,000	1,305,000	1,501,000	Buildout	As Development Occurs	0%	100%	0	1,501,000
Z7-P10	7	Segovia Ln	From Sierra Ave to Citrus Ave	-	New	18	5,950	300	1,783,926	1,784,000	2,141,000	2,463,000	Buildout	As Development Occurs	0%	100%	0	2,463,000
Z7-P11	7	Cypress Ave	From Segovia Ln to Terra Vista Dr	-	New	12	1,225	200	244,853	245,000	294,000	339,000	Buildout	As Development Occurs	0%	100%	0	339,000
Z7-P12	7	Terra Vista Dr	From Sierra Ave to Citrus Ave	-	New	12	5,225	200	1,044,371	1,045,000	1,254,000	1,443,000	Buildout	As Development Occurs	0%	100%	0	1,443,000
Z7-P13	7	Cypress Ave	From Terra Vista Dr to Sunrise Dr	-	New	12	2,650	200	529,681	530,000	636,000	732,000	Buildout	As Development Occurs	0%	100%	0	732,000
Z7-P14	7	Citrus Ave	From Terra Vista Dr to Duncan Canyon Rd	-	New	16	1,350	267	359,783	360,000	432,000	497,000	Buildout	As Development Occurs	0%	100%	0	497,000
Z7-P15	7	Sunrise Dr	From Sierra Ave to Citrus Ave	-	New	12	5,625	200	1,124,323	1,125,000	1,350,000	1,553,000	Buildout	As Development Occurs	0%	100%	0	1,553,000
Z7-P16	7	Future ROW	From Citrus Ave to Lytle Creek Rd	-	New	18	600	300	179,892	180,000	216,000	249,000	Buildout	As Development Occurs	0%	100%	0	249,000
Z7-P16C	7	Future ROW	From Citrus Ave to Lytle Creek Rd (Casing)	-	New	-	600	24	547,200	548,000	658,000	757,000	Buildout	As Development Occurs	0%	100%	0	757,000
Z7-P17	7	Coyote Canyon Rd	From Lytle Creek Rd to Hawk Ridge Rd	-	New	12	4,150	200	829,501	830,000	996,000	1,146,000	Five-Year	As Development Occurs	0%	100%	0	1,146,000

Table 8.3 Capital Improvement Costs - Pipelines

Water Facilities Master Plan
West Valley Water District

Improv. No.	Pressure Zone	Alignment	Limits	Pipeline Improvements		Infrastructure Costs				Baseline Constr. Costs	Estimated Const. Costs[1]	Capital Improv. Costs[2,3]	Improvement Horizon	Construction Trigger	Suggested Cost Allocation		Cost Sharing	
				Existing Diameter (in)	New/Parallel/ Replace	Diameter (in)	Length (ft)	Unit Cost ($)	Infr. Cost ($)	($)	($)	($)			Existing Users	Future Users	Existing Users	Future Users
Z7-P18	7	Future ROW	Planned Development south of Duncan Canyon Rd	-	New	12	5,875	200	1,174,293	1,175,000	1,410,000	1,622,000	Buildout	As Development Occurs	0%	100%	0	1,622,000
						Subtotal - Pressure Zone 7				**12,890,000**	**15,470,000**	**17,798,000**					**0**	**17,798,000**
Bunker Hill Supply																		
BH-P1	-	To be determined	From planned wells 43, 44, 45, and 46 to planned Bunker Hill aeration tank			18	2,025	300	607,134	608,000	730,000	840,000	Five-Year	With Well 43	0%	100%	0	840,000
BH-P2	-	To be determined	From planned Bunker Hill supply to existing pump station 3A site			36	6,375	600	3,822,699	3,823,000	4,588,000	5,277,000	Five-Year	With Well 43	0%	100%	0	5,277,000
						Subtotal - Pressure Zone 8				**4,431,000**	**5,318,000**	**6,117,000**					**0**	**6,117,000**
Total Improvement Cost																		
									Pressure Zone 2	**5,262,000**	**6,315,000**	**12,687,000**					**10,824,000**	**1,863,000**
									Pressure Zone 3	**4,876,000**	**5,852,000**	**6,943,000**					**3,713,000**	**3,230,000**
									Pressure Zone 3A	**-**	**-**	**143,500**					**143,500**	**0**
									Pressure Zone 4	**15,429,000**	**18,516,000**	**21,300,000**					**0**	**21,300,000**
									Pressure Zone 5	**4,983,000**	**5,980,000**	**6,880,000**					**0**	**6,880,000**
									Pressure Zone 6	**9,542,000**	**11,452,000**	**13,177,000**					**1,297,000**	**11,880,000**
									Pressure Zone 7	**12,890,000**	**15,470,000**	**17,798,000**					**0**	**17,798,000**
									Bunker Hill Supply	**4,431,000**	**5,318,000**	**6,117,000**					**0**	**6,117,000**
									Total Improvement Costs	**57,413,000**	**68,903,000**	**85,045,500**					**15,977,500**	**69,068,000**

AKEL ENGINEERING GROUP, INC.

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Notes:

1. Baseline construction costs plus 20% to account for unforeseen events and unknown conditions.
2. Estimated construction costs plus 15% to cover other costs including: engineering design, project administration (developer and District staff), construction management and inspection, and legal costs.
3. Costs for improvements shown with only Capital Improvement Cost are based on information provided by WVWD staff.

Table 8.4 Capital Improvement Costs - Storage Reservoirs, Pump Stations, Pressure Reducing Valves

Water Facilities Master Plan
West Valley Water District

Improv. No.	Pressure Zone	Location	New/ Replace	Infrastructure Costs		Baseline Constr. Costs	Estimated Const. Costs[1]	Capital Improv. Costs[2,3]	Improvement Horizon	Construction Trigger	Suggested Cost Allocation		Cost Sharing	
				Recommended Capacity	Infr. Cost						Existing Users	Future Users	Existing Users	Future Users
					($)	($)	($)	($)		(EDU)				
Storage Reservoir Improvements				(MG)										
Z3-R3-4	3	Approx. 1,100' sw/o the intersection of Jurupa Ave and Alder Ave	New	3.25	4,485,000	4,485,000	5,382,000	6,190,000	Buildout	2,200 EDUs	0%	100%	0	6,190,000
Z4-R4-4	4	Reservoir 4-3 site	New	7.00	9,660,000	9,660,000	11,592,000	13,331,000	Buildout	4,900 EDUs	0%	100%	0	13,331,000
Z5-R5-4	5	Lytle Creek Ranch Development, approx. 1,000' ne/o reservoir 5-1 site	New	2.60	3,588,000	3,588,000	4,306,000	4,952,000	Buildout	10,900 EDUs	0%	100%	0	4,952,000
Z6-R6-5	6	Reservoir 6-2 site	New	6.00	8,280,000	8,280,000	9,936,000	11,427,000	Buildout	2,900 EDUs	0%	100%	0	11,427,000
Z6-R6-6	6	Approx. 1,100' e/o the intersection of Citrus Avenue and Segovia Ave	New	3.00	4,140,000	4,140,000	4,968,000		Buildout	As Development Occurs	0%	100%	0	0
Z7-R7-5	7	Intersection of Clearwater Pkwy and Glen Helen Pkwy	New	3.40	4,692,000	4,692,000	5,631,000	6,476,000	Buildout	6,300 EDUs	0%	100%	0	6,476,000
Z8-R8-3	8	Existing Z8 Tank Site	Replace	2.10	-	-	-	4,080,000	Five-Year	Immediate	10%	90%	408,000	3,672,000
BH-AER	-		New	1.00	1,380,000	1,380,000	1,656,000	1,905,000	Buildout	With Well 43	0%	100%	0	1,905,000
LR-R3-5	-	Existing Lord Ranch Facility	New	1.00	-	-	-	1,905,000	Five-Year	Immediate	0%	100%	0	1,905,000
				Total Reservoir Improvement Costs		**36,225,000**	**43,471,000**	**50,266,000**					**408,000**	**49,858,000**
Pump Station Improvements				(gpm)										
Z3-PS2-1	3	Existing Pump Station 2-1 site	New	1,500	-	-	-	320,000	Buildout	With Well 16	100%	0%	320,000	0
Z4-PS4-2	4	Existing Pump Station 4-2 site	New	9,600	3,403,097	3,404,000	4,085,000	4,698,000	Buildout	With Well 43	0%	100%	0	4,698,000
Z4-PS4-3	4	Lord Ranch Facility	New	11,920	-	-	-	3,000,000	Five-Year	Immediate	0%	100%	0	3,000,000
Z5-PS5-3	5	Lytle Creek Ranch development, approx. 2,200' ne/o reservoir 4-3 site	New	8,000	2,963,680	2,964,000	3,557,000	4,091,000	Buildout	As Development Occurs	0%	100%	0	4,091,000
Z6-PS6-3	6	Lytle Creek ranch development, approx. 1,000' ne/o reservoir 5-1 site	New	5,200	2,137,782	2,138,000	2,566,000	2,951,000	Buildout	As Development Occurs	0%	100%	0	2,951,000
Z7-PS7-2	7	Existing Pump Station 7-1 site	New	6,000	2,382,814	2,383,000	2,860,000	3,289,000	Five-Year	Immediate	0%	100%	0	3,289,000
Z7-PS7-3	7	Lytle Creek Ranch development, approx. 1,500' ne/o reservoir 6-2 site	New	5,250	2,153,351	2,154,000	2,585,000	2,973,000	Buildout	As Development Occurs	0%	100%	0	2,973,000
Z8-PS8-3	8	Intersection of Clearwater Pkwy and Glen Helen Pkwy	New	4,890	2,040,427	2,041,000	2,450,000	2,818,000	Buildout	As Development Occurs	0%	100%	0	2,818,000
BH-PS	-	Intersection of 16th St and Pennsylvania Ave	New	17,500	5,365,545	5,366,000	6,440,000	7,406,000	Buildout	With Well 43	0%	100%	0	7,406,000

Table 8.4 Capital Improvement Costs - Storage Reservoirs, Pump Stations, Pressure Reducing Valves

Water Facilities Master Plan
West Valley Water District

Improv. No.	Pressure Zone	Location	New/ Replace	Infrastructure Costs		Baseline Constr. Costs	Estimated Const. Costs[1]	Capital Improv. Costs[2,3]	Improvement Horizon	Construction Trigger	Suggested Cost Allocation		Cost Sharing	
				Recommended Capacity	Infr. Cost ($)	($)	($)	($)		(EDU)	Existing Users	Future Users	Existing Users	Future Users
				Total Pump Station Improvement Costs		**20,450,000**	**24,543,000**	**31,546,000**					**320,000**	**31,226,000**
Pressure Reducing Valve Improvements														
Z6-PRV1	7B-6	Sierra Ave, approx. 1,000' n/o Casa Grande Dr	New		75,000	75,000	90,000	104,000	Five-Year	As Development Occurs	0%	100%	0	104,000
Z6-PRV2	7B-6	Coyote Canyon Rd, approx. 300' ne/o Hawk Ridge Ave	New		75,000	75,000	90,000	104,000	Five-Year	As Development Occurs	0%	100%	0	104,000
Z7-PRV1	7-7B	Lytle Creek Ranch Development	New		75,000	75,000	90,000	104,000	Five-Year	As Development Occurs	0%	100%	0	104,000
Z7-PRV2	7-7B	Intersection of Terra Vista Dr and Cypress Ave	New		75,000	75,000	90,000	104,000	Buildout	As Development Occurs	0%	100%	0	104,000
Z7-PRV3	7-7B	Intersection of Terra Vista Dr and Citrus Ave	New		75,000	75,000	90,000	104,000	Buildout	As Development Occurs	0%	100%	0	104,000
Z7-PRV4	7-7B	Lytle Creek Rd, nw/o Monarch Hills Development	New		75,000	75,000	90,000	104,000	Five-Year	Immediate	0%	100%	0	104,000
				Total Pressure Reducing Valve Improvement Costs		**450,000**	**540,000**	**624,000**					**0**	**624,000**
Total Improvement Costs														
				Storage Reservoir Improvements		**36,225,000**	**43,471,000**	**50,266,000**					**408,000**	**49,858,000**
				Pump Station Improvements		**20,450,000**	**24,543,000**	**31,546,000**					**320,000**	**31,226,000**
				Pressure Reducing Valve Improvements		**450,000**	**540,000**	**624,000**					**0**	**624,000**
				Total Improvement Costs		**57,125,000**	**68,554,000**	**82,436,000**					**728,000**	**81,708,000**

AKEL ENGINEERING GROUP, INC.

3/7/2019

Notes:

1. Baseline construction costs plus 20% to account for unforeseen events and unknown conditions.
2. Estimated construction costs plus 15% to cover other costs including: engineering design, project administration (developer and District staff), construction management and inspection, and legal costs.
3. Costs for improvements shown with only Capital Improvement Cost are based on information provided by WVWD staff.

Table 8.5 Capital Improvement Costs - OPR WFF Expansion

Water Facilities Master Plan
West Valley Water District

Item No.	Expansion Item	Capital Improvement Cost ($)
1	Civil Costs	15,719,030
2	Raw Water Control Structures	1,376,530
3	Microfiltration	20,160,000
4	UV	3,216,401
5	GAC Contactors	18,276,187
6	Chlorine Contact	525,960
7	Equalization Storage	1,722,652
8	Membrane Pumping	1,552,386
9	Chemicals	680,507
10	Influent Blending Ponds	2,174,933
11	Sludge Ponds	3,342,534
12	Administration Building (7,000 s.f.)	3,000,000
	Total Improvement Cost	**71,747,120**

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Notes:

1. Capital Improvement costs extracted from opinion of probable costs prepared by Carollo Engineers March 19, 2019 and provided by District staff.
2. Estimate is based on a number of assumptions an dlimited information, approximate accuracy is +50% to -30%.

Table 8.6 Capital Improvement Costs - Supply

Water Facilities Master Plan
West Valley Water District

Improv. No.	New/ Rehabilitate	Infrastructure Costs				Baseline Constr. Costs	Estimated Const. Costs[1]	Capital Improv. Costs[2]	Improvement Phase	Construction Trigger	Suggested Cost Allocation		Cost Sharing	
		Planned Capacity (gpm)	Well Construction Cost	Treatment Cost	Total Infr. Cost ($)	($)	($)	($)		(year)	Existing Users	Future Users	Existing Users	Future Users
Groundwater Supply Improvements[3,4]														
W54	Rehabilitate	1,000	-	150,000	150,000	-	-	150,000	Five-Year	2019	80%	20%	120,000	30,000
W18A	Rehabilitate	2,700	-	7,668,839	7,668,839	-	-	7,669,000	Five-Year	2019	80%	20%	6,135,200	1,533,800
W42	Rehabilitate	2,200	-	9,246,213	9,246,213	-	-	9,247,000	Five-Year	2019	80%	20%	7,397,600	1,849,400
W39	Rehabilitate	4,000	-	9,334,214	9,334,214	-	-	9,335,000	Five-Year	2019	80%	20%	7,468,000	1,867,000
W41	Rehabilitate	2,200	-	550,000	550,000	-		550,000	Five-Year	2020	80%	20%	440,000	110,000
W50	New	1,500	-	7,208,559	7,208,559	-	-	7,209,000	Five-Year	2020	80%	20%	5,767,200	1,441,800
W52	New	2,000	-	8,690,777	8,690,777	-	-	8,691,000	Five-Year	2021	80%	20%	6,952,800	1,738,200
W16	Rehabilitate	1,500	-	5,716,015	5,716,015	-	-	5,717,000	Five-Year	2021	80%	20%	4,573,600	1,143,400
W29A	New	1,500	7,208,559		7,208,559	-	-	7,209,000	Five-Year	2022	80%	20%	5,767,200	1,441,800
W40	Rehabilitate	1,500	-	7,208,559	7,208,559	-	-	7,209,000	Five-Year	2022	80%	20%	5,767,200	1,441,800
W43	New	3,500	3,000,000	-	3,000,000	-	-	3,000,000	Five-Year	2023	0%	100%	0	3,000,000
W44	New	3,500	3,000,000	-	3,000,000	-	-	3,000,000	Five-Year	2023	0%	100%	0	3,000,000
W45	New	3,500	3,000,000	-	3,000,000	-	-	3,000,000	Five-Year	2024	0%	100%	0	3,000,000
W46	New	3,500	3,000,000	-	3,000,000	-	-	3,000,000	Five-Year	2024	0%	100%	0	3,000,000
W7	Rehabilitate	2,100	-	50,000	50,000	-	-	50,000	Buildout	2029	0%	100%	0	50,000
W8A	Rehabilitate	2,400	-	3,288,359	3,288,359	-	-	3,289,000	Buildout	2029	0%	100%	0	3,289,000
W36	Rehabilitate	2,700	-	3,550,000	3,550,000	-	-	3,550,000	Buildout	2030	0%	100%	0	3,550,000
W51	New	3,000	-	11,311,441	11,311,441	-	-	11,312,000	Buildout	2036	0%	100%	0	11,312,000
W34B	New	2,000	-	2,920,864	2,920,864	-	-	2,921,000	Buildout	2040	0%	100%	0	2,921,000
W35C	New	2,000	-	2,920,864	2,920,864	-	-	2,921,000	Buildout	2040	0%	100%	0	2,921,000
W22A	Rehabilitate	1,500	-	5,716,015	5,716,015	-	-	5,717,000	Buildout	2042	0%	100%	0	5,717,000
		Subtotal - Groundwater Supply Improvements			**104,739,278**	**0**	**0**	**104,746,000**					**50,388,800**	**54,357,200**
Surface Water Supply Improvements[5]														
OPR WFF	New	16.0 mgd expansion		-	-	-	-	71,747,120	Five-Year	2022	0%	100%	0	71,747,120
		Subtotal - Surface Water Supply Improvements			**0**	**0**	**0**	**71,747,120**					**0**	**71,747,120**
Total Improvement Cost														
				Groundwater Supply Improvements		0	0	104,746,000					50,388,800	54,357,200
				Surface Water Supply Improvements		0	0	71,747,120					0	71,747,120
				Total Supply Improvement Costs		**0**	**0**	**176,493,120**					**50,388,800**	**126,104,320**

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Notes:

1. Baseline construction costs plus 25% to account for unforeseen events and unknown conditions.
2. Estimated construction costs plus 22% to cover other costs including: engineering design, project administration (developer and District staff), construction management and inspection, and legal costs.
3. Costs and contingencies shown provided by Kleinfelder, Inc.
4. Costs shown for new wells include both construction costs and costs for any potential treatment identified.
5. Costs shown prepared by Carollo Engineers and provied by District staff April 1, 2019.

Table 8.7 5-year Improvement Phasing
Water Facilities Master Plan
West Valley Water District

CIP ID	Project Name	Project Description	Fiscal Year Improvement Phasing													
			FY 2018/19		FY 2019/20		FY 2020/21		FY 2021/22		FY 2022/23		FY 2023/24		Total Improvement Cost	
			Existing Users ($)	Future Users ($)	Existing Users ($)	Future Users ($)	Existing Users ($)	Future Users ($)	Existing Users ($)	Future Users ($)	Existing Users ($)	Future Users ($)	Existing Users ($)	Future Users ($)	Existing Users ($)	Future Users ($)
Pipeline Improvements																
Capacity Improvements																
Z2-P1	Bloomington Pipeline Replacement (Phase 4)	Construct new 24-inch transmission main in Eighth St							2,222,000						2,222,000	0
Z2-P2	Bloomington Pipeline Replacement (Phase 4)	Construct new 8-inch pipelines in Eighth St							850,000						850,000	0
Z2-P3	Bloomington Pipeline Replacement (Phase 5)	Replace existing 4-inch and 6-inch pipelines with new 8-inch pipelines in Ninth St									650,000				650,000	0
Z2-P4	Bloomington Pipeline Replacement (Phase 3)	Replace existing 4-inch and 8-inch pipelines with new 8-inch pipelines in Tenth St	650,000												650,000	0
Z2-P5	Bloomington Pipeline Replacement (Phase 3)	Construct new 8-inch pipelines in Eleventh St	400,000												400,000	0
Z2-P6	Bloomington Pipeline Replacement (Phase 3)	Replace existing 6-inch pipelines with new 12-inch pipelines in Maple St	650,000												650,000	0
Z2-P7	Zone 2 Santa Ana Transmission	Construct new 12-inch transmission main on Santa Ana Ave					380,000								380,000	0
Z2-P8	Zone 2 Santa Ana Transmission	Replace existing 12-inch pipelines with new 20-inch transmission main on Santa Ana Ave									3,794,000				3,794,000	0
Z2-P9	Zone 2 I-10 Crossing	Construct 24-inch transmission main crossing I-210					304,000								304,000	0
Z2-P9C	Zone 2 I-10 Crossing	Casing for pipeline crossing I-210					585,000								585,000	0
Z3-P4	Zone 3 Santa Ana Transmission	Replace existing 4-inch, 6-inch, and 12-inch pipelines with new 12-inch pipeline in Santa Ana Ave							1,484,000						1,484,000	0
Z3-P5	Zone 3 Santa Ana Transmission	Construct new 16-inch transmission main in Santa Ana Ave					462,000								462,000	0
Z3-P6	Valley Blvd Pipeline Replacements	Replace existing 2-inch, 4-inch, and 6-inch pipelines with 8-inch pipelines									517,000				517,000	0
Z3-P7	Valley Blvd Pipeline Replacements	Replace existing 4-inch and 6-inch pipelines with 8-inch pipelines									1,040,000				1,040,000	0
Z3-P8	Zone 3 Hydraulic Reliability	Construct a new 12-inch pipeline in Valley Blvd	50,000		160,000										210,000	0
Z3A-P1	Zone 3A Hydraulic Reliability	Construct a new 10-inch pipeline in Cactus Ave					35,000		108,500						143,500	0
Z7-P10	Zone 7 Transmission	Construct a new 18-inch transmission main in Segovia Ln from Sierra Ave to Citrus Ave												2,463,000	0	2,463,000
Z7-P16	Zone 7 Transmission	Construct a new 18-inch transmission main within future ROW from Citrus Ave to Lytle Creek Rd (includes casing for I-15 crossing)												1,006,000	0	1,006,000
BH-P1	Bunker Hill Well Field Transmission	From planned wells 43, 44, 45, and 46 to the Bunker Hill aeration tank						840,000							0	840,000
BH-P2	Bunker Hill Well Field Transmission	From Bunker Hill aeration tank to existing Pump Station 3A						5,277,000							0	5,277,000
		Subtotal - Capacity Improvements	**1,750,000**	**0**	**160,000**	**0**	**1,766,000**	**6,117,000**	**4,664,500**	**0**	**6,001,000**	**0**	**0**	**3,469,000**	**14,341,500**	**9,586,000**
			1,750,000		**160,000**		**7,883,000**		**4,664,500**		**6,001,000**		**3,469,000**		**23,927,500**	
Reservoir Improvements																
Z8-R8-3	Zone 8 Reservoir Replacement	Replace existing Zone 8 storage reservoir with new 2.1 MG reservoir	8,000	72,000	400,000	3,600,000									408,000	3,672,000
LR-R3-5	Lord Ranch Aeration Tank	Construct a new 1.0 MG aeration reservoir at Lord Ranch Facility		1,905,000											0	1,905,000
BH-AER	Bunker Hill Aeration Tank	Construct a new aeration tank at the Bunker Hill supply location					0	1,905,000							0	1,905,000
		Subtotal - Reservoir Improvements	**8,000**	**1,977,000**	**400,000**	**3,600,000**	**0**	**1,905,000**	**0**	**0**	**0**	**0**	**0**	**0**	**408,000**	**7,482,000**
			1,985,000		**4,000,000**		**1,905,000**		**0**		**0**		**0**		**7,890,000**	

Table 8.7 5-year Improvement Phasing
Water Facilities Master Plan
West Valley Water District

CIP ID	Project Name	Project Description	Fiscal Year Improvement Phasing											
			FY 2018/19		FY 2019/20		FY 2020/21		FY 2021/22		FY 2022/23		FY 2023/24		Total Improvement Cost	
			Existing Users ($)	Future Users ($)	Existing Users ($)	Future Users ($)	Existing Users ($)	Future Users ($)	Existing Users ($)	Future Users ($)	Existing Users ($)	Future Users ($)	Existing Users ($)	Future Users ($)	Existing Users ($)	Future Users ($)
Pump Station Improvements																
Z4-PS4-3	Lord Ranch Pump Station	Construct new Pressure Zone 4 pump station at Lord Ranch Facility		3,000,000											0	3,000,000
Z7-PS7-2	New Zone 7 Pump Station	Construct a new pump station adjacent to existing PS 7-1					0	4,091,000							0	4,091,000
BH-PS	New Bunker Hill supply Pump Station	Construct a new pump station at the Bunker Hill supply location					0	7,406,000							0	7,406,000
		Subtotal - Pump Station Improvements	**0**	**3,000,000**	**0**	**0**	**0**	**11,497,000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**14,497,000**
			3,000,000		**0**		**11,497,000**		**0**		**0**		**0**		**14,497,000**	
Pressure Reducing Valves Improvements																
Z6-PRV1	Zone 6 PRV	Construct new pressure reducing station on Sierra Ave		104,000											0	104,000
Z6-PRV2	Zone 6 PRV	Construct new pressure reducing station on Coyote Canyon Rd		104,000											0	104,000
Z7-PRV1	Zone 7 PRV	Construct new pressure reducing station within planned Lytle Creek Ranch development		104,000											0	104,000
Z7-PRV4	Zone 7 PRV	Construct new pressure reducing station on Lytle Creek Rd, northwest of planned Monarch Hills Development		104,000											0	104,000
		Subtotal - Pressure Reducing Valves Improvements	**0**	**416,000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**416,000**
			416,000		**0**		**0**		**0**		**0**		**0**		**416,000**	
Supply Improvements																
W41	Well 41 Rehabilitation	Implement ion-exchange treatment for nitrate	440,000	110,000											440,000	110,000
W39	Well 39 Rehabilitation	Existing well drilled but not equipped			7,468,000	1,867,000									7,468,000	1,867,000
W7	Well 7 Rehabilitation	Existing well blind flanged						50,000							0	50,000
W8A	Well 8A Rehabilitation	Implement arsenic removal						3,289,000							0	3,289,000
W36	Well 36 Rehabilitation	Implement arsenic removal										3,550,000			0	3,550,000
W18A	Well 18A Rehabilitation	Implement ion-exchange treatment for nitrate			6,135,200	1,533,800									6,135,200	1,533,800
OPR WFF		Design and Construct OPR WFF expansion		500,000		71,747,120									0	72,247,120
W43		Construct new well						3,000,000							0	3,000,000
W44		Construct new well								3,000,000					0	3,000,000
W45		Construct new well										3,000,000			0	3,000,000
W46		Construct new well												3,000,000	0	3,000,000
		Subtotal - Supply Improvements	**440,000**	**610,000**	**13,603,200**	**75,147,920**	**0**	**6,339,000**	**0**	**3,000,000**	**0**	**6,550,000**	**0**	**3,000,000**	**14,043,200**	**94,646,920**
			1,050,000		**88,751,120**		**6,339,000**		**3,000,000**		**6,550,000**		**3,000,000**		**108,690,120**	
Other Currently Planned Projects																
Property Acquisition for Reservoir R3-4 (1.5 acres)		Purchase land for future reservoir R3-4								523,000					0	523,000
Property Acquisition for Reservoir R6-6 (1.5 acres)		Purchase land for future reservoir R6-6										523,000			0	523,000
Property Acquisition for Bunker Hill Supply		Purchase land for future Bunker Hill wells, pump station, and aeration reservoir				1,300,000									0	1,300,000
R7-5 Reservoir Site Investigation		Conduct site investigation for future reservoir R7-5				59,000									0	59,000
Grading, Fencing, and Paving at Lord Ranch Facility		Grade, pave, and erect fencing at Lord Ranch facility							700,000						700,000	0

Table 8.7 5-year Improvement Phasing
Water Facilities Master Plan
West Valley Water District

CIP ID	Project Name	Project Description		Fiscal Year Improvement Phasing													
				FY 2018/19		FY 2019/20		FY 2020/21		FY 2021/22		FY 2022/23		FY 2023/24		Total Improvement Cost	
				Existing Users ($)	Future Users ($)	Existing Users ($)	Future Users ($)	Existing Users ($)	Future Users ($)	Existing Users ($)	Future Users ($)	Existing Users ($)	Future Users ($)	Existing Users ($)	Future Users ($)	Existing Users ($)	Future Users ($)
	Sierra Ave, Developer Pipeline Capacity Increase	Increase size of development required pipe to accommodate additional future development			120,000											0	120,000
	Cedar Pl, Developer Pipeline Capacity Increase	Increase size of development required pipe to accommodate additional future development			84,000											0	84,000
	Well 54 Deaeration Tank	Construct deaeration tank at existing well 54		330,000												330,000	0
		Subtotal - Other Currently Planned Projects		330,000	204,000	0	1,359,000	0	0	700,000	523,000	0	523,000	0	0	1,030,000	2,609,000
				534,000		1,359,000		0		1,223,000		523,000		0		3,639,000	
Total Improvement Costs																	
		Existing/Future Users	Fiscal Year Total	$2,528,000	$6,207,000	$14,163,200	$80,106,920	$1,766,000	$25,858,000	$5,364,500	$3,523,000	$6,001,000	$7,073,000	$0	$6,469,000	-	
			Cumulative Total	$2,528,000	$6,207,000	$16,691,200	$86,313,920	$18,457,200	$112,171,920	$23,821,700	$115,694,920	$29,822,700	$122,767,920	$29,822,700	$129,236,920	$29,822,700	$129,236,920
		Combined Project Costs	Fiscal Year Total	$8,735,000		$94,270,120		$27,624,000		$8,887,500		$13,074,000		$6,469,000		-	
			Cumulative Total	$8,735,000		$103,005,120		$130,629,120		$139,516,620		$152,590,620		$159,059,620		$159,059,620	

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constructed in the near-term period. This table also includes currently planned projects identified by District staff that support the existing water system, such as land acquisition and site development. The projects included in this 5-year capital improvement program are based on current District priorities and may not include all improvements identified for construction within the 5-year development horizon.

8.3.4 Existing and Buildout EDUs

The calculation of total EDUs, under existing and future conditions, enables the District to effectively plan for capital improvement funding and to appropriately adjust water rates and impact fees as necessary. The calculation methodology for determining the existing, 5-year, and buildout EDU totals is briefly summarized as follows:

- **Existing:** Consistent with the 2012 WMP the existing number of EDUs were based on meter sizes of existing customers; the conversion factors utilized in determining the existing EDUs are summarized on **Table 8.8**. It should be noted the existing EDUs were based on 2016 account information provided by District staff.

- **5-year Development:** The additional EDUs added through the 5-year development horizon were based on development information summarized in **Table 2.5**.

- **Buildout Development:** The additional EDUs added through the Buildout development horizon were determined based on demand projections summarized in a previous chapter. The demand was converted to EDUs using a factor of 670 gpd/EDU, which is based on meter sizes and quantities, as provided by District staff, and using industry standard conversion factors.

The total number of EDUs at the existing, 5-year, and Buildout development horizons are summarized on **Table 8.9**.

Table 8.8 Water Meter EDUs

Water Facilities Master Plan
West Valley Water District

Meter Size	Meter Type	Safe Maximum Operating Flow[1,2] (gpm)	EDU
5/8" & 3/4"	Positive Displacement Type	30	1.0
1"	Positive Displacement Type	50	1.7
1-1/2"	Positive Displacement Type	100	3.3
2"	Turbine Type	160	5.3
3"	Turbine Type	350	11.7
4"	Turbine Type	630	20.0
6"	Turbine Type	1,300	41.7
8"	Turbine Type	1,800	60.0

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4/2/2018

Notes:
1. Source: WVWD 2012 Master Plan
2. Flows are based on safe maximum operating flow per AWWA standards C701-15

Table 8.9 EDUs by Pressure Zone

Water Facilities Master Plan

West Valley Water District

Pressure Zone	Existing[1] (2016)	Total, 5-Year Projection[2] (2022)	Total, Buildout[3] (2055)
Zone 2	3,479	3,679	6,317
Zone 3	6,975	7,379	11,115
Zone 3A	2,120	2,170	2,227
Zone 4	3,209	3,269	3,675
Zone 5	3,232	4,232	4,522
Zone 6	5,051	6,858	10,506
Zone 7	4,199	6,611	10,293
Zone 8	91	481	1,081
Total	**28,356**	**34,679**	**49,736**

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4/5/2019

Notes :

1. Existing EDUs based on 2016 account information provided by WVWD staff.
2. Includes additional EDUs based on 5-year growth information provided by WVWD staff.
3. Includes additonal EDUs based on demand projections, assuming 670 gpd/EDU

APPENDICES

APPENDIX A

Demand Unit Factor Comparison

Table 1 Average Daily Water Use Unit Factors

Water Facilities Master Plan

West Valley Water District

2012 Water Master Plan[1]					2020 Water Facilities Master Plan	
Land Use Designation	Development Density (du/ac)	Persons/du	Water Use[2] (gpm/ac)	Water Use[2] (gpd/ac)	Land Use Designation[3]	Water Use[4] (gpd/ac)
Residential						
Estate Residential	1	5.9	0.82	1,181		
Low Density	3	3.8	1.58	2,275		
Rural Residential	2	5.0	1.39	2,002	Residential 2	990
Medium Density	4	3.8	2.10	3,024		
Single Family	4	3.8	2.00	2,880		
Planned Community	4.5	3.2	1.75	2,520		
Medium High Density	9	2.1	2.62	3,773	Residential 6	2,650
Medium Density	9	2.1	2.62	3,773		
High Density	12	1.7	2.83	4,075	Residential 12	4,580
Very High Density	*Not included in 2012 WMP*				Residential 21	5,630
Regional Mixed Use	-	-	2.62	3,773		
Non-Residential						
Office	-	-	2.43	3,500	Office	1,410
Community Commercial	-	-	2.43	3,500	Commercial	1,800
Commercial Recreation	-	-	2.08	3,000	Retail	1,890
Industrial Park	-	-	1.39	2,000	Industrial	1,000
General Industrial	-	-	2.08	3,000	Heavy Industrial	1,530
Light Industrial	-	-	1.39	2,000	Light Industrial	500
Landfill	-	-	1.00	1,440		
School	-	-	2.43	3,500	Educational	1,790
Institutional	*Not included in 2012 WMP*				Institutional	1,410
Public Facility	*Not included in 2012 WMP*				Public Facility	230
Park	-	-	2.43	3,500	Landscape Irrigation	2,690
Golf Course	-	-	2.43	3,500		
Open Space	-	-	0.00	0		
Agricultural	-	-	0.00	0		
Public Utility Corridor (Greenbelt)	-	-	2.43	3,500		
Right of way	-	-	0.00	0		
Wells, Reservoirs, Energy	-	-	1.39	2,000	Utilities	10

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3/2/2018

Notes:

1. Land use designations and water use extracted from WVWD 2012 Water Master Plan, Table 5.1.
2. Residential water use factors calculated assuming 200 gallons per person per day.
3. Land use designations extracted from parcel database provided by WVWD staff July 5, 2017.
4. Water use factors calculated based on existing development and 2016 consumption records normalized to 2014 production minus 10%.

Appendix A Design and Planning Criteria Comparison

Water Master Plan Update
West Valley Water District

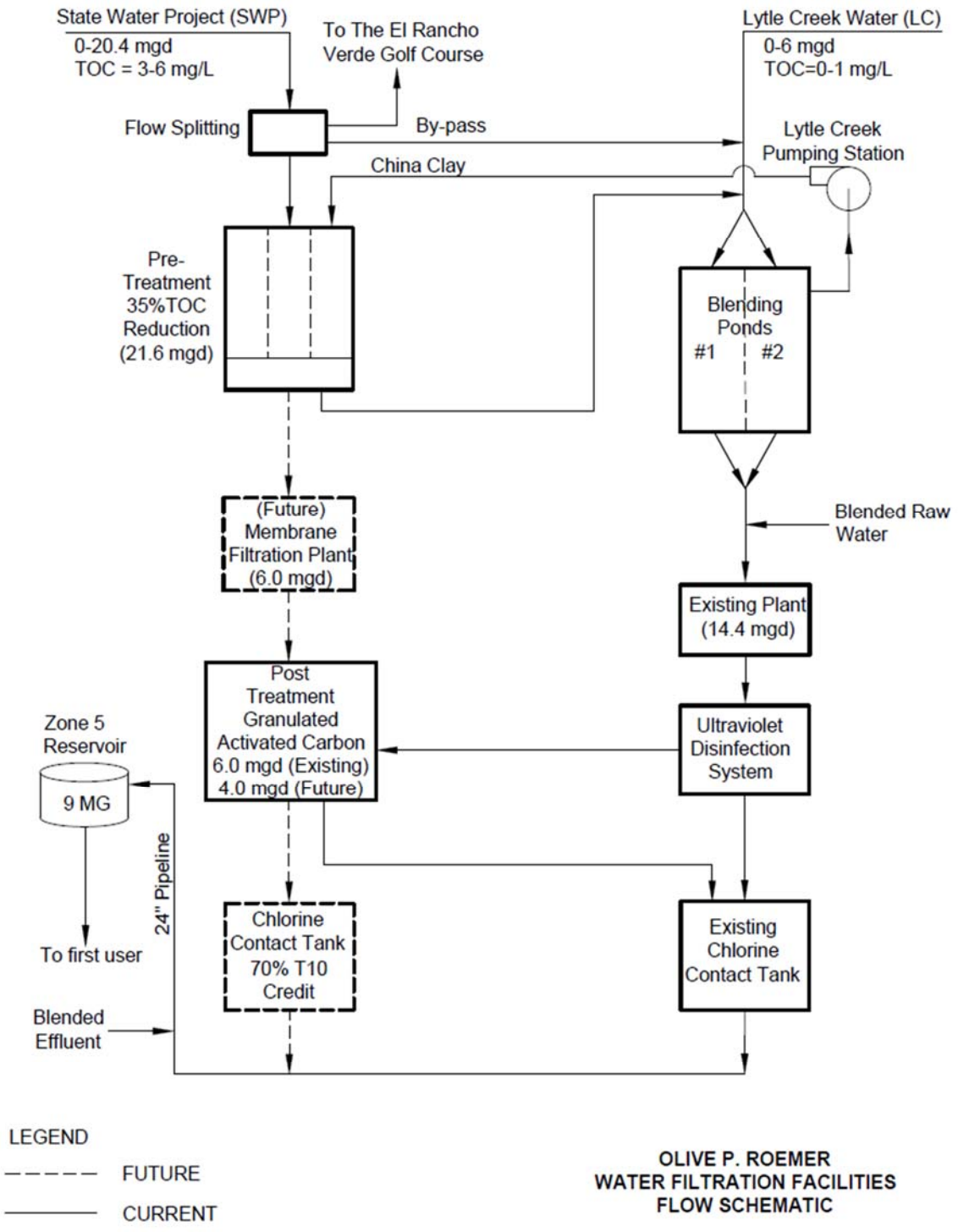
Design Parameter	2012 Water Master Plan Recommended Supply and Planning Criteria	2017 Water Master Plan Recommended Supply and Planning Criteria
Supply Requirement	Supply to meet Peak Day Demand with firm capacity only Peak day pumping shall be based on 16 hour of pumping/ day	Supply to meet Peak Day Demand with firm capacity only Peak day pumping shall be based on 16 hour of pumping/ day
Storage Requirement	Total Required Storage = Operational + Fire (For Zone 2, 3, 3A, 8) Total Required Storage = Operational + Fire + Pumping (For Zone 4, 5, 6,&7) Operational Storage: 100% of Peak Day Demand Fire Storage: Low Density Residential: 0.18 MG (1,500 gpm for 2 hours) High Density Residential: 0.54 MG (3,000 gpm for 3 hours) Schools/Commercial: 0.54 MG (3,000 gpm for 3 hours) Office/Light Industrial: 0.54 MG (3,000 gpm for 3 hours) Heavy Industrial: 0.96 MG (4,000 gpm for 4 hours) Pumping Storage: 100% Average Day Demand for Supply Dependent Pumping Zones	Total Required Storage = Operational + Fire (For Zone 2, 3, 3A, 8) Total Required Storage = Operational + Fire + Pumping (For Zone 4, 5, 6,&7) Operational Storage: 100% of Peak Day Demand Fire Storage: Low Density Residential: 0.18 MG (1,500 gpm for 2 hours) High Density Residential: 0.54 MG (3,000 gpm for 3 hours) Schools/Commercial: 0.54 MG (3,000 gpm for 3 hours) Office/Light Industrial: 0.54 MG (3,000 gpm for 3 hours) Heavy Industrial: 0.96 MG (4,000 gpm for 4 hours) Pumping Storage: 100% Average Day Demand for Supply Dependent Pumping Zones
Pump Stations[1]	Not Specified	Pump Stations shall meet Peak Day Demand with respective firm capacity of Pressure Zone (on a 16-hour per day pumping schedule). Firm capacity of Pressure Zone is defined as the sum of the total capacity of each pump station pumping into the pressure zone, with each pump station operating without their largest unit.
Pressure Reducing Valves[1]	Not Specified	PRV should be designed to meet the greater of: Peak Hour Demand, or Peak Day Demand + Fire Flow
Pipelines	Pipelines should be designed to meet the greater of: 1) Peak Hour Demand, or 2) Peak Day Demand + Fire Flow Criteria for existing and future pipelines include Maximum Velocity: 5 ft/s during Peak Day Demand 10 ft/s during Peak Day Demand + Fire Flow Maximum Headloss: 5 ft/1,000 ft during Peak Day Demand (assuming a C-Factor of 120) Dead-end pipelines shall not exceed 660 feet in length	Pipelines should be designed to meet the greater of: 1) Peak Hour Demand, or 2) Peak Day Demand + Fire Flow Criteria for existing and future pipelines include Maximum Velocity: 5 ft/s during Peak Day Demand 10 ft/s during Peak Day Demand + Fire Flow Maximum Headloss: 5 ft/1,000 ft during Peak Day Demand (assuming a C-Factor of 120) Dead-end pipelines shall not exceed 660 feet in length
Service Pressures	Maximum Pressure In Pipelines: 130 psi At Service Connections: 80 psi Minimum Pressure Peak Hour Demand: 40 psi Peak Day Demand + Fire Flow: 20 psi	Maximum Pressure In Pipelines: 130 psi At Service Connections: 80 psi Minimum Pressure Peak Hour Demand: 40 psi Peak Day Demand + Fire Flow: 20 psi
Demand Peaking Factors	Peak Month Demand Peak Day Demand: 1.70 x Average Day Demand Peak Hour Demand: 1.70 x Peak Day Demand	Peak Month Demand Peak Day Demand: 1.70 x Average Day Demand Peak Hour Demand: 1.70 x Peak Day Demand
Water Demand Factors	Water Use Rate: 200 gallons per capita per day (gpcd) Average Daily Flow: 200 gpcd x 3.5 of persons per dwelling unit based on land use x total number of dwelling units in each area or = water use rate (gpm/ac) x total acres served	Water Use Rate: 190 gallons per capita per day (gpcd) Average Daily Flow: 190 gpcd x 3.5 of persons per dwelling unit based on land use x total number of dwelling units in each area or = water use rate (gpm/ac) x total acres served
Fire Flows	Low Density Residential: 1,500 gpm for 2 hours High Density Residential: 3,000 gpm for 3 hours Schools/Commercial: 3,000 gpm for 3 hours Office/Light Industrial: 3,000 gpm for 3 hours Heavy Industrial: 4,000 gpm for 4 hours	Low Density Residential: 1,500 gpm for 2 hours High Density Residential: 3,000 gpm for 3 hours Schools/Commercial: 3,000 gpm for 3 hours Office/Light Industrial: 3,000 gpm for 3 hours Heavy Industrial: 4,000 gpm for 4 hours

Notes:

1. Criteria not included in District 2012 Water Master Plan. Criteria shown recommended by Akel Engineering Group.
2. Water use rate consistent with 2020 per capita water use target per District 2015 Urban Water Management Plan.

APPENDIX B

OPR Facility Flow Schematic

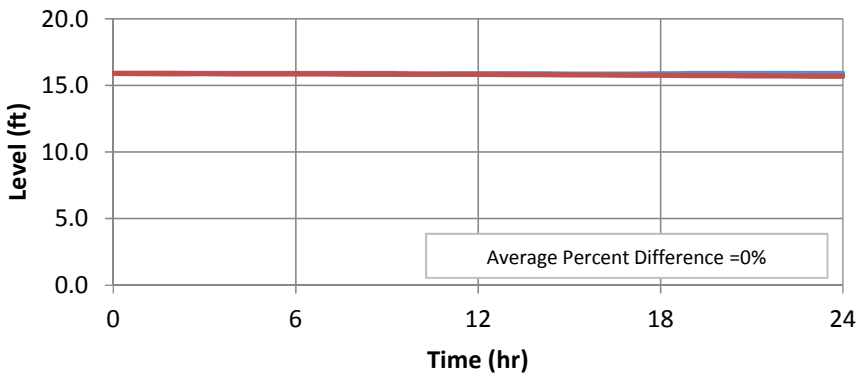


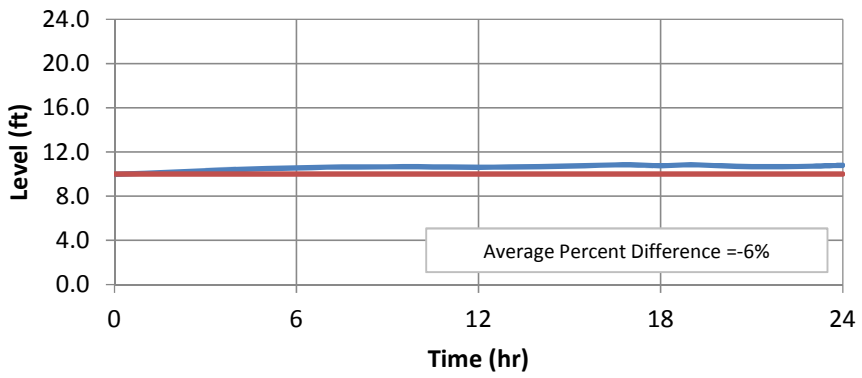
OLIVE P. ROEMER WATER FILTRATION FACILITIES FLOW SCHEMATIC

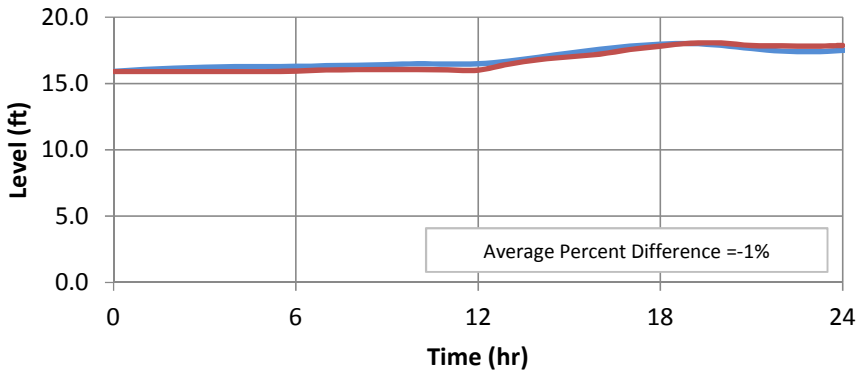
FIGURE 4.1 **(REVISED FIGURE 3.3 FROM 2012 WATER MASTER PLAN)**

APPENDIX C

Hydraulic Model Calibration







LEGEND

SCADA (July 9, 2017)

Hydraulic Model

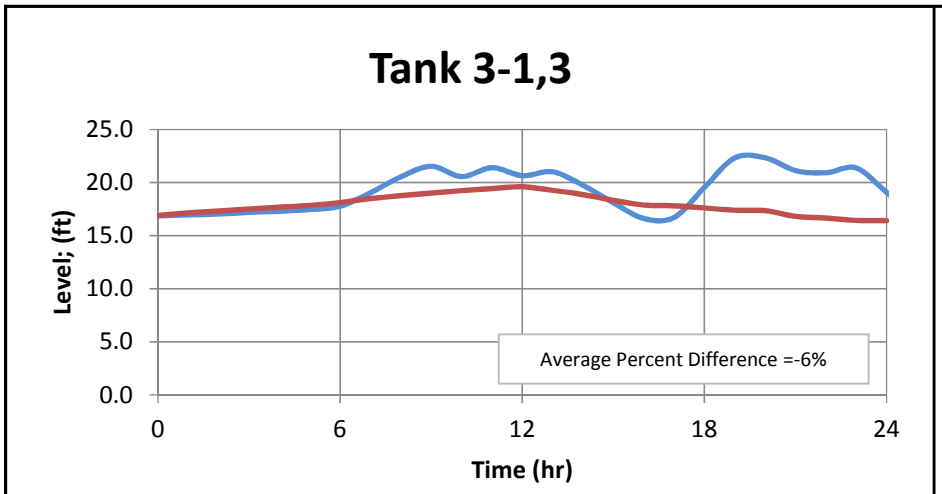
PRELIMINARY

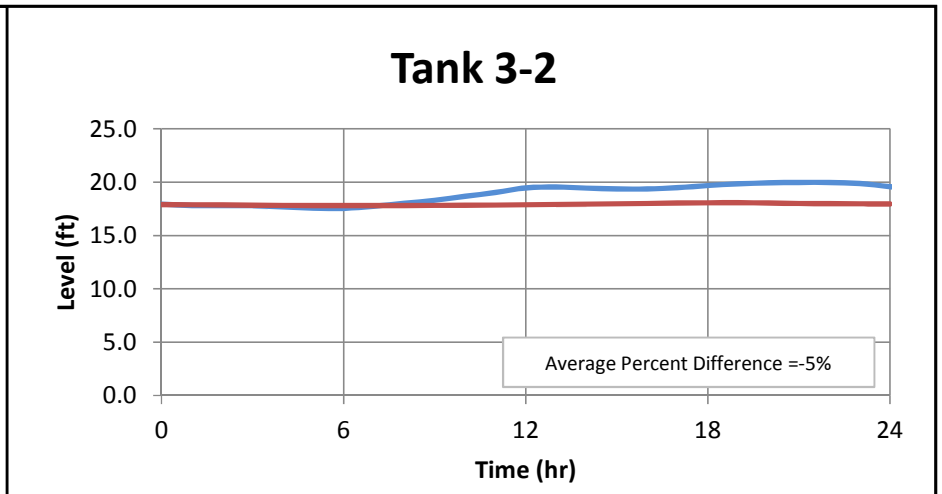
January 23, 2018

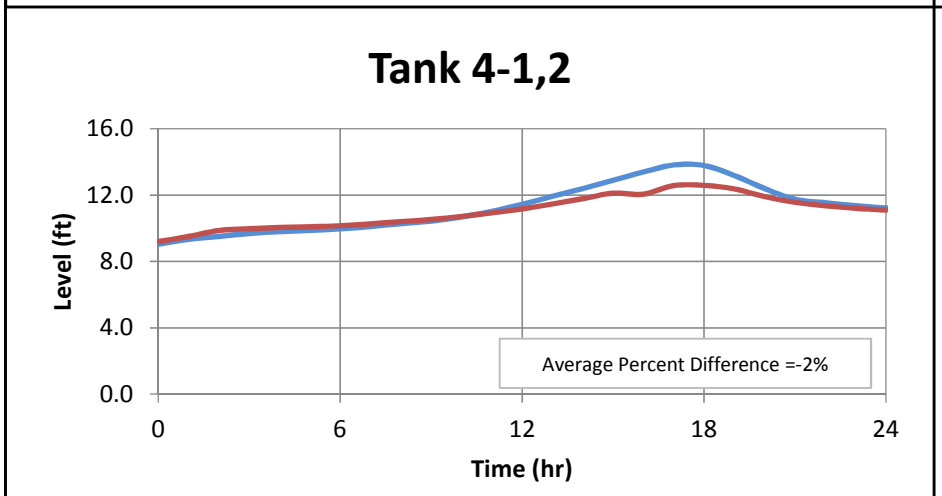
Figure 1
Tank Calibration

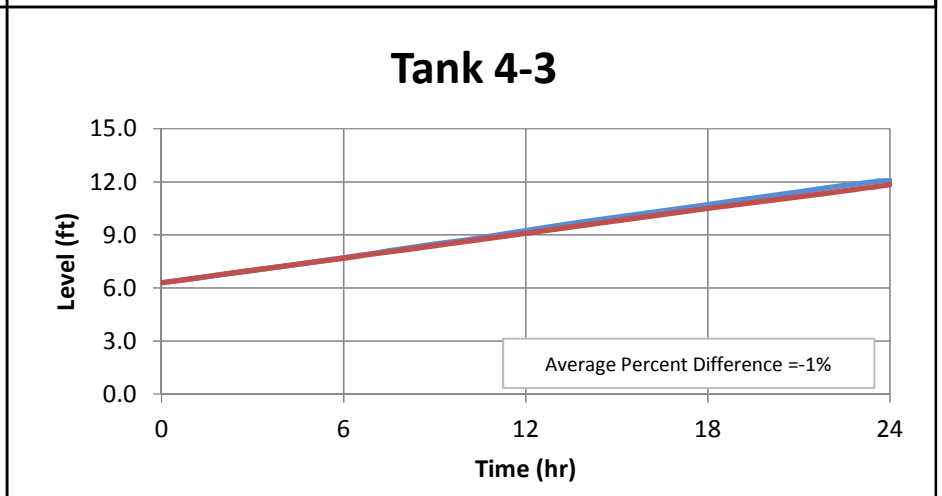
Water Facilities Master Plan
West Valley Water District

AKEL ENGINEERING GROUP, INC.









LEGEND

SCADA (July 9, 2017)

Hydraulic Model

PRELIMINARY

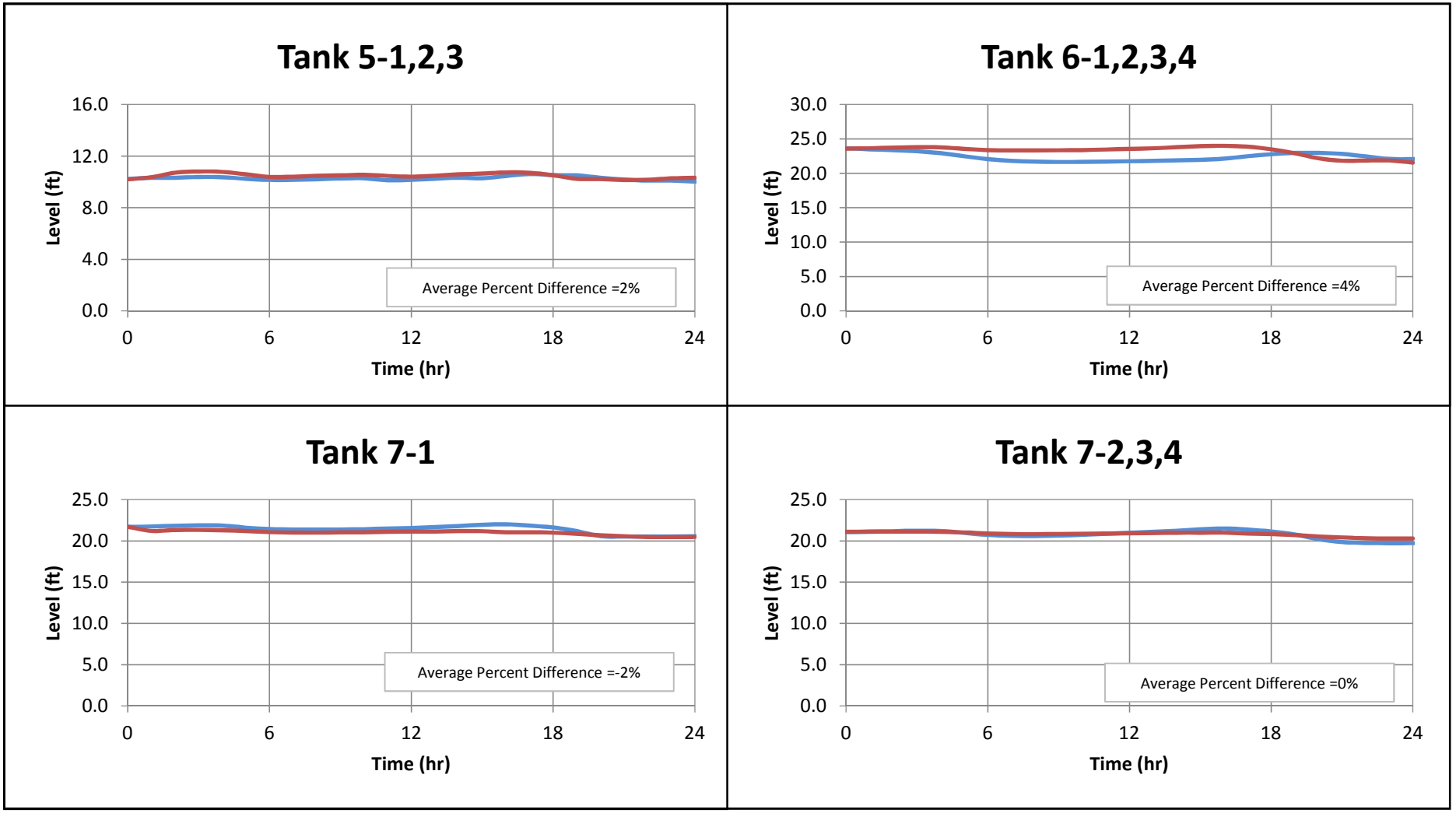
January 23, 2018

Figure 2
Tank Calibration

Water Facilities Master Plan
West Valley Water District

West Valley Water District

AKEL ENGINEERING GROUP, INC.



LEGEND

SCADA (July 9, 2017)

Hydraulic Model

PRELIMINARY

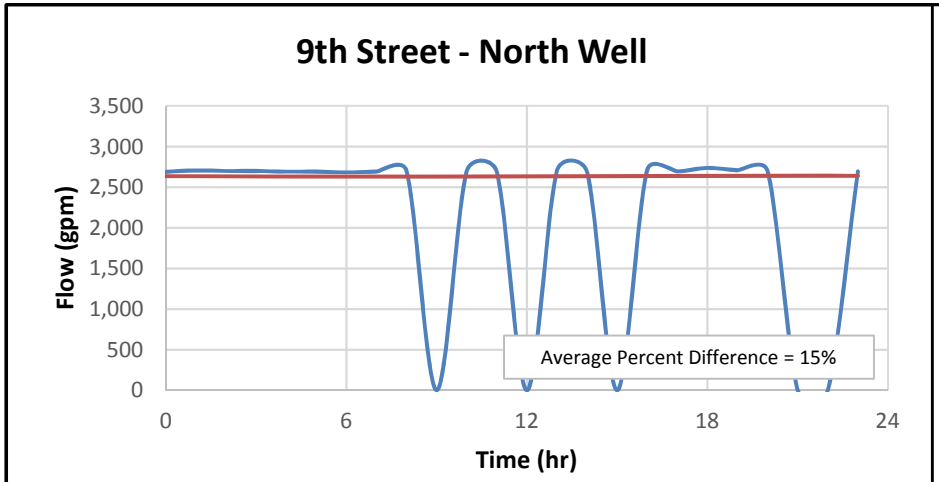
January 23, 2018

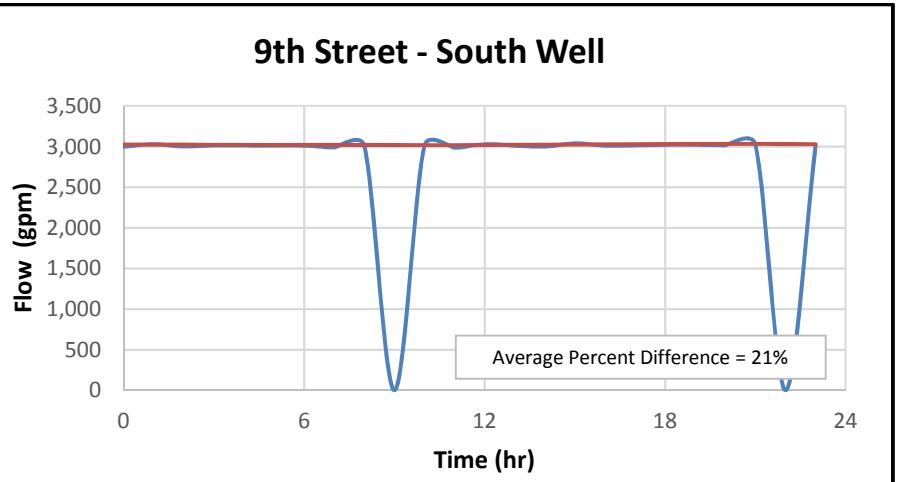
Figure 3
Tank Calibration

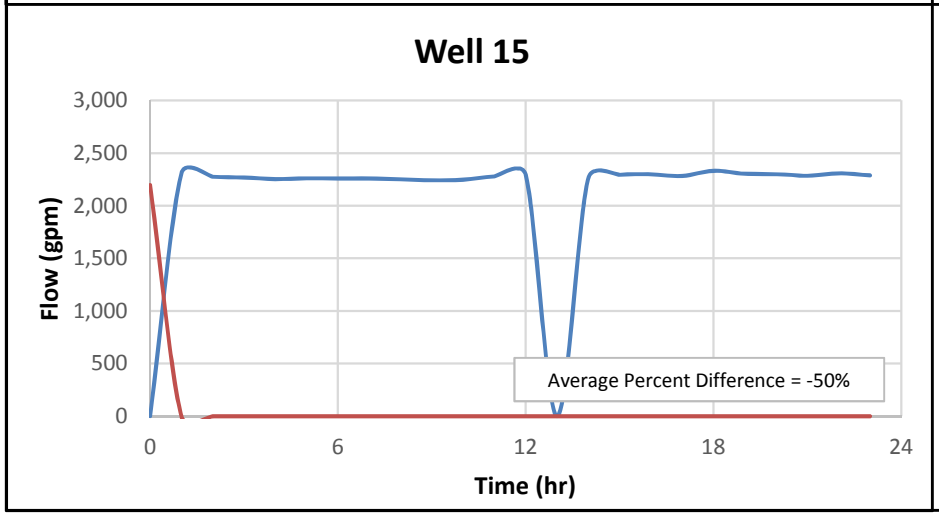
Water Facilities Master Plan
West Valley Water District

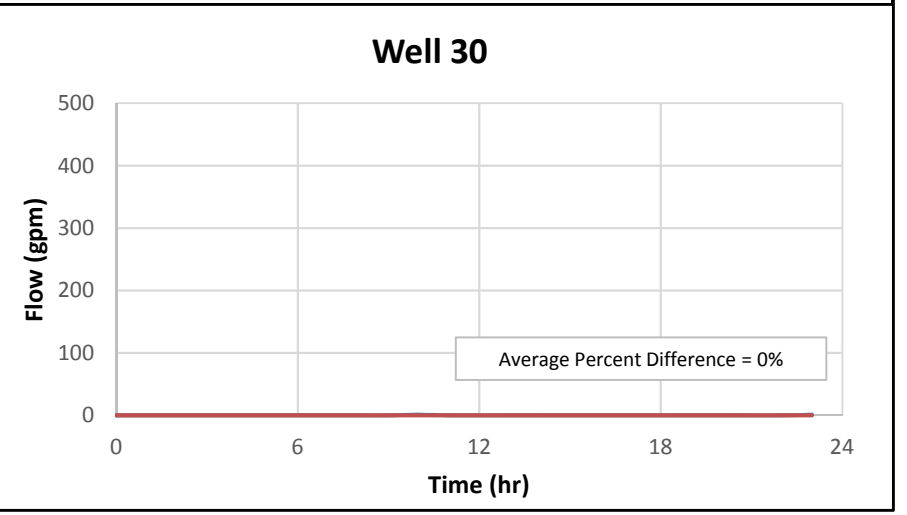
West Valley Water District

AKEL ENGINEERING GROUP, INC.









LEGEND

SCADA (July 9, 2017)

Hydraulic Model

PRELIMINARY

Note: Graphs showing zero flow indicate pump did not operate during calibration period

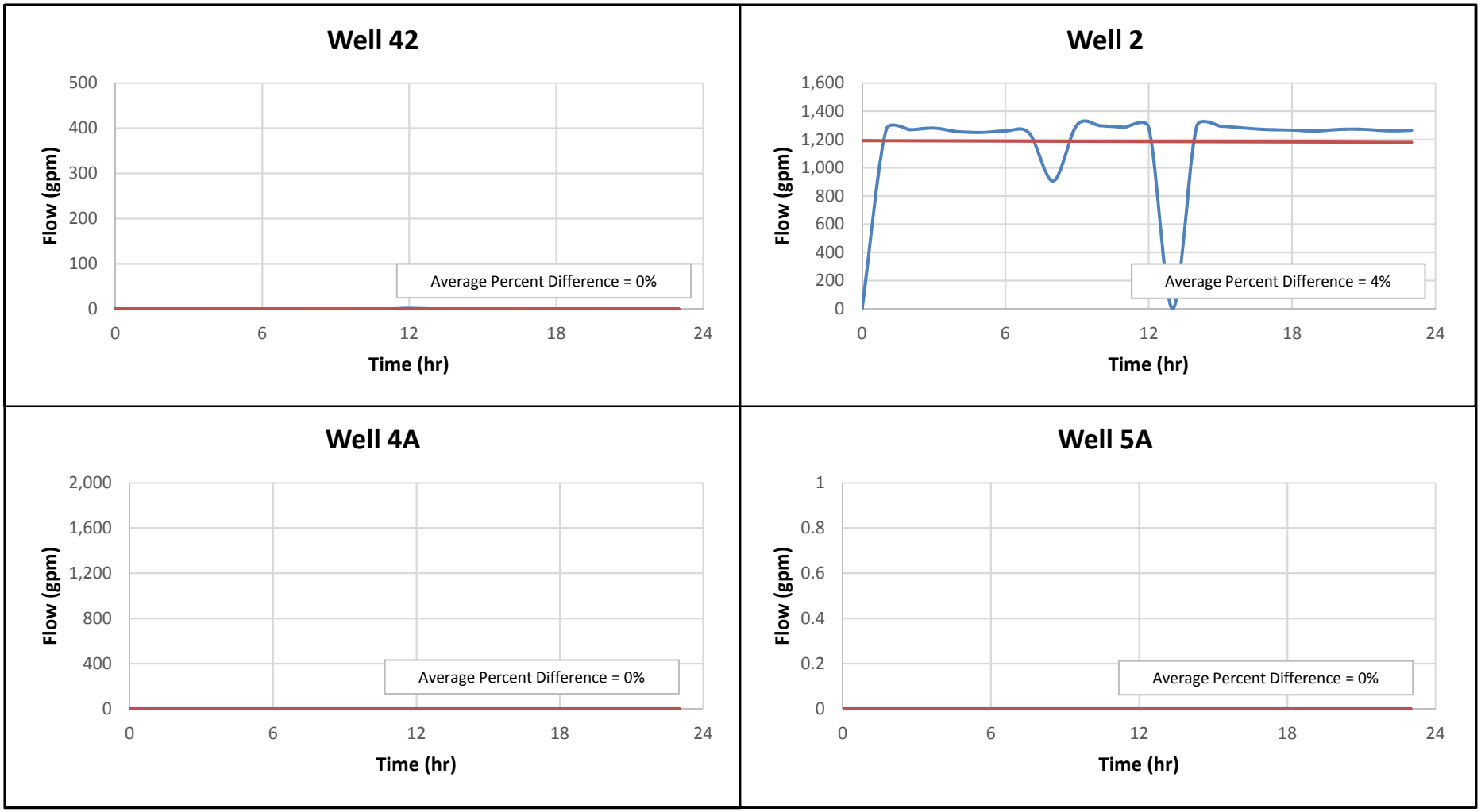
January 23, 2018

Figure 4
Well Calibration

Water Facilities Master Plan
West Valley Water District

West Valley Water District

AKEL ENGINEERING GROUP, INC.



LEGEND

SCADA (July 9, 2017)

Hydraulic Model

PRELIMINARY

Note: Graphs showing zero flow indicate pump did not operate during calibration period

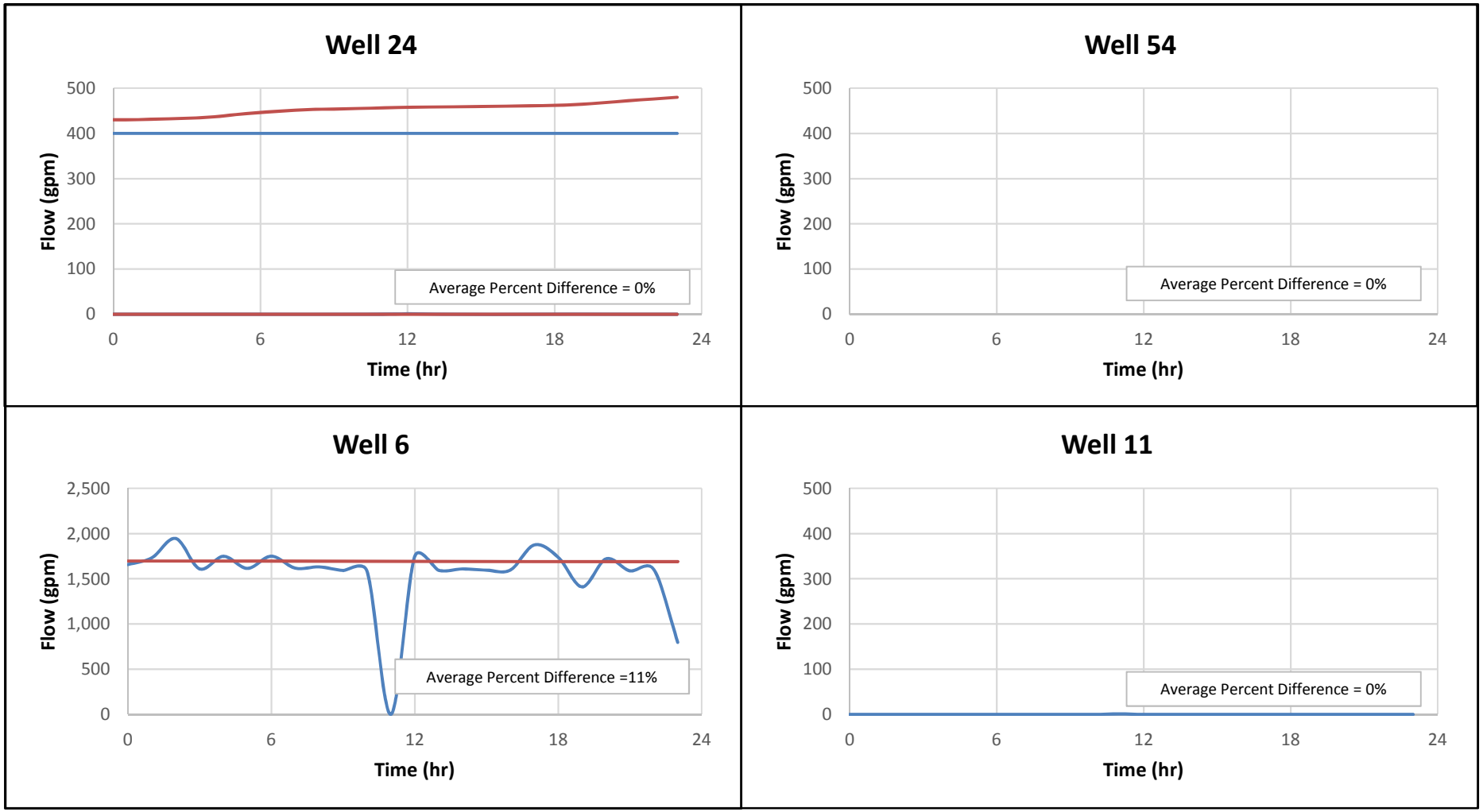
January 23, 2018

Figure 5
Well Calibration

Water Facilities Master Plan
West Valley Water District

West Valley Water District

AKEL ENGINEERING GROUP, INC.



LEGEND

SCADA (July 9, 2017)

Hydraulic Model

PRELIMINARY

Note: Graphs showing zero flow indicate pump did not operate during calibration period

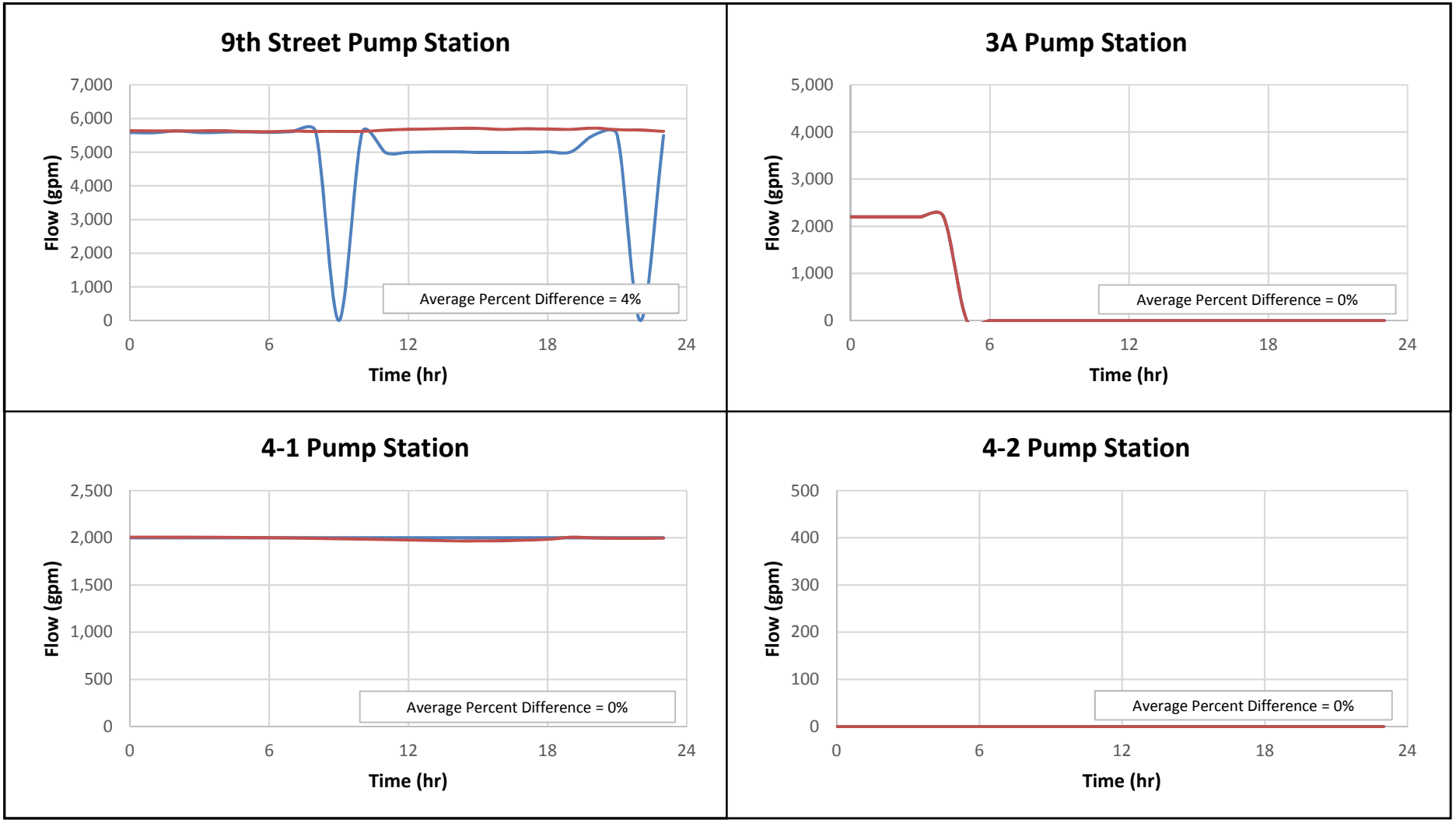
January 23, 2018

Figure 6
Well Calibration

Water Facilities Master Plan
West Valley Water District

West Valley Water District

AKEL ENGINEERING GROUP, INC.



LEGEND

SCADA (July 9, 2017)

Hydraulic Model

PRELIMINARY

Note: Graphs showing zero flow indicate pump did not operate during calibration period

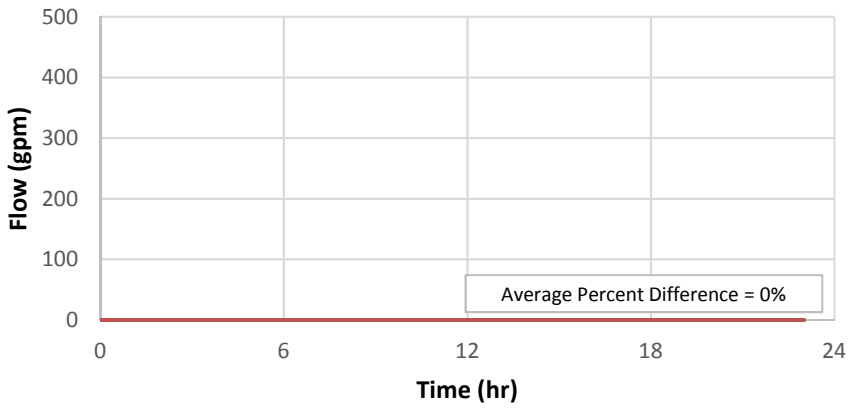
January 23, 2018

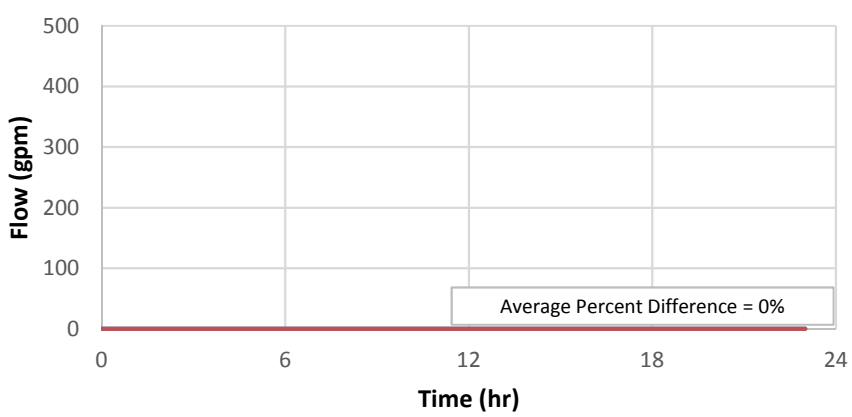
Figure 7
Booster Calibration

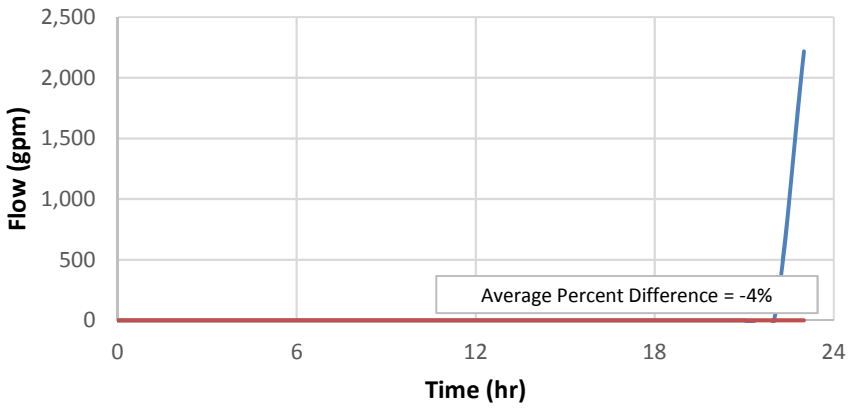
Water Facilities Master Plan

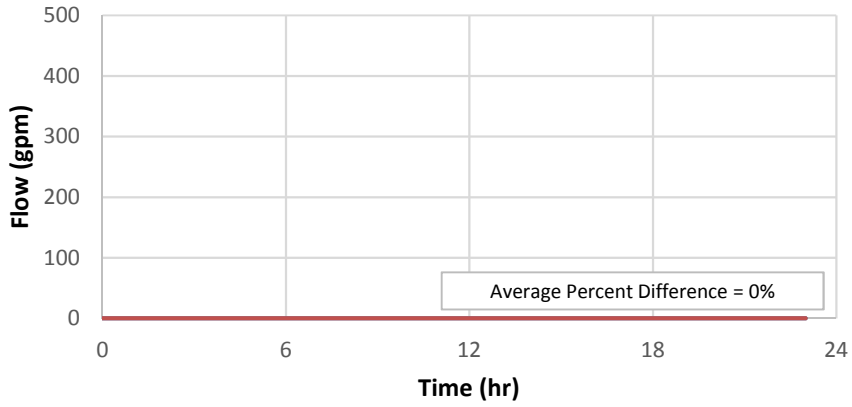
West Valley Water District

AKEL ENGINEERING GROUP, INC.









LEGEND

SCADA (July 9, 2017)

Hydraulic Model

PRELIMINARY

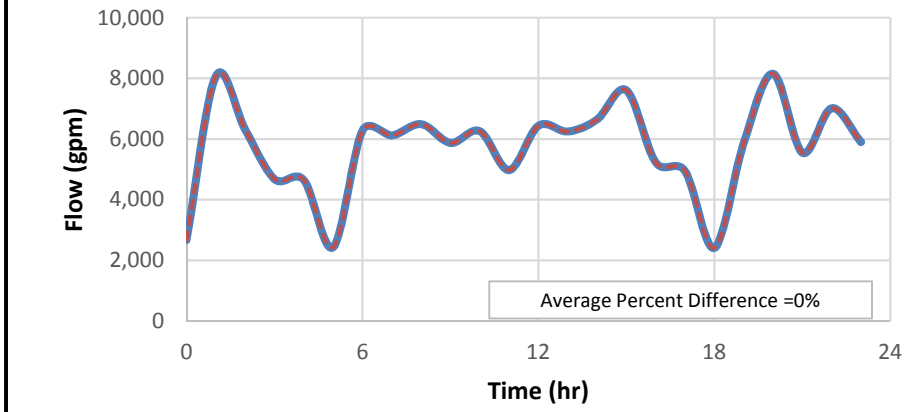
Note: Graphs showing zero flow indicate pump did not operate during calibration period

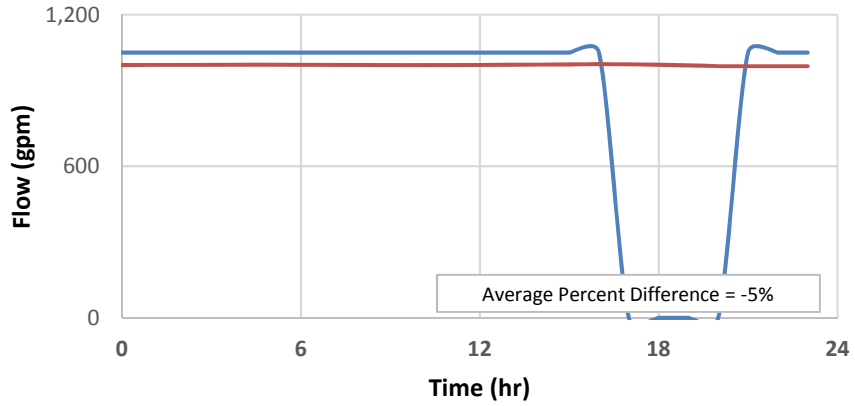
January 23, 2018

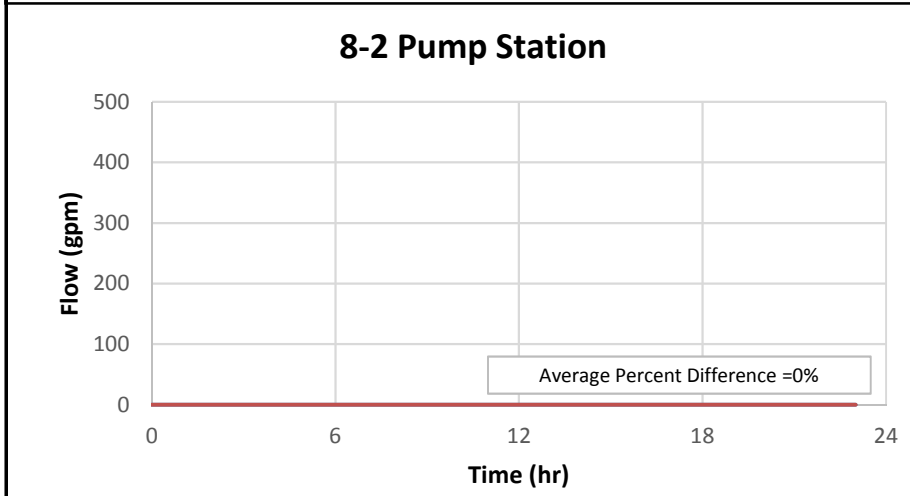
Figure 8
Booster Calibration

Water Facilities Master Plan
West Valley Water District

AKEL ENGINEERING GROUP, INC.







LEGEND

SCADA (July 9, 2017)

Hydraulic Model

PRELIMINARY

Note: Graphs showing zero flow indicate pump did not operate during calibration period

January 23, 2018

Figure 9
Booster Calibration

Water Facilities Master Plan

West Valley Water District

AKEL ENGINEERING GROUP, INC.