PREPARED BY **WATER SYSTEMS CONSULTING**

2021 CITY OF VICTORVILLE WATER MASTER PLAN UPDATE

Final

2021 Water Master Plan Update

for the

City of Victorville

Prepared Under the Responsible Charge of:

Laine Carlson

California R.C.E. No. 072424, Expires 6/30/22

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WATER SYSTEMS CONSULTING, INC.

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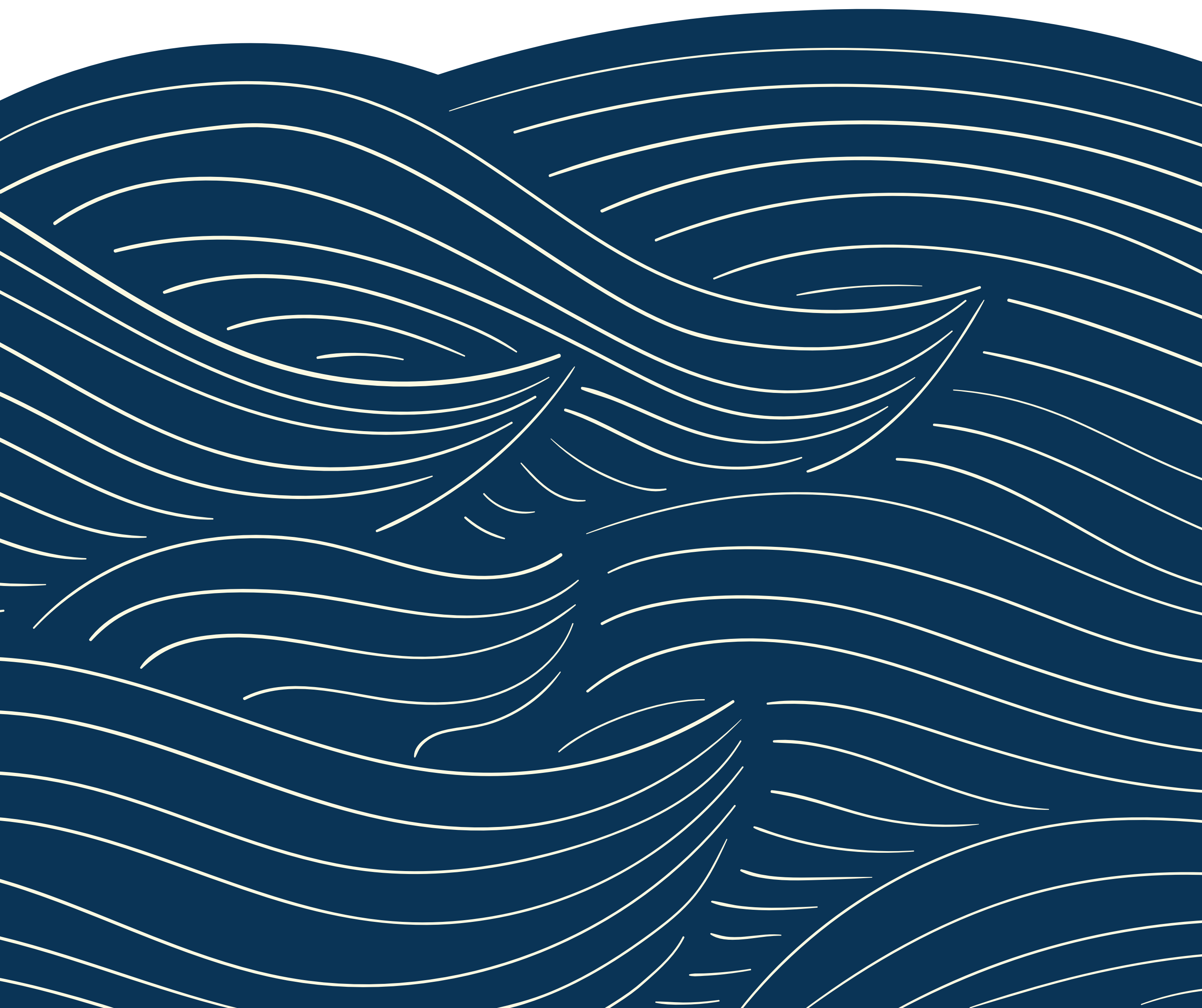
Glossary of Terms

°F	degrees Fahrenheit
~	approximately
[#]	reference material – see Chapter 10
2010 model	hydraulic model developed as a component of the 2010 Water Master Plan
2010 WMP	2010 Water Master Plan
2015 UWMP	2015 Urban Water Management Plan
2016 model	City's hydraulic model updated by IDModeling, Inc. in 2016
2016 SMP	2016 Sewer Master Plan
ADD	average day demand
AFY	Arce feet per year
AMI	Advanced Metering Infrastructure
AMR	Automatic Meter Reading
Areas	Improvement Areas
ATP	Arsenic Treatment Plant
AWWA	American Water Works Association
Basin	Mojave River Basin
BMWD	Baldy Mesa Water District
BPS	booster pump stations
CEC	California Energy Commission
cfs	cubic feet per second
C-factor	Hazen-Williams roughness coefficient
CII	commercial, industrial, and institutional
City	City of Victorville
CMLCS	cement mortar lined and coated steel
DDW	Division of Drinking Water
DIP	ductile iron pipe
District	Victorville Water District
DLR	Detection Limit for Reporting
DWR	California State Department of Water Resources
EO	Executive Order
EPA	U.S. Environmental Protection Agency

ETo	evapotranspiration
FPA	Free Production Allowance
FY	fiscal year
GAFB	George Air Force Base
GPCD	gallons per capita per day
gpm	gallons per minute
HDPP	High Desert Power Project
HGL	Hydraulic Grade Line
HSLA	High Strength Low Alloy
HWL	high water level
HWY	Highway
IDModeling	IDModeling, Inc
kW	kilo-Watt
MCL	maximum contaminant levels
MCC	motor control center
MDD	maximum day demands
MG	million gallons
MGD	million gallons per day
MOL	Maximum Operating Level
MWA	Mojave Water Agency
PHD	Peak Hour Demand
ppb	parts per billion
PRV	pressure reducing valve stations
psi	pounds per square inch
PVC	Polyvinyl Chloride
R3 or R^3	Regional Recharge and Recovery Project
R&R	rehabilitation and replacement
ROV	Remote Operated Vehicle
SBCFD	San Bernardino County Fire Department
SCADA	supervisory control and data acquisition
SCLA	Southern California Logistics Airport
SS	stainless steel
State Water Board	California State Water Resources Control Board

Suez	Suez Advanced Solutions
SWP	State Water Project
TAI	Tank Assessment Index
TDS	total dissolved solids
VCWD	Victorville County Water District
VVWD	Victor Valley Water District
VVWRA	Victor Valley Water Reclamation Authority
VWTF	Victorville Wastewater Treatment Facility
WMP	Water Master Plan
WSC	Water Systems Consulting, Inc.
WWTP(s)	wastewater treatment plant(s)
µg/L	micrograms per liter

1 INTRODUCTION



CHAPTER 1

Introduction

Victorville Water District (District) selected Water Systems Consulting, Inc. (WSC) to prepare an updated Water Master Plan (WMP) to guide the District's planned capital project expenditures and asset management in an efficient and cost-effective manner. The following section describes the purpose of this updated water master plan, planning documents referenced in the preparation of this plan, and background information about the District's system.

1.1 Purpose

The primary purposes of this WMP are to:

- Prepare for growth expected within the District's boundaries with an adaptive framework to respond to changing conditions
- Identify existing and future system deficiencies, including fire flow
- Establish rehabilitation and replacement needs to maintain aging infrastructure
- Develop a prioritized list of improvement projects, including anticipated costs, to address the deficiencies and maintain the condition and capacity of the distribution system
- Provide realistic estimates of revenue requirements to support budgeting and fee setting

IN THIS CHAPTER

1.2 Relationship to Other Documents

The following is a summary of other recent planning documents that were referenced during the preparation of the WMP.

- **2015 Urban Water Management Plan –** The 2015 Urban Water Management Plan (2015 UWMP) assesses the District's current and long term demands and sources of supply and complies with California State Department of Water Resources (DWR) criteria for water supply planning. The 2015 UWMP and the WMP are complementary documents, with the 2015 UWMP focusing on source of supply and the WMP focusing on storage and distribution of the water. As required by DWR, the 2015 UWMP will be updated in 2020 and every 5 years thereafter.
- **2010 Water Master Plan –** The District's most recent WMP was completed in 2010, referred to as the 2010 WMP. The 2010 WMP presents a 20-year capital improvement program totaling $160 million. Some of the recommended projects have been completed; however, a majority of the projects have not been built and may no longer be necessary due to reductions in per-capita water demand, changes in evaluation criteria, and slower than anticipated growth. Also, the 2010 WMP did not establish a comprehensive rehabilitation and replacement plan for existing facilities.
- **2016 Sewer Master Plan –** The Sewer Master Plan (2016 SMP) was completed in December 2016. The 2016 SMP contained a demand forecast methodology to determine projected sewer flows. In order to maintain consistency between the 2016 SMP and the WMP, the water demand factors calculated in the WMP used the flow projection methodology presented in the 2016 SMP.

1.3 Background

1.3.1 Location

The District is located in the southwest region of San Bernardino County, California. The District lies north of the San Bernardino Mountains in the Mojave Desert approximately 90 miles northeast of Los Angeles. The District's service area, shown in Figure 1-1, encompasses the entire City of Victorville (City) as well as areas within the City's sphere of influence. The District is bounded by the City of Adelanto to the west and the City of Hesperia to the south. The Town of Apple Valley, Spring Valley Lake, and the Mojave Narrows Regional Park lie to the east.

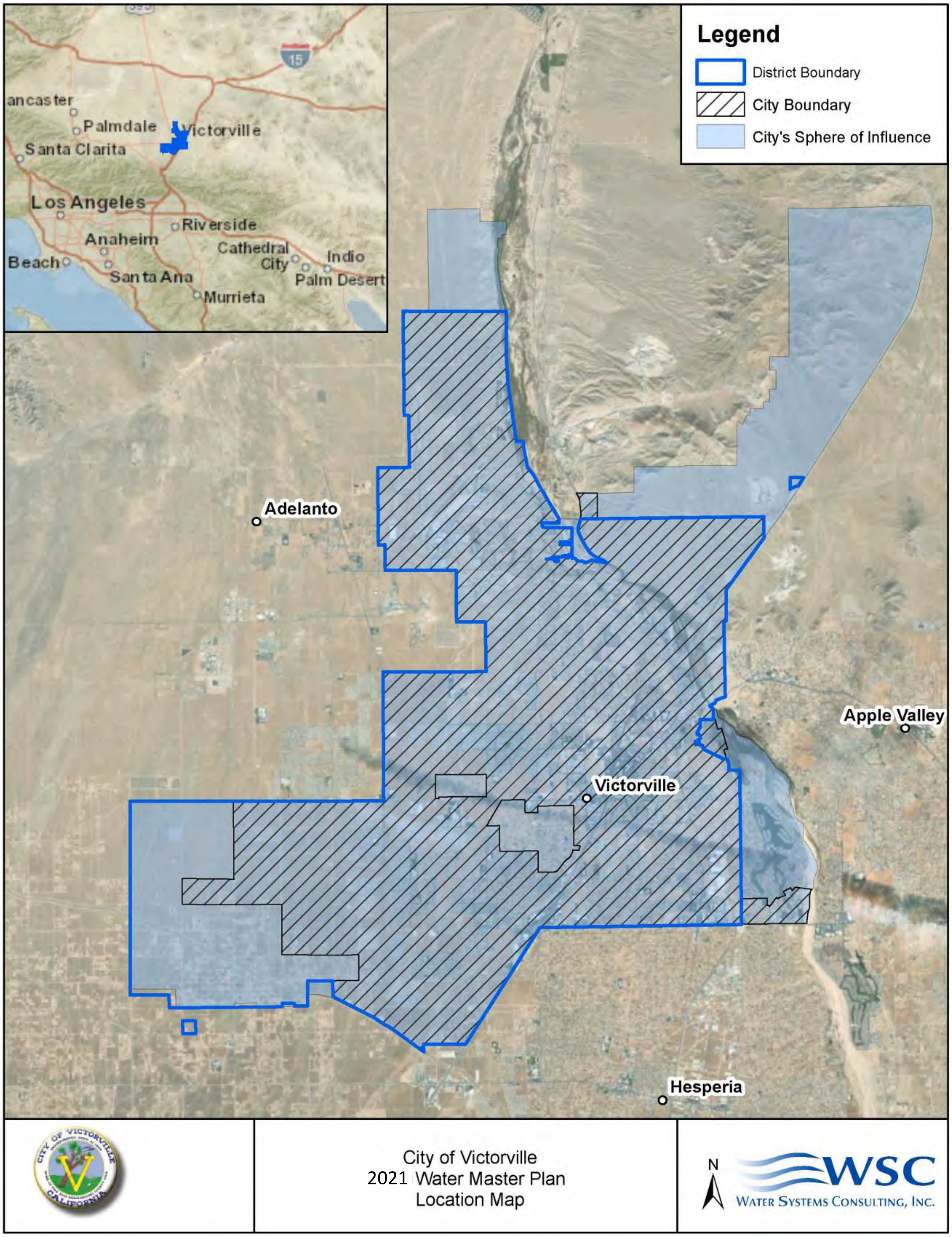


Figure 1-1. District Location Map

1.3.2 History of the District

In July of 2007, the former Victor Valley Water District (VVWD) and Baldy Mesa Water District (BMWD) were consolidated to form the District and became a subsidiary district to the City of Victorville, as ordered by Resolution No. 2977 of the Local Agency Formation Commission for the County of San Bernardino. The combined service areas of VVWD and BMWD form the District's current service area, which is approximately 85 square miles. At the time the District was created, it was formed as Improvement District No. 1 (former VVWD boundaries) and Improvement District No. 2 (former BMWD boundaries) and was required to establish and maintain separate accounts for the assets and liabilities of each improvement district. These improvement districts were known as ID1 and ID2; however, it is no longer necessary to maintain separate improvement districts from an operational perspective so this WMP does not distinguish these areas. Table 1-1 summarizes the history of the District.

Table 1-1. Timeline of the District

Year	Description
1931	Victorville County Water District (VCWD) was formed and provided service to the unincorporated area of Victorville and included 60 acres of land.
1936	VCWD purchased Appleton Company, a privately owned water facility, and began operations.
1941	George Air Force Base (GAFB) opened and brought new growth to the area.
Mid 1950s	VCWD annexed an additional 6,700 acres and purchased Pacific Water Company facilities.
1962	City of Victorville was incorporated.
1965	BMWD was created and served customers west of Victorville with water from VCWD.
1972	VCWD purchased a portion of Hesperia Water Company
1973	VCWD changed its name to Victor Valley County Water District
1989	Victor Valley County Water District dropped "County" from its name and became known as VVWD.
~1989	BMWD began to supply customers with its own groundwater.
1992	GAFB closed. The existing GAFB's water and wastewater systems along with a portion of the groundwater production capacity were acquired by the City.
1995	Former GAFB facility began operation as Southern California Logistics Airport (SCLA).
July 2007	VVWD and BMWD were consolidated to form the District and became a subsidiary district of the City.

1.3.3 Climate

The District's climate is characterized by warm summers and cool winters. Table 1-2 presents average climate data for the service area, including temperature, rainfall and reference evapotranspiration (ETo). As shown in Table 1-2 the warmest month of the year is July with an average temperature of 80 degrees Fahrenheit (°F), while the coldest months of the year are December and January with an average temperature of 44°F.

The annual average precipitation at the District is about 6 inches. As shown in Table 1-2, the majority of the rainfall occurs in the months of November through March. January and February are the wettest months with an average rainfall of approximately 1 inch.

Table 1-2. Historical Climate Data

Month	Average Temperature, °F[1]	Average Precipitation, in[1]	Average Standard ETo, in[2]
January	44.4	0.95	2.02
February	47.8	1.05	3.51
March	52.0	0.80	5.16
April	58.0	0.36	6.55
May	65.2	0.13	7.65
June	73.2	0.04	8.75
July	80.0	0.14	8.68
August	78.8	0.21	9.27
September	72.9	0.23	6.73
October	62.4	0.32	4.26
November	51.0	0.50	2.90
December	44.4	0.79	2.16

1. NOAA weather station 049325 in Victorville; data from 1917 through 2016; http://wrcc.dri.edu

2. CIMIS weather station 117 in Victorville; http://wwwcimis.water.ca.gov/

1.3.4 Population

The population in the District's service area was estimated to be 128,005 in 2015 [1]. Per the 2015 UWMP, the average annual population growth for the District service area through 2040 is estimated to be 1.9%. The estimated population for 2040 is 204,986. Population projections were prepared by Beacon Economics under contract with Mojave Water Agency (MWA) for the 2015 UWMP. Historical data used in the forecast of the incorporated cities were obtained from the California Department of Finance, which makes estimates available from 1970 forward on an annual basis. Based on this data, Beacon Economics created an econometric time series model to capture the historical correlations with countywide population growth. Future population growth was then estimated using these historic correlations and a forecast of countywide population growth.

The historical and projected annual population growth rates are shown in Table 1-3. The historical, current, and projected service area populations are shown in Table 1-4 and Figure 1-2. Additional details on the population projection methodology can be found in the 2015 UWMP.

Table 1-3. Historical and Projected Annual Growth Rate

	2005-2010	2010-2015	2015-2020	2021-2025	2026-2030	2031-2035	2036-2040
Growth Rates	5.9%	1.0%	1.7%	2.3%	2.0%	1.9%	1.6%

Table 1-4. Historical, Current and Projected Population

	2000	2005	2010	2015	2020	2025	2030	2035	2040
Population Served	69,095	91,832	122,051	128,005	139,151	155,657	172,143	188,896	204,986

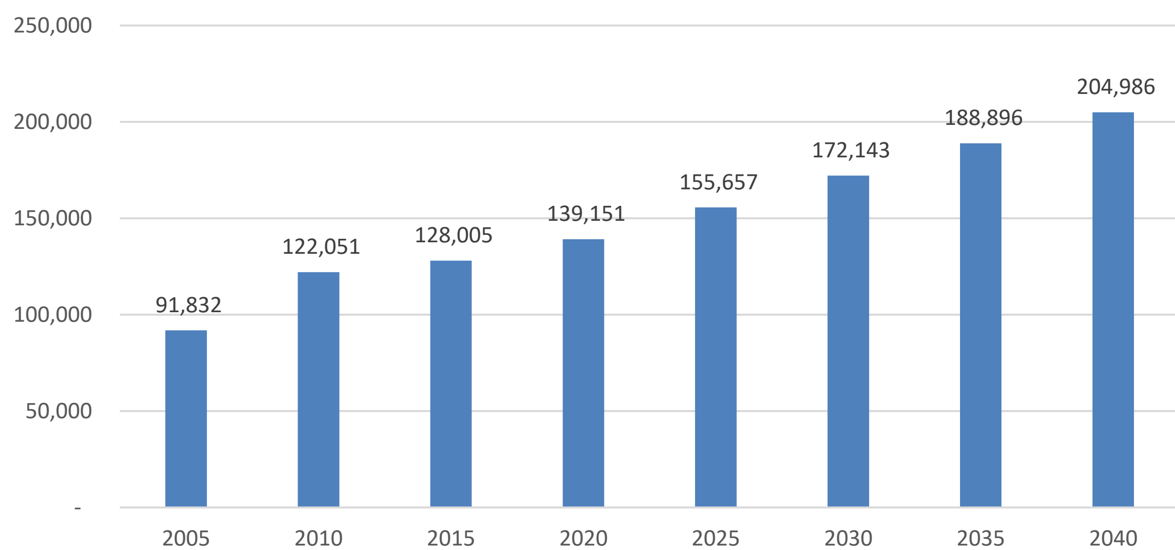
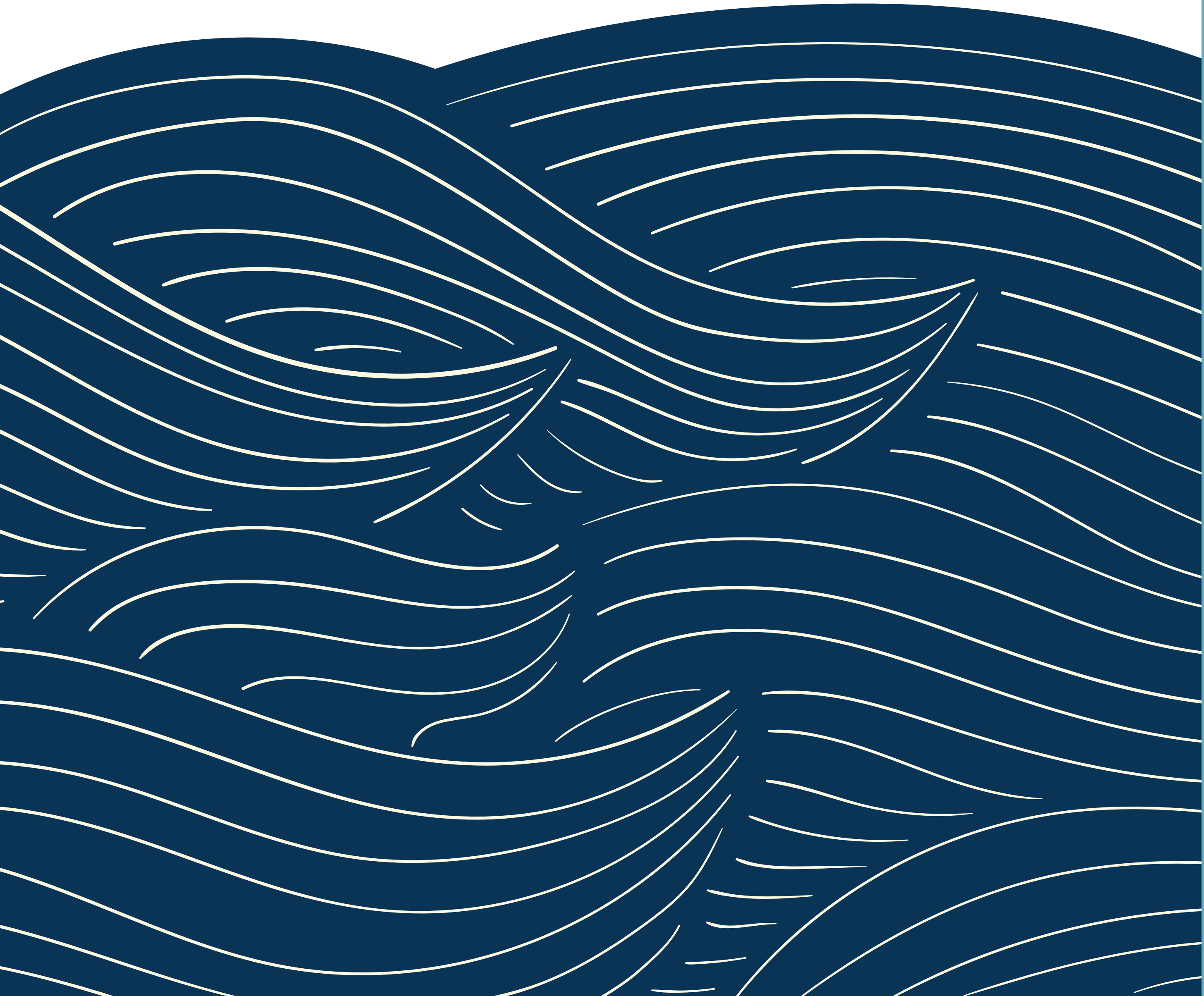


Figure 1-2. Historical, Current and Projected Population

2 EXISTING WATER SYSTEM FACILITIES



CHAPTER 2

Existing Water System Facilities

The following chapter describes the District's existing pressure zones, water supply sources, water treatment methods, and major infrastructure including booster pump stations, pressure reducing valve stations, and transmission and distribution pipelines.

2.1 Overview

The District owns and operates a potable water system that includes approximately 700 miles of pipeline, 34 active groundwater wells, four pump stations, 24 active storage reservoirs and 25 active pressure reducing valve stations (PRV) within an 85-square mile service area. The District's distribution system includes eight pressure zones and three sub-zones that provide water at suitable pressures across the range of elevations in the service area. The Southern California Logistics Airport (SCLA) area, at the former GAFB, is part of Zone 3170; however, this area is analyzed separately since most of the existing pipes' diameters and exact locations are unknown and the large industrial and commercial land uses generate unique demands. The District obtains local groundwater supplies from their own wells and from MWA. The District also has agreements and interconnections with neighboring agencies for emergency water if needed and available. The following sections describe the District's facilities in more detail. Facilities that formerly served ID1 begin with a 1 and facilities that formerly serve ID2 begin with a 2, except where noted.

IN THIS CHAPTER

2.2 Pressure Zones

The District's distribution system contains eight pressure zones and three subzones and serves elevations ranging from 2,650 feet to 3,660 feet, as summarized in Table 2-1, and referred to as zones or subzones throughout this document.

Table 2-1. Pressure Zone Summary

<table>
<tr><th>Zone Name [1]</th><th>Subzone</th><th>Elevations Served for Current Zones</th><th>Elevations Served for Future Zones [2]</th></tr>
<tr><td>2890</td><td></td><td>2,650-2,830</td><td>2,650-2,830</td></tr>
<tr><td>2906</td><td></td><td>2,675-2,800</td><td>2,675-2,800</td></tr>
<tr><td rowspan="3">3065</td><td></td><td>2,760-3,000</td><td>2,760-2,965</td></tr>
<tr><td>3065A</td><td>2,790-2,880</td><td>-</td></tr>
<tr><td>3065B</td><td>2,780-2,890</td><td>-</td></tr>
<tr><td rowspan="2">3170</td><td></td><td>2,770-3,115</td><td>2,770-3,115</td></tr>
<tr><td>3170A</td><td>2,820-2,900</td><td>-</td></tr>
<tr><td>3290</td><td></td><td>2,940-3,230</td><td>2,940-3,205</td></tr>
<tr><td>3485</td><td></td><td>3,150-3,390</td><td>3,150-3,390</td></tr>
<tr><td>3675</td><td></td><td>3,340-3,490</td><td>3,340-3,530</td></tr>
<tr><td>3820</td><td></td><td>3,480-3,665</td><td>3,480-3,665</td></tr>
</table>

1. Zone Name is taken from mid-level reservoir elevation in feet. Zone name does not represent zone Hydraulic Grade Line (HGL) elevation, as zone HGL is calculated from high water level (HWL) of reservoirs.

2. Portions of some current zones are planned to be rezoned in the future to meet the District's service pressure criteria; see Section 6.7.2 for more information.

Pressure Zones 2890, 2906, 3065, 3170 and 3290 were formerly part of VVWD and Pressure Zones 3485, 3675 and 3820 were formerly part of BMWD. The SCLA distribution system is part of Zone 3170. Portions of the distribution system inherited from GAFB are currently operated at a lower HGL than the 3170 zone to protect older existing pipes that were previously served by Zone 3065. These lower pressures are served through seven PRVs, effectively creating a subzone of Zone 3170 (Zone 3170A). As older facilities from GAFB are replaced and new customers are added, it is anticipated that the size of the subzone will be decreased.

Zone 3065 contains two subzones (Zone 3065A and 3065B) with reduced pressure in order to protect the small, steel pipes from the higher pressure of Zone 3065. Once the small, steel pipes located within the subzones are replaced, Zone 3065A and 3065B can be rezoned to Zone 3065.

2.3 Supply Sources

The District currently pumps potable water supplies from groundwater in the Mojave River Basin (Basin) and purchases potable water from MWA's Regional Recharge and Recovery Project (R3), when available. Recycled water is currently used at SCLA to offset some potable water demands. This section provides a brief overview of the District's water supplies; additional information about the supplies and long-term water supply reliability can be found in the 2015 UWMP.

2.3.1 Groundwater

As of 2021, the District has 34 active groundwater wells within the service area that pump groundwater from the Basin which lies beneath the Victor Valley. The Basin is adjudicated and MWA serves as the Watermaster. Per the Mojave Basin Area Judgment, producers in the Mojave Basin Area are allocated a Free Production Allowance (FPA). FPA can be reduced by the court via a universal rampdown for all producers in a particular subbasin. VWD lies within the Alto subbasin, which is currently ramped down to 55% of the FPA originally established by the court for municipal and industrial users. Producers may pump more than their FPA, provided they pay for Replacement Water through the Watermaster for any amount of over production. Funds collected for Replacement Water are then used by MWA to purchase imported water supplies when available and recharge them into the Basin for use in dry years and as a basin management tool to help keep it in balance.

Replacement Water obligations can be reduced by purchasing additional water rights, purchasing imported water from MWA, or leasing unused groundwater rights on an annual basis from other water rights holders. The District's total adjusted FPA in water year 2019-2020 2015 was 15,681 AF and the District pumped 24,138 AF, which resulted in a replacement obligation of 8,457 AF. The District will continue aggressive water conservation efforts and increased use of recycled water to offset potable water demand in an effort to balance supplies and demands into the future. Pumping beyond the FPA is anticipated to continue as needed to meet water demands, and will require the District to continue to pay for Replacement Water to support additional water supply projects being implemented by MWA and/or purchase of water rights from other agencies in the subbasin.

As stated above, the District maintain 34 active wells, with the capacity to produce a total of approximately 57.3 million gallons per day (MGD) or 39,770 gallons per minute (gpm). These wells range in production capacity with the largest well capable of producing up to 4,600 gpm. Well ages range from 9 to 67 years and all wells include chlorine addition for disinfection.

In addition to the active groundwater wells, the District has six inactive wells, which include four wells that have been drilled but not yet equipped (status shown as Future in Table 2-2) and two wells that have been inactivated due to water quality problems (status shown as Inactive in Table 2-2). The locations of the District's wells are presented in Figure 2-1. The well characteristics and details are summarized in Table 2-2. Wells which have been previously abandoned or destroyed prior to the development of this WMP are not included in the summary table or figure.

In addition to the wells presented in Table 2-2, some additional groundwater wells are located within the District's service area, east of SCLA near the Mojave River. GAFB originally obtained water from these groundwater wells. These wells are currently used to supply water for the City of Adelanto and are not connected to the SCLA distribution system.

2.3.2 Purchased Water

The District currently purchases water from MWA through the R^3 Project when it is available. Through R^3, MWA delivers State Water Project (SWP) water to recharge sites located along the Mojave River in Hesperia and southern Apple Valley. MWA recovers the recharged water at wells downstream and delivers it through pipelines directly to retail water agencies. This project provides an alternate source of supply that allows agencies to reduce pumping and maintain groundwater water levels around their wells. The District began receiving water from R^3 when Phase 1 of the project was completed in 2013. The District has a contract to purchase up to 6,800 AFY or 11.43 cubic feet per second (cfs), when available. The District can receive R^3 water at two delivery points, called Turnout 3 and Turnout 6, shown in Figure 2-1. A third delivery point, Turnout 5, is planned to be constructed in 2021-2022. Turnout 5 will allow the District to receive water into Zones 3290 or 3485 at and will provide a new source of water to blend with the District's wells serving Zones 3485, 3675 and 3820, which will give the District more flexibility on which wells are operated and more reliability to this part of the system in the event that a well if offline or water quality changes.

Water supply from R^3 is interruptible because it depends on the amount of SWP available and other operational constraints. The District intends to continue maximizing purchases of water from R^3 when available; however, since this is an interruptible source of supply, the District does not rely on this source to meet its demands. For the purposes of this WMP and the 2015 UWMP, it is assumed that the District will meet all current and future potable demands through groundwater and will need to maintain adequate well production capacity to meet that need.

2.3.3 Recycled Water

The District has access to recycled water supplies from the District's Industrial Wastewater Treatment Plant (IWTP), which is located north of SCLA on Helendale Road in Victorville, and the Victor Valley Water Reclamation Authority (VVWRA) facility on Shay Road in Victorville. The District currently supplies recycled water to the High Desert Power Project (HDPP) for cooling water and to two City parks facilities within SCLA for irrigation. The District plans to expand the recycled water distribution system at SCLA to serve additional customers, offsetting some potable water supply requirements. An SCLA Recycled Water Master Plan is being prepared concurrently and will provide additional detail on the District's current and planned recycled water supplies and facilities.

2.3.4 Future Supplies

The District is participating in MWA projects to implement groundwater recharge though surface spreading in order to further increase the water supply available from the Mojave Groundwater Basin. The MWA projects include:

- R^3 Phase 2: Phase 2 of the R^3 project is expected to be completed in increments on an as-needed basis and could increase the project's total water supply up to 40,000 AFY. Phase 2 will include construction of additional wells and groundwater recharge facilities by MWA. All of the District's infrastructure is built to accommodate the additional supply from Phase 2. Even though the quantity and reliability of the supply is expected to increase upon completion of Phase 2, groundwater will continue to be used to meet future demands since supply from the R^3 project is not guaranteed.
- Oro Grande Wash Recharge Project: This project is a regional supply project that will deliver SWP water to recharge basins in the Oro Grande Wash, which are west of I-15 and south of Bear Valley Road in Victorville. This project has two phases and is expected to recharge a total of 8,000 AFY to support the groundwater in the Alto Subarea of the Mojave Groundwater Basin. This project will benefit the wells that are in close proximity to the project, but it will not directly add to the District's water supply; therefore, it is not identified as a source for future supply. The recharge basins are owned by San Bernardino County Flood Control District (SBCFCD) and jointly operated for flood control and groundwater recharge in partnership with MWA. SBCFCD detains stormwater runoff and MWA also provides supplemental SWP water for recharge.

2.3.5 Emergency Interconnections

The District currently has four emergency interconnections with neighboring water agencies. Although these connections have been historically used only to supply water to neighboring agencies; the District can also receive water from these connections.

- Liberty Utilities: Apple Valley
  - Interconnection to Zone 2906; located at the intersection of Dante Street and Stoddard Wells Road.
- City of Adelanto
  - Interconnection to SCLA area; located at the intersection of Air Expressway and Adelanto Road.
  - Interconnection to Zone 3485; located north of the intersection of Duncan Road and Bellflower Street.
- Phelan Pinon Hills Community Services District (PPHCSD)
  - Interconnection to Zone 3820 through the PPHCSD booster station at the Reservoir 206 and 210 site.

2.3.6 High Desert Power Project Supplies

The District also operates imported water and groundwater supply facilities on behalf of High Desert Power Project (HDPP), a power plant located within SCLA. The District has a connection from the MWA Mojave River Pipeline that is used to deliver raw State Water Project (SWP) to HDPP to use for cooling water. HDPP also stores water in the Mojave Groundwater Basin and uses four wells to extract groundwater for cooling water when SWP supply is not available to HDPP. HDPP has their own water rights and storage account in the groundwater basin so HDPP's imported water and groundwater supplies are not supplies of the District.

The District operates the pipeline that provides SWP to HDPP as well as the wells and pipelines that provide groundwater as a backup supply. The District is reimbursed by HDPP for all costs related to operation and maintenance of these facilities. The HDPP facilities are a separate system, not connected to the District's potable water system, and are not evaluated in this Water Master Plan.

Table 2-2. Groundwater Well Summary

Well No.	Location	Pressure Zone	Status	Year Drilled	Ground Elevation, ft	Pump Test Year[1]	Motor Size, hp	Enclosure	Water Quality Contaminants Requiring Treatment	Equipped with Pump to Waste?	TDH, ft	Well Capacity, gpm
102	15445 8th Street	2890	Inactive	1937	2,753	1993	40	None	-	-	237	548
105	Mojave & Village	3065	Destroyed	1954	2,894	2008	75	None	-	-	393	478
109	Palmdale & Amargosa	3290	Active	1950	2,985	2016	200	None	None	No	604	838
116	13777 Hesperia Rd.	3065	Active	1983	2,880	2016	150	None	None	Yes	394	863
118	Dante St & Stoddard Wells	2906	Active	1983	2,730	2016	60	None	None	No	289	737
119	Abbey Ln. & Stoddard Wells	2906	Active	1984	2,710	2016	60	None	None	No	270	552
120	16955 Jasmine	3170	Active	1986	3,000	2016	300	None	None	No	472	1,835
121[2]	16144 Torrance	3065	Inactive	1989	2,860	2008	75	None	-	-	452	462
122	12326 1st Ave.	3170	Active	1989	3,000	2016	300	None	None	No	458	1,789
123[5]	14671 Maricopa	3290	Active	1983	3,060	2016	200	None	Arsenic	No	612	890
126[5]	14945 Luna Rd.	3290	Active	1985	3,110	2016	200	None	None	No	593	857
127	15379 Pamela Ln.	3065	Active	1986	2,930	2013	150	None	None	Yes	426	915
128[5]	13199 Pacoima	3290	Active	1987	3,105	2010	200	None	Arsenic Chromium VI	No	614	609
129[5]	11734 Amethyst	3485	Active	1992	3,265	2010	200	None	Arsenic	Yes	673	800
130	16038 Cazadero Rd.	3065	Active	1993	2,940	2016	200	None	None	Yes	450	857
131[5]	13637 El Rio & Dos Palmas	3290	Active	1992	3,020	2012	400	None	Arsenic Chromium VI	Yes	608	1,357
132	13176 Seneca & Cobalt	3065	Active	1993	3,040	2016	150	None	None	No	400	781
133	16634 Avalon	2890	Active	1993	2,885	2016	150	None	None	No	202	994
134[5]	13869 Cobalt & Palmdale	3290	Active	1993	3,110	2016	250	None	Arsenic	Yes	621	709
135	11 St n/o Verde St.	2890	Active	1997	2,874	2016	75	None	None	No	245	660
136	Chula Vista St.	3065	Active	1999	2,925	2013	200	None	None	No	410	381
137[5]	Dos Palmas & El Evado	3290	Active	1998	3,050	2013	200	Building	Arsenic	Yes	648	1,075
138[5]	Dos Palmas & Amethyst	3290	Active	2003	3,106	2016	200	Building	Arsenic	Yes	641	778
139[5]	Balsam & Nisqualli	3065	Active	2003	3,053	2012	500	Building	Arsenic	Yes	466	2,944
140	11546 Pinon & Sycamore	3170	Active	2003	3,151	2016	500	Building	None	Yes	489	3,266
141[5]	Mesa & Desert Knoll	3065	Active	2003	2,941	2016	300	Building	Arsenic	Yes	428	1,692
142	13258 Del Gado & Luna	3290	Future	2005	3,070	2006	250	-	-	-	700	1,000[4]
143[5]	Balsam & Nisqualli	3065	Active	2008	2,930	2016	350	Building	Arsenic	Yes	403	1,149
144[3,5]	Del Gado & Peral	3290	Active	2,006	2,930	2016	1,250	Building	Arsenic	Yes	603	4,600
145	Nutro & Enterprise	3170	Future	2006	2,890	2006	-	-	-	-	-	2,000[4]
146	Mojave Drive & Ferndale Rd	3065	Future	2005	2,923	2006	-	-	-	-	-	650[4]
147	Avalon St. & A St.	2890	Future	2007	2,818	2006	-	-	-	-	-	1,000[4]

Well No.	Location	Pressure Zone	Status	Year Drilled	Ground Elevation, ft	Pump Test Year[1]	Motor Size, hp	Enclosure	Water Quality Contaminants Requiring Treatment	Equipped with Pump to Waste?	TDH, ft	Well Capacity, gpm
201[6]	13875 Bear Valley Rd	3485	Active	1986	3,210	2016	300	Building	None	Yes	815	903
203[5]	13490 Northstar Ave	3485	Active	1987	3,205	2016	300	Building	Arsenic	Yes	872	864
204[5]	14114 Sycamore St	3485	Active	1994	3,230	2016	300	None	Arsenic Chromium VI	Yes	770	997
205[5]	12292 Cobalt Rd	3485	Active	1989	3,220	2016	300	None	Arsenic	Yes	828	916
206[6]	11783 Amethyst Rd	3485	Active	1988	3,250	2016	25	None	None	Yes	785	876
207[5]	13123 La Mesa Dr	3485	Active	1989	3,200	2016	150	Building	Arsenic	Yes	821	448
208[5]	14086 Sierra Rd	3485	Active	1997	3,220	2016	300	Building	Arsenic Chromium VI	Yes	776	858
209[5]	Armargosa Rd S/of Bear Valley Rd	3485	Active	2003	3,200	2016	250	Building	Arsenic	Yes	854	616
210[9]	-	-	Monitoring	2006	-	-	-	Building	-	-	-	50
212[5]	Sierra Rd & Boxwood	3485	Active	2008	3,209	2016	400	None	Arsenic	Yes	811	1,363
BT[7,8]	Greentree Golf Course on Burning Tree Drive	Greentree Golf Course	Irrigation Only	Unknown	2,970	N/A	-	Building	-	Yes	-	-
CB[7,8]	Greentree Golf Course on Camelback Drive	Greentree Golf Course	Irrigation Only	Unknown	2,910	N/A	-	Building	-	Yes	-	-
GT[7,8]	Grady Trammel Park	Grady Trammel Park	Irrigation Only	Unknown	2,740	N/A	-	-	-	-	-	-
											Active Drinking Water Well Capacity	**39,769**

1. Pump Tests are from 2010 WMP or performed in-house by the District in the year shown (2012, 2013, 2016).
2. Taken offline in 2014 due to levels of Chromium-6 approaching the new MCL established in 2014. May be returned to service if Chromium-6 levels decline.
3. Equipped with a variable frequency drive (VFD); Well 144 is operated at a range of flows depending on operational needs but has a maximum capacity of 4,600 gpm.
4. Preliminary estimate from 2010 WMP. Well is drilled but not equipped.
5. Flow from well is treated prior to introducing flow to potable system, either by treatment or blending. See Table 2-3 for a summary of which treatment facility each well flows to.
6. Flow from well is pumped to the Avenal Blending Line to contribute to blending for other wells requiring treatment.
7. BT – Burning Tree Well; CB – Camel Back Well; GT – Grady Trammel Park Well. Well construction and performance data for these wells is not available at this time.
8. Irrigation well only and is not permitted for drinking water.
9. Well is used for monitoring only and is not equipped.

2.4 Water Treatment

2.4.1 Water Quality

The Mojave River's groundwater basins contain numerous areas with water quality issues, and many studies have characterized groundwater quality in the Basin. Despite local groundwater quality degradation in Barstow and variability elsewhere, these studies generally confirmed the suitability of groundwater for beneficial uses in the region. Key contaminants found in areas of the Basin include arsenic, nitrates, iron, manganese, Chromium-6, and total dissolved solids (TDS). Some of these are naturally occurring in desert environments while others are associated with human activities. Measurements in excess of drinking water standards have been found for some of these constituents within the Basin. Groundwater in these areas may have to be treated prior to consumption.

Currently, approximately 44% of the District's groundwater wells (15 of the 34 active wells) meet state and federal drinking water standards without treatment. These wells receive wellhead chlorination for disinfection and pump directly into the distribution system or into storage tanks. The remaining 56% of the District's wells (19 of the 34 active wells) have levels of arsenic or Chromium-6 detected near or above the maximum contaminant levels (MCL) and require treatment.

2.4.2 Arsenic Treatment

Arsenic is a naturally occurring element in groundwater. Ingestion of arsenic can result in short term discomfort and long-term health effects such as skin discoloration, circulatory system impacts and increased cancer risks, and in high concentrations, arsenic consumption can lead to death. In 2006, the U.S. Environmental Protection Agency (EPA) reduced the allowable MCL of arsenic from 50 micrograms per liter (µg/L) or parts per billion (ppb) to 10 ppb. That new requirement affected several existing District wells, and the District had to implement new treatment and blending operations to meet the MCL. Arsenic levels in the District's wells fluctuate over time; the arsenic levels detected in the District's wells ranged from 0 ppb to 19.3 ppb in 2016 [2]. For wells which exceed the MCL, the District provides physical treatment and blending to reduce the levels below the MCL prior to distributing the water to the customers.

The District operates three arsenic treatment plants (ATP) and an arsenic and chromium-6 blending pipeline (known as the Avenal Blending Line). The Balsam and El Evado ATPs are coagulation/filtration treatment plants and the La Mesa ATP is an ion exchange plant. The Avenal Blending Line is located in Zone 3485 and is used to blend water from all but three wells in Zone 3485 to produce a blended water quality that meets the drinking water MCL prior to entering the distribution system for Zones 3485, 3675 and 3820. Treatment and blending facilities are summarized in Table 2-3.

Table 2-3. Treatment Facilities

Arsenic Treatment Facilities	Zone	Wells Treated by Facility	Capacity (MGD)	Type of Treatment
Balsam ATP	3065	139, 143	9	Coagulation/filtration
El Evado ATP(1)	3290	123, 128, 131, 134, 137, 138, 144	13	Coagulation/filtration
La Mesa ATP	3485	203, 205, 207	3	Ion exchange
Avenal Blending Line	3485	129, 201, 204, 206, 208, 209, 212	~14	Blending

1. El Evado ATP has a backup generator for controls.

2.4.3 Chromium-6 Treatment

In 2014, the California State Water Resources Control Board (State Water Board) established a specific MCL for hexavalent chromium (also referred to as chromium-6) at 10 ppb. Previously, chromium-6 in California has been regulated under the 50-ppb primary drinking water standard for total chromium. On May 31, 2017, the Superior Court of Sacramento County issued a judgment invalidating the chromium-6 MCL for drinking water and ordering the State Water Board to adopt a new MCL for hexavalent chromium that adequately considers the economic feasibility of complying with the MCL. A new MCL has not yet been adopted but may in 2021. See Section 8.2 for additional information and potential impacts to the District's operation.

Although the 10 ppb MCL has been invalidated, it is possible that it will be reset so this section describes the impact of that standard. Several of the District's wells were affected by the 10 ppb requirement and one well (Well 121) has been temporarily taken out of service because it does not meet the 10 ppb MCL. The District does not currently intend to install blending or treatment facilities for these wells because the total production capacity is sufficient to meet demands with these wells offline so the additional cost of treatment is not warranted. The District will continue to monitor the water quality of these wells and may be able to restore them to service if chromium-6 levels decline or if blending or treatment is added. Additionally, several wells in ID2, which pump into the Avenal Blending Line, have levels of chromium-6 that exceed the MCL. The District has adapted the operation of the Avenal Blending Pipeline such that blended water quality meets the 10 ppb MCL for both arsenic and chromium-6.

2.5 Storage

The District has 24 welded steel cylindrical storage reservoirs that provide operational, emergency and fire flow storage for the District's distribution system. The total active storage capacity for the District is approximately 67 million gallons (MG). Table 2-4 details the storage reservoir characteristics for each zone. Reservoirs located in Zones 2890, 2906, 3065, 3170 and 3290 have been retrofitted with flex couplings and/or motorized butterfly valves to help protect the reservoir against seismic activity. The existing motorized butterfly valves are not currently connected to SCADA. The reservoir locations are presented in Figure 2-1.

Reservoir 201, a 2-MG reservoir located along I-15, was being used to store untreated water for the Avenal ATP and was disconnected from the distribution system as of 2010. However, the Avenal ATP is no longer in use because the District has been able to maintain compliance through use of the Avenal Blending Line. Therefore, Reservoir 201 may be reconnected to the distribution system in the future to increase available storage capacity.

Reservoir 211, a located at Le Panto Road and Fremontia Road, is currently being leased to MWA as part of the R^3 distribution system. MWA controls the operation of the tank; however, the tank is still hydraulically connected to the District's distribution system through Turnout 6 on the R^3 system. The overflow pipe in Reservoir 211 was been lowered to provide increased seismic safety, reducing the storage capacity from 5.8 MG to the current 5.1 MG. The District is working with MWA to coordinate returning this tank to the District's system once MWA constructs a new tank for R^3 use. The timing of this transition has not been confirmed, but MWA is currently working on plans to fund and/or seek grant opportunities to construct a new tank for R^3 use.

Two additional small reservoirs (203 and 204) along Monte Vista Road are currently inactive due to lining issues; they are small tanks and the District does not currently have plans to restore them to service.

Table 2-4. Storage Summary

Reservoir Number	Location	Year Constructed	Base Elevation (ft)	Diameter (ft)	Depth (ft)	HWL (ft)	Pressure Zone	Capacity (MG)
102[3]	11 St n/of Verde St.	1965	2874	95	32	2,906	2890	1.5
104[3]	16634 Avalon	1959	2874	95	32	2,906	2890	1.5
105[3]	Dos Palmas/El Evado	1960	3049	104	32	3,081	3065	2.0
107[3]	11734 Amethyst Rd.	1971	3269	105	40	3,309	3290	2.5
108[3]	11734 Amethyst Rd.	1982	3269	104	40	3,309	3290	2.5
109[3]	e/of Interstate 15	1983	2894	60	24	2,918	2906	0.5
110[3]	Sycamore & Balsam	1987	3150	110	39	3,189	3170	2.5
111[3]	Sycamore & Balsam	1988	3150	104	39	3,189	3170	2.5
112[3]	11734 Amethyst Rd.	1988	3268	150	38	3,306	3290	5.0
113[3]	Dos Palmas/El Evado	1989	3050	129	31	3,081	3065	3.0
114[3]	11734 Amethyst Rd.	1989	3268	150	38	3,306	3290	5.0
115[3]	Dos Palmas/El Evado	1990	3050	165	31	3,081	3065	5.0
116[3]	Sycamore & Balsam	1991	3150	150	39	3,189	3170	5.0
117[3]	Sycamore & Balsam	1991	3150	104	39	3,189	3170	2.5
118[3]	Dos Palmas/El Evado	1991	3050	129	31	3,081	3065	3.0
119[3]	13176 Seneca/Cobalt	1993	3050	165	31	3,081	3065	5.0
120[3]	Balsam & Nisquali	2004	3055	182	27	3,082	3065	5.0
121[3]	e/of Interstate 15	2007	2894	60	24	2,918	2906	0.5
202	Hwy 395	1988	3469	105	30.9	3,500	3485	2.0
205	Caughlin Rd	1987	3809	60	24	3,833	3820	0.5
207	Hwy 395	1992	3469	120	32.4	3,501	3485	2.7
208	White Rd	1992	3657	120	37.5	3,695	3675	3.1
209	White Rd	1992	3657	96	37.5	3,695	3675	2.0
210	Caughlin Rd	1999	3809	122	24	3,833	3820	2.0
							Active Storage Capacity	**66.8**
201[1]	I – 15 (Inactive)	1988	3476	105	30.8	3,507	3485	2.0
203[1]	Monte Vista Rd (Inactive)	1988	3475	27	24	3,499	3485	0.1
204[1]	Monte Vista Rd (Inactive)	1998	3475	38	24	3,499	3485	0.2
211[2]	Le Panto/Fremontia	2007	3465	166	32	3,497	3465	5.1

1. Reservoir 201 has been disconnected from the system since the 2010 WMP and is not included in the Active Storage Capacity. May be reconnected in the future. Reservoirs 203 and 204 are inactive and will not be returned to service.
2. Reservoir 211 has been leased to MWA and is incorporated into the R3 Project but will be returned to the District in the future. Overflow piping on tank was lowered reducing the design capacity from 5.8 MG to 5.1 MG.
3. Reservoir has been retrofitted with flex couplings and/or motorized butterfly valves to help protect against damage from seismic activity.

2.6 Booster Pump Stations

The District currently maintains and operates four active Booster Pump Stations (BPS) within the distribution system. There was previously another booster station called Plant 133 located at the Reservoir 104 site, but it has been taken out of service since the 2010 Water Master Plan.

The El Evado BPS is only used in emergency situations to provide water from Zone 3065 to 3290. Since Zone 3675 and Zone 3820 do not have groundwater wells, Highway (HWY) 395 BPS and White Road BPS are required in order to pump supply from Zone 3485 to Zone 3675 and from Zone 3675 to Zone 3820, respectively.

The Amethyst BPS was recently completed in FY 2020-2021 and provides improved redundancy, reliability and operational flexibility for Zone 3485, 3675 and 3280. This new BPS gives the District the ability to boost water from Zone 3290 to Zone 3485, which can then boost water to the 2 highest zones. The Amethyst BPS also enables the District to introduce an additional water supply into Zone 3485 to provide more operational flexibility to meet water quality blending requirements in that zone. The Amethyst BPS was constructed on the site of the Zone 3290 reservoirs. The Amethyst BPS is equipped with 2 high head pumps that can boost from Zone 3290 to Zone 3485 and one lower head pump that can boost directly from a new Turnout 5 from the R^3 project to Zone 3485. The booster station will discharge into the Amethyst Blending Line where flow is blended with the wells in Zone 3485 before entering the Zone 3485 system.

The stations are all equipped with vertical turbine pumps that pump water into higher pressure zones to provide supply to zones without wells and increase supply reliability throughout the distribution system. Table 2-5 provides a summary of the four stations, and Figure 2-1 presents the BPS locations within the District's system.

Table 2-5. BPS Summary

Facility Name	Location	Zone From/ To	Ground Elev., ft	Back-up Power	Pump #	Name Plate Hp	Design Head, ft[1]	Design Capacity, gpm[1]	Up-Stream Pressure, psi	Down-Stream Pressure, psi
El Evado BPS	El Evado Arsenic WTP	3065/ 3290	3050	No[2]	1	100	254	1000	NA[6]	NA[6]
					2	100	254	1000		
					3	100	254	1000		
White Road Booster	10573 White Road	3675/ 3820	3657	Yes	1	30	146[3]	623[3]	14.05	74.00
					2	30	145[3]	618[3]		
					3	30	145[3]	613[3]		
HWY 395 Booster	10676 Highway 395	3485/ 3675	3476	No[2]	1	200	241[4]	2165[4]	13.46	94.10
					2	200	247[3]	2010[3]		
					3	200	N/A[5]	N/A[5]		
Amethyst BPS	11734 Amethyst Rd.	3290/ 3485	3268	Yes	150	203	2000	150	93.60	131.57
					300	397	2000	300	12.97	131.63
					300	397	2000	300	12.96	131.63

1. Head and flow are from pump tests conducted as a part of Southern California Edison Pump Tests (SCE 2008) unless otherwise noted.

2. Equipped with manual transfer switch for a portable generator connection. The District also maintains two portable booster pumps as a backup.

3. Test conducted on September 19, 2008.

4. Test conducted July 9, 2007.

5. Pump test not available. For hydraulic model and system analysis, capacity will be assumed to be similar to Hwy 395 Booster Pump 1.

6. Up-stream and down-stream pressure data is not available at this time.

2.7 Pressure Reducing Valve Stations

The District maintains 25 active and 9 inactive PRVs within its distribution system, which generally convey and regulate flow of water from higher-pressure zones to lower zones. Each station has one or more pressure reducing valves. Currently, none of the PRVs are metered or connected to SCADA, but the District plans to install meters and connect the PRVs to SCADA in the future. Locations of the PRVs are shown in Figure 2-1 and detailed information for the PRVs is summarized in Table 2-6.

Table 2-6. PRV Summary

PRV	Location	Status	Station Elevation, ft	Pressure Zone		Valve Size, in	Pressure Setting, psi
				Up-stream	Down-stream		
101	Nisqualli Rd. w/o Balsam Rd.	Inactive	3050	3290	3170	6/6	-
102	Balsam Rd. & Bear Valley Rd.	Active	3108	3290	3170	6	12
103	3rd Ave. s/o Green Trees Blvd.	Active	2950	3170	3065	6	52
104	Yates Rd. & Mariposa Rd.	Inactive	2988	3290	3170	6	-
105	Dos Palmas Rd. & I15 Freeway	Inactive	2992	3290	3170	8	-
106	Amargosa Rd. n/o Seneca Rd.	Inactive	2956	3290	3170	6/6	-
107	Seneca Rd. & Civic Dr.	Inactive	2950	3290	3170	8/6	-
108	Cobalt Rd. & Mojave Dr.	Active	2970	3290	3065	6/8	25/20
109	Hook Blvd. & Amethyst Rd.	Inactive	2997	3290	3065	8/8	-
110	Dean Ave. & Shivers St.	Inactive	2917	3170	3065	8/4	-
111	Zenda Dr. & Circle Dr.	Active	2878	3065	3065B	6	45
112	Yucca St e/o Fresno St.	Active	2854	3065	3065A	4	60
113	Forrest St. & Louise St.	Active	2865	3065	3065A	8	56
114	Rodeo Dr. & Victor St.	Active	2849	3065	3065B	8	60
115	Air Expy & Ranch Rd.	Active	2783	3065	2890	6	75
118(3)	Luna Rd. & Mesa Linda St.	Active	3195	3485	3290	12	41
119(3)	La Mesa Rd. & Amethyst Rd.	Active	3162	3485	3290	12	55
120(3)	11th St. & Verde St.	Active	2885	3065	2906	12	69
201(2)	Goss Rd. & Shasta Rd.	Inactive	3614	-	-	4/8	-

PRV	Location	Status	Station Elevation, ft	Pressure Zone		Valve Size, in	Pressure Setting, psi
				Up-stream	Down-stream		
202	Duncan Rd. & Pueblo Trail	Active	3472	3820	3675	6	68
203	Beaver Ave n/o California Aqueduct	Active	3484	3820	3675	6	71
204	Barker Rd & Marco Rd.	Active	3358	3675	3485	4	60
205	Duncan Rd. & Bellflower St.	Active	3351	3675	3485	4/8	20
206	Joshua Dell Rd w/o Hwy 395	Active	3386	3675	3485	6	20
208	White Rd. & Mesa St.	Inactive	3617	3820	3820(1)	6	-
209(3)	Aster Rd. s/o Goodwin Rd.	Active	3465	3820	3675	2	98
210	NE corner of Hesperia Road and Eureka Street	Active	2873	3170	3065	12/4	79/83
A	Phantom & Nevada Ave	Active	2864	3170	3170A	8/3	55
B	N/o High Desert Power Plant	Active	2848	3170	3170A	3	40
C	North Taxi-way & Readiness St.	Active	2854	3170	3170A	4	60
D	Aerospace Dr w/o Phantom	Active	2886	3170	3170A	8/3	50
E	North of Runway	Active	2846	3170	3170A	12/4	n/a(4)
F	SE corner High Desert Power Plant	Active	2860	3170	3170A	4	n/a(4)
G	Phantom & Turner Rd	Active	2726	3170	3170A	n/a(4)	n/a(4)

1. PRV reduces HGL of water from reservoirs to mitigate high pressure experienced by some customers in Zone 3820.
2. Related to previous use of Reservoir 201. No longer in use after construction of Avenal ATP.
3. PRV has been added to the District's system since the 2010 WMP.
4. Information not available at the time of publishing

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2.8 Backup Power

The District currently has a permanent stationary generator for backup power at the following facilities:

- Highway 395 BPS
- White Road BPS
- Well 140
- Well 201

The Highway 395 and White Road BPS are critical facilities because they provide the sole source of supply to Zone 3675 and 3820. Well 201 is run the most often in Zone 3675 and is critical for blending and Well 140 is the largest producer in Zone 3170.

The District has also installed a natural gas powered generator at the El Evado ATP, which will be placed online once the new gas service and wiring is complete, which is expected by the end of 2021.

The remaining well sites currently do not have permanent stationary generators for backup power; however, the District does have three portable generators which can be utilized at various sites as needed. One is 500 kW and two are 375 kW.

All wells in Zones 2890, 2906, 3065, 3170 and 3290 are equipped with a manual transfer switch with generator receptacle. The remaining wells will be equipped with automatic transfer switches in the future. In an emergency, a portable generator can be hardwired into the electrical panel without an automatic transfer switch.

2.9 Transmission and Distribution Pipelines

The District's potable water system includes approximately 700 miles of transmission and distribution mains ranging from 2 to 30 inches in diameter. The majority of the District's mains consist of 8-inch and 12-inch diameter pipelines (approximately 66 percent of the total length).

2.9.1 Pipeline Data Assumptions

Upon review of the District's current GIS database for the District's pipeline facilities, it was discovered that some of the material and age data for the District's pipelines was missing or incorrect. Based on input from District staff, as well as known information about recent pipeline improvements, WSC updated the GIS data to reflect the best available information for pipeline installation year and material. For the pipelines that were missing data for the installation year, material or both, WSC made assumptions so that a pipeline replacement rate analysis of the system could be completed, except for pipes within SCLA which were excluded from the analysis. WSC created two new fields in the GIS database for the pipeline installation year and material to input these assumptions: 'Year of Installation_99' and 'Material_99', respectively. The sections below describe the assumptions made to populate these fields. The data within the two new fields was used for the summaries presented in this chapter and for the analysis provided in Chapter 7 of this WMP.

Currently, the District is in the midst of a comprehensive GIS update to populate missing information, correct spatial inaccuracies, and make record drawings and essential information available to field personnel on mobile platforms.

2.9.1.1 Pipeline Installation Year Assumptions

Pipeline installation years were estimated primarily based on the material (if known), location, and installation years of the surrounding pipelines. Within Zones 3485, 3675 and 3820, there are large tracts of PVC pipe with no known installation date. Based on District input, an installation year of 1990 was assigned for these PVC pipes. Based on the District's input, pipelines with unknown installation years, material, and missing data for surrounding pipelines were assumed to have an installation year of 1989.

Some of the data indicated that steel pipe was installed after 1990, however through discussions with the District, it was determined there has not been any installation of steel pipe after 1990. It was assumed that all steel pipe with an installation date after 1990 was installed in 1990.

2.9.1.2 Pipeline Material Assumptions

For the tracts and segments of unknown pipe material, WSC initially reviewed the material and installation dates of surrounding pipelines to determine if the unknown pipe was likely similar in material to adjacent pipes. If the surrounding pipe material was unknown, the pipe installation year was used to determine the pipe material based on the following assumptions:

- Pipelines installed prior to 1990 were assumed to be AC
- Pipeline installed after 1990 were assumed to be PVC

Also, the GIS database used several different categories to refer to steel pipe and it was not clear which were lined or unlined. It was assumed that any existing steel pipe installed after 1980 is cement mortar lined and coated steel (CMLCS) pipe and the remainder of the pipe was recategorized as a single category of unlined steel pipe (SP). The pipe material abbreviations used in the GIS database and in this report are presented in Table 2-7.

Table 2-7. Pipe Material Abbreviations

Pipe Material	Abbreviation
Asbestos Cement	AC
Cement Mortar Lined and Coated Steel	CMLCS
Ductile Iron	DIP
Polyvinyl Chloride	PVC
Steel (Unlined)	SP
Cast Iron	CAS
Galvanized	GP
Unknown	UNK

Table 2-8, Table 2-9 and Table 2-10 summarize the pipe material and diameter, based on the revised pipeline data using the assumptions described, excluding the SCLA area. SCLA area pipes were not updated using the assumptions described because very few historical records are available for this area and, as additional development is built at SCLA, the smaller pipes that have unknown information such as material and install year will be abandoned.

Table 2-8. Distribution Pipe Material

Pipe Material	System Pipe Length, Miles	System Material %	SCLA Pipe Length, Miles(1)	SCLA Material %	Total Pipe Length, Miles	Total Material %
AC	329.1	50.5%	2.2	5.4%	331.3	47.8%
CMLCS	4.4	0.7%	5.3	12.9%	9.7	1.4%
DIP	38.7	5.9%	3.3	8.0%	42.0	6.1%
PVC	260.6	40.0%	3.8	9.3%	264.4	38.1%
SP	18.9	2.9%	0.3	0.7%	19.2	2.8%
CAS	-	-	1.1	2.7%	1.1	0.2%
GP	-	-	0.1	0.2%	0.1	0.01%
UNK	-	-	24.7	60.2%	24.7	3.6%
Total	**652**		**41**		**693**	

1. SCLA pipes were not updated using the assumptions described in Section 2.9.1.

Table 2-9. Distribution Pipe Diameter

Pipe Diameter, in	System Pipe Length, Miles	System Diameter %	SCLA Pipe Length1, Miles	SCLA Diameter %	Total Pipe Length, Miles	Total Diameter %
2	0.1	0.02%	0.7	1.70%	0.8	0.10%
3	0.5	0.07%	0.1	0.20%	0.6	0.10%
4	32.8	5.03%	1.5	3.70%	34.3	5.00%
5	3.7	0.57%	0	0.00%	3.7	0.50%
6	83.3	12.78%	4.2	10.20%	87.5	12.60%
8	307.4	47.18%	8	19.50%	315.4	45.50%
10	7.2	1.10%	3	7.30%	10.2	1.50%
12	134.7	20.68%	7.3	17.80%	142.0	20.50%
14	4.6	0.71%	0	0.00%	4.6	0.70%
16	33.4	5.13%	2.3	5.60%	35.7	5.20%
18	11.8	1.81%	9.8	23.90%	21.6	3.10%
2	3.5	0.54%	0	0.00%	3.5	0.50%
24	24.7	3.79%	3.8	9.30%	28.5	4.10%
30	3.9	0.60%	0	0.00%	3.9	0.60%
Total	**652**		**41**		**693**	

1. SCLA pipes were not updated using the assumptions described in Section 2.9.1.

Table 2-10. Distribution Pipe Install Year

Pipe Install Year	System Pipe Length, Miles	System %	SCLA Pipe Length[1], Miles	SCLA %	Total Pipe Length, Miles	Total %
Prior to 1950	0.5	0.1%	-	-	0.5	0.1%
1951-1960	23.9	3.7%	-	-	23.9	3.4%
1961-1970	32.3	5.0%	-	-	32.3	4.7%
1971-1980	35.1	5.4%	-	-	35.1	5.1%
1981-1990	196	30.1%	-	-	196.0	28.3%
1991-2000	132.5	20.3%	13.26	32.3%	145.8	21.0%
2001-2010	216.6	33.2%	23.47	57.3%	240.1	34.6%
After 2010	14.8	2.3%	0.07	0.2%	14.9	2.1%
Unknown	-	-	3.86	9.4%	3.9	0.6%
Total	**652**		**41**		**693**	

1. SCLA pipes were not updated using the assumptions described in Section 2.9.1.

2.10 Water Meters and Service Lines

2.10.1 Automatic Meter Reading and Advanced Metering Infrastructure System

As part of the Automatic Meter Reading (AMR) program, the District replaced virtually 100% of their over 37,000 small and large meters with new AMR meters over the last 5 years. The new “smart” meters have the ability to collect meter readings remotely, accurately, and safely. Special devices known as Encoder Receiver Transmitters are installed on meters to send their readings to handheld devices that meter readers carry (or are installed in vehicles and collected by staff driving through various areas of the District). The data is automatically transferred to a central database for analysis and billing, which provides better reading accuracy because there is no opportunity for human error in recording the readings. The radios paired with these meters can provide hourly consumption profile information over an account’s last 96 days, with a register reading interval of every 15 minutes. They also provide leak history/diagnostics, proactive leak notification, and tamper detection; and have the ability to identify reverse flow and significant periods of zero consumption. Other benefits include more staff time available to focus on other District goals and priorities, improved employee safety and decreased health risk of exposures and injuries and decreased fuel consumption and reduced emissions due to more efficient meter reading routes.

This aggressive meter replacement program has improved metering accuracy and helped reduce water loss.

The next step is to implement an Advanced Metering Infrastructure (AMI) system. The new AMR meters are compatible with an AMI system that enables two-way communication over a fixed network between the utility system and the metering endpoints. With AMI, the District's distribution network can be continuously monitored by hourly interval reads. This allows for real-time notifications identifying many potential issues, from meter tampering to continuous use. With the detailed usage data available in an AMI system, customer service representatives have immediate access to consumers' consumption information. When a customer calls with a high water bill complaint, the customer service representative can give them a complete picture of how and when they are using water.

Once the system is in place and has been thoroughly tested, the District's customers will be provided a web portal where they can track and review their water use data. All customers will have access to hourly, daily, and monthly water consumption information and trends. This information can be used to see how and when they are using water in their home or business on a day-today basis prior to receiving their bill.

The District has developed a three-phase plan to install the data collectors and software needed for the transition to an AMI system. Smart meters previously installed in the District's system will automatically communicate with the AMI system once it is activated. The first phase is a pilot project beginning in 2021 and covering the westerly most remote and sparse area of the District.

2.10.2 Small Meters

The District's small meters (2-inch and smaller) are mechanical positive displacement meters. The District has recently implemented a new standard for small meters to be ultrasonic meters and currently has 184 ¾" ultrasonic meters installed. The District is transitioning to ultrasonic meters because they can withstand demanding service conditions and deliver sustained accuracy over the life of the meter. They also have extended low-flow range for superior leak detection. Because these meters have no moving parts, accuracy will not diminish with wear over time and maintenance requirements are significantly reduced.

2.10.3 Large Meters

The District has already replaced most of their large (3-inch and above) mechanical meters with ultrasonic smart meters as part of their AMR program over the past 5 years. They have similar advantages to the small ultrasonic meters. The ultrasonic meters are capable of accurately measuring a wide range of flows with as single device, thereby eliminating the need in many cases for compound meters that require large meter boxes with confined space restrictions. The new meters are also compatible with the radios paired with the District's small meters.

2.10.4 Service Lines

The use of High Density Polyethylene pipe (HDPE or PE) for water service lines in its present form was introduced in the 1960's. Across the country, throughout the 1970's and 1980's, the use of PE pipe grew tremendously. It was seen as an inexpensive, non-corrosive, easily installed long term solution for iron or galvanized pipe. In the 1990's, the use of PE services began to decline due to the premature aging of the pipe. Originally the life span of PE was thought to be 100 years. Some agencies remain satisfied with this material, but others found that the pipe material began to split or develop pin holes after just 10 or 20 years. With each new development, the manufacturers of PE pipe claimed that the process was improved; unfortunately, many agencies experienced similar problems with each new generation of PE pipe.

This same set of circumstances were experienced in the High Desert, with widespread use of PE in the 1980's and 1990's. In 2000, Victor Valley Water District (VVWD) removed PE from their approved material list and replaced it with copper. Because Baldy Mesa Water District's (BMWD) growth was several years behind VVWD, the PE services were not failing at the same rate. Therefore, BMWD kept PE as the approved material for service lines. Copper became the unilateral standard once both agencies were merged as a subsidiary district of the City in 2007.

As the service lines in BMWD (prior to 2007) and VVWD (prior to 2000) continued to age, the number of service line leaks continued to multiply. Service line leaks represented over 90% of the total leaks for the District in any given year. The leaks become increasingly active as the temperature increases. During the summer months, it is not uncommon to have 75% of the field crews replacing service lines due to leaks.

As the District was approaching the 20-year mark of the housing boom around the turn of the century, they could only speculate that there could be service line failures at an unmanageable rate. To respond to these circumstances, the District developed a pilot project in FY 2015-16 wherein 50 PE service lines were replaced with copper via an outsourced contractor. This pilot project evolved into larger projects on an annual basis to embark on an effort to replace all plastic services in the District (estimated at roughly 20,000) over a multi-year span. This proactive approach, instead of a reactive response, was taken to prevent an epidemic of future leaks, minimize roadway cuts, and to help conserve water.

Over the past four years following the pilot project, the District has replaced 7,325 PE services with copper pipe. This has been accomplished through a combination of force labor and outsourcing, with District crews replacing 67% (4,874) of the services and solicited contractors replacing 33% (2,451). This effort is expected to continue over the next several years until all PE services have been replaced.

2.11 Existing System Summary

Table 2-11 summarizes the District's facilities by zone. The locations of the District's facilities are shown in Figure 2-1, and a hydraulic profile of the District's system is presented in Figure 2-2 and Figure 2-3.

Table 2-11. Water System Facilities Summary

Zone Name[1]	Subzone	Elevations Served[2]	Wells	Reservoirs	PRV (Flow into Zone)	Booster Stations (Pumping from Zone)
2890		2,650-2,830	133, 135, 147[7]	102, 104	115	
2906		2,675-2,800	118, 119	109, 121	120	
3065		2,760-3,000	116, 121[3], 127, 130, 132, 136, 139[6], 141[6], 143[6], 146[7]	105, 113, 115, 118, 119, 120	103, 108, 109, 110, 121, 210	El Evado Booster Pump Station
	3065A	2,790-2,880			112, 113	
	3065B	2,780-2,890			111, 114	
3170		2,770-3,115	120, 122, 140, 145[7], 148[7]	110, 111, 116, 117	101, 102, 104, 105, 106, 107	
	3170A[4]	2,820-2,900			A, B, C, D, E, F, G	
3290		2,940-3,230	109, 123[6], 126, 128[6], 131[6], 134[6], 137[6], 138[6], 142[7], 144[6]	107, 108, 112, 114	117, 118, 119	Amethyst Booster
3485		3,150-3,390	129[5,6], 201[6], 203[6], 204[6], 205[6], 206[6], 207[6], 208[6], 209[6], 212[6]	202, 207	204, 205, 206	395 Booster
3675		3,340-3,490		208, 209	202, 203, 209	White Road Booster
3820		3,480-3,665		205, 210		

1. Zone Name is taken from mid-level reservoir elevation in feet. Zone name does not represent zone Hydraulic Grade Line (HGL) elevation, as zone HGL is calculated from high water level (HWL) of reservoirs.
2. Per the 2010 WMP, elevations from 2005 GPS Survey for ID 1 (VVWD, 2005) and 2005 Water Supply Plan for ID 2 (HDR, 2005).
3. Taken offline in 2014 due to levels of Chromium-6 approaching the new maximum contaminant level (MCL) established in 2014. May be returned to service if Chromium-6 levels decline.
4. 3170A is a subzone within the SCLA area.
5. Well 129 previously served Zone 3290 but has been rerouted into Zone 3485 as part of a blending strategy to achieve arsenic and chromium compliance.
6. Well is treated prior to flow being introduced to the potable system. Flow is either treated chemically or by blending with other sources.
7. Well is drilled but currently offline. Planned to be equipped when needed.

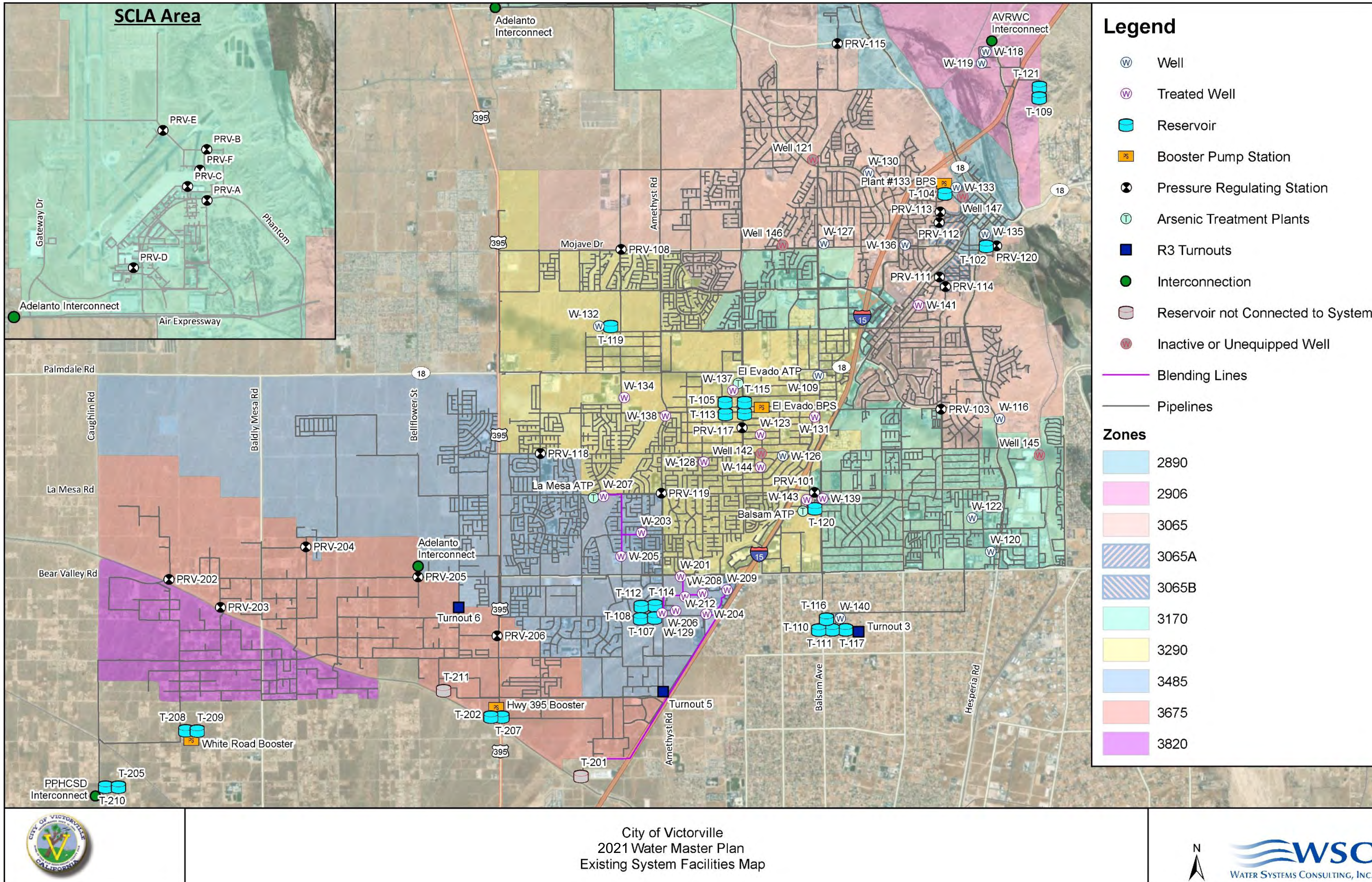


Figure 2-1. Existing System Facilities Map

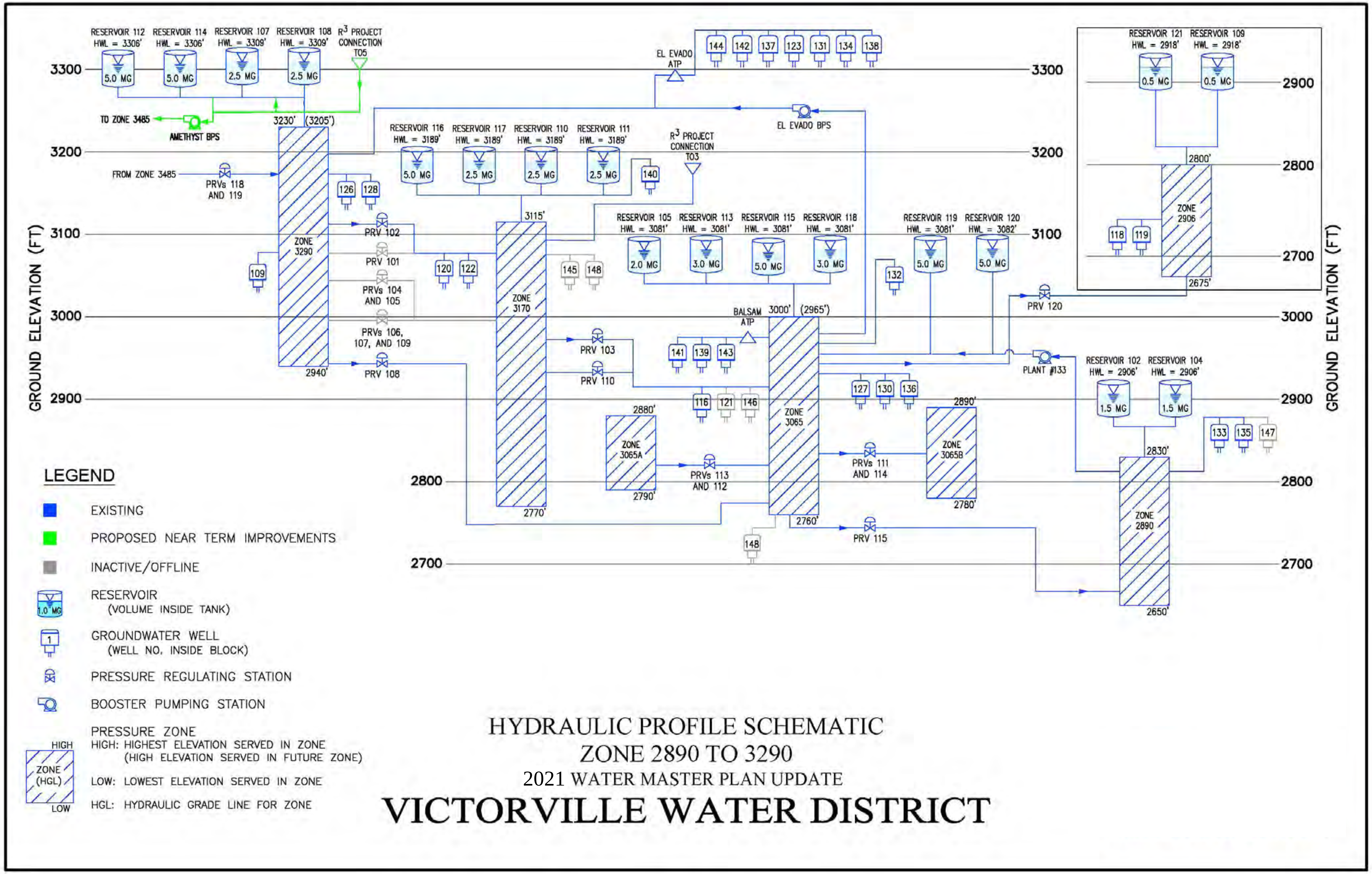


Figure 2-2. Hydraulic Profile (Zones 2890 to 3290)

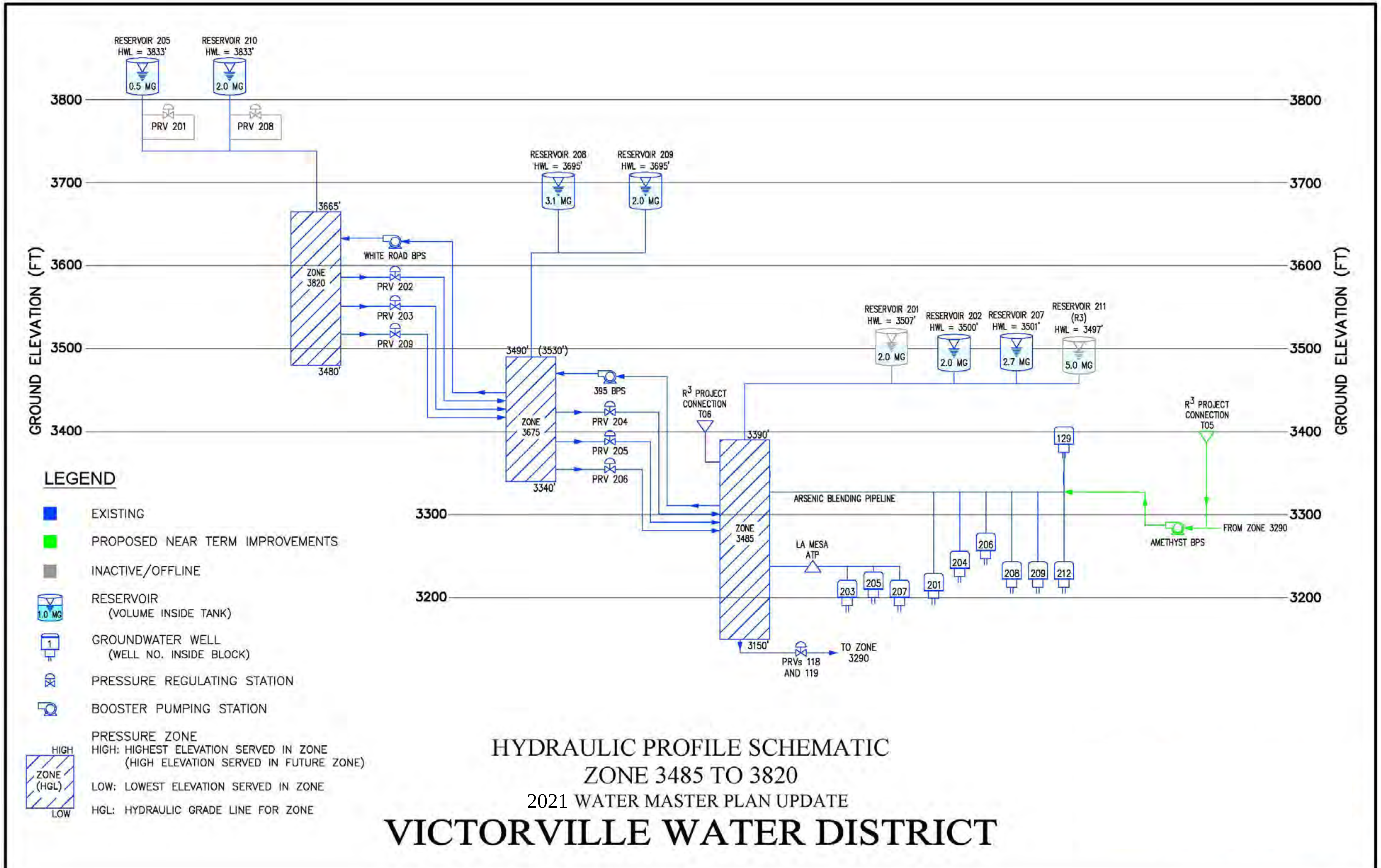
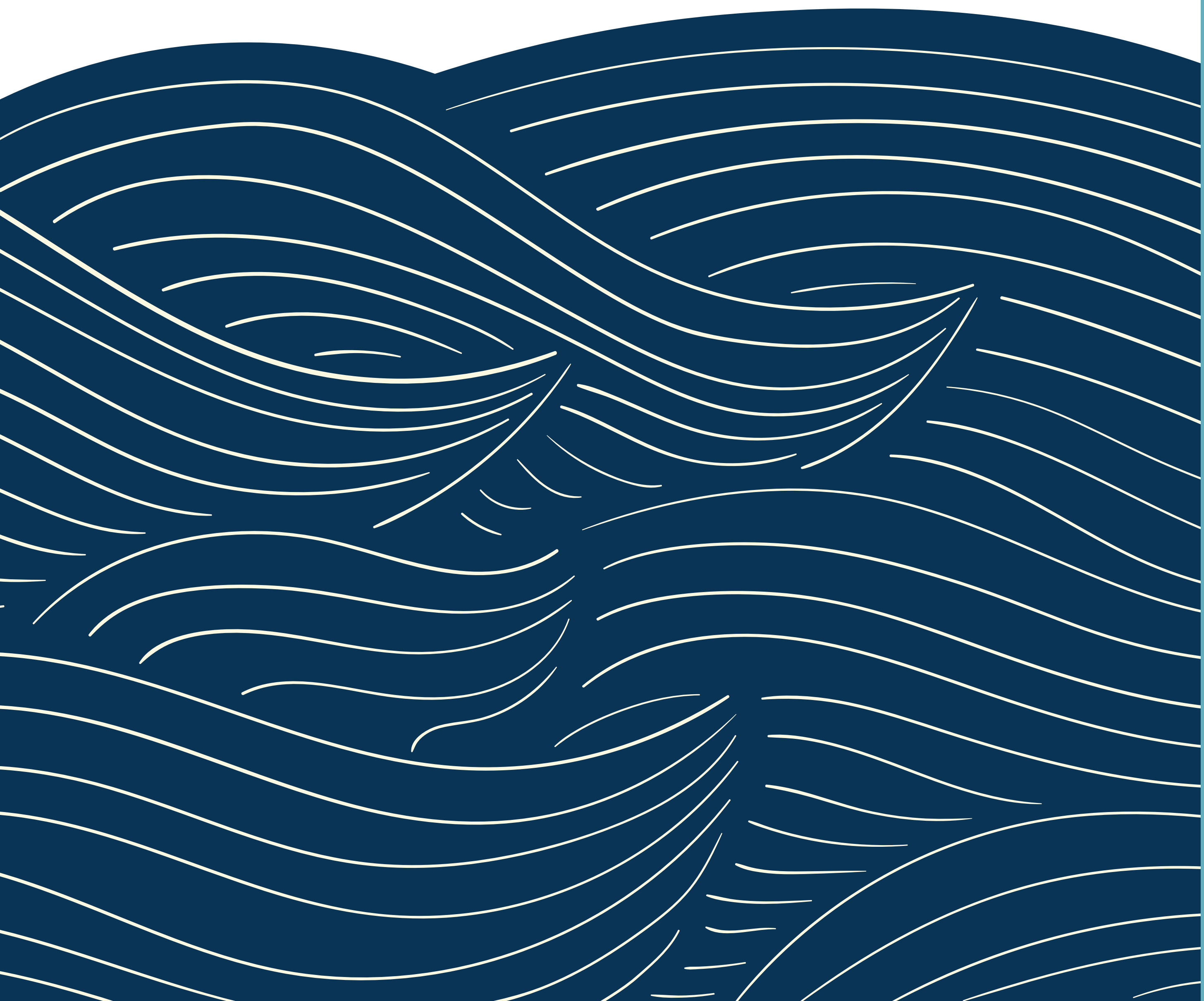


Figure 2-3. Hydraulic Profile (Zones 3485 to 3820)

3 EVALUATION CRITERIA



CHAPTER 3

Evaluation Criteria

This chapter presents the evaluation criteria to be used for the evaluation of the existing and future water facilities. The water system performance criteria were developed from the California Waterworks standards, the District's standards and preference, fire protection standards, and engineering judgement.

3.1 Supply Reliability and Demand Projections

The California Waterworks Standards require that a public water system must be able to meet Maximum Day Demands (MDD) with source capacity only. Systems must also be able to meet four hours of Peak Hour Demand (PHD) through a combination of source capacity and storage capacity. For systems supplied by groundwater, reliable water source capacity is calculated by determining system capacity with the agency's largest source out of service. This is also known as firm capacity.

However, with a system like the District's that is fed by 34 groundwater wells, removing the largest single source does not provide a sufficiently conservative basis for supply reliability evaluation. Through discussions with the District, criteria have been developed that the water system shall meet MDD with the two largest wells in the entire system out of service, as well as R^3 being out of service because it is not a guaranteed supply.

IN THIS CHAPTER

Since earthquakes are prone to occur in Southern California and can damage a range of the system's facilities, this master plan defines supply criteria for earthquake conditions, or other emergency conditions. If a water system is supplied by one or two large water sources, an earthquake or major facility failure could interrupt most or all of a system's supply. However, with the District's large number of groundwater wells located throughout the service area, the largest well out of service in each improvement district is considered reasonable for emergency conditions as well. In the event of an emergency, water conservation notices would be issued to customers in order to reduce water demands to average day demand (ADD) or lower. Therefore, the evaluation criteria for emergency conditions is that the water system shall meet ADD with the two largest wells and R^3 out of service.

For pressure zones that receive their supply through booster stations from other zones, booster station facilities must meet the MDD within that zone with the largest pump out of service. Table 3-1 summarizes the supply reliability evaluation criteria.

Table 3-1. Supply Reliability Evaluation Criteria

Condition	Evaluation Criteria
Normal and Emergency Conditions	• Meet total system MDD with the two largest wells and the R^3 supply out of service. • Meet total system PHD through a combination of source capacity and storage capacity. • Meet zone MDD with the largest booster pump out of service for zones that receive supply through booster stations.

3.2 System Pressure

Minimum system pressures are evaluated under two scenarios, and the requirements are established in the California Waterworks Standards:

- PHD – Minimum pressure shall be 40 pounds per square inch (psi)
- MDD with fire flow conditions – Minimum pressure shall be 20 psi

Lower pressures are only acceptable for junctions at system facilities and on transmission mains. However, pressure shall not be less than 5 psi at any location to avoid potential contamination from back siphonage. The pressure analysis of the distribution system using the hydraulic model will be limited to demand junctions because only locations with service connections need to meet the pressure requirements.

The maximum static pressure should be maintained below 80 psi at customer connections. Where maximum pressure exceeds 80 psi, customer connections should be equipped with individual pressure regulators, in accordance with the 2017 Uniform Plumbing Code. The District desires to maintain distribution system pressures below 125 psi regardless of whether connections are equipped with pressure regulators. Table 3-2 summarizes the pressure requirements.

Table 3-2. System Pressure Evaluation Criteria

System Pressure	Evaluation Condition	Value
Maximum	ADD	125 psi[1]
Minimum, without fire flow	PHD	40 psi
Minimum, with fire flow	MDD	20 psi

1. *Customer connections with service pressure greater than 80 psi should equipped with individual pressure regulators, in accordance with the 2017 Uniform Plumbing Code.*

3.3 Required Fire Flow

In addition to providing sufficient water supply and pressure to serve the domestic and irrigation demands of the District's customers, the water system must also deliver an adequate supply for firefighting (fire flow) during MDD, while maintaining 20 psi, which is the minimum allowable system pressure established in the California Waterworks Standards. San Bernardino County Fire Department (SBCFD) was responsible for establishing fire flow requirements for the District's service area when this plan was started, and was therefore contacted to identify the fire flow requirements for this plan. Table 3-3 summarizes the current fire flow requirements as of 2017.

Table 3-3. Fire Flow Requirements

Land Use	Minimum Flow Required (gpm)	Duration (hours)
Single-Family Residential (LDR)	1,500	2
Multi-Family Residential (MDR)	2,500	3
Public Facility	3,500	4
Commercial	3,500	4
Industrial	4,000	4
Hospital	4,000	4
Existing SCLA Users[1]	6,000	4

1. *Some existing industrial users at SCLA have been assigned higher fire flow requirements than the typical industrial value.*

3.4 Storage Volume

Storage facilities for water distribution systems must provide operational, fire flow and emergency storage. Ideally, each pressure zone would have sufficient storage to meet the following criteria for each zone; however, excess storage from higher zones can be used to supplement lower zones through PRVs if needed.

3.4.1.1 Operational Storage

Operational storage is the amount of water needed to equalize the daily supply and demand. Without operational storage, water supply facilities would need to be sized to meet the instantaneous peak demands throughout the day. Water systems are usually designed to meet maximum day demands with source capacity, and use reservoir storage to provide additional water for peak hour flows. The District has established that the operational storage shall be at least 25 percent of MDD.

Historically, the District's electric utility rates from Southern California Edison (SCE) were designed to incentive pumping at night during off-peak periods so the District would minimize pumping during the day and fill the tanks at night to take advantage of lower electricity rates. However, beginning in 2019, SCE shifted the times that are considered off-peak due to the significant contribution of solar energy during daytime hours. As a result, the District is now running the majority of their pumps, including booster pumps, during the day.

3.4.1.2 Fire Flow Storage

Storage for fire flows shall be at least the volume equal to the maximum fire flow and its corresponding duration within each pressure zone. For all pressure zones except 3170, the maximum fire flow is based on industrial and hospital land uses and is 4,000 gpm for a duration of 4 hours, as shown in Table 3-3, equaling a total of 1.0 MG of required fire flow storage. Zone 3170 serves SCLA, where some existing land uses require a higher fire flow of 6,000 gpm for 4 hours, which equates to 1.44 MG of required fire flow storage in Zone 3170.

3.4.1.3 Emergency Storage

Emergency storage is water that is available for use by water system customers in the event of a longer-term disruption of water supply, such as pipeline failures, equipment failures, power outages, pumping system failures, water treatment plant failures, raw water contamination, or natural disasters. The quantity of emergency storage is determined by the agency, typically based on the estimated amount of time expected to elapse before the disruption caused by the emergency is corrected. However, the occurrence and magnitude of emergency can be difficult to predict; therefore, emergency storage can be set as a percentage of ADD or MDD. This is the method used in the District's 2010 WMP and will be used in this water master plan as well. Since the District has a large number of groundwater wells throughout the service area, which provide redundancy, and groundwater wells have the ability to pump during a power outage through the use of portable generators, storage reservoirs for each pressure zone shall be capable of providing storage for 50 percent of MDD. Table 3-4 summarizes the District's evaluation criteria for required storage volumes.

Table 3-4. Storage Evaluation Criteria

	Evaluation Condition
Operational	25% of MDD
Fire Fighting	Maximum fire flow demand for required duration
Emergency	50% of MDD

3.5 Distribution Pipelines

Evaluation criteria for distribution pipeline characteristics are summarized in the subsections below.

3.5.1 Velocity and Headloss

The velocity and headloss evaluation criteria for existing and proposed pipelines are presented in Table 3-5. Table 3-6 presents velocity ranges for system conditions for proposed pipelines.

Table 3-5. Velocity and Headloss Evaluation Criteria

	Evaluation Condition	Value
Pipeline Velocity		
Existing Pipelines[1]	MDD	7 fps
New pipelines (≤ 12-in diameter)	MDD	5 fps
New pipelines (≥ 16-in diameter)	MDD	4 fps
Pump station suction pipelines	MDD	8 fps
Pipeline Headloss		
Existing Pipelines[1]	MDD	10 ft/kft
New pipelines	MDD	5 ft/kft

1. Excludes hydrant laterals.

Table 3-6. Proposed Pipeline Velocity Ranges

System Analysis Condition	Desired Range	Questionable Range	Deficient Range
Average Day	0 to 5 fps	5 to 7 fps	Over 7 fps
Maximum Day	0 to 7 fps	7 to 10 fps	Over 10 fps
Peak Hour	0 to 7 fps	7 to 10 fps	Over 10 fps
Fire Flow	0 to 15 fps	-	Over 15 fps

3.5.2 Pipeline Diameter and Material

In order to meet the District's level of service objectives and operational preferences, the following criteria are recommended for new pipelines:

- Minimum diameter for new pipelines shall be 8 inches.
- New pipelines shall be of standard diameter; the District considers 10-inch and 14-inch to be non-standard and these sizes are not allowed to be installed.
- Pipeline material shall be either Polyvinyl Chloride (PVC) C-900 or C-909 or ductile iron pipe (DIP). Cement mortar lined and coated steel pipe may be allowed on a case by case basis. Pipelines 18-inch and greater shall be DIP only.
- Due to the potential for soil contamination in the SCLA area, the District should be consulted prior to selecting pipe material in this area.
- All pipelines shall be looped, excluding cul-de-sac streets, to reduce the potential for service disruption to an area due to pipeline outage. Dead-end pipes, when necessary, shall be terminated with a blow-off.
- For new waterlines linking two facility sites, the District will consider whether a fiber conduit for future use should be installed with the waterline to help expand the City's fiber network. If installed, the conduit shall be three inch diameter with a pull box every 500 ft.

3.5.3 Roughness Coefficient

Existing pipelines were assigned a roughness coefficient (C-factor) ranging from 120 to 140 based on the results from the model calibration performed by ID-Modeling for ID1 and ID2. Pipes in the SCLA area were assigned a C-factor ranging from 80 to 140 based on results of calibration performed by WSC for the SCLA area calibration task in 2016 (see Appendix B – SCLA Model Calibration Technical Memo). New pipelines are assigned a C-factor of 130.

3.6 Booster Pump Station Capacity

Each BPS within the system shall have a true spare unit, allowing for normal operations during typical repairs or replacements. For zones that require a BPS to provide supply, such as Zone 3675 and Zone 3820, the BPS must meet the following evaluation criteria for zone reliability and emergency conditions.

- **Zone Supply Reliability.** Each BPS providing the sole supply to a zone shall meet MDD with the largest pump unit out of service.
- **Emergency Conditions.** The pumping capacity shall be sufficient to meet ADD and to fill tanks for fire flow during an emergency event, such as a power outage or earthquake, using only those pump stations and/or pump units that have a stationary backup power supply. Although an emergency event can take place at any time of year, it is assumed that meeting ADD is sufficient because it would be reasonable to temporarily reduce water demands through public water conservation notices.

The pumping capacity evaluation criteria are summarized in Table 3-7.

Table 3-7. Pumping Capacity Evaluation Criteria

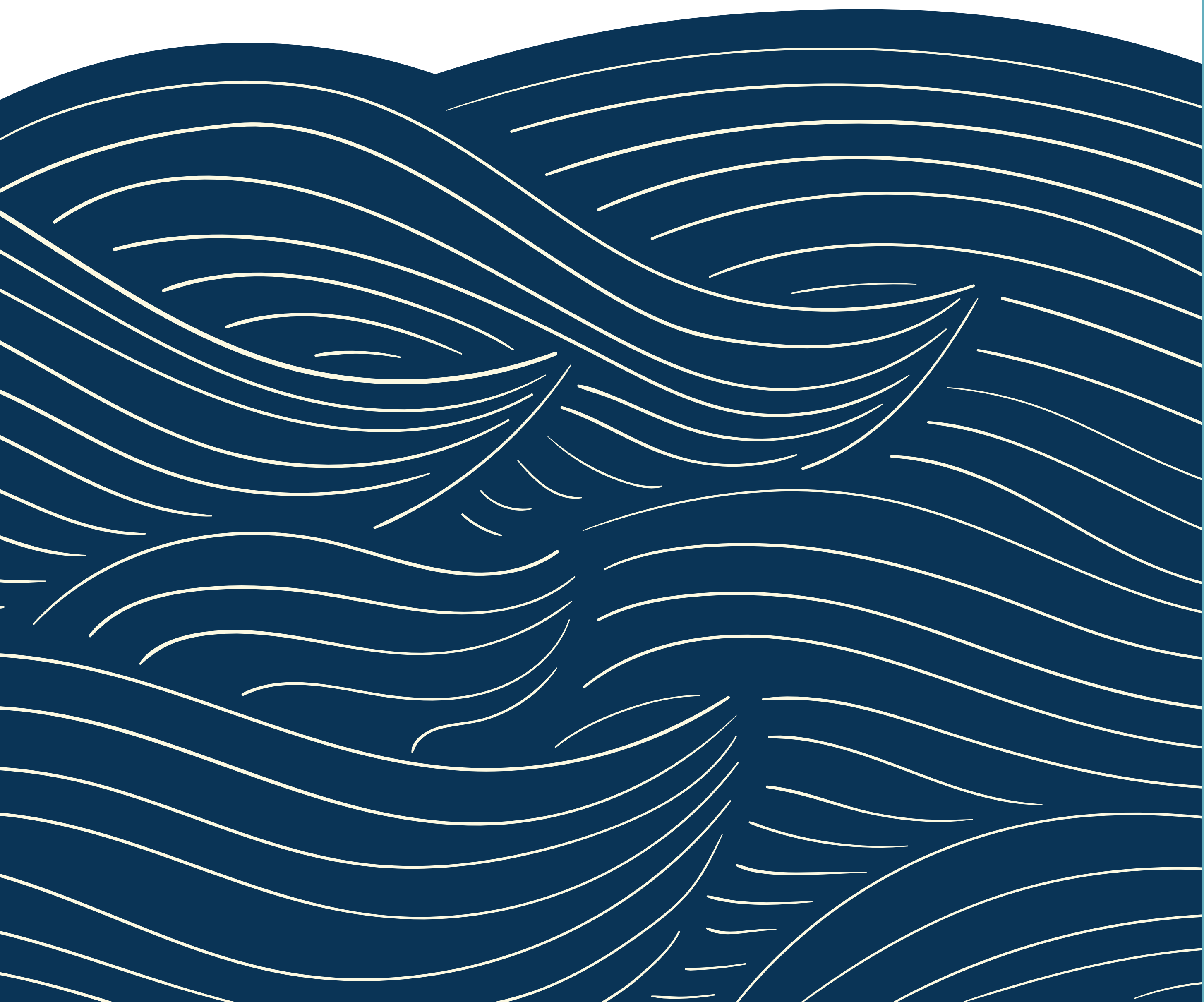
Evaluation Condition	
Zone Supply Reliability	Meet MDD with the largest pump unit out of service
Emergency Conditions	Meet ADD and fill tanks for fire flow with back-up power only

3.7 Power Reliability

During power outages, the District desires to have portable or stationary backup power available for at least one well in each zone. The District has stationary generators for wells in Zone 3485 and 3170 and three additional portable generators. This provides coverage for all except one zone.

Backup power shall also be available at the Highway 395 BPS and White Road BPS, which provide the sole supply to Zone 3765 and Zone 3820.

4 DEMAND ANALYSIS



CHAPTER 4

Demand Analysis

This chapter summarizes the District's historical, current, and projected water demands, and factors accounting for seasonal, daily, and hourly fluctuations in water demands.

IN THIS CHAPTER

Water Demand Analysis

Peaking Factors

4.1 Water Demand Analysis

4.1.1 Historical Water Demands

The District categorizes its water use customers as single family residential, multi-family residential, commercial/institutional, industrial, landscape/irrigation and other. The District's historical retail water use by customer type for the years from 2011 through 2017 is summarized in Table 4-1.

Prior to 2015, some water sales to construction meters, government agencies, schools, churches, prisons, and some institutional entities were billed under the "other" category. In the last few years, many of these meters have been reclassified into the appropriate categories so the usage in the "other" category will be reduced or eliminated.

The Water Losses category represents the difference in the amount of water produced by the District's wells and the amount of water sold according to the customer billing records. Some water losses are real losses that occur as a result of leaks, fire hydrant testing, or system flushing. Others are known as apparent losses, which could be a result of metering inaccuracies. Some losses are normal and unavoidable. With the implementation of AMR meters and future AMI system, the District expects their water losses to trend down in the future.

Through emergency system connections, the District has at times sold water to Adelanto Public Utilities Authority and Phelan Pinon Hills Community Services District when needed; this water is shown in the Exported Water category.

Table 4-1. Historical Water Demand by Use Type, AFY

Customer Type	2011	2012	2013	2014	2015	2016	2017
Single Family	16,766	16,961	16,949	15,113	14,119	13,056	12,700
Multi-Family	1,437	1,874	1,870	1,806	1,692	1,562	1,273
Commercial / Institutional	2,152	2,807	1,528	1,316	1,233	2,836	4,770
Industrial	0	0	0	778	729	299	0
Landscape / Irrigation	347	453	1,580	1,445	1,354	1,244	1,056
Other	5	7	7	7	18	2	0
Water Losses	2,086	1,159	1,509	2,955	1,437	1,997	1,606
Exported Water	0	4	308	109	262	0	875
Total Demand	**22,793**	**23,264**	**23,751**	**23,529**	**20,843**	**20,997**	**22,282**

4.1.1.1 Conservation

SBX7-7 requires all water suppliers to increase water use efficiency with the overall goal to decrease per-capita water consumption within the state by 20 percent by the year 2020. An urban retail water supplier must establish their Baseline water use and set a 2020 water use target (Compliance Water Use Target) and a 2015 interim target (Interim Water Use Target). Baseline water use and reduction targets are based on water use in gallons per capita per day (GPCD). Additional information on the methodology and data used to calculate these values can be found in Chapter 5 of the 2015 UWMP; only the results are presented in this section.

The District's Baseline water use is based on the 10-year average between 1996 and 2005 and was determined to be 253 GPCD. A 20 percent reduction from the District's baseline water use of 253 GPCD is 202 GPCD; this is the District's 2020 Compliance Water Use Target. The 2015 Interim Water Use Target is simply the midpoint of the baseline and the 2020 Compliance Water Use Target, which is 227 GPCD. In 2015, the District's actual demand was 143 GPCD, below both the Interim Water Use Target and the Compliance Water Use Target, although a slight rebound is expected following the end of the recent drought.

The 2015 UWMP projected future GPCD values using a logarithmic regression analysis that allows for recognition of reductions in per capita water use over the last several years, while also allowing for future reductions in per capita water use, although at a slower rate of change. Future reduction in per capita water demand will be realized through ongoing conservation programs and passive savings from laws and ordinances requiring utilization of low-flow housing fixtures and water-efficient landscaping. The future projected GPCD is summarized in Table 4-2. Baseline, historic and projected GPCD are depicted in Figure 4-1.

Table 4-2. Projected GPCD

	2020	2025	2030	2035	2040
GPCD	155	154	153.3	152.5	151.7

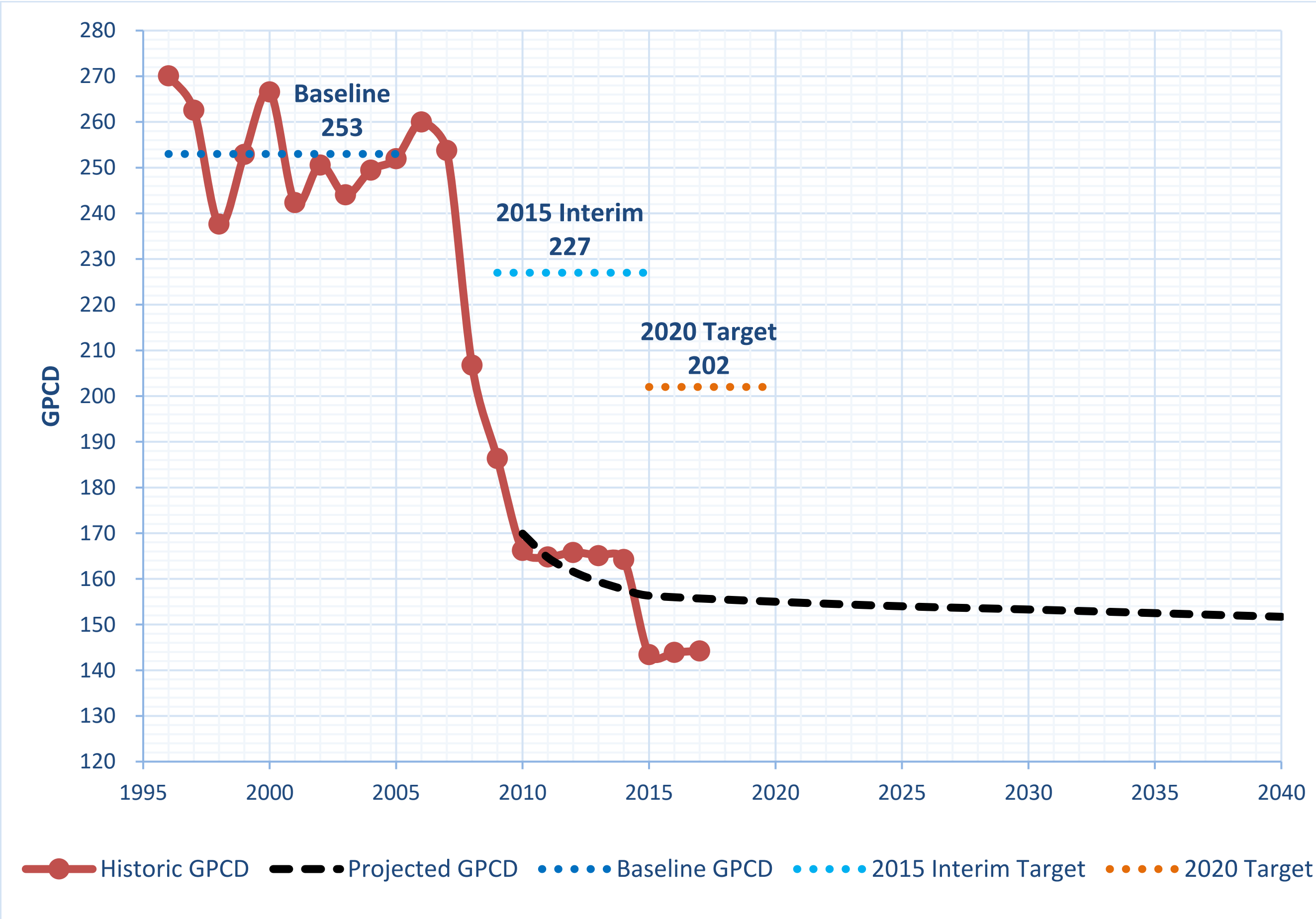


Figure 4-1. Baseline, Historic and Projected GPCD

4.1.1.2 Drought Response and New Conservation Regulations

On May 9, 2016 California's then Governor Brown issued Executive Order (EO) B-37-16 to Make Conservation a California Way of Life. EO B-37-16 tasked 5 State agencies with crafting a long-term water conservation framework to help prepare for changing climate conditions and water shortages. In 2018, the California State Legislature (Legislature) enacted two policy bills, (Senate Bill (SB) 606 and Assembly Bill (AB) 1668), to establish a new foundation for long-term improvements in water conservation and drought planning to adapt to climate change and the resulting longer and more intense droughts in California. These two bills amend existing law to provide expanded and new authorities and requirements to enable permanent changes and actions for those purposes, improving the state's water future for generations to come.

As part of this framework State agencies are in the process of developing new urban water use efficiency standards that are to be adopted by the State Water Board, in coordination with DWR, by June 30, 2022. See Section 8.1 for additional information.

4.1.2 Water Demand Factors

Water demand factors were developed by dividing 2014 water demands by the developed acreage per use type determined based on GIS parcel data received from the City. For consistency with the wastewater generation projection methodology used in the City's 2016 Sewer Master Plan, the use types in this Master Plan were grouped into Residential, Commercial and Industrial categories. The developed acreage and water demands per use type are summarized in Table 4-3. The 2014 water demands were used in this calculation because 2014 represents a relatively "normal" water usage year for the District, prior to the drought related conservation mandates that began in 2015.

The calculated water demand factors were compared with water demand factors from similar agencies and adjusted to align with the future water demand projections estimated in the 2015 UWMP. The selected water demand factors used for the water demand projections in this Master Plan are summarized in Table 4-4.

Table 4-3. Water Demand Factors Calculations

Land Use	Developed Acres	2014 Water Demand by Use Type (AFY)	2014 Water Demand by Use Type (gpd)	Calculated Water Demand Factor (gpd/ac)
Residential	11,006	19,349[1]	17,273,856	1570
Commercial	3,620	3,166[2]	2,826,055	780
Industrial	852	890[3]	794,318	930

1. *Includes demands for Single Family and Multiple Family categories from Table* 4-1*, as well as a proportional share of the Losses category.*
2. *Includes demands for Commercial/Institutional, Landscape Irrigation and Other categories from Table* 4-1*, as well as a proportional share of the Losses category.*
3. *Includes a proportional share of the Losses category from Table* 4-1.

Table 4-4. Selected Water Demand Factors

Land Use	Water Demand Factor (gpd/ac)
Residential	1500
Commercial	1000
Industrial	1000

4.1.2.1 SCLA Water Demand Factors

Due to the unique characteristics of the SCLA area, and to align with the methodology used in the 2016 Sewer Master Plan, demand factors for the SCLA area were determined using a different methodology, based on employees.

The following wastewater flow factors for SCLA area were used in the 2016 Sewer Master Plan:

- Commercial: 35 gpd/employee
- Industrial: 75 gpd/employee

To determine the water demand factors for SCLA, it was assumed that 70% of water use is returned to the sewer; this factor is based on the typical ratio of indoor water use for commercial and industrial users. Therefore, the selected water demand factors used for the SCLA area are as follows:

- Commercial: 50 gpd/employee
- Industrial: 107 gpd/employee

4.1.3 Demand Projection Methodology

To provide consistency among planning documents, the demand projection methodology used in the City's 2016 Sewer Master Plan was applied to the Water Master Plan, with some necessary modifications to account for a different planning horizon and the difference in the City and District boundaries.

According to the City's General Plan, the City is broken down into ten planning areas due to their distinctive land use characteristics and growth rates. These planning areas are as follows:

- Baldy Mesa
- Central City
- East Bear Valley
- Golden Triangle
- North Mojave
- Spring Valley Lake
- SCLA
- West Bear Valley
- West City
- Northern Expansion

The locations of these planning areas are shown in Figure 4-2. Spring Valley Lake planning area is not located within the District's boundary; therefore, it was not included in the water demand projection or allocation. The SCLA planning area water demand projections were analyzed separately from the rest of the planning areas.

The 2016 SMP used estimates of projected developed percentages in each planning area, provided by the City's Planning Department, to determine the acres to be developed in each planning area between 2016 and 2040. The developed acres were then converted to wastewater flow rates by multiplying them by unit flow factors, which are comparable to water demand factors.

The estimated development percentages for each planning area and land use category used for the WMP are summarized in Table 4-5. They are comprised of the development percentages used for the 2016 SMP for areas within the City only plus estimated development percentages for portions of the District that lie outside the City boundary. The development percentages for the areas outside the City boundary were also provided by the City Planning Department. These development percentages were applied to total available parcel acreage for each planning area to determine the projected 2040 parcel area. The 2016 parcel area was subtracted from the projected 2040 parcel area to determine the existing vacant parcel acreage to be developed between 2016 and 2040, summarized in Table 4-6. The existing vacant parcel acreage to be developed for each land use was then multiplied by the Water Demand Factors in Table 4-4 to determine the projected increase in water demand by 2040.

The SCLA planning area was analyzed separately because of its faster growth rate especially with industrial land uses. Water demand was projected using the employment growth rate in lieu of development percentages. The employment growth rate was provided in the 2016 SMP. The employee growth rate and the SCLA water demands from Section 4.1.2 were used to calculate the additional water demand for the SCLA area, summarized in Table 4-7. The planning horizon for this plan is 2028. The 2040 projected demands were scaled back to 2028 projections based on population projections from Table 1-4. The 2028 Additional Water Demand is also shown in Table 4-7.

Table 4-5. Projected 2040 Development Percentages by Planning Areas (excluding SCLA)

Planning Area	% Development within City (from 2016 SMP)			Additional % Development for District Areas Outside of City[1]		
	Residential	Commercial	Industrial	Residential	Commercial	Industrial
Baldy Mesa						
Baldy Mesa - In	62%	45%				
Baldy Mesa - Out				40%	10%	100%
Central City	76%	95%	79%			
East Bear Valley	76%	70%	71%			
Golden Triangle	62%	70%	59%			
North Mojave	18%	20%	24%			
West Bear Valley						
West Bear Valley - In	85%	75%	75%			
West Bear Valley - Out				95%	75%	95%
West City						
West City - In	80%	80%	32%			
West City - Out				95%	80%	40%

1. *Estimated development rates were provided by the City Planning Department for District areas that are located outside of City boundaries. These development rates were adjusted to align with the 2016 SMP development rates.*

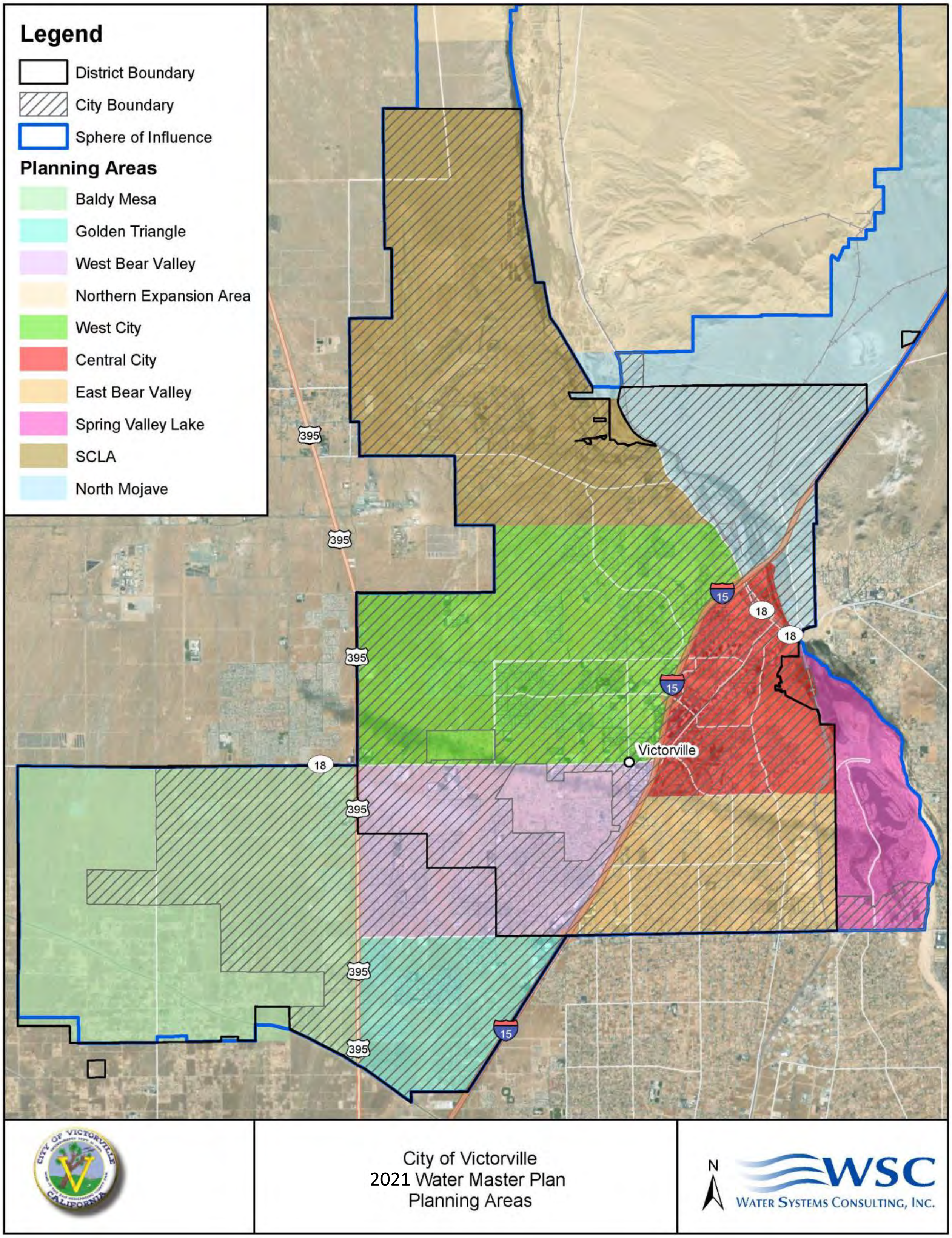


Figure 4-2. City's Planning Areas

Table 4-6. Total Available, Projected 2040, 2016 Developed and Existing Vacant Parcel Area

Planning Area	Total Available Parcel Area, acre			Projected 2040 Developed Parcel Area, acre			2016 Developed Parcel Area, acre			Existing Vacant Parcel Area to be Developed between 2016 and 2040 (acres)		
	Residential	Commercial	Industrial	Residential	Commercial	Industrial	Residential	Commercial	Industrial	Residential	Commercial	Industrial
Baldy Mesa[1]	9,502	1,595	40	4,766	471	40	2,293	18	40	2,473	453	-
Baldy Mesa - In	4,329	890	0	2,697	400	0	474	10	0	2,223	390	-
Baldy Mesa - Out	5,173	705	40	2,069	71	40	1,819	8	40	250	63	-
Central City	2,024	773	56	1,531	734	44	1,049	581	6	482	153	38
East Bear Valley	2,096	998	484	1,586	699	344	1,416	486	283	170	213	61
Golden Triangle	1,885	773	23	1,174	541	13	672	202	10	502	339	3
North Mojave	2,027	527	536	361	105	127	111	64	82	249	42	45
West Bear Valley[1]	3,468	931	59	3,018	698	47	2,908	370	36	110	328	11
West Bear Valley - In	2,648	911	50	2,239	683	38	2,234	361	27	5	322	11
West Bear Valley - Out	820	20	9	779	15	9	674	9	9	105	6	-
West City[1]	5,798	1,106	749	4,679	885	237	2,476	368	9	2,203	517	228
West City - In	5,560	1,106	749	4,453	885	237	2,259	368	9	2,194	517	228
West City - Out	238	0	0	226	0	0	217	0	0	9	-	-
Total	26,800	6,703	1,947	17,115	4,133	852	10,925	2,089	466	6,189	2,045	386

1. Includes acres inside and outside of City Limits.
2. Projected 2040 Developed Parcel Area was calculated by multiplying the Total Available Parcel Area by the Development Rate from Table 4-5.

Table 4-7. Additional Water Demand

Existing Vacant Parcel Acreage to be Developed between 2016 and 2040							Additional Water Demand Projected		
Planning Area	Residential	Commercial	Commercial Employees[4]	Industrial	Industrial Employees[4]	Total	Additional Water Demand by 2040[2], mgd	Additional Water Demand by 2028[3], mgd	Additional Water Demand by 2028, gpm
SCLA			378		9,509		1.04	0.54	376
Baldy Mesa[1]	2,473	453		-		2,926	4.16	2.17	1,509
Baldy Mesa - In	250	63		-		313	0.44	0.23	159
Baldy Mesa - Out	2,223	390		-		2,613	3.72	1.94	1,350
Central City	482	153		38		673	0.91	0.48	332
East Bear Valley	170	213		61		444	0.53	0.28	192
Golden Triangle	502	339		3		844	1.10	0.57	397
North Mojave	249	42		45		336	0.46	0.24	167
West Bear Valley[1]	110	328		11		449	0.50	0.26	183
West Bear Valley - In	105	6		-		111	0.16	0.09	59
West Bear Valley - Out	5	322		11		338	0.34	0.18	123
West City[1]	2,203	517		228		2,948	4.05	2.11	1,468
West City - In	9	-		-		9	0.01	0.01	5
West City - Out	2,194	517		228		2,939	4.04	2.10	1,463
Total	**6,189**	**2,045**		**386**		**8,728**	**12.75**	**6.66**	**4,624**

1. *Includes acres inside and outside of City Limits.*
2. *Additional water demands by 2040 were calculated by multiplying the existing vacant parcel acreage to be developed between 2016 and 2040 values by the water demand factors from Table 4-4.*
3. *Additional Water Demand by 2040 was scaled based on population projections in Table 1-4 in order to obtain Additional Water Demand by 2028.*
4. *Commercial and Industrial Employee projections are assumptions from the 2016 SMP.*

The additional water demands presented in Table 4-7 were added to the 2015 water demand from the 2015 UWMP. Table 4-8 summarizes the projected 2028 and 2040 water demands. As shown, the projected 2040 water demand calculated for the Water Master Plan aligns well with the projected 2040 water demand projected in the 2015 UWMP.

The projected 2028 total water demand of 25.3 MGD was used for this WMP.

Table 4-8. District's Current and Projected Demands

	2015 Demands (MGD)	2028 Demands (MGD)	2040 Demands (MGD)
2015 UWMP Demands	18.7		31.2
WMP Calculated Demands		25.3	31.4

4.1.3.1 Civic Center Specific Plan

The Civic Center Specific Plan was adopted in April 2016 and is a sustainability plan for Victorville's Civic Center that is intended to revitalize the area, promote infill development, reduce greenhouse gas emissions and encourage energy efficient development. The Civic Center Specific Plan boundary is Roy Rogers Dr/La Paz Dr to the north, Seventh St and Interstate 15 to the west, Palmdale Rd to the south, and Borego Rd to the east. The Civic Center Specific Plan is approximately 473 acres and consist of mixed residential and commercial uses within the West City, Central City and West Bear Valley planning areas. Based on the demand projection methodology for the WMP, demands for this specific plan are included.

4.1.4 Future Demand Allocation

The projected additional water demands for 2028 shown in Table 4-7 were spatially allocated in the hydraulic model.

For commercial and industrial uses in the main system and in SCLA, demands were added to the model using land use acreage and water demand factors. The locations of these demands were added to the hydraulic model based on the future wastewater flow locations provided in the 2016 SMP. In order to allocate the remainder of the demands within a planning area, the demand was allocated to vacant parcels using acreage and water demand factors.

For residential uses, the District keeps a database of potential residential developments that are in various phases of development. These records include the development names, number of lots, pressure zone and proposed water demand. Using this information, GIS parcel data and demands per land use in Table 4-7, the additional residential demands were spatially allocated in the model. Demands for approved residential developments were added first and then potential developments were added. Once the demands for all of the potential residential developments in the City database were allocated, there was still 378 gpm of additional demand to allocate. The remainder of the additional residential demands were allocated using vacant residential parcel acreage and water demand factors. Figure 4-3 illustrates the spatially allocated demands that were added to the model for 2028. Table 4-9 summarizes the existing and future water demands allocated to the model per zone. See Appendix A – Demand Allocation for additional demand allocation details.

Table 4-9. Existing and Future Average Day Demands per Zone

Pressure Zone	2015 (gpm)	2015 (MGD)	2028 (gpm)	2028 (MGD)
Zone 2890	203	0.29	210	0.30
Zone 2906	50	0.07	211	0.30
Zone 3065	2,802	4.04	3,996	5.75
Zone 3170	3,808	5.48	4,775	6.88
Zone 3290	3,531	5.08	3,866	5.57
Zone 3485	2,225	3.20	3,530	5.08
Zone 3675	207	0.30	787	1.13
Zone 3820	130	0.19	190	0.27
Total	**12,956**	**18.7**	**17,565**	**25.3**

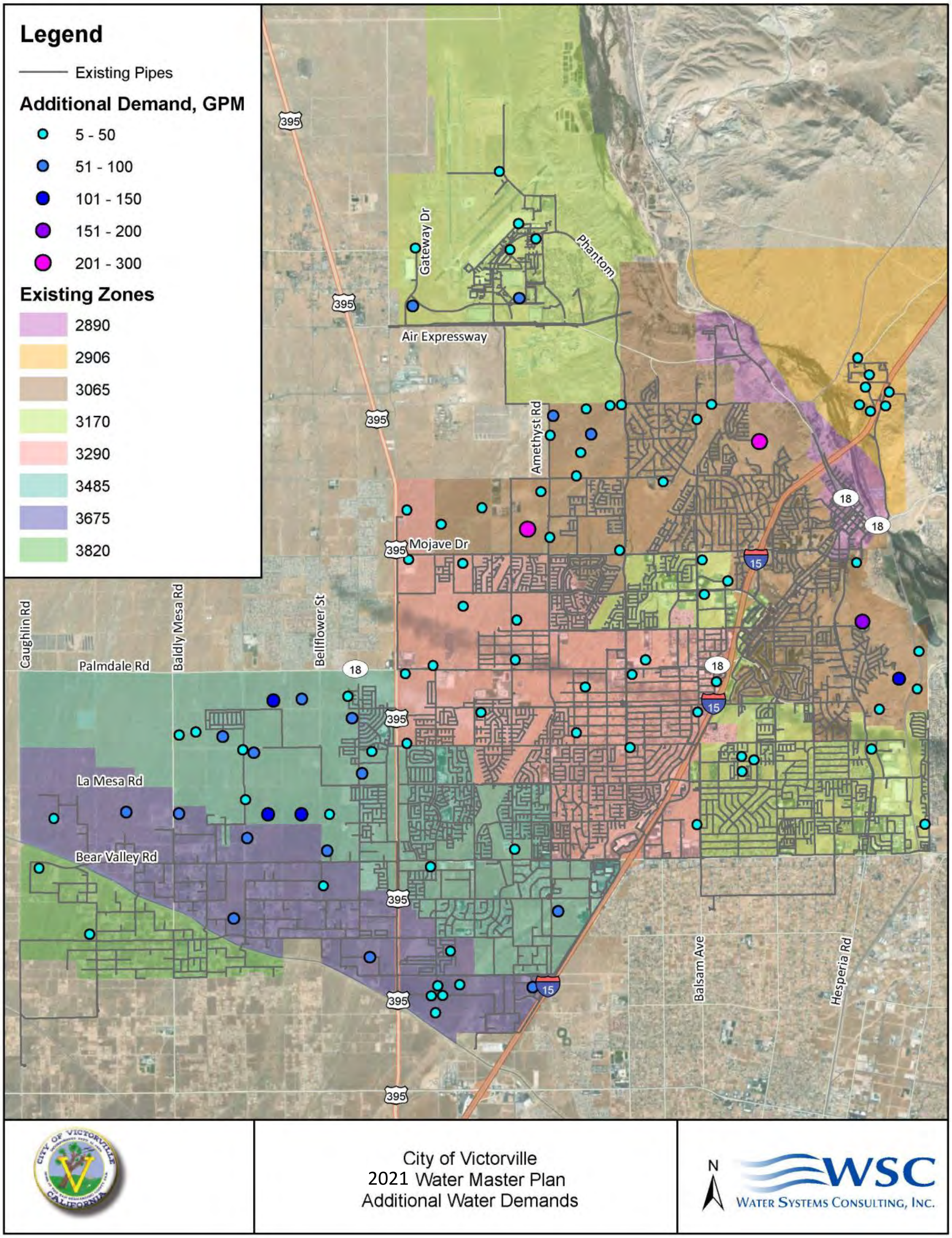


Figure 4-3. Future Water Demand Locations

4.2 Peaking Factors

Peaking factors account for fluctuations in demands on a seasonal, daily, or hourly basis. Since many of the District's pressure zones have somewhat unique characteristics and demand patterns, peaking factors were calculated for each pressure zone. Peaking factors were calculated using data from the District's production records and SCADA system. The District provided production data and tank levels for 2016, which was the most recent full year of data available at the time of the analysis. Time intervals of the data points provided vary from every ten minutes to every couple of hours based on how the facility is operated and how the data is reported and stored in the SCADA historian.

Using the District's 2016 monthly production records for each zone, the maximum demand month was identified for each pressure zone. The maximum month varied by zone, but occurred in either June, July or August for each zone, which is expected due to higher summer temperatures. Using the District's daily production records for each maximum month, the maximum day demand was identified for each zone. SCADA data then was used to determine the peak hour demands on the maximum day for each zone. The timesteps of the available SCADA data varied for sources and tanks so it was necessary to reformat the data to be on a common timestep for this analysis. The SCADA data was reformatted into 10-minute timesteps in Excel using the data point nearest to each 10-minute timestep. The total demand for each timestep was calculated by tabulating the total flow that entered the system and the change in storage based on change in tank levels. This analysis yielded the hour with the highest demand on the maximum day, the PHD. Using the calculated demands, the MDD and PHD peaking factors were calculated. Table 4-10 summarizes the calculated peaking factors for each zone. Table 4-11 summarizes the 2015 ADD, MDD and PHD demands allocated in the model.

As shown, peaking factors vary from zone to zone, likely due to the different mix of land uses and the size of each zone. For example, the peaking factors for Zone 2906 are particularly high compared to other zones; this may be due to several factors. Zone 2906 is a very small zone (average day demand of approximately 50 gpm) compared to most of the other zones. In a small zone with fewer connections, the impact of demand peaks can be more significant because there are fewer other customers with different demand patterns to damp the peaks, as is the case in larger zones. Zone 2906 also serves two large industrial customers which may have large peak hour demands compared to the minimal demands in the rest of the zone. Zone 3170 has the lowest PHD factors. This is likely due to the relatively high percentage of commercial and industrial customers in this zone compared to other zones. Zone 3170 serves SCLA as well as the Foxborough Industrial Park on Hesperia Road, which collectively make up the majority of the industrial uses in the City. Industrial demand peaks tend to be lower because demands are often spread more evenly throughout the work day or the production shift and are often low when residential demands are highest, effectively damping peaks from other types of uses in the zone.

The peaking factors presented in Table 4-10 were applied to the projected 2028 ADD to determine the projected 2028 MDD and PHD for each zone in the existing system, which is summarized in Table 4-12.

Table 4-10. Peaking Factors by Pressure Zone

Pressure Zone	ADD:MDD	MDD:PHD	ADD:PHD
Zone 2890	1.5	2.1	3.2
Zone 2906	2.8	2.9	8.1
Zone 3065[1]	1.9	1.5	2.9
Zone 3170[2]	1.4	1.2	1.7
Zone 3290	1.3	1.4	1.8
Zone 3485	1.6	2.0	3.2
Zone 3675	2.3	1.8	4.1
Zone 3820	1.4	2.2	3.1
System Wide Average	**1.5**	**1.5**	**2.3**

1. Zone 3065 subzones (3065A and 3065B) have the same peaking factors as Zone 3065.
2. Zone 3170 subzone 3170A has the same peaking factor as Zone 3170.

Table 4-11. 2015 Demands by Pressure Zone

Pressure Zone	ADD, gpm	MDD, gpm	PHD, gpm
Zone 2890	203	304	648
Zone 2906	50	140	406
Zone 3065[1]	2,802	5,221	7,878
Zone 3170[2]	3,808	5,331	6,473
Zone 3290	3,531	4,590	6,355
Zone 3485	2,225	3,560	7,120
Zone 3675	207	476	849
Zone 3820	130	181	402
Total	**12,956**	**19,803**	**30,131**

1. Includes Zone 3065 subzones 3065A and 3065B.
2. Includes Zone 3170 subzones 3170A.

Table 4-12. 2028 Demands by Pressure Zone

Pressure Zone	ADD, gpm	MDD, gpm	PHD, gpm
Zone 2890	210	314	670
Zone 2906	211	591	1,710
Zone 3065[1]	3,996	7,490	11,341
Zone 3170[2]	4,775	6,685	8,117
Zone 3290	3,866	5,025	6,958
Zone 3485	3,530	5,648	11,298
Zone 3675	787	1,810	3,227
Zone 3820	190	265	588
Total	**17,565**	**27,828**	**43,909**

1. Includes Zone 3065 subzones 3065A and 3065B.
2. Includes Zone 3170 subzones 3170A.

5 HYDRAULIC MODEL

CHAPTER 5

Hydraulic Model

This chapter summarizes the District's current water distribution system hydraulic model and additional updates and scenarios added to the model.

IN THIS CHAPTER

5.1 Overview of model

The City maintains mapping of the District's system in GIS, which was utilized by IDModeling, Inc (IDModeling) to develop an updated hydraulic model in 2016 (2016 Model). The hydraulic model is in InfoWater, Innovyze's GIS based hydraulic modeling software. IDModeling spatially allocated the District's 2015 water demands in the 2016 Model and the model was calibrated by IDModeling. WSC used the 2016 Model for the system hydraulic analysis and updated the pipe network to include facilities that were recently constructed or otherwise missing from the 2016 Model. The hydraulic model that was developed as a component of the 2010 WMP (2010 Model) has been maintained by WSC as part of other ongoing work and was used for reference as needed in updating the 2016 Model. The 2010 Model is now obsolete.

5.2 Hydraulic Model Updates

Several system improvements were added to the 2016 Model during the course of the WMP. These projects are listed in Table 5-1.

Table 5-1. Pipeline Projects Added to Hydraulic Model

Project	Zone	Source
Small Diameter Replacement 'Old Town' Phase 1	2890	Plan WP-1303
Small Diameter Replacement 'Old Town' Phase 2	2890	Plan WP-1391
SCLA Subzone	3170	System CAD file
Amethyst Rd Booster Station	3290/3485	Plan Project No. 74242
Nisqualli Bridge	3290	Plan WP-1072
3290 subzone	3290	Plan WP-1006
Wal-Mart Dunia Plaza	3485	Plan SP-06-035
Missing Links Water Pipeline Project	3170	Plan WP-0516
Transportation Facility WIP	3290	Plan WP-1221
Small Diameter Replacement Tract 3786 and 3900	3290	Plan WP-1294
I-15 Widening Project	2890	Plan WP-1386

In comparing the 2016 Model to the 2010 Model, the pipe C-factors were similar between the two models for the whole system except the SCLA area. The pipe roughness values in the SCLA area in the 2016 Model were much higher than the 2010 Model. WSC previously completed the calibration of the SCLA area in the 2010 Model in August of 2016 using field fire flow tests (see Appendix B – SCLA Model Calibration Technical Memo). Therefore, the pipe roughness values in the SCLA area were updated to match the values in the calibrated 2010 Model.

In order to perform the hydraulic analysis for the future system, future demands were added to the model. The process for allocating these demands is described in Section 4.1.4. The 2016 Model did not contain fire flow demands. However, the 2010 Model contained fire flow demands which were assigned to fire hydrants based on land use. WSC updated the nodes in the 2016 Model to match the fire flow demands from the 2010 model. The fire flow demands loaded in the 2016 Model were reviewed to check for correct values based on land use and remove any fire flow demands adjacent to undeveloped properties. Table 3-3 in Section 3.3 summarizes the required fire flows based on land use.

5.3 Model Scenarios

IDModeling added five Planning scenarios to the 2016 Model along with 28 scenarios which were used for calibration of the model. WSC added an additional nine scenarios in order to complete the hydraulic analysis for the WMP. All scenarios, except the calibration scenarios, are summarized in Table 5-2.

Table 5-2. Model 2016 Scenarios

Scenario Name	Description of Scenario	Child Scenario of	Demand Condition
Base	Base Network Scenario (Do Not Run)	-	-
Existing System	Folder to Hold Existing System Scenarios (Do Not Run)	Base	-
Calibration[2]	Folder to Hold Calibration Scenarios (Do Not Run)	Existing System	-
Ex ADD	Existing System Average Day Demand	Existing System	ADD
Ex MDD	Existing System Max Day Demand	Existing System	MDD
Existing System WMP[1]	Folder to Hold Existing System Scenarios for WMP (Do Not Run)	Base	-
EX ADD WMP[1]	Existing System Average Day Demand for WMP	Existing System WMP	ADD
Ex MinDD EPS[1,3]	Existing System Minimum Day Demand for WMP	Ex ADD WMP	MinDD
EX MDD WMP[1]	Existing System Max Day Demand for WMP	Existing System WMP	MDD
EX PHD WMP[1]	Existing System Peak Hour Demand for WMP	EX MDD WMP	PHD
Future System	Folder to Hold Future System Scenarios (Do Not Run)	Base	-
Future System WMP[1]	Folder to Hold Future System Scenarios for WMP (Do Not Run)	Base	-
Future Sys 2028 ADD[1]	Future System Average Day 2028 Demand for WMP	Future System WMP	ADD
Future Sys 2028 MDD[1]	Future System Max Day 2028 Demand for WMP	Future System WMP	MDD
Future Sys 2028 PHD[1]	Future System Peak Hour 2028 Demand for WMP	Future Sys 2028 MDD	PHD

1. Scenarios added to the 2016 Model by WSC.
2. There are an additional 28 scenarios under the Calibration scenario which were used to calibrate 2016 Model.
3. MinDD – Minimum Day Demand; EPS - Extended Period Simulation.

6 WATER SYSTEM ANALYSIS

CHAPTER 6

Water System Analysis

This chapter describes the assumptions, methodology and the findings of the water system analysis for the existing and future system. The water system analysis evaluated supply, storage, pumping capacity, power and hydraulic performance (system pressure, pipeline velocity and fire flow capabilities). The hydraulic performance in the SCLA area was analyzed separately from the rest of the system.

6.1 Supply Analysis

As stated in Section 2.3, the District's potable water supply is from groundwater and MWA's R^3 project. As discussed in Section 3.1, the evaluation criteria require that the water system shall meet MDD with the two largest wells out of service, as well as R^3 being out of service because it is not a guaranteed supply. The reduced supply with these sources out of service is referred to as the Firm Capacity. The District has numerous booster stations and PRVs which allow the District to transfer water between pressure zones in the event a well is out of service, enabling them to continue to serve demands when limited to the Firm Capacity.

As shown in Table 6-1, the system wide total capacity is 43,982 gpm (including R^3 supply) and the system wide firm capacity is 31,903 gpm. The 2028 system wide MDD is projected to be 27,828 gpm. There is approximately 4,075 gpm surplus of supply; therefore, additional supply sources are not anticipated to be needed within the 2028 planning horizon of this WMP. The total and firm supply capacity compared with current and future demands are summarized in Table 6-1.

IN THIS CHAPTER

Table 6-1. Supply Capacity vs Demand

	Supply Capacity, gpm
Current Well and R^3 Capacity	43,982
Current Firm Capacity	31,903
2015 MDD	19,803
2028 MDD	27,828
Excess Supply in 2028	**4,075**

1. Firm capacity is the total supply excluding the two largest wells in the system (Well 140 and Well 144) and R^3.

6.1.1 Supply Improvements

System wide there are no supply deficiencies; therefore, no new wells will be required in the 10-year Project Plan. Existing wells shall be maintained per the Rehab and Replacement Plan, described in Section 7.3.

6.1.2 Water Age Evaluation

WSC ran a water age scenario in the hydraulic model for the existing system. Existing operation of supply was added to the model using SCADA data and input from the District. The results of the water age run show the water moves quickly throughout most of the system. Water age in Zones 2906, 3675 and 3820 is higher compared to the rest of the system since these zones have a lower amount of demand then the other zones. This evaluation was performed for informational purposes only and it is the District's choice whether or not to modify operating levels for supply. The supply operation settings for the water age evaluation and the results are presented in Appendix G – Water Age Results.

6.2 Storage Analysis

The District currently has 26 storage reservoirs with a combined capacity of almost 74 MG (excluding Reservoir 211, which is operated by MWA as part of the R^3 Project). Details of these reservoirs can be found in Section 2.5.

The existing system storage in each zone is compared with the required storage of each zone, which consists of a combination of operational storage, fire flow storage, and emergency storage. Sizing requirements for each of these components are summarized in Section 3.4. Table 6-2 presents the results of the existing system storage analysis based off 2015 demands and shows that most of the zones currently have sufficient storage. Zones 2906 and 3485 have a small storage deficit, totaling approximately 0.30 MG of deficient storage capacity. However, these zones are connected to higher pressure zones by PRVs, allowing excess storage capacity from higher zones to be transferred to meet storage needs.

In Zone 3485, there are some additional factors that are relevant to the existing system storage analysis. Reservoir 201 is a 2.0 MG reservoir in Zone 3485 which is currently out of service due to a hydraulic imbalance in the zone. The District ultimately plans to construct a 30-inch diameter Zone 3485 Balancing Main, which will enable Reservoir 201 to be reconnected to the system to increase the Zone 3485 storage volume by 2.0 MG. Also, Reservoir 211 is a 5.1 MG storage reservoir that is being leased to MWA as part of the R^3 distribution system, but is hydraulically connected to Zone 3485. Although the capacity of this reservoir is not included in the District's storage analysis, it could be utilized to effectively increase the available storage in Zone 3485 in the case of an emergency and will be restored as part of the District's system in the future.

While the District prefers that each zone have sufficient storage independent of other zones, the existing storage deficiencies are relatively minor and can be mitigated by excess storage in higher zones, so the expense of storage improvements for existing customers is not warranted at this time. For this reason, no storage improvements were identified for the existing system.

Table 6-2. Existing System Storage Analysis

Pressure Zone	Operational Storage, MG	Fire Flow Storage, MG	Emergency Storage, MG	Total Required Storage, MG	Available Existing Storage, MG	Storage Surplus/ (Deficit), MG
2890	0.11	1.0	0.22	1.33	3.00	1.67
2906	0.05	1.0	0.10	1.15	1.00	(0.15)
3065	1.88	1.0	3.76	6.64	23.00	16.36
3170	1.92	1.4	3.84	7.16	12.50	5.34
3290	1.65	1.0	3.30	4.84	15.00	9.04
3485	1.28	1.0	2.56	4.84	4.70	(0.14)
3675	0.17	1.0	0.34	1.51	5.10	3.59
3820	0.07	1.0	0.13	1.20	2.50	1.30
Total	**7.13**	**8.4**	**14.26**	**29.79**	**66.80**	**37.01**

For the future system analysis, the existing storage in each zone is compared with the required storage for each zone based on the projected 2028 demands. The fire flow storage needs are the same as the existing system, but the operational and emergency storage requirements are higher because they are based on the water demands in each zone. Table 6-3 presents the results of the 2028 storage analysis.

As shown, the storage deficit in Zone 2906 increases to 0.64 MG, but there is still nearly 14 MG of excess storage in the next highest zone, Zone 3065, which can be transferred to Zone 2906 through a PRV. Therefore, no storage improvements are recommended for Zone 2906 in the 10-Year Project Plan.

The storage deficit in Zone 3485 increases to 2.4 MG by 2028. The Zone 3485 Balancing Main is recommended to be constructed in 2023, or when needed to meet future demands (see the P-30" Balancing Main Capital Project Description in Appendix E for more information). Once the Zone 3485 Balancing Main is constructed, the District can restore Reservoir 201 to service and increase the Zone 3485 storage volume by 2.0 MG. With Reservoir 201 back online, the storage deficit will be approximately 0.4 MG. However, there is still approximately 3.3 MG of excess storage in the next two higher zones, which can be transferred to Zone 3485 through PRVs.

Table 6-3. 2028 Storage Analysis

Pressure Zone	Operational Storage, MG	Fire Flow Storage, MG	Emergency Storage, MG	Total Required Storage, MG	Available Existing Storage, MG	Surplus/ (Deficit), MG
2890	0.11	1.0	0.23	1.34	3.00	1.66
2906	0.21	1.0	0.43	1.64	1.00	(0.64)
3065	2.70	1.0	5.39	9.09	23.00	13.91
3170	2.41	1.4	4.81	8.62	12.50	3.88
3290	1.81	1.0	3.62	6.44	15.00	8.57
3485	2.03	1.0	4.07	7.10	4.70	(2.40)
3675	0.65	1.0	1.30	2.95	5.10	2.15
3820	0.10	1.0	0.19	1.29	2.50	1.21
Total	**10.02**	**8.4**	**20.04**	**38.45**	**66.80**	**28.35**

6.2.1 Storage Improvements

Minor storage deficits can be met by excess storage in higher zones; therefore, no new reservoirs will be required in the 10-year Project Plan. Existing reservoirs shall be maintained per the Rehab and Replacement Plan, described in Section 7.3.

6.2.2 Seismic Freeboard for Reservoirs

This section discusses the current standards for freeboard in a reservoir according to American Water Works Association (AWWA) D100-11 (Welded Carbon Steel Tanks for Water Storage), where freeboard is defined as the distance from the Maximum Operating Level (MOL) to the lowest roof framing. According to AWWA D100-11, when establishing freeboard needs for a water tank, the sloshing wave height must be considered. Providing adequate freeboard can reduce damage to the roof and upper shell from a wave induced by seismic action. While damage to a tank as a result of sloshing may not be catastrophic, it may be costly to repair, could be considered a contamination risk and could affect the District's ability to serve stored water after an earthquake. This discussion is intended to address potential impacts to the District's reservoir capacity in relation to freeboard for the purposes of identifying potential reservoir capacity improvements only. It is not intended to serve as a seismic risk evaluation or to make recommendations for seismic retrofits.

Note that the current standards were not in effect at the time of construction of the District's existing tanks, and reservoir retrofits to meet these standards are not required. However, the freeboard heights required under the current standard can be used as a guide in assessing risks related to seismic safety and can aid the District in making operational decisions related to the freeboard in the existing tanks. Often the freeboard of existing reservoirs is less than that required by current code. The District does not have detailed information on the amount of freeboard in each reservoir, but it is generally estimated to be in the range of 1-2 feet for each reservoir. As shown in Table 6-4, the calculated freeboard for the District's reservoirs based on the equations in AWWA D-100-11 ranges from 4.6 to 7.3 feet. The District's options to address insufficient freeboard include:

- Raise the roof to increase freeboard
- Lower the maximum operating level to increase freeboard (reduces storage capacity)
- Retrofit roof connections to withstand forces applied to roof by sloshing wave to mitigate the risk of insufficient freeboard
- Accept the risk of insufficient freeboard and make no changes

If the District desires to lower the maximum operating level of all the reservoirs, Table 6-4 also presents the storage capacity reduction that would result. The total capacity reduction would be 8.9 MG, which is a 14% reduction from the current storage volume. Table 6-5 summarizes the impact that increased freeboard for all reservoirs would have on the storage capacity analysis for each pressure zone for the current system and the 2028 system. This comparison shows that the storage deficiencies in Zones 2906 and 3485 would increase slightly, but not enough to significantly impact the conclusions and recommended improvements in Section 6.2.1.

It is the District's choice whether or not to modify operating levels for any or all reservoirs; the information presented here is for discussion purposes only regarding potential storage impacts.

Table 6-4. Reservoir Seismic Freeboard and Capacity Reduction

Reservoir Number	Calculated Freeboard Height, ft	Total Reservoir Height, ft	Calculated Current Capacity, MG	Adjusted Capacity with Freeboard, MG	Reduction in Capacity, MG	Lost Capacity, %
102	6.5	32.0	1.6	1.4	0.2	15%
104	6.4	32.0	1.6	1.4	0.2	15%
105	6.7	32.0	1.9	1.6	0.3	16%
107	7.2	40.0	2.5	2.1	0.3	14%
108	7.2	40.0	2.4	2.1	0.3	14%
109	5.5	24.0	0.5	0.4	0.1	16%
110	7.3	39.0	2.6	2.3	0.4	14%
111	7.2	39.0	2.4	2.0	0.3	14%
112	6.9	38.0	4.8	4.1	0.7	14%
113	6.5	31.0	2.8	2.4	0.4	16%
114	6.9	38.0	4.8	4.1	0.7	14%

Reservoir Number	Calculated Freeboard Height, ft	Total Reservoir Height, ft	Calculated Current Capacity, MG	Adjusted Capacity with Freeboard, MG	Reduction in Capacity, MG	Lost Capacity, %
115	5.5	31.0	4.6	4.1	0.6	12%
116	7.1	39.0	4.9	4.2	0.7	14%
117	7.2	39.0	2.4	2.0	0.3	14%
118	6.5	31.0	2.8	2.4	0.4	16%
119	5.5	31.0	4.6	4.1	0.6	12%
120	4.6	27.0	4.9	4.4	0.5	10%
121	5.5	24.0	0.5	0.4	0.1	16%
202	6.6	30.9	1.9	1.6	0.3	16%
205	5.4	24.0	0.5	0.4	0.1	16%
207	6.9	32.4	2.6	2.2	0.4	16%
208	7.3	37.5	3.0	2.6	0.4	15%
209	6.9	37.5	1.9	1.7	0.3	14%
210	5.5	24.0	1.9	1.6	0.3	16%
Total			**64.2**	**55.3**	**8.9**	**14%**

Table 6-5. Seismic Freeboard Storage Reduction Summary by Pressure Zone

Pressure Zone	Current Surplus/ (Deficit), MG	2028 Surplus/ (Deficit), MG	Storage Reduction for Increased Freeboard, MG	Current Surplus/ (Deficit) with Increased Freeboard, MG	2028 Surplus/ (Deficit) with Increased Freeboard, MG
2890	1.67	1.66	0.47	1.20	1.19
2906	(0.15)	(0.64)	0.15	(0.30)	(0.78)
3065	16.36	13.91	2.82	13.54	11.09
3170	5.34	3.88	1.70	3.64	2.18
3290	9.04	8.57	1.97	7.07	6.60
3485	(0.14)	(2.40)	0.72	(0.86)	(3.12)
3675	3.59	2.15	0.71	2.87	1.43
3820	1.30	1.21	0.38	0.93	0.84
Total	**37.01**	**28.35**	**8.92**	**28.09**	**19.42**

6.3 Pump Station Analysis

As stated in Section 3.6, each BPS shall have a true spare unit for operational needs. All BPS, except for Plant 133 BPS, contain one or more spare pump units. As discussed in Section 2.6, HWY 395 BPS and White Rd BPS provide supply to Zone 3675 and Zone 3820. The evaluation criteria for these BPS require that they meet MDD with the largest unit out of service for zone supply reliability and must meet ADD plus fireflow for emergency conditions.

As shown in Table 6-6 and Table 6-7, both BPS meet the zone supply reliability and the emergency condition criterion, with an excess of pumping capacity for both current and 2028 demands.

Table 6-6. Pump Capacity for Zone Supply Reliability

BPS	Provides Supply to Zones	Total Pump Capacity, gpm[1]	Existing MDD	Existing Pump Capacity Surplus/(Deficit), gpm	2028 MDD	2028 Pump Capacity Surplus/(Deficit), gpm
HWY 395	Zone 3675 & Zone 3820	4175	657[2]	3518	2,075[2]	2,100
White Rd	Zone 3820	3150	181	2969	265	2,885

1. Total pump capacity is with the largest pump unit out of service for each BPS.
2. Includes demands for Zone 3675 and Zone 3820 since Zone 3820 demands must be pumped through both HWY 395 BPS and White Rd BPS from Zone 3485.

Table 6-7. Pump Capacity for Emergency Conditions

BPS	Provides Supply to Zones	Total Pump Capacity, gpm	Existing ADD plus FF, gpm	Existing Pump Capacity Surplus/(Deficit), gpm	2028 ADD plus FF	2028 Pump Capacity Surplus/(Deficit), gpm
HWY 395	Zone 3675 & Zone 3820	6340	4657[1]	1683	6,075[1]	265
White Rd	Zone 3820	4800	4181	619	4265	535

1. Includes demands for Zone 3675 and Zone 3820 since Zone 3820 demands must be pumped through both HWY 395 BPS and White Rd BPS from Zone 3485.

6.3.1 Pump Station Improvements

There are no pumping capacity deficiencies; therefore, no new BPS will be required in the 10-year Project Plan. Existing BPS shall be maintained per the Rehab and Replacement Plan, as described in Section 7.5.

6.4 Power Analysis

During power outages, the District desires to have portable or stationary backup power available for at least one well in each zone. The District has stationary generators for wells in Zone 3485 and 3170 and three additional portable generators. This provides coverage for all except one zone, but since the District's zones are interconnected the existing generators provide sufficient reliability.

Stationary backup power is also available at the Highway 395 BPS and White Road BPS, which provide the sole supply to Zone 3765 and Zone 3820.

The remaining well sites currently do not have permanent stationary generators for backup power; however, the District does have three portable generators which can be utilized at various sites as needed. One is 500 kW and two are 375 kW.

6.4.1 Power Improvements

The District recently procured three new portable backup generators and no additional generators are needed at this time. Generators shall be maintained per the Rehab and Replacement Plan, as described in Section 7.7.

6.5 Hydraulic Analysis Methodology

The hydraulic analysis was performed in the hydraulic model and assessed the existing system and 2028 system performance in terms of system pressure, pipeline velocity, and fire flow. Evaluation criteria for each of these elements are summarized in Chapter 3.

6.5.1 Hydraulic Analysis Assumptions

The assumptions used in the model for each system analysis is summarized in Table 6-8.

Table 6-8. Facilities Status for System Analysis

System Analyses	Demand Condition	Water Supply Status	Tank Level (% full)	PRV Status
System Pressure	PHD	On	50%	On
Pipeline Velocity	PHD	On	50%	On
Fire Flow Analysis	MDD	Off	50%	On

Per the District's preference, all small diameter pipes (5" diameter pipe and smaller) and older steel pipe, 5" diameter or smaller, are to be replaced. These improvements are expected to resolve numerous existing system deficiencies, so the pipes were replaced in the hydraulic model prior to performing the hydraulic analysis.

The following subsections summarize each scenario used for the hydraulic analysis.

6.5.2 System Pressure

Under PHD conditions, any nodes under 40 psi during the steady state model run were considered to be deficient. Some deficient nodes occurred in areas where small pipe diameters result in high friction losses and lower pressure; these were resolved by replacing small diameter pipelines with larger pipelines. Many areas that experienced this low pressure were caused by low static pressures at the higher end of a pressure zone. These areas were near a zone boundary and were recommended for rezoning into the adjacent higher zone to increase the pressure. Areas of high pressure (above 125 psi) were also evaluated. If areas of high pressure could be converted to a lower pressure zone without having any nodes under 40 psi, these areas were also considered for rezoning.

6.5.3 Pipeline Velocity

Under PHD conditions, any pipe with a velocity over 7 fps is considered to be deficient and will be recommended to be replaced with a larger pipe. Note that recommended projects from the system pressure analysis or fire flow analysis resolved the pipeline velocity deficiencies.

6.5.4 Fire Flow Capabilities

Under MDD, any node with a residual pressure less than 20 psi during fire flow conditions was considered to be deficient. Note that fire flow demands were not simulated along transmission mains or at water treatment plants.

Deficient nodes identified during the initial analysis were reviewed to determine if nodes were truly deficient. The following conditions were checked:

- Improper Land Use Designations. Fire flow demands were allocated to the hydraulic model based on the adjacent land use. Deficient nodes were reviewed and it was determined that some nodes were assigned higher fire flow demands than necessary based on the closest land use to the node. These fire flow demands were adjusted based on the actual land use and some nodes were no longer deficient. Deficient nodes that were located adjacent to vacant lots or in areas where no fire hydrants exist in the system were removed from the fire flow analysis and no longer considered deficient.
- Use of Multiple Hydrants – Large fires are typically fought with multiple fire hydrants. For deficient nodes with multiple fire hydrants in close proximity, a multi-hydrant fire flow run was performed. This analysis distributes the fire flow demand among two or three hydrants and typically results in a lower pressure drop compared with using one node. As a result, some of the initial deficient nodes were resolved.

6.6 System Hydraulic Analysis

The results of the existing system analysis are depicted in Figure 6-4. There are several areas with pressure deficiencies within the existing system, primarily due to low static pressure near zone boundaries. There are three areas with deficient pressure within the southern portion of Zone 3290 and one area in the southern portion of Zone 3170, and a large portion of Zone 3065. There are many fire flow deficiencies throughout the system, particularly in the areas of Zone 3065 that are also experiencing low pressure, and in portions of the system with dead end pipes. The future system (with 2028 demands) was also evaluated to identify additional deficiencies resulting from future growth. The improvements recommended to resolve the existing and future system deficiencies are summarized in the following sections.

6.6.1 SCLA Area Hydraulic Analysis

SCLA was analyzed separately from the rest of the water system. The SCLA water system currently contains a large quantity of old small pipes that were dedicated to the City after the closure of GAFB. The District does not have detailed as-builts for this system and the age, material and condition of the older pipes is largely unknown. As the area has been redeveloped, a backbone of new large-diameter mains has been installed. As new industrial and commercial customers connect to the new backbone pipelines, the District is upgrading the distribution pipes and abandoning the old pipes. The areas that still contain old pipes are operated under reduced pressure through seven PRVs that create a 3170A subzone. As old pipes are replaced, the subzone can be converted to Zone 3170 and the PRVs can be abandoned.

WSC performed a hydraulic analysis on the SCLA area using the criteria described previously. Fire flow runs were only performed on all pipes not in Subzone 3170A since the District does not intend to make any general improvements to the older portion of the system. When new developments occur at SCLA, the pressure and fire flow are assessed on a project specific basis and necessary improvements are identified at that time. There were no pressure, velocity or fire flow deficiencies identified in the backbone system. Available fire flow along the backbone pipes range from about 5,900 gpm to 10,900 gpm with current demands and from about 5,200 gpm to 10,500 gpm with 2028 demands.

6.7 System Improvement Recommendations

To address the existing and future deficiencies, recommendations were made for system wide improvements. The recommended improvement projects include pipeline, rezoning, storage and water quality projects. These projects were grouped into improvement areas (Areas) based on geographic area, phasing requirements, priorities and desired project size. Figure 6-5 and Figure 6-6 illustrate the location of the Areas. A large-scale map of the Areas is available in Appendix F – Large Scale Recommended Improvement Areas Map and detailed figures that illustrate the location and type of the recommended individual improvement projects are available in Appendix I – Recommended Improvement Projects Maps. See Appendix E – Recommended Improvement Areas Descriptions for more detailed information on each of the recommended projects.

6.7.1 Pipeline Improvements

There are several pipeline improvement project types that are recommended based on the different system analyses. For new waterlines linking two facility sites, the District will consider whether a fiber conduit for future use should be installed with the waterline to help expand the City's fiber network. If installed, the conduit shall be three inches with a pull box every 500 ft. The unit cost for installation of the conduit and pull boxes is approximately $ 20/ft and is not included in the costs in the 10-year Project Plan.

The recommended project types are as follows.

6.7.1.1 Small Diameter Replacement (SD), Steel Replacement (STL) and Looping (L)

These projects are incorporated per District preference. There is approximately 100,000 feet (19 miles) of existing steel pipe within the District's system. Most of the existing steel pipe is four inches in diameter and is often found to be in poor condition and leaking. The complete diameter distribution is shown in Figure 6-1. There is approximately 121,000 feet (23 miles) of existing AC and PVC pipe from two to four inches in diameter; pipes in this diameter range restrict available flow in parts of the water system. The lengths of each size and material are shown in Figure 6-2.

SD and STL projects assume that small diameter and old small steel pipes will be replaced with 8-inch pipe and that new service laterals will be installed. Looping projects are recommended to add pipe to the system in order to eliminate dead ends, which require periodic flushing and limit fire flow.

The District has identified specific pipeline areas that need to be prioritized for replacement and these are reflected in the 10-Year Project Plan. The highest priority is the STL projects because these are pipes that are typically in poor condition and leaking.

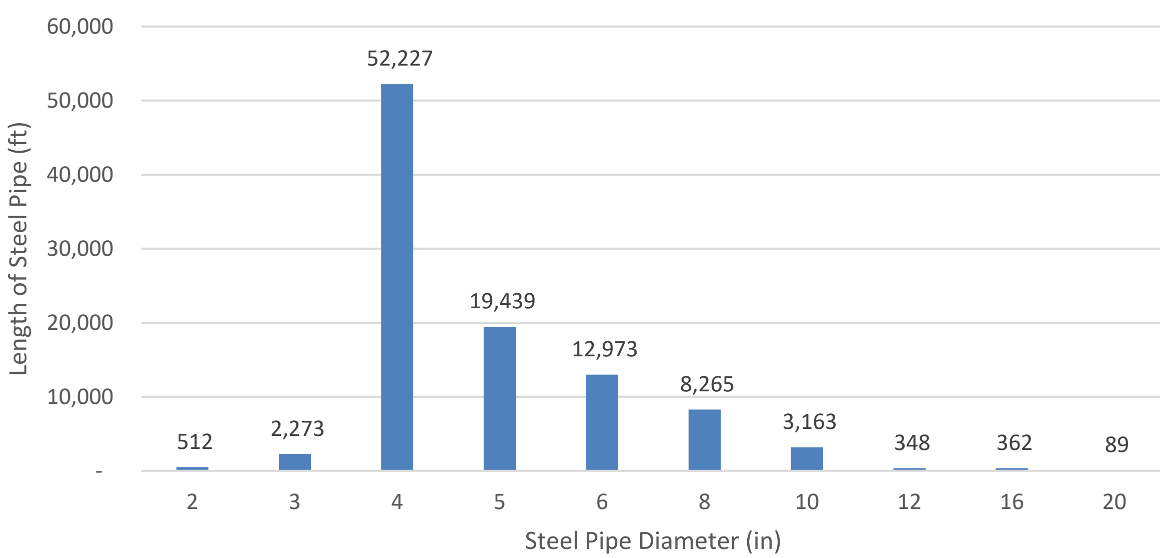


Figure 6-1. Existing Steel Pipe Diameter Distribution

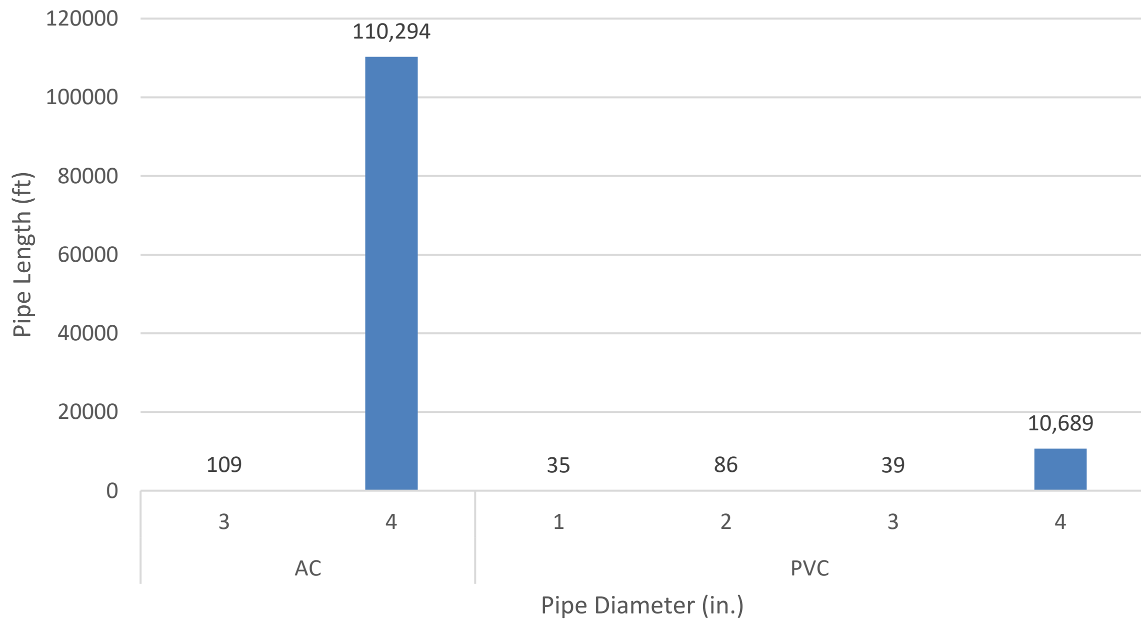


Figure 6-2. Existing Small Diameter Size and Material

6.7.1.2 Rezoning (RZ)

In some locations pressure deficiencies could be addressed by adjusting pressure zone boundaries. It should be noted that if there are any small diameter or steel pipes in the rezoning area, then the SD and STL projects shall be completed prior to the rezoning project is implemented. RZ projects are discussed further in the following section.

6.7.1.3 Fire Flow Projects (FF)

If there were deficient nodes due to fire flow, it was recommended that pipelines near deficient nodes be replaced with large diameter pipes.

6.7.2 Rezoning Projects

Several rezoning projects are recommended to resolve pressure deficiencies. It is recommended that a portion of Zone 3820 be rezoned to Zone 3675 to decrease pressure below 125 psi but maintain pressure above 40 psi. There are also several projects to resolve pressure deficiencies caused by low static pressure so it is recommended to rezone these areas into the next higher zone in order to increase the pressure above 40 psi. In areas where pressure is being increased above 80 psi, it is necessary to install pressure regulators at each customer service in order to protect the plumbing on the customer side. The District typically installs regulators in this case to reduce the risk of damage caused by the rezoning. The cost of installing pressure regulators are included in the cost option for each project. Details for each conversion project are included in Appendix E – Recommended Improvement Areas Descriptions.

6.7.2.1 3170 Zone Conversion

Over the past ten years, the District has worked to convert portions of Zone 3065 and 3290 to Zone 3170 to improve pressure in a large portion of the service area. There is still a portion of the original Zone 3170 Conversion identified in the 2010 WMP that needs to be completed. Project RZ-3 addresses the final changes that need to occur to complete the conversion. A large portion of the conversion area is not yet developed; therefore, this conversion should be completed prior to the start of development to avoid complications and additional conversion work.

6.7.2.2 Demands After Completion of Rezoning Projects

The rezoning projects will impact the distribution of demands among the District's pressure zones. The projected 2028 demands by pressure zone after all of the rezoning projects in the 10-year Project Plan are complete are shown in Table 6-9.

Table 6-9. 2028 Demands After Rezoning Projects are Complete

Pressure Zone	ADD, gpm	MDD, gpm	PHD, gpm
Zone 2890	210	314	670
Zone 2906	211	591	1,710
Zone 3065	3,686	7,005	10,691
Zone 3170[1]	4,929	6,954	8,509
Zone 3290	3,800	4,953	6,820
Zone 3485	3,752	5,936	11,695
Zone 3675	801	1,829	3,270
Zone 3820	176	246	544
Total	**17,565**	**27,828**	**43,909**

1. Includes Zone 3170 subzones 3170A.

6.7.3 Backbone Pipelines for Development

As development occurs, developers will need to construct backbone pipelines in major streets to serve their developments. These backbone pipelines that are anticipated to be constructed in the 10 year planning period were added to the model, located in areas of potential growth based on the 2028 demands. Backbone pipelines were limited to major streets and run approximately 0.5 miles apart in parallel and shown in Figure 6-5 and Figure 6-6. There is approximately 5 miles (26,400 ft) of 8 inch, 15 miles (79,200 ft) of 12 inch and 750 feet of 30-inch pipeline. Backbone pipelines are anticipated to be constructed by developers as needed for their respective developments; therefore they are not included in the 10-year Project Plan. The City may elect to provide credits against the Connection Fees for projects that construct backbone pipelines that are larger than that required to serve their specific development.

6.7.4 SCLA Area Improvements

The District has two near term pipeline projects at SCLA. These projects are described below and are shown in Figure 6-3. These projects are also included in the 10-year Project Plan.

- **SCLA West Side Pipe Phase II**
  There is potential for future growth in the north-western portion of SCLA near the north/south runway. There is currently an existing 12-inch pipeline across the north airport which is within Zone 3170A and a 24-inch pipeline along Gateway Dr which is within Zone 3170, as shown in Figure 6-3. A hydraulic analysis of the existing and potential future demands and fire flow needs in this area showed that a new 16-inch pipeline must be installed in order to support future commercial/industrial users. Since pressures in this area can reach greater than 125 psi, a PRV along Gateway Dr. is recommended to be installed. This new loop will be within Zone 3170A.

- **SCLA Flightline Pipe**
  There is an existing 8-inch pipeline under the SCLA tarmac that is vulnerable to failure due to the age and condition. A recent break on this main incurred a very high replacement cost due to the depth of the concrete tarmac so the City would like to proactively replace this main to avoid additional high cost emergency repairs. The existing 8-inch, which is currently in Subzone 3170A, shall be replaced with an 8-inch DIP along the same alignment as the existing, as shown in Figure 6-3. The City may elect to convert this new pipeline to Zone 3170 from Subzone 3170A. If so, the existing PRV-C will need to be relocated and two new PRVs will need to be added to system to make this conversion, as shown in Figure 6-3.

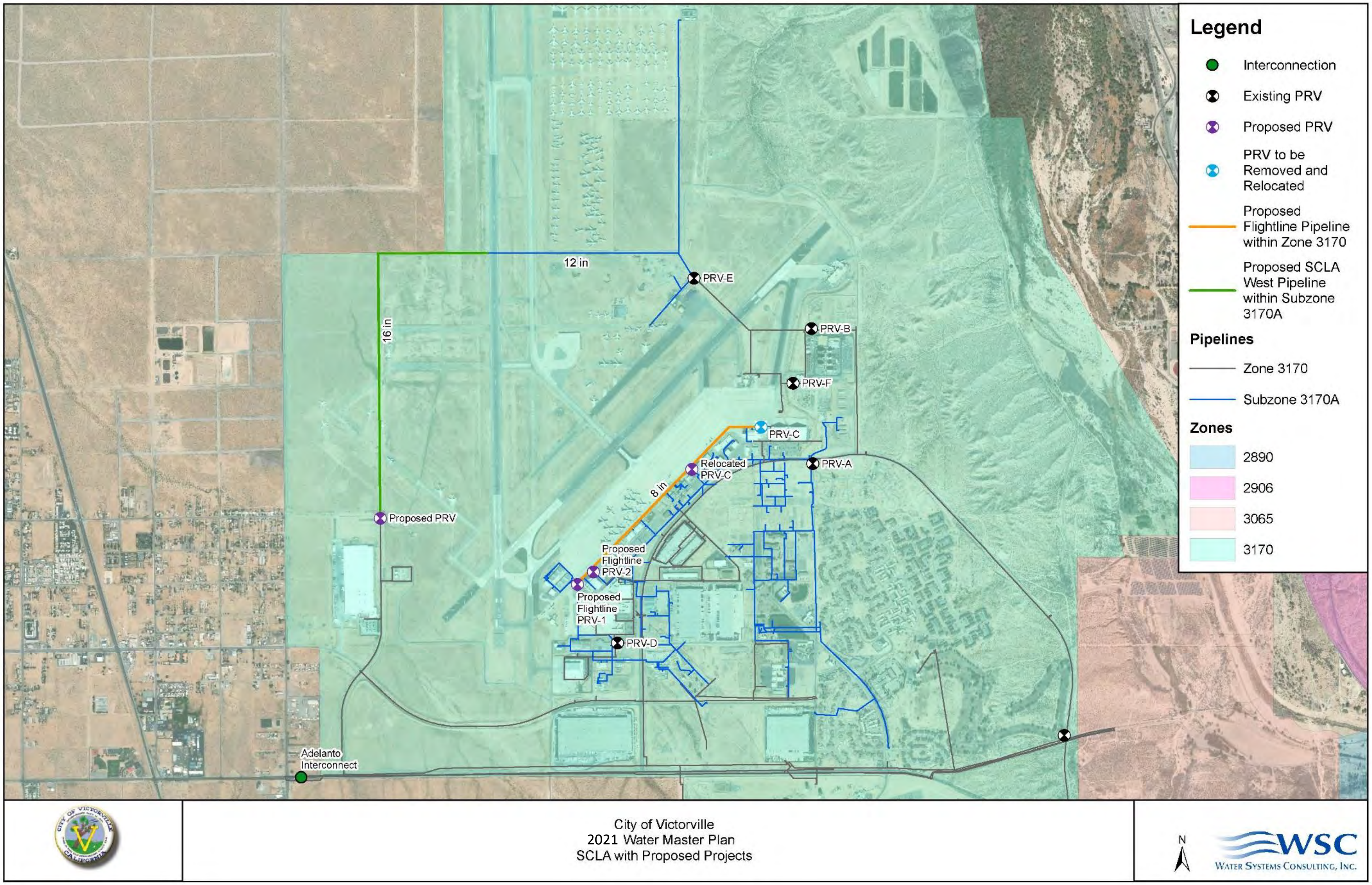


Figure 6-3. SCLA with Proposed Projects

6.7.5 Storage

The storage analysis determined that no new reservoirs need to be added to the system in the 10-year Project Plan. However, the City is coordinating with MWA regarding future use of Reservoir 201, which will be returned to the City's system at some point in the future.

6.7.6 Water Supply

There are several new water supply related facilities included in the 10 Year Project Plan.

- **Turnout 5 Metering Station and Pipeline**
  The District is constructing a new Turnout 5 (TO5) from the R^3 project to provide a new source of potable water to Zone 3485. The project includes a new turnout and metering station near MWA's R^3 pipeline and a 24-inch pipeline from the metering station to the Amethyst Booster Station. The pressure in the R^3 system is typically similar to or lower than the pressure in Zone 3485 so the Amethyst Booster is needed to convey the supply from TO5 into Zone 3485. There will also be a PRV to enable water from TO5 to enter the Zone 3290 reservoirs. Construction is expected to be begin in 2021 or 2022.

- **Turnout 6 Booster Station**
  The District currently receives water from the R^3 project in Zone 3485 through Turnout 6 (TO6) located on Mesa View Drive. However, the pressure in the R^3 system is typically similar to or lower than the pressure in Zone 3485 so the flow available from TO6 is very limited depending on hydraulic conditions. The desired minimum flow rate from TO6 is 2,000 gpm, which can only be achieved if the District reduces the water level in their Zone 3485 tanks to 35% full and the R^3 tanks are full. This is not a desirable operating scenario for the District because it significantly reduces operational storage. In addition, MWA is currently designing a new Turnout 7 (TO7) to the City of Adelanto, which will draw from the same pipeline as TO6 and further reduce the available flow to TO6 when Adelanto is also taking water from TO7. The District has been working closely with MWA to develop a solution to increase the available flow at TO6 and they have agreed that a booster station would be needed at TO6 to increase available flows. TO5 is being implemented in the near term to supplement supply to Zone 3485 so TO6 is a lower priority. This booster station is under construction and will be completed by summer 2021.

- **Zone 3485 Balancing Main**
  Due to hydraulic constraints in the Zone 3485 distribution system, the flow that can be conveyed through the Avenal Blending line into Zone 3485 (which includes flow from the new Amethyst Booster Station) is limited to 6,250 gpm. Additionally, Reservoir 201 was taken out of service after the Avenal Blending Line was installed because the hydraulic constraints caused it to overflow before sufficient water could be conveyed to the western portion of Zone 3485. The 2010 Water Master Plan identified the need for a 30-inch Zone 3485 Balancing Main to address the hydraulic constraint in the system, which would increase the flow that can be conveyed into Zone 3485 from the Avenal Blending Line and enable Reservoir 201 to be returned to service. That project is included in this 10-year Project Plan as well; other alternatives could be considered but were not evaluated in the 2021 WMP. The timing for this project is dependent upon development in Zones 3485, 3675 and 3820 and should be implemented when the flow needs from the east side of Zone 3485 exceed 6,250 gpm, or when the District needs to put Reservoir 201 back online to increase storage capacity. The hydraulic constraints and timing considerations are discussed further in Appendix H – ID1-ID2 Booster Station Impact Analysis TM. The District will monitor the rate of development and actual demands in these zones.

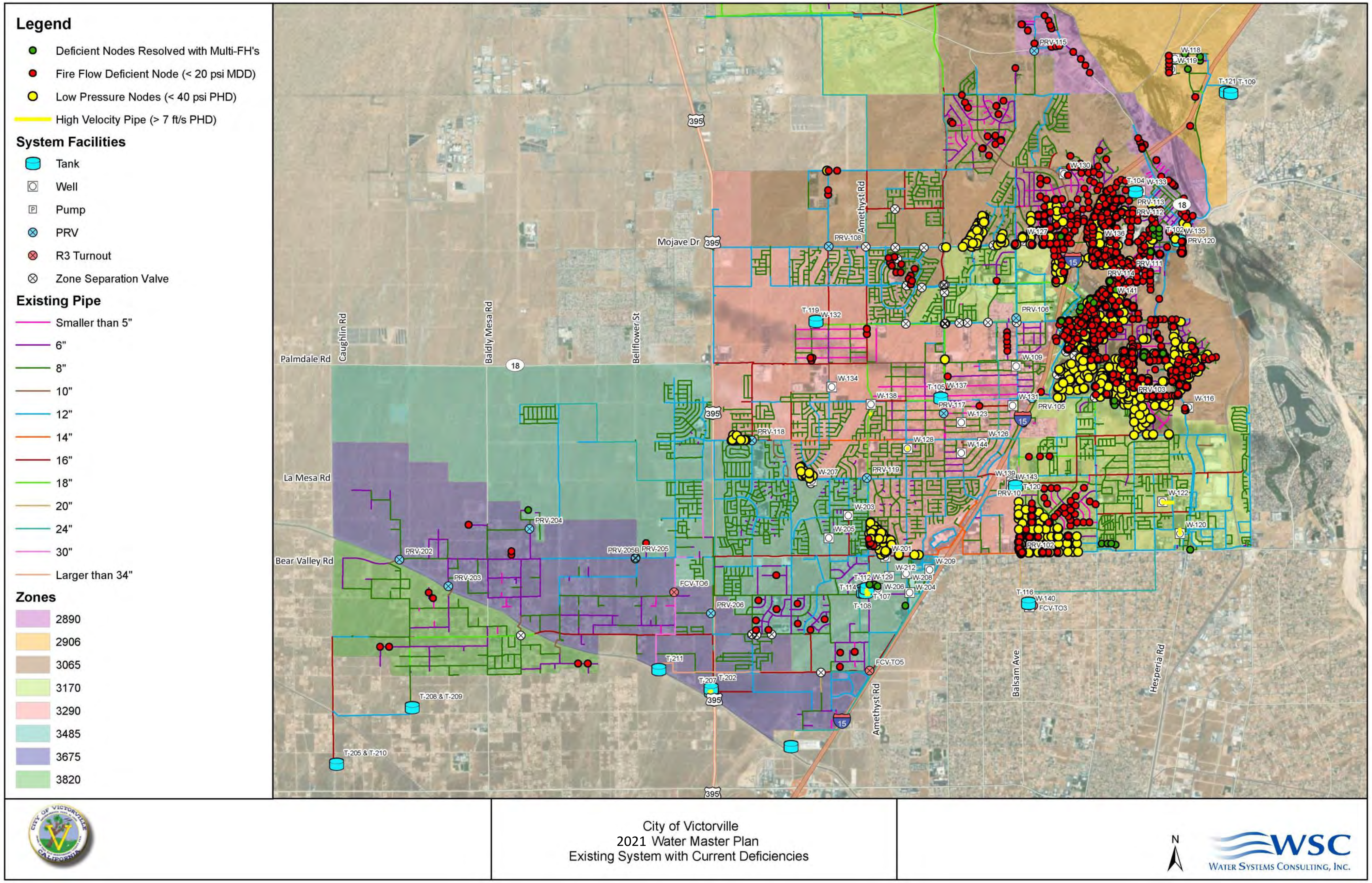


Figure 6-4. Existing System with Current Deficiencies

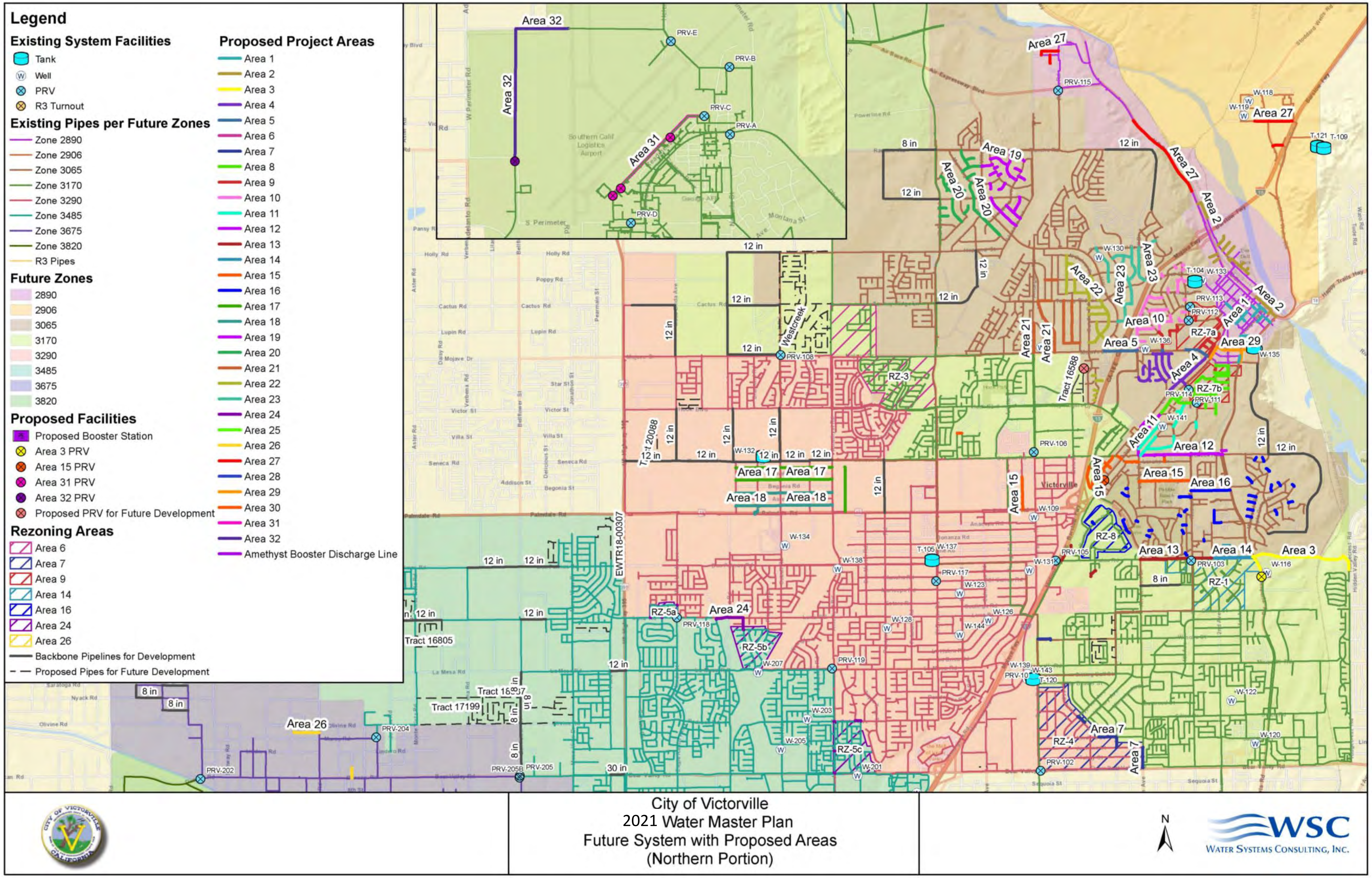


Figure 6-5. 2028 System with Proposed Projects (Northern Portion of System)

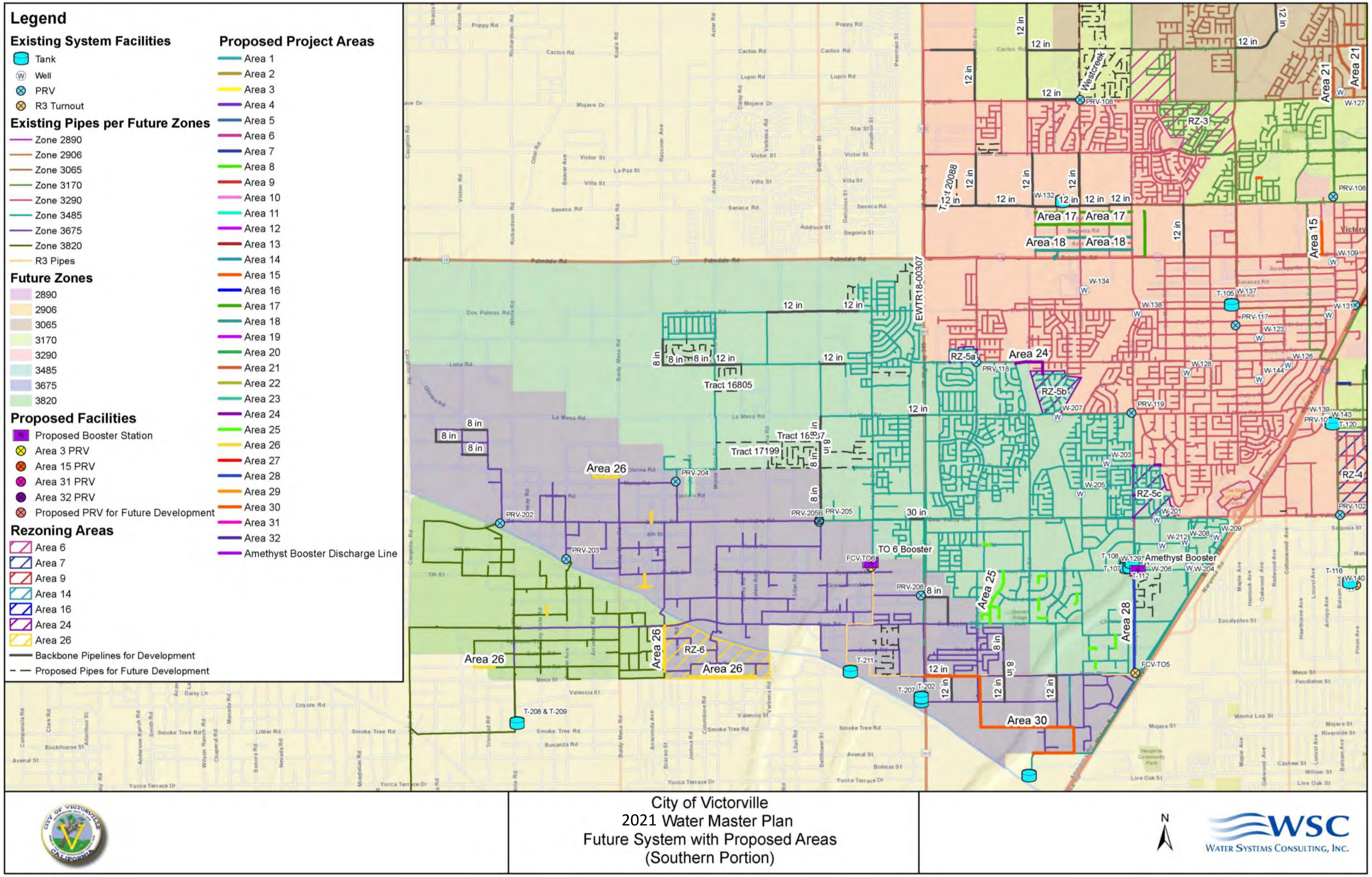
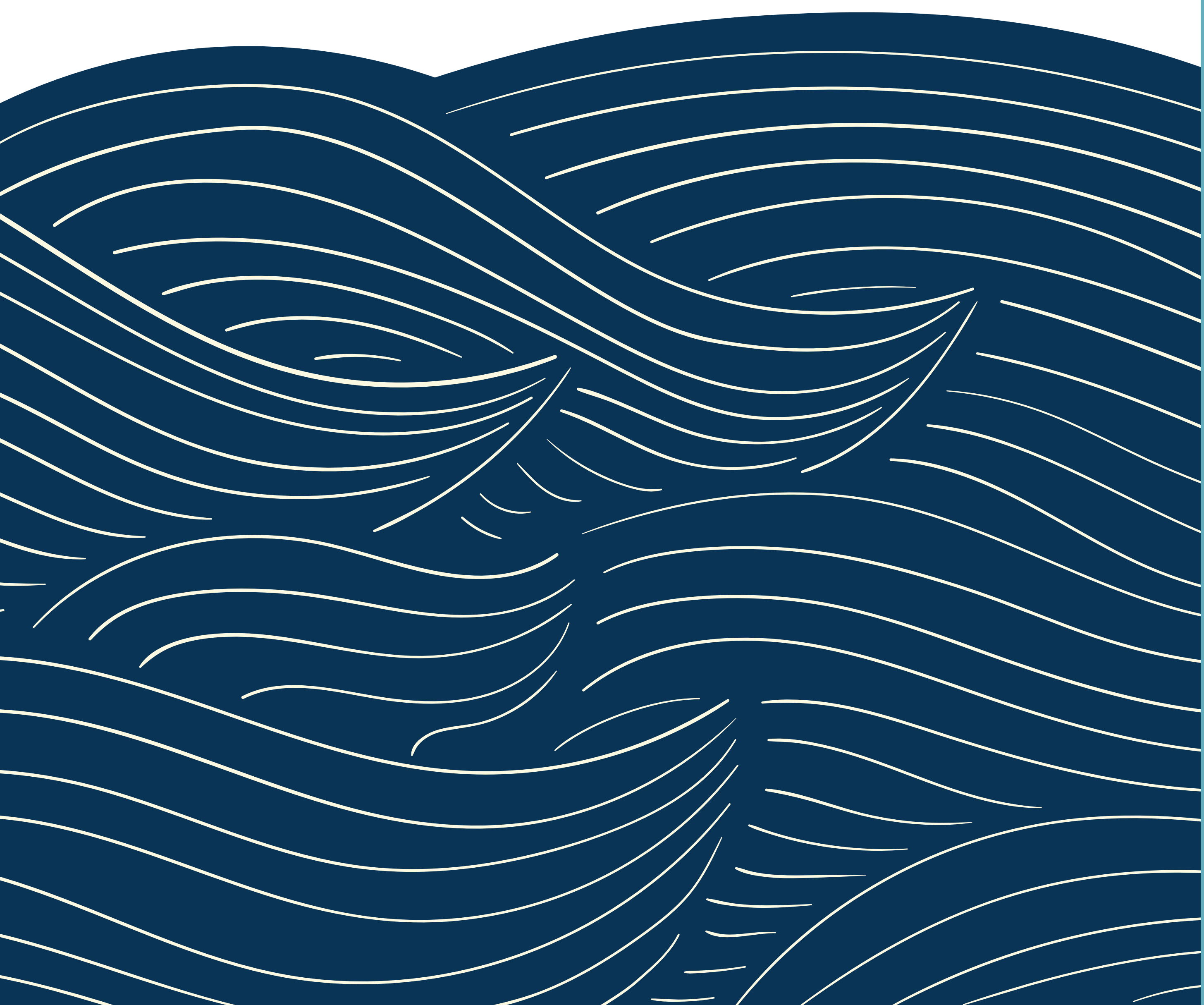


Figure 6-6. 2028 System with Proposed Projects (Southern Portion of System)

7 REHABILITATION & REPLACEMENT PLAN



CHAPTER 7

Rehabilitation and Replacement Plan

The following section describes the condition of the District's major facilities to establish rehabilitation and replacement needs to maintain safe and reliable water system operations.

7.1 Background and Purpose

The District values the importance of establishing a routine replacement program for aging assets so that they can be replaced proactively to avoid accumulating a backlog of replacement needs that could lead to service interruptions and/or sudden and significant financial impacts to the ratepayers. For each of the following major facilities, factors such as age, expected useful life, and District knowledge of condition were considered to establish appropriate rehabilitation and replacement (R&R) needs:

- Distribution system pipelines
- Pressure reducing valves
- Groundwater wells
- Booster pump stations
- Water treatment plants
- Back-up generators
- Storage reservoirs
- Water meters and service lines

The analysis used District input as well as AWWA and EPA sources on the expected useful life of various assets in the service area to evaluate what will need to be inspected, rehabilitated, or replaced on a periodic basis in the future to maintain the distribution system in safe and reliable operating condition.

IN THIS CHAPTER

The District identified specific pipeline areas that need to be prioritized for replacement, and these are reflected in the 10-Year Project Plan. Once the District's near-term priorities are addressed, the R&R Plan in this chapter identifies the assets that need to be inspected, rehabilitated, or replaced each year. For pipelines, this analysis presents rehabilitation and replacement recommendations based on several annual spend options to allow the District to select the most appropriate approach to infrastructure rehabilitation, given budgeting and level of service goals. This R&R Plan is intended to provide a framework to guide future policy and budgeting decisions related to asset maintenance. R&R needs identified for the next 10 years (through FY 2028/29) are incorporated in the 10-Year Project Plan, but future R&R costs beyond that horizon may increase as additional facilities reach the end of their useful lives.

7.1.1 SCLA

According to District staff, the water system serving the SCLA area is currently in adequate working order and there are no specific near-term improvements required to address condition. Although many of the existing pipelines at SCLA are likely reaching the end of their useful lives, there is substantial redevelopment planned for the SCLA area that often dictates relocation, replacement and upsizing of existing pipes to meet the specific needs of new developments, and these requirements cannot be anticipated in advance due to the diverse nature of the development at SCLA. Therefore, the District intends for facility R&R at SCLA to be driven by development on an as-needed basis. Therefore, the facilities in the SCLA area are excluded from this R&R Plan.

There is one exception identified in 2018, which is the SCLA Flightline Pipeline. This pipeline runs along the flightline beneath the 12-inch thick concrete tarmac and serves many customers. This pipeline experienced a failure in 2018 and was very costly to repair on an emergency basis due to the thick concrete cover. The District anticipates additional failures on this pipeline in the future and is planning to replace this line proactively to avoid a series of costly repairs and service interruptions. This project is considered a high priority and is included in the 10-year Project Plan.

7.1.2 Estimated Useful Life

Pipes, tanks, valves, pumps, and other system components wear out over time and should be scheduled for future replacement. The expected "useful life" of water distribution system components depends on execution of routine maintenance, dynamic system conditions such as pump cycling and pipeline operating conditions including velocity, the quality of the installing contractor's work and a wide range of other factors. However, industry accepted guidelines and local experience may be used for long term planning of infrastructure replacement.

Table 7-1 provides estimated useful life spans for a variety of water system assets based on District experience and information published by AWWA and the EPA. These are estimates only, for the purpose of establishing sufficient budget to keep up with long term rehabilitation and replacement needs. The District will evaluate individual infrastructure components prior to replacement.

Table 7-1. Estimated Life for Potable Water System Facilities

Facility	Estimated Life (years)
Pipelines[1, 2]	60-100
Steel (unlined/uncoated)	60
Asbestos Cement	90
Ductile Iron	100
PVC	70
Steel (Cement Mortar Lined and Coated)	95
Water Meters[1]	20
Wells (varies with casing material, design, maintenance, and water quality)[1]	50
Pump Building (not including pumps, motors, and electrical)[1, 2]	60
Pumps & Motors[1, 2]	15
Electrical and control systems at pumping and storage facilities[1, 2]	20
Chlorination Equipment[1, 3]	10
Valves (i.e. pressure reducing valves)[1, 2]	40
Welded steel storage tanks (except coating)[1, 2]	60
Tank coatings[1]	15
Portable Diesel Generator[1]	15

1. District's experience.
2. Copeland, Ari. "Can a Small System Develop an Effective Asset Management Program?" AWWA Opflow Jan. 2008: 6; EPA. Asset Management: A Handbook for Small Water Systems. EPA Office of Water, 2003; AWWA. Buried No Longer: Confronting America's Water Infrastructure Challenge.
3. EPA, Asset Management: A Handbook for Small Water Systems, 2003.

7.1.3 Condition Assessment Approach

For each facility type, an appropriate condition assessment approach was identified in coordination with the District based on the available information. The results of the condition assessment serve as the basis of recommendations in the R&R Plan.

7.1.3.1 Pipelines

Pipelines were evaluated by comparing the installation year and material with expected useful lives for similar facilities to forecast potential future replacement needs. While this approach does not reflect the actual condition or remaining useful life of the pipelines, it does provide guidance on the magnitude of potential future replacement costs and timing.

7.1.3.2 PRVs, Wells, Booster Pumps, Treatment Plants and Generators

The District's Production Staff maintains thorough records of pump tests, repairs, and replacements as well as comprehensive inspections for each of their PRVs, groundwater wells, booster pump stations, water treatment plants, and generators. District staff used their existing records and knowledge to assess the condition of these facilities using an assessment framework provided by WSC, as described further below. The District provided the results of their assessment for incorporation in the R&R Plan.

A structured evaluation process is an effective way to objectively document facility condition and provide justification for R&R projects, as well as help with prioritization of improvements. All of the existing assets in this category were assigned a letter grade for each major component of the system based on apparent condition and functionality observed by District staff. This tool can also be used by District staff on an ongoing basis to re-evaluate future needs and priorities as replacements are completed and as new deficiencies develop over time. Table 7-2 shows the grading scale used to summarize the condition of assets and their components.

Table 7-2. Asset Condition Grading Scale and Definitions

Grade	Definition
E	Component appears in good condition but is not being used
A	85-100% useful life left of component (or system)
B	50-85% useful life left of component (or system)
C	15-50% useful life left of component (or system)
D	0-15% useful life left of component (or system)
F	Component or system has already failed
U	Condition unknown or not visible
N	Component does not exist

7.1.3.3 Reservoirs

Each existing reservoir was inspected by a team from Suez Advanced Solutions (Suez) using a remote operated vehicle (ROV) to access the interior of active reservoirs. Suez scored the condition of each reservoir using a similar framework to the one described above.

7.1.3.4 Water Meters and Service Lines

The District provided information on their ongoing meter and service line replacement program, which has previously established replacement rates.

7.2 Pipelines

7.2.1 Assessment

The District is faced with the challenge of maintaining more than 650 miles of water main in a cost effective, proactive manner. The water mains that comprise the distribution system are of various materials and range in size from 2-in to 30-in diameter, installed during different eras of growth. Figure 7-1 shows the percent of existing pipe installed by decade, and Figure 7-2 shows the percent of existing pipe by material based on GIS data. For pipe install year and material for pipes with missing data, see assumptions in Section 2.8.

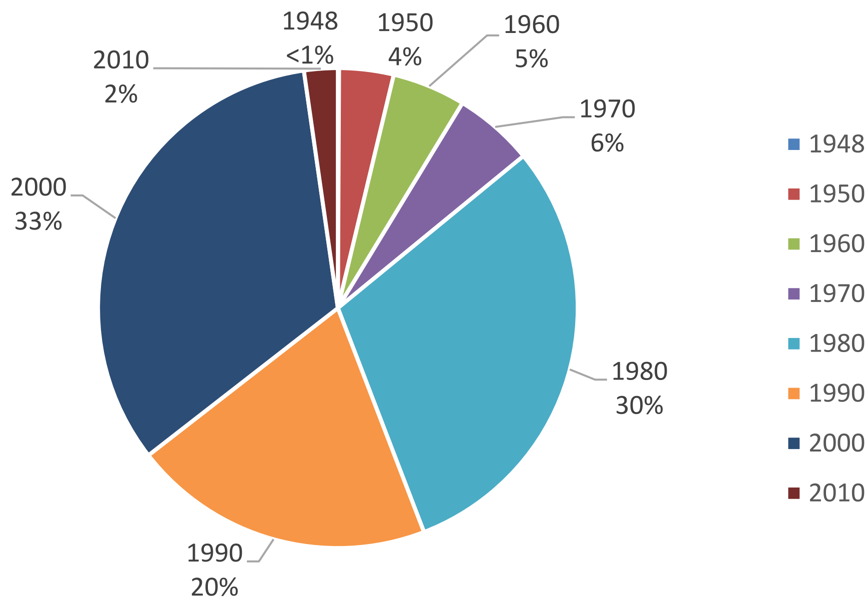


Figure 7-1. Percent of Existing Pipe by Installed Decade

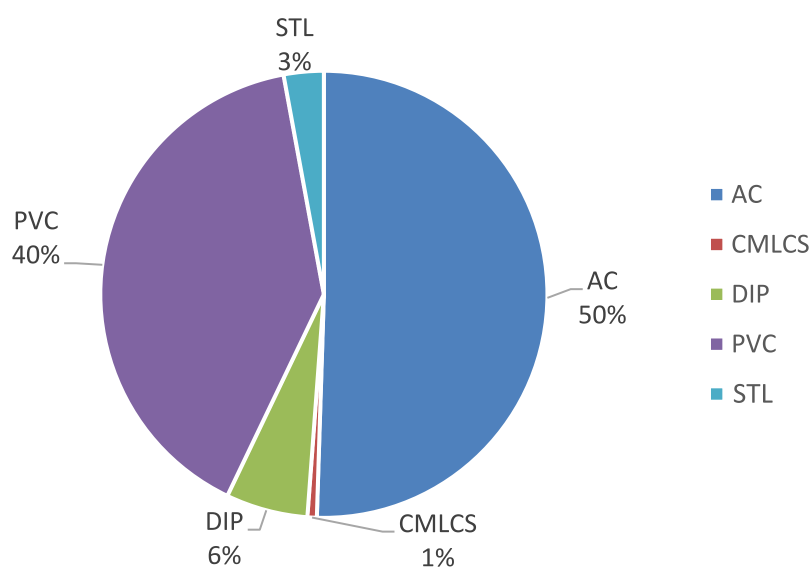


Figure 7-2. Percent of Existing Pipe by Material

For financial planning, an assumed useful service life was set for each common pipe material in the distribution system, as listed in Table 7-3. Starting with the pipe installation year and adding the assumed useful service life, the expected replacement year was established for each pipeline in the water system.

Table 7-3. Estimated Useful Service Life for Pipelines by Material

Pipeline Material[1, 2]	Material Abbreviation	Estimated Useful Service Life (years)[1]
Steel (unlined/uncoated)	STL	60
Asbestos Cement	AC	90
Ductile Iron	DI	100
PVC	PVC	70
Steel (Cement Mortar Lined and Coated)	CMLCS	95

1. District's experience.
2. Copeland, Ari. "Can a Small System Develop an Effective Asset Management Program?" AWWA Opflow Jan., 2008: 6; EPA. Asset Management: A Handbook for Small Water Systems. EPA Office of Water, 2003, AWWA. Buried No Longer: Confronting America's Water Infrastructure Challenge.

To ensure the SD projects and the STL projects identified in Section 6.7.1.1 were not duplicated with the condition based improvements evaluated in the R&R Plan, the pipelines planned for replacement under STL and SD projects were assumed to have a replacement date of 2120, reflecting an assumed 100-year service life.

To ensure pipelines that are proposed to be replaced due to FF projects identified in Section 6.7.1.3 were not duplicated with the condition based improvements evaluated in the R&R plan, pipelines that are planned to be replaced due to FF projects were assumed a replacement date of the proposed FF project construction year plus a 100-year service life.

7.2.2 Rehabilitation and Replacement

The District is looking to develop a replacement program for the existing distribution pipes varying in size from 6 to 24 inches based on the estimated useful life of the pipe material. Based on the existing pipe material, installation year and estimated remaining useful life, WSC does not anticipate any pipeline replacement needs over the next 15 years (excluding the STL and SD projects discussed in Section 6.7.1.1). However, a large amount of AC and PVC pipe was installed in the late 1980's and early 1990's that may all reach the end of its estimated useful life in 50 to 70 years, which presents a challenge. As discussed in Section 2.6.1, the District's pipeline age data in GIS was partially incorrect or incomplete so some assumptions were made about installation dates to correct apparent errors and fill in data gaps. The assumed installation years were used in this analysis. This data is currently being updated in the comprehensive GIS update currently underway.

The pipeline replacement unit costs used for this analysis are summarized in Table 7-4. For pipelines 16" and smaller, it was assumed that there were 15 service lines for every 1,000 feet of pipe that would be replaced as part of the pipeline replacement project. For pipelines 18" and larger, it was assumed that no service laterals would need to be replaced.

For new waterlines linking two facility sites, the District will consider whether a fiber conduit for future use should be installed with the waterline to help expand the City's fiber network. If installed, the conduit shall be three inches with a pull box every 500 ft. The unit cost for installation of the conduit and pull boxes is $20/ft. This unit cost is not included in the costs presented in Table 7-4.

Table 7-4. Pipeline Replacement Unit Costs

Pipe Diameter (in)	Project Unit Cost with Laterals ($/LF)[1]	Project Unit Cost without Laterals ($/LF)[1]
2 - 6	$180[2]	$140[2]
8	$180	$140
10	$197	$157
12	$213	$172
16	$258	$218
18	-	$299[3]
20	-	$331[3]
24	-	$413[3]
30	-	$473[3]

1. *Includes a 20% construction contingency and 25% project development allowance. Costs are in 2018 dollars.*
2. *All existing pipe smaller than 8-inch diameter is assumed to be replaced with 8-inch pipe.*
3. *18-inch and larger diameter pipe are assumed to be DIP.*

The District can take several approaches to a replacement strategy, and two options are presented here for information only: a straight line replacement rate and a phased replacement rate.

Using a straight-line replacement approach beginning in 2018 would result in spending approximately $6.3 million per year (in 2018 dollars; future costs would be escalated). While this option stabilizes the replacement costs over time, it would result in replacement of pipelines before the end of their useful lives, which does not maximize the use of existing assets. This option is presented as an illustration to identify the magnitude of long term replacement needs but is not recommended as the most efficient replacement strategy.

The second strategy is a phased approach that more closely follows the estimated end of life for the pipelines but still represents a proactive approach to replacing pipelines to avoid accumulating a backlog of replacement needs that could lead to service interruptions and/or sudden and significant financial impacts to the ratepayers. The phased approach presented here is a representative example to illustrate the concept but does not necessarily reflect the District's actual planned approach.

The estimated pipe replacement costs by time period for both options are summarized in Table 7-5 and depicted graphically in Figure 7-3.

As discussed in Section 2.9.1, the District's pipeline age data in GIS was incomplete so some assumptions were made about installation dates to fill in the gaps.

Table 7-5. Estimated Pipe Replacement Costs

	Pipe Replacement Costs[1]	
Time Period	Straightline Option ($/Year)	Phased Option ($/Year)
2018 to 2020	$6.8 M	$0 M
2021 to 2030	$6.8 M	$0.1 M
2031 to 2045	$6.8 M	$0.6 M
2046 to 2060	$6.8 M	$5.2 M
2061 to 2080	$6.8 M	$23.4 M
2081 to 2100	$6.8 M	$2.7 M
2101 to 2116	$6.8 M	$4.5 M

1. All values shown in 2018 dollars; future costs would need to be escalated.

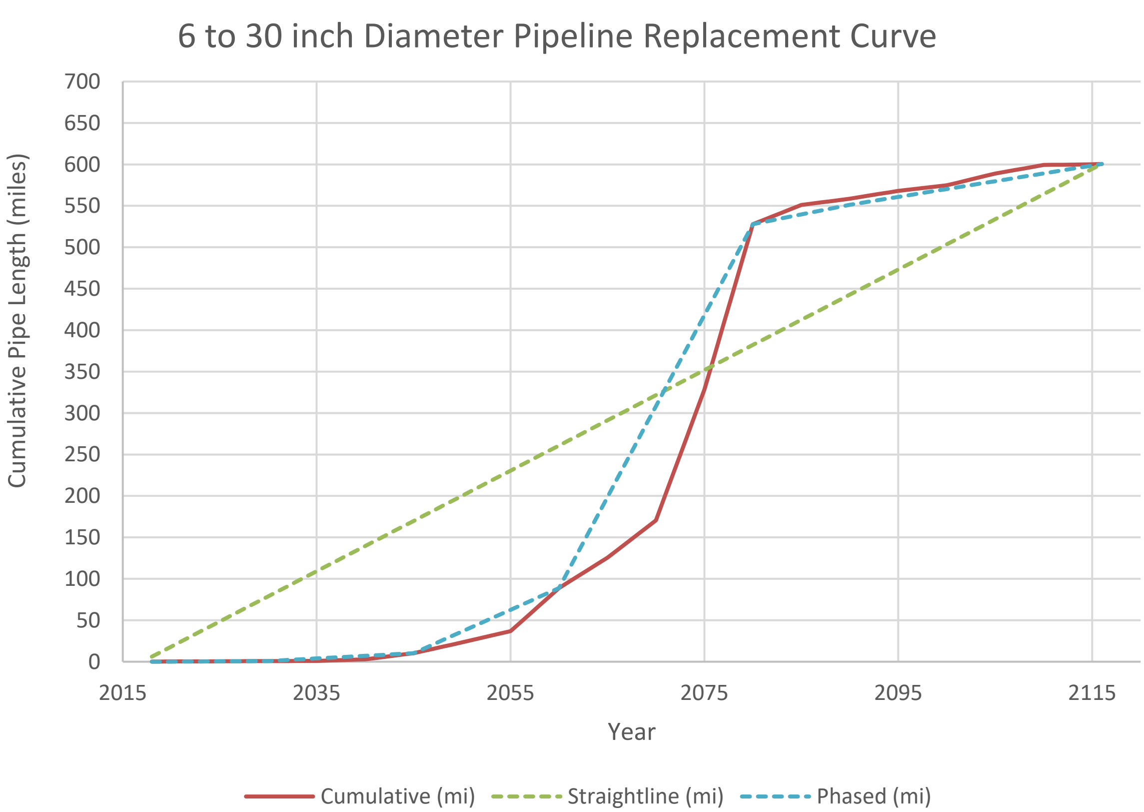


Figure 7-3. Representative Pipeline Replacement Strategies

The costs presented in Table 7-5 assume an "open trench" approach to waterline replacement. Cost assumptions are discussed in further in Section 9.1. Trenchless replacement or trenchless rehabilitation could reduce the cost of replacing the mains when viable, such as in areas with numerous utility conflicts, pipelines with few valves/service laterals, and when existing diameters are hydraulically acceptable. WSC recommends the District evaluate the suitability of trenchless rehabilitation for upgrading mains with those characteristics.

Further pipeline assessment is required to prioritize pipelines to optimize the replacement program. Information such as historical breaks, in-situ pipeline condition, wall thickness, gasket condition, localized soil properties, and ground water combined with criticality and hydraulic importance rankings can be used in conjunction with the pipe material and age database to further refine and optimize the replacement strategy, if desired by the District. This initial effort is intended to set the stage and inform the District of potential asset liabilities that could arise in the near future. A case-by-case evaluation is recommended for each replacement project.

7.3 Pressure Reducing Valves

7.3.1 Assessment

The District operates 25 PRVs to control flow between pressure zones. As discussed in Section 7.1.3, the District's operating staff performed an assessment on the PRVs. The results of the assessment are shown in Table 7-6 and Table 7-7.

Table 7-6. PRV Condition Assessment Summary (102 – 209)

PRV Component	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	118	119	120	121	201[1]	202	203	204	205	206	208	209
Site (grading, drainage, fencing, paving, etc.)	B	B	A	A	A	A	A	A	A	A	C	A	A	B	A	A	B	B	B	A	U	A	A	A	C	A	A	U
Vault	A	F	D	F	C	B	B	B	A	A	A	C	A	F	F	A	A	A	A	A	U	A	A	A	A	A	A	B
Pressure Reducing Valves	A	C	C	F	C	C	C	C	A	B	A	C	B	D	D	B	B	B	B	A	U	C	C	D	D	C	C	B
Gate/Butterfly Valves	A	B	C	C	B	B	C	B	A	B	A	B	B	D	D	B	B	B	B	A	U	B	A	A	D	B	B	B
Air Release Valves	N	N	N	C	N	N	N	N	N	B	N	N	N	N	D	N	N	N	N	N	U	N	N	N	N	N	N	N
Piping	A	B	B	C	B	B	B	B	A	B	A	B	B	D	C	B	A	A	A	A	U	A	A	B	B	B	B	B
Flow Meter	N	N	C	N	C	N	C	N	A	A	A	N	N	N	N	N	N	N	A	N	U	N	N	N	N	N	N	N
SCADA	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	U	N	N	N	N	N	N	N

The Grading System is as follows:

E:	**Component appears in good condition but is not being used**
A:	**100-85% useful life left of component (or system**
B:	**85-50% useful life left of component (or system)**
C:	**50-15% useful life left of component (or system)**
D:	**15-0% useful life left of component (or system)**
F:	**0% useful life left of component (or system)**
U:	**Condition unknown or not visible**
N:	**Component does not exist**

1. *PRV 201 lid is welded shut.*

Table 7-7. PRV Condition Assessment Summary (SCLA-A – SCLA-G)

PRV Component	SCLA-A	SCLA-B	SCLA-C	SCLA-D	SCLA-E	SCLA-F	SCLA-G
Age in 2017							
Site (grading, drainage, fencing, paving, etc.)	A	A	A	A	A	A	A
Vault	A	A	A	A	A	A	A
Pressure Reducing Valves	A	A	A	A	A	B	A
Gate/Butterfly Valves	A	A	A	A	A	A	A
Air Release Valves	N	N	N	N	B	N	A
Piping	A	A	A	A	B	A	A
Flow Meter	N	N	N	N	B	N	N
SCADA	N	N	N	N	N	N	N

The Grading System is as follows:

E:	**Component appears in good condition but is not being used**
A:	**100-85% useful life left of component (or system)**
B:	**85-50% useful life left of component (or system)**
C:	**50-15% useful life left of component (or system)**
D:	**15-0% useful life left of component (or system)**
F:	**0% useful life left of component (or system)**
U:	**Condition unknown or not visible**
N:	**Component does not exist**

7.3.2 Rehabilitation and Replacement

The District currently repairs or rehabs PRVs on an as-needed basis. After the initial rehabilitation on the PRV I completed, it's the District's goal is to conduct routine rehabilitation of each PRV on a 10-year cycle.

Currently, none of the District's PRVs are equipped with flow meters. The District plans to add flow meters to all PRVs to enable more detailed accounting of water use within each zone and flow between zones. Due to the spacing requirements for meter installation and the limited space within existing PRV vaults, it may be necessary to install meters outside of the PRV vault in a separate meter enclosure. The installation requirements at each PRV will vary based on available space, pipe configuration and depth, and pipe size. New meters will be integrated with SCADA through the District's AMI facilities currently in the initial planning/implementation phase. A representative cost of $30,000 per meter installation is used for the purposes of this R&R Plan.

7.4 Wells

7.4.1 Assessment

The District owns and operates 34 active groundwater wells. As discussed in Section 7.1.3, the District's operating staff performed an assessment on the major components of each active well, excluding the well casing. WSC assigned grades to the condition of the well casing using the age of the well and an estimated useful life of 50 years. The results of the assessment are shown in Table 7-8, Table 7-9 and Table 7-10.

The District is aware of some failed components at existing wells and will be prioritizing the replacement of these components as necessary. Overall, the wells are in fair to good condition with only one well casing beyond the estimated useful life (Well 109). There are 15 wells within the estimated useful life that have at least one component that is at the end of its useful life, will need to be replaced or rehabilitated in the next 7 years, or has already failed. The most common issues are with the existing motor control center (MCC) and supervisory control and data acquisition (SCADA) components. The condition of the Well 109 casing should be inspected to determine whether the well can be rehabilitated and remain in service or if it needs to be abandoned and replaced.

Table 7-8. Well Condition Assessment Summary (Wells 109 – 131)

Well Component	109	116	118	119	120	122	123	126	127	128	130	131
Age in 2019	69	36	36	35	33	30	36	34	33	32	26	27
Well Casing[1]	F[2]	C	C	C	C	C	C	C	C	C	B	B
Site (grading, drainage, fencing, paving, etc.)	F	A	A	A	A	A	A	A	A	A	A	A
Building	N	N	N	N	N	N	N	N	N	N	N	N
Chemical Feed System	A	A	A	A	A	A	A	A	A	A	A	A
Chemical Enclosure	A	A	A	A	A	A	A	A	A	A	A	A
Pump to Waste	N	A	N	N	N	N	N	N	N	N	A	A
Pump	A	A	A	A	A	A	A	A	C	A	A	A
Motor	A	A	A	A	A	A	A	A	A	A	A	A
Pipes and Valves	A	A	A	A	A	A	A	A	A	A	A	A
Flow Meter	A	A	A	A	A	A	A	A	A	A	B	A
Hydro-Pneumatic System	N	N	N	N	N	N	N	N	N	N	N	N
MCC	B	C	D	D	D	D	C	B	D	D	F	D
SCADA System	B	C	B	B	B	B	C	B	B	C	D	B

The Grading System is as follows:

E	**Component appears in good condition but is not being used**
A	**85-100% useful life left of component (or system)**
B	**50-85% useful life left of component (or system)**
C	**15-50% useful life left of component (or system)**
D	**0-15% useful life left of component (or system)**
F	**Component or system has already failed**
U	**Condition unknown or not visible**
N	**Component does not exist**

1. *Estimated based on the age of the well in 2019 and an estimated useful life of 50 years.*
2. *Actual condition of the Well 109 casing is unknown; grade is based on the casing age exceeding the expected useful life.*

Table 7-9. Well Condition Assessment Summary (Wells 132 – 144)

Well Component	132	133	134	135	136	137	138	139	140	141	143	144
Age in 2019	26	26	26	22	20	21	16	16	16	16	11	13
Well Casing[1]	B	B	B	B	B	B	B	B	B	B	B	B
Site (grading, drainage, fencing, paving, etc.)	A	A	A	B	A	N[2]	A	A	B	A	N[2]	A
Building	N	N	N	N	N	A	A	A	A	A	A	A
Chemical Feed System	A	A	A	A	A	N	A	E	A	N	A	A
Chemical Enclosure	A	A	A	A	A	N	A	A	A	A	A	A
Pump to Waste	N	N	N	N	N	A	A	A	A	E	B	N
Pump	A	A	A	B	C	A	A	A	A	E	A	A
Motor	A	A	A	B	C	A	A	A	A	E	A	A
Pipes and Valves	A	A	A	A	A	A	A	A	A	E	A	A
Flow Meter	A	B	A	A	A	A	A	A	A	E	A	A
Hydro-pneumatic System	N	N	N	N	N	N	N	N	N	N	N	N
MCC	C	C	C	C	C	B	B	B	B	B	C	A
SCADA System	B	B	B	B	B	B	B	B	B	B	B	B

The Grading System is as follows:

E	**Component appears in good condition but is not being used**
A	**85-100% useful life left of component (or system)**
B	**50-85% useful life left of component (or system)**
C	**15-50% useful life left of component (or system)**
D	**0-15% useful life left of component (or system)**
F	**Component or system has already failed**
U	**Condition unknown or not visible**
N	**Component does not exist**

1. *Estimated based on the age of the well in 2019 and an estimated useful life of 50 years.*
2. *Well 137 is located inside the El Evado ATP building and Well 143 is located inside the Balsam ATP building; site conditions do not apply.*

Table 7-10. Well Condition Assessment Summary (Wells 201 – GC-2)

Well Component	201	203	204	205	206	207	208	209	212	BT[2]	CB[2]
Age in 2019	33	32	25	30	31	30	22	16	11	22	22
Well Casing[1]	C	C	B	C	C	C	B	B	B	B	B
Site (grading, drainage, fencing, paving, etc.)	A	A	A	A	A	A	A	A	A	A	A
Building	N	A	A	N	N	N	A	A	A	B	B
Chemical Feed System	N	N	N	N	N	N	N	N	N	N	N
Chemical Enclosure	N	N	N	N	N	N	N	N	N	N	N
Pump to Waste	A	A	B	A	A	A	A	A	A	A	A
Pump	A	A	A	A	A	A	A	A	A	A	A
Motor	A	A	A	A	A	A	A	A	A	A	A
Pipes and Valves	A	A	A	A	A	A	A	A	A	B	B
Flow Meter	A	C	A	A	A	B	C	A	A	B	A
Hydro-pneumatic System	N	N	N	N	N	N	N	N	N	N	N
MCC	D	D	F	D	C	D	C	C	A	A	A
SCADA System	B	F	B	D	B	C	B	B	B	N	N

The Grading System is as follows:

E	Component appears in good condition but is not being used
A	85-100% useful life left of component (or system)
B	50-85% useful life left of component (or system)
C	15-50% useful life left of component (or system)
D	0-15% useful life left of component (or system)
F	Component or system has already failed
U	Condition unknown or not visible
N	Component does not exist

1. *Estimated based on the age of the well in 2019 and an estimated useful life of 50 years.*
2. *Age and condition of components are estimated based on drill date of 1997.*

Unequipped Wells

In addition to the 34 active wells evaluated in this section, the District has 4 wells (Wells 142, 145, 146 and 147) that were drilled in 2005 – 2007 to accommodate planned demand growth but have not been equipped due to a decline in development and reduction in demands due to conservation. Wells that remain idle are often impacted by declining water quality, aesthetic issues, and impacts on well efficiency as a result of clogging. Wells 142 and 146 were constructed with 316 stainless steel (SS) casing and Wells 145 and 147 were constructed with High Strength Low Alloy (HSLA) steel. All four wells have casing perforations consisting of Ful-flo louvers.

To assess the condition of the unequipped wells with HSLA casing, the District performed a downhole video survey of Wells 145 and 147 in May 2018. The Well Inspection Reports, which are attached as Appendix C – Well Video Inspection Reports, show heavy scale and growth in the perforated casing section of both wells. The inspection of Well 145 also found water flowing out of a casing joint. A video survey of Wells 142 and 146 has not yet been performed, but the District expects those wells to be in better condition due to the use of SS casing.

7.4.2 Rehabilitation and Replacement

Water wells require regular maintenance to ensure adequate water flow and continued drinking water safety. The District's goal is to conduct routine rehabilitation of each well casing, pump and motor on a 10-15 year cycle and electrical equipment on a 30-year cycle to maintain them in good working condition. With 34 wells currently in service, this requires inspection and rehabilitation of 2 to 3 wells per year, on average. When wells reach the end of their useful life, they will need to be destroyed and replaced, if needed. The District established a prioritized R&R schedule for the wells for the next 10 years based on the current condition and the length of time since the previous R&R work was done. There are several categories of R&R work that apply to wells. A description of each category along with the estimated cost is summarized in Table 7-11. The Well rehabilitation prioritization for the next 10 years is presented in Table 7-12.

An Arc Flash Analysis will need to be completed when the electrical rehabilitation and replacement occurs at wells that currently does not have an Arc Flash Analysis completed. The cost of the Arc Flash Analysis is included in the costs presented in Table 7-11.

The estimated cost and timing of the well R&R plan is included in the 10-Year Project Plan in Chapter 9. The components of wells 109, 116, 130, 203, 204, and 205 that were noted as failed in the assessment will be addressed along with the planned R&R activities summarized in Table 7-12.

Table 7-11. Well R&R Categories and Costs

Well R&R Category	Abbreviation	Description	Estimated Cost[1]
Destroy Well	D	When a well reaches the end of its useful life and/or the District does not intend to continue use of the well, it must be destroyed in accordance with the California Well Standards, published as DWR Bulletin 74, to protect the groundwater and eliminate a physical hazard to humans and animals.	$65,000
Well Rehabilitation	W	Over the life of a well, the screened portion of a well casing may become clogged and result in reduced production capacity and/or increased pumping drawdown. Well rehabilitation is intended to restore lost production capacity as well as lost water quality in some cases. Rehabilitation efforts consist of cleaning, inspecting and rehabilitating the well as needed using a variety of chemical and/or mechanical methods.	$100,000
Pump & Motor R&R	P	Pumps and motors wear over time and lose efficiency. To maintain them in efficient working order and prevent premature failure, routine maintenance includes removing the pump and motor to inspect, clean, and replace the pump, shaft, and column pipe as necessary, and rewind the motor and replace the bearing.	$100,000
Electrical Equipment R&R	E	The life and reliability of electrical equipment can be impacted by operating conditions such as exposure to moisture and chemicals, loading, temperature, vibration, and mechanical stress. Replacement of various components can be driven by technology changes or system efficiency and safety. Includes new Arc Flash Analysis.	$105,000

1. *In 2018 dollars. Well rehabilitation costs can vary widely depending on the depth of the well and the condition of the well and other equipment. The estimated costs provided here are representative estimates for an average well rehabilitation and are not intended for budgeting purposes. Each facility should be assessed on a case by case basis to determine individual budget requirements.*

Table 7-12. Well Rehabilitation Prioritization

Well	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Beyond Year 10
109			W/P			E					
116						W/P/E					
118			E					W/P			
119		E					W/P				
120			W/P	E							
121											D
122				W/P/E							
123	W/P	E									
126	W/P										E
127											W/P/E
128			E		W/P						
129											W/P/E
130											W/P/E
131					E		W/P				
132					W/P						E
133		W/P									E
134					E					W/P	
135										W/P	E
136						E				W/P	
137											W/P/E
138						W/P					E
139											W/P/E
140		W/P									E
141											W/P/E
142											W
143				E							W/P
144			W/P								E
145			W								
146											W
147				W							
148											W
201						W/P/E					
203				E							W/P
204					W/P						E
205									W/P/E		
206								W/P/E			
207											W/P/E
208							W/P/E				

Well	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Beyond Year 10
209								W/P			E
212							W/P				E
GC-1											W/P/E
GC-2											W/P/E

7.5 Booster Pump Stations

7.5.1 Assessment

The District operates four BPS's to transfer water between zones and fill storage reservoirs. As discussed in Section 7.1.3, the District's operating staff performed an assessment on the major components of each booster station. The results of the assessment are shown in Table 7-13.

Table 7-13. Booster Station Condition Assessment Summary

Booster Pump Station Component	Plant #133	El Evado	White Road	HWY 395
Site (grading, drainage, fencing, paving, etc.)	B	A	A	A
Building	N	A	A	A
Pumps	C	A	A	A
Motors	B	A	A	A
Pipes	A	A	A	A
Flow Meter	U	A	A	A
Cla Val/Check Valves	B	A	A	A
Gate/Butterfly Valves	A	A	A	A
Air Release Valves	A	A	A	A
MCC	F	A	F	D
SCADA System	U	B	B	B

The Grading System is as follows:

E	Component appears in good condition but is not being used
A	85-100% useful life left of component (or system)
B	50-85% useful life left of component (or system)
C	15-50% useful life left of component (or system)
D	0-15% useful life left of component (or system)
F	Component or system has already failed
U	Condition unknown or not visible
N	Component does not exist

7.5.2 Rehabilitation and Replacement

Booster stations require regular maintenance to ensure adequate water flow and system efficiency are maintained. The District's goal is to conduct routine rehabilitation of each booster station pump and motor on a 10-year cycle and electrical equipment on a 30-year cycle to maintain them in good working condition. When booster stations reach the end of their useful life, they will need to be replaced. The District established a prioritized R&R schedule for the booster stations for the next 10 years based on the current condition and the length of time since the previous R&R work was done. The Pump and Motor R&R (P) and Electrical Equipment R&R (E) described in Table 7-11 also apply to booster stations and are used in this section.

The estimated cost and timing of the booster station R&R plan is included in the 10-Year Project Plan in Chapter 9. The components of Plant #133 and White Road booster stations that are noted as failed in Table 7-13 will be addressed along with the planned R&R activities summarized in Table 7-14.

Table 7-14. Booster Station Rehabilitation Prioritization

Booster Station	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Beyond Year 10
Plant 133											P/E
El Evado											P/E
White Road							P/E				
395 (Pump 1)											P/E
395 (Pump 2)						P/E					

1. *E – Electrical Equipment R&R, P – Pump and Motor R&R*

7.6 Arsenic Treatment Plants

7.6.1 Assessment

The District operates three ATPs for arsenic removal from several of the District's wells. All three of the ATP's became operational in 2007. As discussed in Section 7.1.3, the District's operating staff performed an assessment on the major components of each ATP. The results of the assessment are shown in Table 7-15.

Table 7-15. Arsenic Treatment Plant Condition Assessment Summary

Treatment Plant Component	El Evado Arsenic	Balsam Arsenic	La Mesa Arsenic
Age in 2017	10	10	10
Site (grading, drainage, fencing, paving, etc.)	A	A	A
Buildings	A	A	A
Security	N	N	N
Filter Media	A	A	B
Pumps	A	A	B
Piping	A	A	B
Electrical Systems	A	A	C
SCADA System	B	B	F
Chemical Feed Systems	A	A	A

The Grading System is as follows:

E	**Component appears in good condition but is not being used**
A	**85-100% useful life left of component (or system)**
B	**50-85% useful life left of component (or system)**
C	**15-50% useful life left of component (or system)**
D	**0-15% useful life left of component (or system)**
F	**Component or system has already failed**
U	**Condition unknown or not visible**
N	**Component does not exist**

7.6.2 Rehabilitation and Replacement

Overall, the District's ATPs are in good condition with the exception of the La Mesa ATP's failing SCADA and electrical systems. The District plans to rehab on a as needed basis. Filter media at the El Evado ATP and Balsam ATP will need to be replaced in ten years. A representative budget of $25,000 per filter media is used in the R&R Plan. El Avado ATP will require seven filters and Balsam ATP will require four filters. The ATP's media should be replaced every 10 to 15 years.

The media in all 7 filters was replaced at El Evado in 2019.

7.7 Generator

7.7.1 Assessment

The District procured three new portable generators in the last year that can be used to provide backup power for the wells and boosters in the event of a power outage. These generators are in new condition. Both the stationary generators and the new portable generators will receive routine maintenance to keep them in reliable working order.

7.7.2 Rehabilitation and Replacement

The District plans to replace or rehab generators on an as needed basis.

7.8 Storage Reservoir

7.8.1 Assessment

There are currently 28 steel potable water storage reservoirs within the District's service area. Reservoirs 203 and 204 are both inactive. Reservoir 211 has been leased to MWA and is incorporated into the R^3 Project and is currently not a component of the District's system. Reservoir 201 is currently disconnected from the system due to distribution system constraints that result in hydraulic issues but was included in this assessment as it may be reconnected in the future once the Zone 3485 Balancing Main is constructed.

The District engaged Suez to perform an inspection and condition assessment of the 24 active and 1 inactive potable water storage reservoirs.

Suez conducted visual inspections of the District's water tanks per American National Standards Institute and AWWA Standards. The purpose of the inspection was to determine the condition of the coatings and structure, and to evaluate the tank for compliance with current sanitation guidelines, safety and security regulations, and guidelines in accordance with AWWA, Occupational Safety and Health Administration and related state and federal agencies.

The inspection process involved an inspection team from Suez utilizing an ROV (Remote Operated Vehicle) to video and take pictures of the interior of the tank while in service. Interior visual inspections included roof support, coatings, ladder, inlet & outlet, sediment, overflow, and water clarity. The exterior included visual inspections of safety features, security, sanitary screens, coating thickness & condition, manways, chime, and foundation conditions.

SUEZ utilizes a tank scoring system called TAI (Tank Assement Index). The TAI allows Suez to track condition changes over time. The TAI range is presented in Table 7-16, and has been color coded to align with the Asset Condition Grading Scale applied to assess the District's other facilities. The TAI system of scoring gives a snapshot of current conditions and allows for future comparison to track condition changes over time and make adjustments to maximize the sustainable life of the asset. Appendix D – Reservoir Inspection Reports includes additional information about reservoir components inspected and how TAI scores are determined.

Table 7-16. Tank Assessment Index Range

Score	Definition
9 – 10	Very Good
7 – 8.9	Good
5 – 6.9	Satisfactory
3 – 4.9	Sub Standard
0 – 2.9	Unacceptable

A report was prepared for each reservoir to document the results of the inspection, the TAI Score for each component inspected, and recommendations for R&R. The information contained in the inspection reports (attached as Appendix D – Reservoir Inspection Reports) represents the best information that could be obtained by Suez at the time of the inspection. All pictures and videos taken during the inspection have been provided to the District on individual CD's. A summary of the results of the reservoir condition assessment is shown in Table 7-17.

Table 7-17. Reservoir Condition Assessment Summary

Number	TANK 102	TANK 104	TANK 105	TANK 107	TANK 108	TANK 109	TANK 110	TANK 111	TANK 112	TANK 113	TANK 114	TANK 115	TANK 116	TANK 117	TANK 118	TANK 119	TANK 120	TANK 121	TANK 201	TANK 202	TANK 205	TANK 207	TANK 208	TANK 209	TANK 210
Roof Coating	8	1	6.5	1.5	5.5	8	5	7	6	0	2	1	5	8.5	8	4.5	2.5	8.5	5	4.5	1	2	5	5.5	1
Roof Structure	9	7.5	8	8	5	4.5	6.5	8	7	5	7	6.5	8	9	8	7	8	8.5	7	8	4.5	5	1	4	6.5
Roof Vent	8.5	7.5	8	4	5	8	8	8	8	7	7	6	5.5	6.5	7	7	4	8.5	6.5	6.5	6	5	4	2	3
Roof Access & Safety	7	5	8	5	6	8	8	8	7.5	7	3	5.5	6.5	6.5	7	5	5	8	6	8	5.5	4.5	6.5	7	7
Ext. Shell Coating	5	3.5	7.5	3.5	5.5	7	3.5	3.5	8	1	7.5	4.5	8	5	5	8	8	8.5	5	6.5	1	5	5.5	6.5	7
Ext. Shell Structure	9	7	7.5	7	8	8	5	8	8	5	8	8	8	7	7.5	8	8	9	7	8	8	7	3	6	7
Foundation	8.5	8.5	6	8	8	8	8	2.5	6.5	8	6	8	8	7	8	8	8	9	7	8	6.5	8	6.5	4.5	8
Shell Access	3.5	5.5	6	4.5	4.5	8	7	8	7	4.5	7	7	6.5	5	5	3.5	8	9	7.5	8	4.5	4.5	4.5	5	7.5
Shell Safety	8.5	7	8	7	7	8	8	7	7	8	5	4.5	8	7.5	5.5	5.5	8	5.5	5	6.5	6.5	7.5	7	7	8
Overflow	5	3	5	4.5	3	5	3.5	4.5	8	8	7.5	7	8	8	7	5.5	5	6	5.5	6.5	7	4	7	4.5	8
Int. Roof Coating	4	2	5.5	3.5	3.5	5	2.5	5	5	6.5	5.5	6.5	6	5.5	4.5	7	8	7.5	2.5	4	6.5	1	1	1	8
Int. Roof Structure	7.5	7.5	8	7	6.5	7	4.5	7	7	8	7.5	8	7	8	7	7	8	8	7	7.5	4.5	4.5	1	2.5	8
Int. Shell & Floor Coat	3.5	2.3	6	6.5	2	5	7	8	4.8	8	3	6.5	2	5	5.5	5	6.5	7.5	1	1	5.5	1	7	1	8
Int. Shell & Floor Structure	6.5	7.5	7	8	6	4.5	8	8	7	8	7	8	7	5	5.5	7	6.5	7.5	2	7	6.5	5	7	6	8
Int. Shell Safety	7	5.5	8	7	5	8	2	5	3	5	5.5	3	8	7	7	7	7	8	7	7	2	3	3	6	7.5
Water Quality	6.5	4.8	5.5	2.5	5.5	2	6	7	3	7	6	8	7	7.5	8	2.5	4.5	3	0	6.5	7	5	7.5	6	8
Overall Average	**6.69**	**5.32**	**6.91**	**5.47**	**5.38**	**6.50**	**5.78**	**6.53**	**6.43**	**6.00**	**5.91**	**6.13**	**6.78**	**6.75**	**6.59**	**6.09**	**6.56**	**7.63**	**5.06**	**6.47**	**5.16**	**4.50**	**4.78**	**4.66**	**6.91**
Overall Coating Score	**5.13**	**2.20**	**6.38**	**3.75**	**4.13**	**6.25**	**4.50**	**5.88**	**5.95**	**3.88**	**4.50**	**4.63**	**5.25**	**6.00**	**5.75**	**6.13**	**6.25**	**8.00**	**3.38**	**4.00**	**3.50**	**2.25**	**4.63**	**3.50**	**6.00**
Overall Structure Score	**8.00**	**7.38**	**7.63**	**7.50**	**6.38**	**6.00**	**6.00**	**7.75**	**7.25**	**6.50**	**7.38**	**7.63**	**7.50**	**7.25**	**7.00**	**7.25**	**7.63**	**8.25**	**5.75**	**7.63**	**5.88**	**5.38**	**3.00**	**4.63**	**7.38**

The Tank Assessment Index is as follows:

9 – 10	**Very Good**
7 – 8.9	**Good**
5 – 6.9	**Satisfactory**
3 – 4.9	**Sub Standard**
0 – 2.9	**Unacceptable**

1. *Each reservoir component is explained in greater detail in Appendix D – Reservoir Inspection Reports.*

7.8.2 Rehabilitation and Replacement

Overall site and tank security measures were found to be in good working order. Safety systems were updated and in good working condition. Overall water clarity is good; with just a few tanks that need immediate washouts for sediment buildup. A little over half the tanks that show interior and exterior coating failures will need repairs and rehabilitation over the next five-years. The remainder are in good working condition and should be inspected annually and scheduled for future work.

Tanks with an overall coating TAI scores under five should be prioritized for rehabilitation. Scores greater than five are in fair to good working condition and will be scheduled for future work. The District's goal is to conduct routine rehabilitation of each reservoir on a 10 to 15-year cycle to maintain them in good working condition. Suez provided cost estimates for each reservoir based on the R&R work recommended in the Reservoir Inspection Reports and prioritized the reservoirs over the 10-Year Project Plan period, as shown in Table 7-18. WSC added construction contingency and implementation costs to Suez's cost estimate and incorporated them into the 10-Year Project Plan in Chapter 9.

Suez recommends establishing a proactive maintenance program that addresses water quality issues and maximizes the life of the asset. A proactive maintenance program protects water quality and maintains the protective coating barrier on the interior and exterior of the tank. Annual inspections with washouts/chemical cleans every other year allows the District to monitor and maintain the coating system and dramatically decreases the chance of coating failure and structural failures to prolong the useful life of the reservoirs.

This includes annual inspections and washouts and/or chemical cleans every other year to preserve water quality in the distribution system and extend the life of the asset. The estimated budget for this proactive maintenance work is $2,500 per year for each tank and will apply to only those tanks that are not being rehabilitated in a given year. For the purposes of the R&R plan, it is assumed that 2 reservoirs will be rehabilitated each year and that the remaining 23 reservoirs will receive proactive maintenance.

Force balanced flexible expansion couplings and/or electrically actuated shutoff valves shall be installed at reservoir located in Zones 3485, 3675 and 3820 to minimize damage to due seismic activity. The estimated budget to install these protective measures is $27,000 per reservoir.

As annual inspections are performed in future years and the TAI scores are updated, the R&R needs may evolve and the District may elect to reprioritize the reservoirs.

Table 7-18. 10-Year Reservoir Rehabilitation Plan

Reservoir	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Beyond Year 10
RR-102											X
RR-104		X									
RR-105											X
RR-107							X				
RR-108								X			
RR-109											X
RR-110								X			
RR-111											X
RR-112											X
RR-113				X							
RR-114					X						
RR-115									X		
RR-116										X	
RR-117											X
RR-118										X	
RR-119									X		
RR-120											X
RR-121											X
RR-201						X					
RR-202							X				
RR-205	X										
RR-207			X								
RR-208						X					
RR-209				X							
RR-210											X
Annual Maintenance	X	X	X	X	X	X	X	X	X	X	X

1. *See Appendix D – Reservoir Inspection Reports for a detailed description of the recommended rehabilitation work for each reservoir.*

7.9 Water Meters and Service Lines

7.9.1 Assessment

As described in Section 2.10, the District has replaced nearly 100% of their large and small meters in the last 5 years and the next major step in their meter program is to implement an AMI system. The District has also replaced many of their PE service lines in the areas with frequent leaks.

7.9.2 Rehabilitation and Replacement

7.9.2.1 Small Meters

The District expects the useful life of the new meters to be approximately 20 years; since nearly all meters have been replaced in the last 5 years, additional replacements are not planned in the next 10 years and are not included in this plan. To ensure meter accuracy over the life of the meters, the District has implemented a strategic program to test meters throughout the distribution system at regular intervals. The testing program follows the guidelines of AWWA. The information received from this ongoing program will help plan for future small meter replacement programs. Small meter replacements will continue as meters reach the end of their useful life.

7.9.2.2 Large Meters

The District has also recently replaced most of their large meters and does not plan any additional replacements in the next 10 years.

7.9.2.3 Service Lines

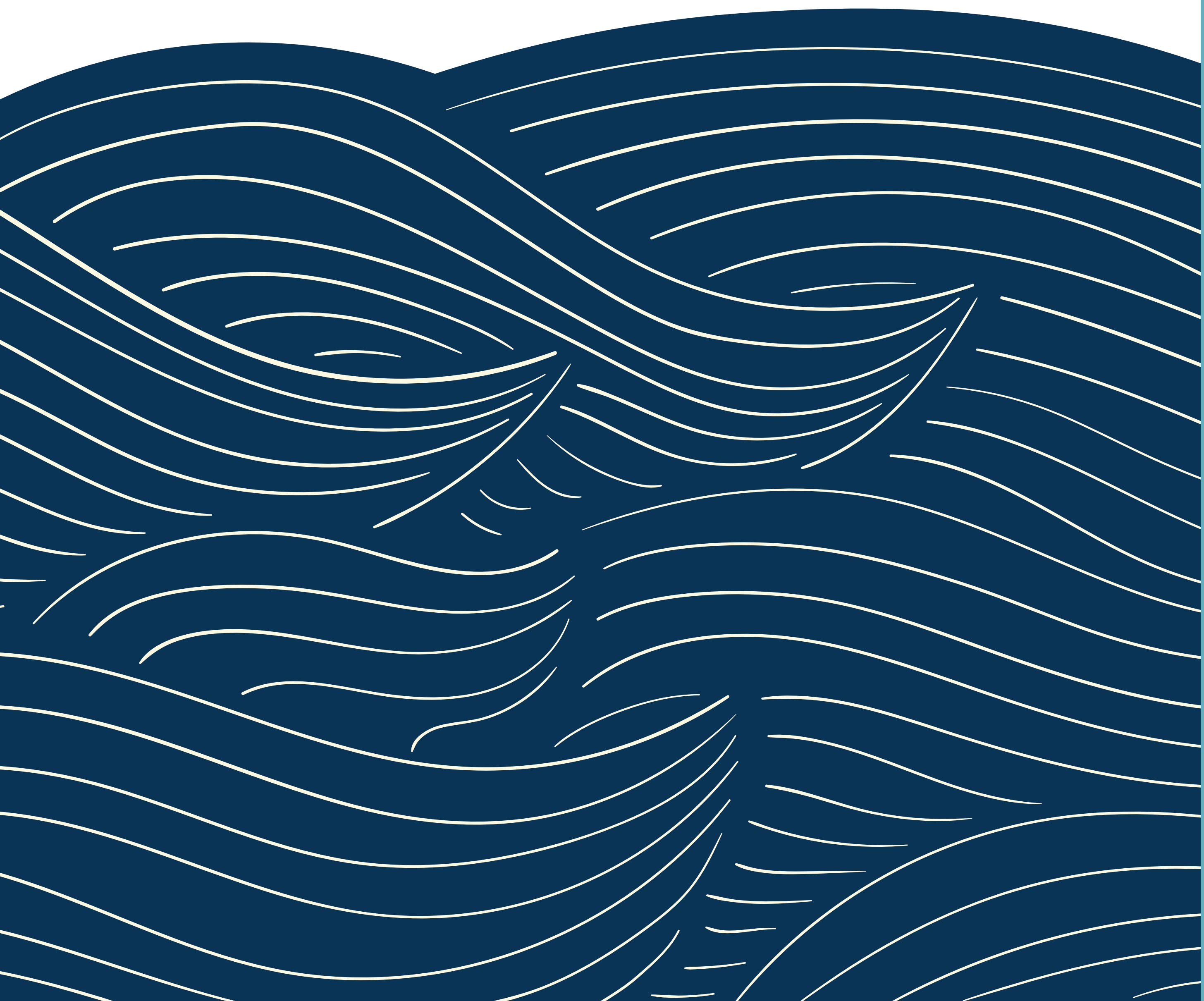
The District has been replacing aging and leaking service lines as needed in areas that have a high percentage of plastic service lines and/or have shown excessive maintenance needs. This effort is expected to continue over the next several years until all PE services have been replaced. District crews are anticipated to be performing the bulk of the work going forward, as the number of service line leaks has decreased significantly due to the vast number of services already replaced in targeted areas that were the most problematic. One area of emphasis going forward will be replacing services in conjunction with various road improvement or surface treatment projects. Since this work will be performed by District staff, it is not included in the 10-year project plan.

7.10 Site Security Upgrades

In order to enhance security at the District's well and reservoir sites, the District will be replacing current fencing and gates with block walls and automated iron gates. Four-foot high curved outward iron rod spikes will be installed on top of the block walls and iron gates to deter climbing. The District will focus on upgrading site security at critical well sites over the next couple years, which includes wells 201, 204, 206, 208, 209 and 212. Well sites 204 and 209 only need the automated gates. Well sites 208 and 212 are the next high priority sites, which will need the block wall and automated gates.

The District will upgrade the remaining well and reservoir sites as budget allows over the next 10 to 20 years.

8 REGULATORY ANALYSIS



CHAPTER 8

Regulatory Analysis

The following sections summarize new or expected future regulations that may impact the District's operations.

8.1 Making Water Conservation a Way of Life

After California experienced a severe drought in winter of 2013-14, Governor Brown issued a proclamation on January 17, 2014, declaring a drought State of Emergency in California. On April 25, 2014, Governor Brown issued an Executive Order (EO) directing the State Water Board to adopt emergency conservation regulations. On July 16, 2014, the State Water Board adopted Resolution No. 2014-0038, adding requirements for monthly reporting of urban water use and prohibiting certain wasteful water use practices during the drought.

On May 9, 2016 Governor Brown issued EO B-37-16 to Make Conservation a California Way of Life. EO B-37-16 tasked 5 State agencies (California Department of Water Resources, State Water Resources Control Board, California Public Utilities Commission, California Department of Food and Agriculture, and California Energy Commission, collectively, the "EO Agencies") with crafting a long-term water conservation framework to help prepare for changing climate conditions and water shortages. With input from both the urban and agricultural communities, the EO agencies developed a framework that will be part of the larger, more encompassing California Water Action Plan. This framework helps implement the Water Action Plan by encouraging Californians to:

- Use water more wisely
- Eliminate wasting water
- Strengthen local drought resilience
- Improve agricultural water-use efficiency and drought planning

IN THIS CHAPTER

Some of the framework actions will require legislation and new or revised regulations; other actions will encourage greater compliance with existing requirements. The following sections summarize the framework established by EO B-37-16 and the potential impacts to the District.

8.1.1 Using Water More Wisely

8.1.1.1 Emergency Conservation Regulations (Executive Order Item 1):

The State Water Resources Control Board (Water Board) will rescind the emergency requirement for a water supply stress test or mandatory conservation standard for urban water agencies, but, to provide a bridge to permanent requirements, it will continue to require monthly reporting and to prohibit wasteful practices (see below).

Impact to District: Addressed under other items below.

8.1.1.2 New Water Use Targets (Executive Order Items 2 and 6):

Upon statutory authorization, the EO Agencies will adopt a new urban water use target methodology based on strengthened water use efficiency standards, rather than a percentage reduction in urban water use. Urban water suppliers would, in turn, be required to calculate their unique water use targets based on those standards and local conditions.

Impact to District: This regulation has a potentially significant impact on the District in the near and long term.

Under the EO Agencies' proposed framework, each retail urban water supplier will be required to annually calculate an overall water use target, which will be calculated as the sum of a retail supplier's residential indoor, outdoor irrigation, and distribution system water loss budgets. Each of these budgets is calculated through the application of a water use efficiency standard and compliance will be based on the supplier's total water use target, rather than on the individual budgets. For commercial, industrial, and institutional (CII) water use, water suppliers will be required to implement performance-based measures rather than a volumetric standard or budget. These CII performance measures include converting certain sized landscape accounts onto dedicated irrigation accounts, classifying all CII accounts using a standardized system, and conducting water use audits for CII accounts over a certain threshold. Water suppliers will also calculate "compliance volume" by subtracting water delivered to the CII sector from total water production. To be in full compliance, (1) the water supplier's compliance volume must be less than or equal to the water use target, and (2) the supplier must document full implementation of the CII performance measures.

In 2018, the California State Legislature (Legislature) enacted two policy bills, (Senate Bill (SB) 606 and Assembly Bill (AB) 1668) in response to EO B-37-16. Among other provisions, the new legislation set default values for indoor residential use but requires DWR, in coordination with the State Water Board, to conduct necessary studies and investigations and authorizes the agencies to recommend to the Legislature efficiency standards for indoor residential use that include benefit and impact assessments for applying such standards by January 1, 2021 (as of the writing of this plan, the recommended efficiency standards have not been publicly released). These jointly-recommended standards may more appropriately reflect the best practices for indoor residential water use than the following default standards set by the Legislature:

- 55 gallons per capita daily (GPCD) until January 1, 2025
- The greater of 52.5 GPCD or a standard recommended by DWR and the State Water Board for the 2025 standard from January 1, 2025, through December 31, 2029
- The greater of 50 GPCD or a standard recommended by DWR and the State Water Board for the 2030 standard after January 1, 2030.

These standards do not require reporting or measurements on the customer level.

The proposed outdoor irrigation water use standard will be defined as a percentage of reference evapotranspiration (ETo), which varies by supplier based on climatic factors such as solar radiation, temperature, humidity and wind. Existing SB X7-7 standards for outdoor water use vary from 45% to 100% of ETo, depending on the type of landscaping and can be used to guide and assist water suppliers in their outdoor water use planning efforts until final standards are adopted. The outdoor irrigation budget is calculated based on the landscape area within a water supplier's service area, which may not be known. To facilitate the transition to the new standards-based approach, the EO Agencies will develop landscape area estimates for each urban retail water supplier in the State. When setting the outdoor water use standards, the EO Agencies will reevaluate whether recycled water use will be included in the outdoor water use standard.

Although the District has been implementing an aggressive conservation program for many years and has staff dedicated to this service, compliance with this regulation is expected to result in significant additional effort for District staff. Beginning in 2019, the District must submit annual progress reports for residential water use, and implementation of the recommended CII performance measures. Starting in 2022, the annual progress reports will include monitoring of progress toward 2025 standards and a description of actions to be taken to ensure compliance by 2025. Monthly and annual reporting requirements will remain in place after 2025, and the water use standards may be updated on a 5-year cycle and will be addressed as part of future UWMPs.

Additionally, these regulations may have an impact on the District's IWTP. The 2011 to 2016 drought, in conjunction with unprecedented statewide conservation legislation, has caused some water agencies to face challenges meeting regulatory water quality standards for the salinity of discharge water from wastewater treatment plants (WWTPs). In particular, total dissolved solids (TDS) concentrations have increased. According to recent research, long-term conservation accounts for an estimated increase of 1.2 mg/L to 1.7 mg/L in TDS for every 1.0 GPCD decrease in indoor per capita water use.[3] Such TDS increases have the potential to impact the District's ability to meet the water quality requirements of their recycled water customers as well as the discharge permits that govern recycled water use, resulting in financial and operational burdens related to the operation of the District's IWTP.

8.1.1.3 Permanent Monthly Reporting (Executive Order Item 3):

The Water Board will open a rulemaking Process to establish permanent monthly urban water reporting on water usage, amount of conservation achieved, and any enforcement efforts.

Impact to District: The District will be required to continue monthly reporting, which is done by existing District staff. This is not expected to be a significant impact to the District.

8.1.2 Eliminating Water Waste

8.1.2.1 Water Use Prohibitions (Executive Order Item 4):

The Water Board will open a rulemaking process to establish permanent prohibitions on wasteful water practices, such as hosing down sidewalks and watering lawns after rain. This will build on the current prohibited uses in the emergency regulation.

Impact to District: This regulation is not expected to impact the District's operations as these requirements are already incorporated into the District's Water Supply Shortage Contingency Plan under Stage 1: Year Round Water Conservation. Stage 1 is in effect at all times unless a higher stage is in effect.

8.1.2.2 Minimizing Water Loss (Executive Order Items 5 and 6):

Senate Bill 555 requires all urban retail water suppliers in the state to submit a completed and validated water loss audit annually to DWR. The EO Agencies will take additional actions to accomplish the directives in that law related to reducing water supplier leaks. These actions include establishment of rules for validated water loss audit reports, water loss performance standards, and technical assistance for water loss audits and minimizing leaks.

Impact to District: The District will need to continue annual water loss reporting, which is done by existing District staff. The Water Board is expected to set water loss standards in 2021, which the District will be required to comply with. The impact to the District will depend on whether the water losses at that time are already in compliance with the new standards.

8.1.2.3 Innovative Water Loss & Control Technologies (Executive Order Item 7):

The California Energy Commission (CEC) is evaluating various options for certification of water loss detection and control technologies at the utility, household, and appliance levels. The CEC is also making investments in research and funding programs for water saving devices and technologies.

Impact to District: This measure is not anticipated to impact the District directly; however, it may result in rebate programs and innovative water management technologies that are available to the District for implementation to enhance the District's existing efforts to reduce water losses.

8.1.3 Strengthening Local Drought Resilience

8.1.3.1 Water Shortage Contingency Plans (Executive Order Items 8, 9, and 6):

Upon statutory authorization, urban water suppliers will be required to submit a Water Shortage Contingency Plan, conduct a Drought Risk Assessment every five years, and conduct and submit a water budget forecast annually.

Impact to District: The District will be required to update their Water Shortage Contingency Plan and conduct a Drought Risk Assessment in accordance with requirements to be established by DWR. These plans will be required as part of the 2020 UWMP, and every five years thereafter. A component of the updated Water Shortage Contingency Plan will be to define the methodology necessary to conduct an Annual Water Budget Forecast, and the District will be required to conduct and submit a water budget forecast annually.

8.1.3.2 Drought Planning for Small Water Suppliers and Rural Communities (Executive Order Item 10):

The EO Agencies' recommendations focus on working with small water suppliers and rural communities to continue to develop more specific drought vulnerability assessments and supplier readiness and responsiveness during drought.

Impact to District: The District is not considered a small water supplier or rural community and will not be impacted by this measure.

8.1.4 Improving Agricultural Water Use Efficiency and Drought Planning

8.1.4.1 Strengthened Agricultural Water Management Plan Requirements (Executive Order Items 11, 12, 13, and 6):

Upon statutory authorization, existing requirements would be expanded to require agricultural water suppliers providing water to over 10,000 irrigated acres of land to prepare, adopt, and submit plans by April 1, 2021, and every five years thereafter.

Impact to District: The District is not an agricultural water supplier and will not be impacted by this regulation.

8.2 Chromium-6 Maximum Contaminant Level

In 2014, the State Water Board established a specific MCL for hexavalent chromium (also referred to as chromium-6) at 10 ppb. Previously, chromium-6 in California has been regulated under the 50-ppb primary drinking water standard for total chromium. Several of the District's wells were affected by this new requirement, and two have been temporarily taken out of service because they do not meet the MCL. The District does not currently intend to install blending or treatment facilities for these wells because the total production capacity is sufficient to meet demands with these wells offline so the additional cost of treatment is not warranted. The District will continue to monitor the water quality of these wells and may be able to restore them to service if chromium-6 levels decline or if blending or treatment is added. Additionally, several wells in ID2, which pump into the Arsenic Blending Line, have levels of chromium-6 that exceed the MCL. The District has adapted the operation of the Arsenic Blending Pipeline such that blended water quality meets the MCL for both arsenic and Chromium-6.

On May 31, 2017, the Superior Court of Sacramento County issued a judgment invalidating the chromium-6 MCL for drinking water. The court ordered the State Water Board to take the necessary actions to delete the chromium-6 MCL from the California Code of Regulations. The change became effective on September 11, 2017, and the MCL for chromium-6 is no longer in effect. The MCL of 50-ppb total chromium remains in effect.

The court's primary reason for finding the MCL invalid is that the State Water Board failed to comply with one of the requirements in the Safe Drinking Water Act for adopting an MCL. In particular, the department "failed to properly consider the economic feasibility of complying with the MCL." The court did "not decide whether the MCL is economically feasible." The court did not make any finding about whether the MCL adequately protected public health, nor did it reach a conclusion about whether the MCL was too low or too high. The court merely found that the State Water Board did not adequately document why the MCL was economically feasible. The court also ordered the State Water Board to adopt a new MCL for hexavalent chromium. The State Water Board anticipates that the new MCL regulation will take between 18 and 24 months to complete and notes that the new standard could be at the same level as the invalidated one.

The District is continuing to operate the blending pipeline such that their blended water quality meets the invalidated standard of 10 ppb for Chromium-6. If the new MCL is set at a value other than 10 ppb, the District will reevaluate the blending operation at that time and assess the need for any operational changes to comply with the new regulation. The State Water Board has not yet adopted a new MCL as of the writing of this plan.

8.3 1,2,3 - Trichloroprone (TCP) Maximum Contaminant Level

The State Water Board 1,2,3-Trichloropropane regulation required water systems to begin initial monitoring of active sources in the first quarter of 2018. The MCL for drinking water is 5 parts per trillion.

The District began quarterly sampling in January 2018 and the results for Quarter 1 and Quarter 2 of 2018 were non-detect.

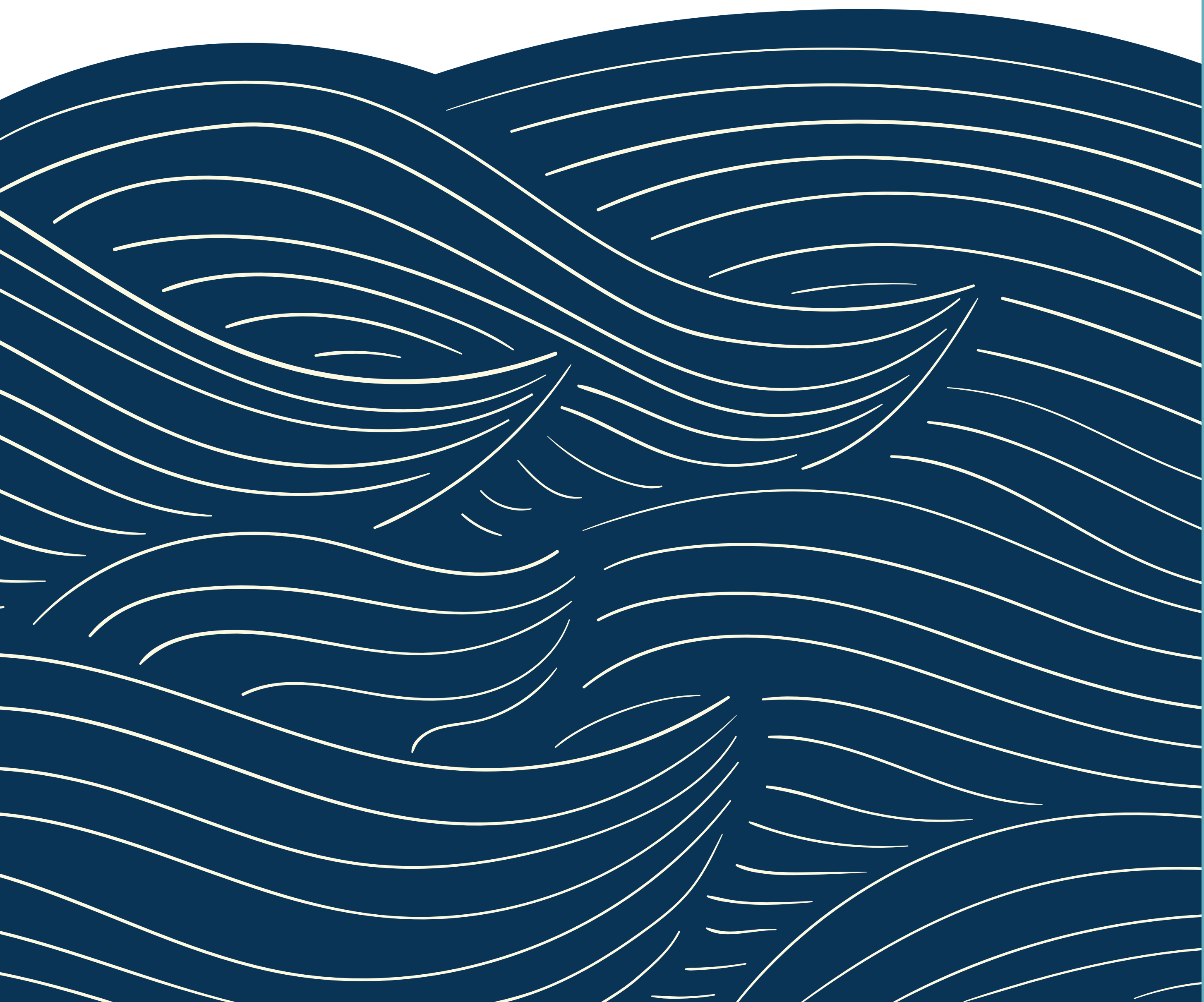
8.4 Perchlorate Maximum Contaminant Level

In 2011, the EPA announced its decision to regulate perchlorate under the Safe Drinking Water Act and determined that perchlorate meets the criteria for regulation as a contaminant. The EPA has not yet established an MCL goal for perchlorate.

In July 2017, the State Water Board established a lower Detection Limit for Reporting (DLR) for perchlorate as part of a two-stage process, and the Division of Drinking Water (DDW) intends to propose a new DLR in 2018 that would be closer to the current 1 ppb.

The District sampled for Perchlorate between 2002-2017 and the results showed detection for some of the sample sites; however, all were below the MCL of 6 ppb.

9 TEN YEAR PROJECT PLAN



CHAPTER 9

Ten Year Project Plan

The purpose of this 10-year Project Plan is to provide the District with a guide for planning and budgeting water system improvements. The 10-Year Project Plan summarizes the projects and cost estimates for the recommended water system improvements identified in this WMP and indicates relative priorities of projects.

IN THIS CHAPTER

9.1 Cost Estimating Basis and Assumptions

The cost opinions (estimates) with the recommended projects in this 10-Year Project Plan have been prepared in conformance with industry practices as planning level cost opinions, and are classified as Class 4 Conceptual Report Classification of Opinion of Probable Construction Costs as developed by the Association for the Advancement of Cost Engineering (AACE International). The purpose of a Class 4 Estimate is to provide a conceptual level of effort that is expected to range in accuracy from -30% to +50%. A Class 4 Estimate also includes an appropriate level of contingency so that it can be used in future planning and feasibility studies. The design concepts and associated costs presented in this 10-year Project Plan are conceptual in nature due to the limited design information that is available at this stage of project planning. These cost estimates have been developed using a combination of data from RS Means CostWorks® and recent bids, experience with similar projects, current and foreseeable regulatory requirements, and an understanding of necessary project components. As the projects progress, the designs and associated costs could vary significantly from the project components identified in this 10-year Project Plan.

The recommended projects and these cost opinions are based on the following assumptions:

1. For projects where applicable cost data is available in RS Means CostWorks® (e.g. pipeline installation), cost data released in Quarter 2 of 2018, adjusted for San Bernardino, is used. Materials prices were further adjusted in some cases to provide estimated that align closer with actual local bid results and material quotes from local vendors.
2. For projects where RS Means CostWorks® data is not available, cost opinions are generally derived from bid prices from similar projects, vendor quotes, material prices, and labor estimates, with adjustments for inflation, size, complexity and location.

3. Cost opinions prepared on a 2018 cost basis were then adjusted to January 2021 dollars using a ratio of the ENR Construction Cost Index (CCI) of 11,116 in July 2018 to 11,628 in January 2021.
4. When budgeting for future years, an escalation factor of 2.7% was applied based on the average annual change in the ENR CCI over the previous 10 years from 2010 to 2020.
5. Cost opinions are planning-level and may not fully account for site-specific conditions that will affect the actual costs, such as soil conditions and utility conflicts.
6. Construction Totals include the following mark-up:
    a. 20% construction contingency based on construction sub-total
7. Total Project Costs include the following allowances:
    a. 15% of Construction Total for project development, including administration, alternatives analysis, planning, engineering, surveying, etc.
    b. 10% of Construction Total for construction phase support services, including administration, inspection, materials testing, office engineering, construction administration, etc.

9.2 Ten-Year Project Plan

The detailed 10-Year Project Plan presented at the end of this section lists each recommended improvement along with the size, length, and/or capacity of the improvement, the cost estimate (including Construction Subtotal, Construction Total and Project Total) and the relative priority or order in which projects are currently planned to be implemented. Actual project implementation may occur in a different order as the District reassess priorities each year based on the conditions at that time.

The 10-year Project Plan also includes a summary of projects recommended in the SCADA Master Plan, to provide a comprehensive list of all of the District's planned projects. See the separate SCADA Master Plan for more information on each of the recommended SCADA Projects.

For each project in the 10-year Project Plan (except the R&R and SCADA projects), an individual write-up was prepared that provides additional information on the Project Need, Recommended Solution, Implementation Considerations, Alternatives (if any), a detailed project map, and a detailed cost estimate. These individual projects descriptions, sometimes called "Rip and Runs", are included in Appendix E – Recommended Improvement Areas Descriptions and can be used independently of the WMP to initiate budgeting and pre-design for selected improvements.

As stated in Section 6.7, individual improvement pipeline projects were grouped into Areas based on geographic area, phasing requirements, priorities and desired project size. Maps depicting the Areas are shown in Figure 9-2 and Figure **9**-**3**. A large-scale map of the Areas is available in Appendix F – Large Scale Recommended Improvement Areas Map.

The costs of projects planned to be implemented in future years are escalated at a rate of 2.7% per year to account for inflation. The 10-Year Project Plan includes a category for Beyond Year 10 to capture those projects that were identified through this WMP process but are not planned to be implemented within the 10-year planning period of this WMP. This 10-Year Project Plan provides a comprehensive list of the projects needed to expand and maintain the water system. Some projects are funded through the Capital budget and some through the Expense budget, as noted in the 10-year Project Plan. Table 9-1 and Figure 9-1 present a summary of project costs in the 10-year Project Plan by Project Type.

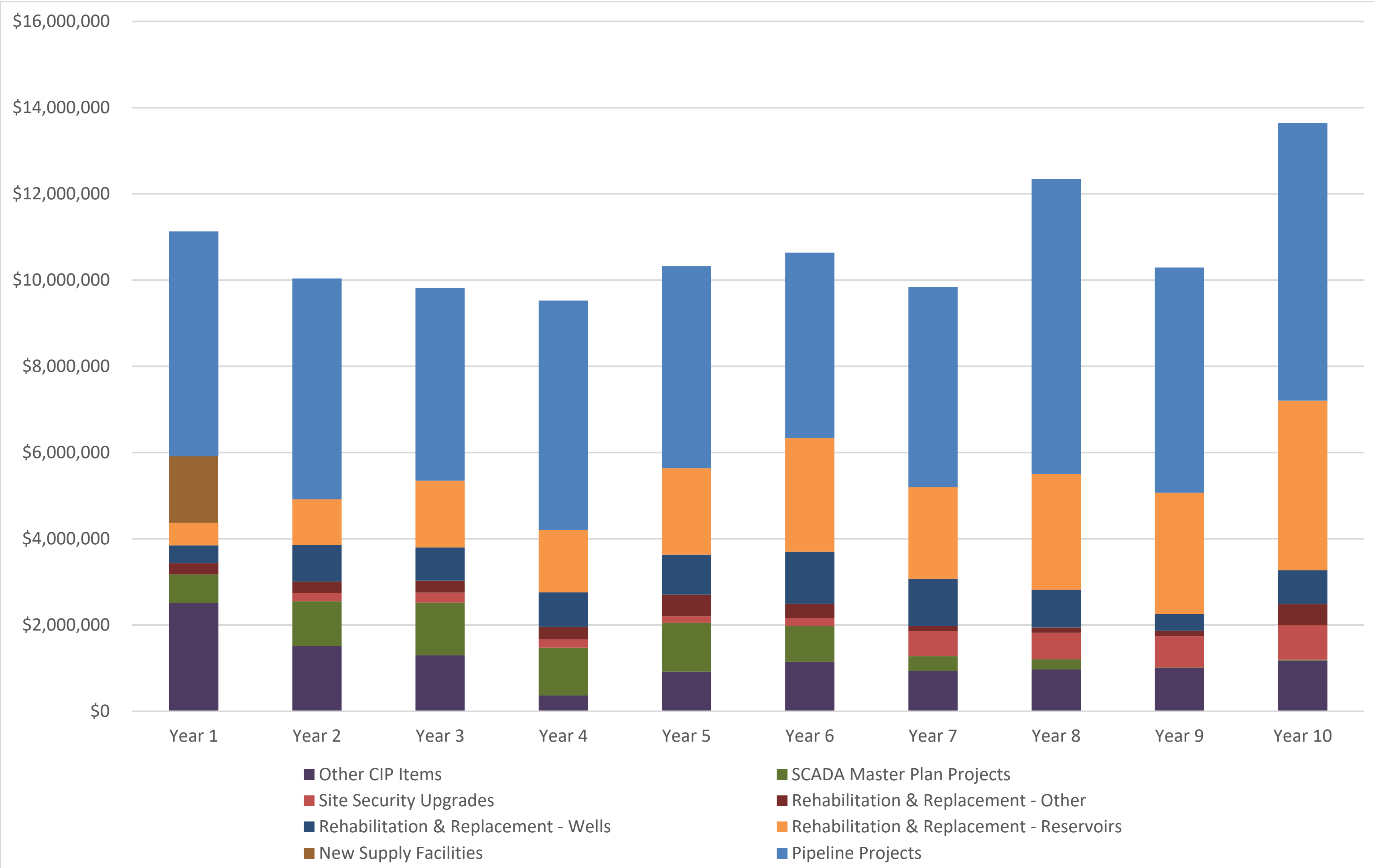


Figure 9-1. Project Costs by Project Type (In Future Year Dollars)

Table 9-1. Summary of Project Costs by Project Type (in Future Year Dollars)

Project Type	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Beyond Year 10
Pipeline Projects (Including Rehabilitation & Replacement)	$5,214,000	$5,120,000	$4,469,000	$5,324,000	$4,687,000	$4,302,000	$4,646,000	$6,833,000	$5,227,000	$6,440,000	$27,719,000
New Supply Facilities	$1,537,000	-	-	-	-	-	-	-	-	-	-
Rehabilitation & Replacement - Reservoirs	$531,000	$1,052,000	$1,546,000	$1,441,000	$2,004,000	$2,638,000	$2,123,000	$2,690,000	$2,811,000	$3,938,000	$13,814,000
Rehabilitation & Replacement - Wells	$412,000	$855,000	$771,000	$803,000	$927,000	$1,201,000	$1,095,000	$874,000	$389,000	$786,000	$6,131,000
Rehabilitation & Replacement - Other	$264,000	$271,000	$278,000	$286,000	$500,000	$331,000	$121,000	$124,000	$128,000	$491,000	$861,000
Site Security Upgrades	-	$188,000	$231,000	$194,000	$154,000	$192,000	$584,000	$617,000	$724,000	$796,000	$9,400,000
SCADA Master Plan Projects	$666,000	$1,038,000	$1,226,000	$1,110,000	$1,133,000	$827,000	$332,000	$233,000	$17,000	$18,000	$1,191,000
Other Items (Meter AMI, Vehicles, IT, Utility Relocations, Planning)	$2,504,345	$1,511,000	$1,294,300	$365,000	$917,700	$1,145,900	$941,700	$969,000	$997,000	$1,177,000	-
Total	$11,128,345	$10,035,000	$9,815,300	$9,523,000	$10,322,700	$10,636,900	$9,842,700	$12,340,000	$10,293,000	$13,646,000	$59,116,000

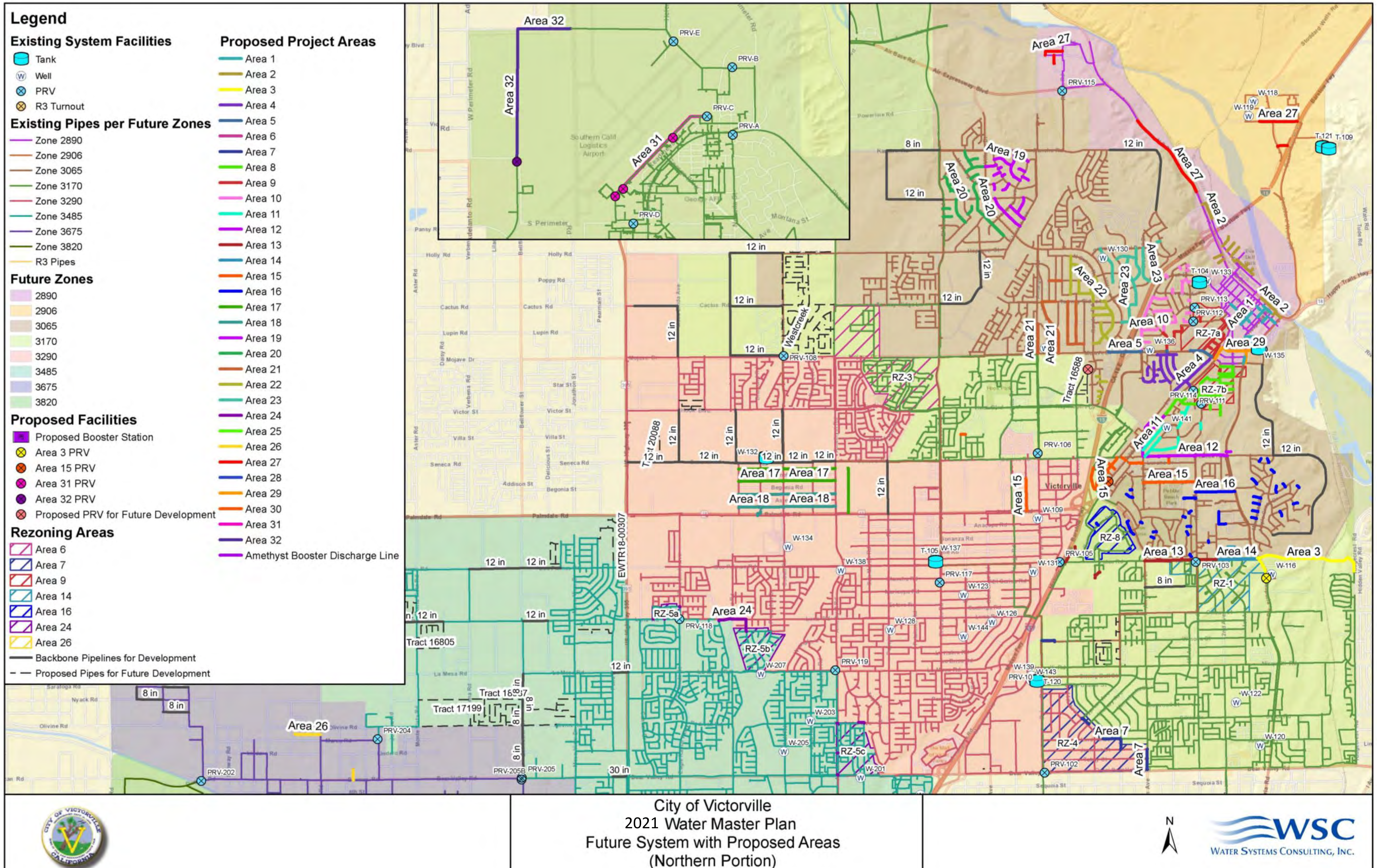


Figure 9-2. Recommended Improvement Areas (Northern Portion of System)

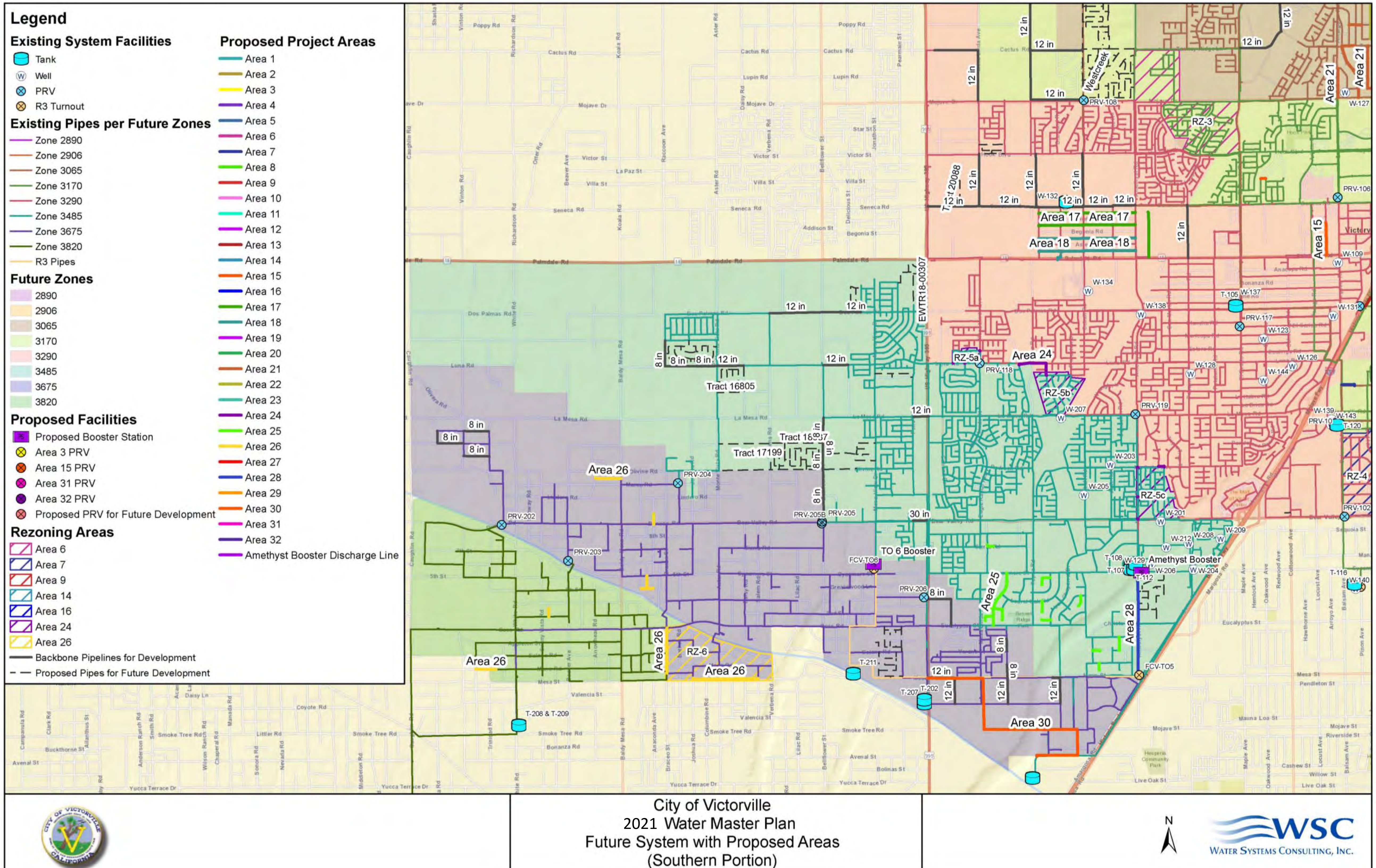


Figure 9-3. Recommended Improvement Area (Southern Portion of System

City of Victorville
2021 Water Master Plan Update
10-Year Project Plan

ID	Pipeline Length (ft)/ Size/ Quantity/ Name	Capital or Expense	Rate Funded %	Connection Fee %	Construction Subtotal (2021 Dollars)	Construction Total (2021 Dollars)	Project Total (2021 Dollars)	Project Value in Future Year Dollars: Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Beyond Year 10	Notes	Project #
Pipeline Projects																				
Area 1	5750	Capital	100%	0%	$ 723,000	$ 867,000	$ 1,084,000	$ -	$ 1,144,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	Construction documents are complete and ready for bid.	
Area 2	7480	Capital	100%	0%	$ 1,053,000	$ 1,263,000	$ 1,579,000	$ -	$ 1,666,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	Construction documents are complete and ready for bid. Requires Caltrans Permit (FF-01). Requires jack and bore under railroad (FF-02)	
Area 3	6790	Capital	100%	0%	$ 896,000	$ 1,075,000	$ 1,343,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	Greentree Extension. Construct with Greentree Street Improvement; already awarded	74411, 60013, 74425
Area 4	12260	Capital	100%	0%	$ 1,517,000	$ 1,820,000	$ 2,274,000	$ -	$ -	$ -	$ 2,530,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -		74414
Area 5	2450	Capital	100%	0%	$ 1,461,000	$ 1,753,000	$ 2,190,000	$ -	$ 2,310,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	Construct prior to Mojave Drive Street Improvement; could defer depending on street improvement timing.	
Area 6	220	Capital	100%	0%	$ 1,438,000	$ 1,868,000	$ 2,335,000	$ -	$ -	$ 2,530,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	Completes Zone 3170 Conversion (high priority); could defer depending on street improvement timing.	
Area 7	3900	Capital	100%	0%	$ 856,000	$ 1,026,000	$ 1,282,000	$ -	$ -	$ 1,389,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	Construct with 7th Avenue Street Improvement; could defer depending on street improvement timing.	
Area 8	13670	Capital	100%	0%	$ 1,675,000	$ 2,009,000	$ 2,511,000	$ -	$ -	$ -	$ 2,794,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
Area 9	9200	Capital	100%	0%	$ 1,327,000	$ 1,593,000	$ 1,990,000	$ -	$ -	$ -	$ -	$ 2,274,000	$ -	$ -	$ -	$ -	$ -	$ -	Area 4 and Area 8 must be completed prior to construction of this Area due to RZ-7 and FF-14 projects within this Area.	
Area 10	11450	Capital	100%	0%	$ 1,408,000	$ 1,690,000	$ 2,112,000	$ -	$ -	$ -	$ -	$ 2,413,000	$ -	$ -	$ -	$ -	$ -	$ -		
Area 11	7720	Capital	100%	0%	$ 912,000	$ 1,094,000	$ 1,367,000	$ -	$ -	$ -	$ -	$ -	$ 1,604,000	$ -	$ -	$ -	$ -	$ -		
Area 12	9700	Capital	100%	0%	$ 1,533,000	$ 1,840,000	$ 2,299,000	$ -	$ -	$ -	$ -	$ -	$ 2,698,000	$ -	$ -	$ -	$ -	$ -		
Area 13	6120	Capital	100%	0%	$ 940,000	$ 1,128,000	$ 1,409,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,698,000	$ -	$ -	$ -	$ -		
Area 14	4440	Capital	100%	0%	$ 711,000	$ 852,000	$ 1,065,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,284,000	$ -	$ -	$ -	$ -		
Area 15	11130	Capital	100%	0%	$ 1,622,000	$ 1,947,000	$ 2,433,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,176,000	$ -	Consider constructing stub prior to Caltrans Hwy 18 Widening Project (~2020) (FF-64)	74416
Area 16	11430	Capital	100%	0%	$ 1,668,000	$ 2,001,000	$ 2,500,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,264,000	$ -		
Area 17	12140	Capital	100%	0%	$ 1,486,000	$ 1,783,000	$ 2,228,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,832,000	$ -	$ -	Construction documents are complete and ready for bid.	
Area 18	10390	Capital	100%	0%	$ 1,257,000	$ 1,508,000	$ 1,884,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,395,000	$ -	$ -	Construction documents are complete and ready for bid.	
Area 19	10650	Capital	100%	0%	$ 1,313,000	$ 1,574,000	$ 1,967,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,637,000		
Area 20	11330	Capital	100%	0%	$ 1,396,000	$ 1,675,000	$ 2,093,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,806,000		
Area 21	12190	Capital	100%	0%	$ 1,499,000	$ 1,798,000	$ 2,247,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,013,000		
Area 22	13240	Capital	100%	0%	$ 1,626,000	$ 1,950,000	$ 2,437,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,267,000		
Area 23	12930	Capital	100%	0%	$ 1,677,000	$ 2,012,000	$ 2,515,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,372,000		
Area 24	2680	Capital	100%	0%	$ 1,033,000	$ 1,240,000	$ 1,549,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,077,000		
Area 25	12340	Capital	100%	0%	$ 1,516,000	$ 1,820,000	$ 2,274,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,049,000		
Area 26	13160	Capital	100%	0%	$ 1,488,000	$ 1,785,000	$ 2,230,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,990,000		
Area 27	8650	Capital	100%	0%	$ 1,125,000	$ 1,349,000	$ 1,686,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,261,000		
Area 28	6700	Capital	100%	0%	$ 3,595,000	$ 4,314,000	$ 3,622,000	$ 3,720,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	TO5 Transmission Main; includes reduction of $1.1M for grant reimbursement	74338
Area 29	3480	Capital	100%	0%	$ 339,000	$ 407,000	$ 507,000	$ -	$ -	$ 550,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
Area 30	13200	Capital	0%	100%	$ 4,601,000	$ 5,521,000	$ 6,901,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,664,000	$ 6,833,000	$ -	$ -	$ -	3485 30" Balancing Main. Timing driven by development and future demands; verify demands prior to construction	
Area 31	5060	Capital	75%	25%	$ 1,058,000	$ 1,163,000	$ 1,454,000	$ 1,494,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	SCLA Flightline Pipeline. High risk pipeline, replacement is a priority	74419
Area 32	7000	Capital	0%	100%	$ 1,118,000	$ 1,342,000	$ 1,676,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,247,000	SCLA West Side Pipe Phase II. Timing unknown, based on growth on west side of SCLA.	
P-Development Pipelines 8"	26400	Capital	0%	100%				$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	Timing and scope dependent on development; not in CIP	
P- Development Pipelines 12"	79200	Capital	0%	100%				$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	Timing and scope dependent on development; not in CIP	
P-Development Pipes 30"	750	Capital	0%	100%				$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	Timing and scope dependent on development; not in CIP	
Subtotal							*$ 67,043,000*	*$ 5,214,000*	*$ 5,120,000*	*$ 4,469,000*	*$ 5,324,000*	*$ 4,687,000*	*$ 4,302,000*	*$ 4,646,000*	*$ 6,833,000*	*$ 5,227,000*	*$ 6,440,000*	*$ 27,719,000*		

ID	Pipeline Length (ft)/ Size/ Quantity/ Name	Capital or Expense	Rate Funded %	Connection Fee %	Construction Subtotal (2021 Dollars)	Construction Total (2021 Dollars)	Project Total (2021 Dollars)	Project Value in Future Year Dollars: Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Beyond Year 10	Notes	Project #
New Supply Facilities																				
F-TO 5 Metering Station		Capital	100%	0%	$ -	$ 1,301,000	$ 1,496,000	$ 1,537,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		74336
							$ 1,496,000	***$ 1,537,000***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***		
Rehabilitation & Replacement - Reservoirs																				
RR-104	-	Expense	100%	0%	$ 645,000	$ 774,000	$ 968,000	$ -	$ 1,021,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	High priority for recoating; interior coating has already failed.	4100500-52300
RR-207	-	Expense	100%	0%	$ 878,000	$ 1,054,000	$ 1,317,000	$ -	$ -	$ 1,427,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	High priority for recoating; interior coating has already failed	4100500-52300
RR-205	-	Expense	100%	0%	$ 324,000	$ 389,000	$ 486,000	$ 500,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	High priority for recoating; exterior coating has already failed	4100500-52300
RR-209	-	Expense	100%	0%	$ 505,000	$ 606,000	$ 758,000	$ -	$ -	$ -	$ 844,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -		4100500-52300
RR-113	-	Expense	100%	0%	$ 291,000	$ 349,000	$ 436,000	$ -	$ -	$ -	$ 486,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -		4100500-52300
RR-114	-	Expense	100%	0%	$ 1,049,000	$ 1,258,000	$ 1,573,000	$ -	$ -	$ -	$ -	$ 1,798,000	$ -	$ -	$ -	$ -	$ -	$ -		4100500-52300
RR-208	-	Expense	100%	0%	$ 980,000	$ 1,176,000	$ 1,470,000	$ -	$ -	$ -	$ -	$ -	$ 1,725,000	$ -	$ -	$ -	$ -	$ -		4100500-52300
RR-107	-	Expense	100%	0%	$ 595,000	$ 714,000	$ 892,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,075,000	$ -	$ -	$ -	$ -		4100500-52300
RR-202	-	Expense	100%	0%	$ 541,000	$ 649,000	$ 811,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 978,000	$ -	$ -	$ -	$ -		4100500-52300
RR-201	-	Expense	100%	0%	$ 479,000	$ 575,000	$ 719,000	$ -	$ -	$ -	$ -	$ -	$ 844,000	$ -	$ -	$ -	$ -	$ -	Restores storage capacity for future growth; after Zone 3485 30" Balancing Main (Area 30)	4100500-52301
RR-108	-	Expense	100%	0%	$ 586,000	$ 703,000	$ 879,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,088,000	$ -	$ -	$ -		4100500-52302
RR-110	-	Expense	100%	0%	$ 797,000	$ 956,000	$ 1,195,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,479,000	$ -	$ -	$ -		4100500-52303
RR-119	-	Expense	100%	0%	$ 1,264,000	$ 1,516,000	$ 1,895,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,409,000	$ -	$ -		4100500-52304
RR-115	-	Expense	100%	0%	$ 172,000	$ 206,000	$ 258,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 328,000	$ -	$ -		4100500-52305
RR-116	-	Expense	100%	0%	$ 1,145,000	$ 1,374,000	$ 1,718,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,243,000	$ -		4100500-52306
RR-118	-	Expense	100%	0%	$ 827,000	$ 992,000	$ 1,240,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,619,000	$ -		4100500-52307
RR-102	-	Expense	100%	0%	$ 503,000	$ 603,000	$ 754,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,011,000		4100500-52308
RR-111	-	Expense	100%	0%	$ 580,000	$ 696,000	$ 870,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,167,000		4100500-52309
RR-210	-	Expense	100%	0%	$ 861,000	$ 1,033,000	$ 1,291,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,731,000		4100500-52310
RR-120	-	Expense	100%	0%	$ 1,456,000	$ 1,747,000	$ 2,184,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,928,000		4100500-52311
RR-109	-	Expense	100%	0%	$ 271,000	$ 325,000	$ 406,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 545,000		4100500-52312
RR-112	-	Expense	100%	0%	$ 1,410,000	$ 1,692,000	$ 2,114,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,834,000		4100500-52313
RR-117	-	Expense	100%	0%	$ 790,000	$ 948,000	$ 1,185,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,589,000		4100500-52314
RR-105	-	Expense	100%	0%	$ 728,000	$ 874,000	$ 1,092,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,464,000		4100500-52315
RR-121	-	Expense	100%	0%	$ 271,000	$ 325,000	$ 406,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 545,000		4100500-52316
RR-Annual Maintenance	-	Expense	100%	0%	$ -	$ -	$ 58,000	$ 31,000	$ 31,000	$ 31,000	$ 65,000	$ 67,000	$ 69,000	$ 70,000	$ 72,000	$ 74,000	$ 76,000	$ -	Reduced recommended budget until 2022 to align with current reservoir expense budget of $30,000	4100500-52317
RR-Seismic Valve and Coupling	7	Expense	100%	0%	$ 189,000	$ 227,000	$ 284,000	$ -	$ -	$ 88,000	$ 46,000	$ 139,000	$ -	$ -	$ 51,000	$ -	$ -	$ -	Reservoirs 201, 202, 205, 207, 208, 209, 210 need upgrades; construct with next scheduled rehab	4100500-52318
Subtotal							***$ 27,259,000***	***$ 531,000***	***$ 1,052,000***	***$ 1,546,000***	***$ 1,441,000***	***$ 2,004,000***	***$ 2,638,000***	***$ 2,123,000***	***$ 2,690,000***	***$ 2,811,000***	***$ 3,938,000***	***$ 13,814,000***		

								Project Value in Future Year Dollars												
ID	Pipeline Length (ft)/ Size/ Quantity/ Name	Capital or Expense	Rate Funded %	Connection Fee %	Construction Subtotal (2021 Dollars)	Construction Total (2021 Dollars)	Project Total (2021 Dollars)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Beyond Year 10	Notes	Project #
Rehabilitation & Replacement - Wells																				
WR-109-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ 217,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
WR-109-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ 124,000	$ -	$ -	$ -	$ -	$ -		
WR-116-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ 235,000	$ -	$ -	$ -	$ -	$ -		
WR-116-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ 124,000	$ -	$ -	$ -	$ -	$ -		
WR-118-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 248,000	$ -	$ -	$ -		
WR-118-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ 114,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
WR-119-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 242,000	$ -	$ -	$ -	$ -		
WR-119-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ 111,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
WR-120-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ 217,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
WR-120-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ 117,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
WR-121-D	-	Expense	100%	0%	$ -	$ -	$ 65,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 88,000		
WR-122-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ 223,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
WR-122-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ 117,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
WR-123-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ 206,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
WR-123-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ 111,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
WR-126-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ 206,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
WR-126-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		
WR-127-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 269,000		
WR-127-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		
WR-128-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ 229,000	$ -	$ -	$ -	$ -	$ -	$ -		
WR-128-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ 114,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
WR-129-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 269,000		
WR-129-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		
WR-130-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 269,000		
WR-130-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		
WR-131-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 242,000	$ -	$ -	$ -	$ -		
WR-131-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ 120,000	$ -	$ -	$ -	$ -	$ -	$ -		
WR-132-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ 229,000	$ -	$ -	$ -	$ -	$ -	$ -		
WR-132-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		
WR-133-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ 211,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
WR-133-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		
WR-134-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 262,000	$ -		
WR-134-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ 120,000	$ -	$ -	$ -	$ -	$ -	$ -		
WR-135-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 262,000	$ -		
WR-135-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		
WR-136-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 262,000	$ -		
WR-136-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ 124,000	$ -	$ -	$ -	$ -	$ -		
WR-137-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 269,000		
WR-137-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		
WR-138-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ 235,000	$ -	$ -	$ -	$ -	$ -		
WR-138-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		
WR-139-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 269,000		
WR-139-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		4100500-52300
WR-140-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ 211,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		4100500-52300
WR-140-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		4100500-52300
WR-141-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 269,000		4100500-52300
WR-141-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		4100500-52300
WR-142-W	-	Expense	100%	0%	$ -	$ -	$ 100,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 135,000		4100500-52300
WR-143-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 269,000		4100500-52300
WR-143-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ 117,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -		4100500-52300
WR-144-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ 211,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		4100500-52300
WR-144-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		4100500-52300

ID	Pipeline Length (ft)/ Size/ Quantity/ Name	Capital or Expense	Rate Funded %	Connection Fee %	Construction Subtotal (2021 Dollars)	Construction Total (2021 Dollars)	Project Total (2021 Dollars)	Project Value in Future Year Dollars: Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Beyond Year 10	Notes	Project #
Rehabilitation & Replacement - Wells (Continued)																				
WR-145-W	-	Expense	100%	0%	$ -	$ -	$ 100,000	$ -	$ -	$ 109,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		4100500-52300
WR-146-W	-	Expense	100%	0%	$ -	$ -	$ 100,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 135,000		4100500-52300
WR-147-W	-	Expense	100%	0%	$ -	$ -	$ 100,000	$ -	$ -	$ -	$ 112,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -		4100500-52300
WR-148-W	-	Expense	100%	0%	$ -	$ -	$ 100,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 135,000		4100500-52300
WR-201-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ 235,000	$ -	$ -	$ -	$ -	$ -		4100500-52300
WR-201-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ 124,000	$ -	$ -	$ -	$ -	$ -		4100500-52300
WR-203-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 269,000		4100500-52300
WR-203-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ 117,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -		4100500-52300
WR-204-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ 229,000	$ -	$ -	$ -	$ -	$ -	$ -		4100500-52300
WR-204-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		4100500-52300
WR-205-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 255,000	$ -	$ -		4100500-52300
WR-205-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 134,000	$ -	$ -		4100500-52300
WR-206-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 248,000	$ -	$ -	$ -		4100500-52300
WR-206-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 130,000	$ -	$ -	$ -		4100500-52300
WR-207-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 269,000		4100500-52300
WR-207-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		4100500-52300
WR-208-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 242,000	$ -	$ -	$ -	$ -		4100500-52300
WR-208-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 127,000	$ -	$ -	$ -	$ -		4100500-52300
WR-209-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 248,000	$ -	$ -	$ -		4100500-52300
WR-209-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		4100500-52300
WR-212-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 242,000	$ -	$ -	$ -	$ -		4100500-52300
WR-212-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		4100500-52300
WR-GC-1-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 269,000		4100500-52300
WR-GC-1-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		4100500-52300
WR-GC-2-W/P	-	Expense	100%	0%	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 269,000		4100500-52300
WR-GC-2-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		4100500-52300
Subtotal							*$ 11,545,000*	*$ 412,000*	*$ 855,000*	*$ 771,000*	*$ 803,000*	*$ 927,000*	*$ 1,201,000*	*$ 1,095,000*	*$ 874,000*	*$ 389,000*	*$ 786,000*	*$ 6,131,000*		

								Project Value in Future Year Dollars												
ID	Pipeline Length (ft)/ Size/ Quantity/ Name	Capital or Expense	Rate Funded %	Connection Fee %	Construction Subtotal (2021 Dollars)	Construction Total (2021 Dollars)	Project Total (2021 Dollars)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Beyond Year 10	Notes	Project #
Rehabilitation & Replacement - Other																				
BR-133-P	-	Expense	100%	0%	$ -	$ -	$ 75,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 101,000		4100500-52300
BR-133-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		4100500-52300
BR-El Evado-P	-	Expense	100%	0%	$ -	$ -	$ 75,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 101,000		4100500-52300
BR-El Evado-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		4100500-52300
BR-White-P	-	Expense	100%	0%	$ -	$ -	$ 75,000	$ -	$ -	$ -	$ -	$ -	$ 89,000	$ -	$ -	$ -	$ -	$ -		4100500-52300
BR-White-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ 124,000	$ -	$ -	$ -	$ -	$ -		4100500-52300
BR-395P1-P	-	Expense	100%	0%	$ -	$ -	$ 75,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 101,000		4100500-52300
BR-395P1-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 141,000		4100500-52300
BR-395P2-P	-	Expense	100%	0%	$ -	$ -	$ 75,000	$ -	$ -	$ -	$ -	$ 86,000	$ -	$ -	$ -	$ -	$ -	$ -		4100500-52300
BR-395P2-E	-	Expense	100%	0%	$ -	$ -	$ 105,000	$ -	$ -	$ -	$ -	$ 120,000	$ -	$ -	$ -	$ -	$ -	$ -		4100500-52300
PR-Annual	-	Expense	100%	0%	$ -	$ -	$ 1,100,000	$ 103,000	$ 106,000	$ 109,000	$ 112,000	$ 115,000	$ 118,000	$ 121,000	$ 124,000	$ 128,000	$ 131,000	$ 135,000		4100500-52300
PRVR-Meters	-	Expense	100%	0%	$ -	$ -	$ 780,000	$ 161,000	$ 165,000	$ 169,000	$ 174,000	$ 179,000	$ -	$ -	$ -	$ -	$ -	$ -		4100500-52300
MR-Large Meter Replacements	-	Capital	100%	0%	$ -	$ -	$ -			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		74012
MR-Service Line Replacements	-	Expense	100%	0%	$ -	$ -	$ -			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -			4104500-52440
ATP-El Evado-Media Replacement	-	Expense	100%	0%	$ -	$ -	$ 175,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 229,000	$ -	4100500-52300	4100500-52300
ATP-Balsam-Media Replacement	-	Expense	100%	0%	$ -	$ -	$ 100,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 131,000	$ -	4100500-52300	4100500-52300
Subtotal							***$ 3,055,000***	***$ 264,000***	***$ 271,000***	***$ 278,000***	***$ 286,000***	***$ 500,000***	***$ 331,000***	***$ 121,000***	***$ 124,000***	***$ 128,000***	***$ 491,000***	***$ 861,000***		
Site Security Upgrades																				
Well 109		Capital	100%	0%	$ -	$ 176,000	$ 220,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 273,000	$ -	$ -	$ -		
Well 118		Capital	100%	0%	$ -	$ 76,000	$ 95,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 118,000	$ -	$ -	$ -		
Well 119		Capital	100%	0%	$ -	$ 145,000	$ 182,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 226,000	$ -	$ -	$ -		
Well 120		Capital	100%	0%	$ -	$ 133,000	$ 167,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 213,000	$ -	$ -		
Well 121		Capital	100%	0%	$ -	$ 181,000	$ 227,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 289,000	$ -	$ -		
Well 122		Capital	100%	0%	$ -	$ 139,000	$ 174,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 222,000	$ -	$ -		
Well 123		Capital	100%	0%	$ -	$ 188,000	$ 235,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 307,000	$ -		
Well 126		Capital	100%	0%	$ -	$ 108,000	$ 135,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 177,000	$ -		
Well 127		Capital	100%	0%	$ -	$ 191,000	$ 239,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 312,000	$ -		
Well 128		Capital	100%	0%	$ -	$ 80,000	$ 100,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 135,000		
Well 130		Capital	100%	0%	$ -	$ 170,000	$ 213,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 286,000		
Well 131		Capital	100%	0%	$ -	$ 210,000	$ 263,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 353,000		
Well 133		Capital	100%	0%	$ -	$ 77,000	$ 97,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 131,000		
Well 134		Capital	100%	0%	$ -	$ 175,000	$ 219,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 294,000		
Well 136		Capital	100%	0%	$ -	$ 175,000	$ 219,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 294,000		
Well 138		Capital	100%	0%	$ -	$ 246,000	$ 308,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 413,000		
Well 141		Capital	100%	0%	$ -	$ 205,000	$ 257,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 345,000		
Well 144		Capital	100%	0%	$ -	$ 46,000	$ 58,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 78,000		
Well 201		Capital	100%	0%	$ -	$ 139,000	$ 174,000	$ -	$ -	$ -	$ 194,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
Well 203		Capital	100%	0%	$ -	$ 107,000	$ 134,000	$ -	$ -	$ -	$ -	$ 154,000	$ -	$ -	$ -	$ -	$ -	$ -		
Well 204		Capital	100%	0%	$ -	$ 13,000	$ 17,000	$ -	$ 18,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	Need automated iron gate only	
Well 205		Capital	100%	0%	$ -	$ 38,000	$ 48,000	$ -	$ -	$ -	$ -	$ -	$ 57,000	$ -	$ -	$ -	$ -	$ -		
Well 206		Capital	100%	0%	$ -	$ 92,000	$ 115,000	$ -	$ -	$ -	$ -	$ -	$ 135,000	$ -	$ -	$ -	$ -	$ -		
Well 207		Capital	100%	0%	$ -	$ 387,000	$ 484,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 584,000	$ -	$ -	$ -	$ -		
Well 208		Capital	100%	0%	$ -	$ 115,000	$ 144,000	$ -	$ 152,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	High Priority	
Well 209		Capital	100%	0%	$ -	$ 13,000	$ 17,000	$ -	$ 18,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	Need automated iron gate only	
Well 212		Capital	100%	0%	$ -	$ 170,000	$ 213,000	$ -	$ -	$ 231,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	High Priority	
R 102 & Well 135		Capital	100%	0%	$ -	$ 316,000	$ 395,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 530,000		
R 104		Capital	100%	0%	$ -	$ 191,000	$ 239,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 321,000		
R 105, 113, 115, 118 & Well 137		Capital	100%	0%	$ -	$ 696,000	$ 870,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,167,000		
R 107, 108, 112, 114 & Well 129		Capital	100%	0%	$ -	$ 465,000	$ 582,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 781,000		
R 109 & 121		Capital	100%	0%	$ -	$ 175,000	$ 219,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 294,000		
R 110, 111, 116, 117 & Well 140		Capital	100%	0%	$ -	$ 554,000	$ 693,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 929,000		
R 119 & Well 132		Capital	100%	0%	$ -	$ 385,000	$ 482,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 647,000		
R 120 & Well 139 & 143		Capital	100%	0%	$ -	$ 489,000	$ 612,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 821,000		
R 202 & 207		Capital	100%	0%	$ -	$ 314,000	$ 393,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 527,000		
R 205 & 210		Capital	100%	0%	$ -	$ 345,000	$ 432,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 580,000		
R 208 & 209		Capital	100%	0%	$ -	$ 282,000	$ 353,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 474,000		
Subtotal							***$ 10,024,000***	***$ -***	***$ 188,000***	***$ 231,000***	***$ 194,000***	***$ 154,000***	***$ 192,000***	***$ 584,000***	***$ 617,000***	***$ 724,000***	***$ 796,000***	***$ 9,400,000***		

ID	Pipeline Length (ft)/ Size/ Quantity/ Name	Capital or Expense	Rate Funded %	Connection Fee %	Construction Subtotal (2021 Dollars)	Construction Total (2021 Dollars)	Project Total (2021 Dollars)	Project Value in Future Year Dollars: Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Beyond Year 10	Notes	Project #
SCADA Master Plan Projects																				
AM01	SCADA Governance	Capital	100%	0%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	In-House project.	
AM02	SCADA System Standards	Capital	100%	0%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	In-House project. AM01 must be completed first	
AM03	SCADA System SOPs	Capital	100%	0%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	In-House project.	
AM04	SCADA Standard Specs	Capital	100%	0%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	In-House project. Not needed until new facilities are designed/bid	
AM05	Cybersecurity Assessment & Planning	Capital	100%	0%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	In-House project. AM01 must be completed first	
AM06	Alarm/Event Rationalization and Management	Capital	100%	0%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	In-House project.	
AM07	Critical SCADA Documentation	Capital	100%	0%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	In-House project. AM01 must be completed first	
AM08	Electronic SCADA Document Management System	Capital	100%	0%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	In-house project. AM07 must be completed first	
AM09	PCN Development	Capital	100%	0%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	AM02 must be completed first	
AM10	Disaster Recovery & Emergency Ops Plan	Capital	100%	0%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	AM05 must be completed first. Included in ERP being prepared in 2020.	
AM11	Organizational Analysis	Capital	100%	0%	$ -	$ -	$ 100,000	$ -	$ -	$ -	$ 55,000	$ 56,000	$ -	$ -	$ -	$ -	$ -	$ -	AM01 must be completed first	
ES01	Server Virtualization & Hardware Upgrade	Capital	100%	0%	$ -	$ -	$ 510,000	$ -	$ 262,000	$ 269,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	AM05 must be completed first	
ES02	Cyber Security Vulnerability Assessment (Biennial)	Capital	100%	0%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	In-House project. AM05 must be completed first	
ES03	SCADA Lifecycle Management	Capital	100%	0%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	AM01 must be completed first	
ES04	Alarm Remediation (Bienniel)	Expense	100%	0%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	AM06 must be completed first. Perpetual maintenance cost.	
ES05	Lifecycle Management (Quarterly Work)	Expense	100%	0%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	In-House project. ES03 must be completed first.	
ES06	Lifecycle Management (Annual Support Costs)	Expense	100%	0%	$ -	$ -	$ 134,330	$ 14,000	$ 14,000	$ 15,000	$ 15,000	$ 15,000	$ 16,000	$ 16,000	$ 17,000	$ 17,000	$ 18,000	$ -	Perpetual maintenance cost.	
NI01	Remote Site Communication	Capital	100%	0%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	In-House project.	
NI02	Radio Replacement	Capital	100%	0%	$ -	$ -	$ 881,000	$ 652,000	$ 236,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	Some work could be self performed to reduce the cost; phasing duration	
NI03	Fiber Extension	Capital	100%	0%	$ -	$ -	$ 1,791,300	$ -	$ 276,000	$ 284,000	$ 292,000	$ 299,000	$ 307,000	$ 316,000	$ 216,000	$ -	$ -	$ -	NI02 must be completed first	
CC01	Emergency Operations Center	Capital	100%	0%	$ -	$ -	$ 607,000	$ -	$ 250,000	$ 193,000	$ 198,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	AM10 must be completed first	
SU01	Control Panel Standardization	Capital	100%	0%	$ -	$ -	$ 1,762,000	$ -	$ -	$ 465,000	$ 478,000	$ 491,000	$ 504,000	$ -	$ -	$ -	$ -	$ -	Control panels will be replaced as part of well and booster RR projects	
SU02	Programming Standardization	Capital	100%	0%	$ -	$ -	$ 912,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,191,000		
BI01	Data Warehouse	Capital	100%	0%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	AM02/UH01 must be completed first	
BI02	Business System Integration	Capital	100%	0%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	BI01 must be completed first	
OI01	Pump Efficiency	Capital	100%	0%	$ -	$ -	$ 148,000	$ -	$ -	$ -	$ -	$ 165,000	$ -	$ -	$ -	$ -	$ -	$ -	In-House project. BI01 must be completed first	
OI02	Water Loss	Capital	100%	0%	$ -	$ -	$ 96,000	$ -	$ -	$ -	$ -	$ 107,000	$ -	$ -	$ -	$ -	$ -	$ -		
OI03	Blended Water Quality	Capital	100%	0%	$ -	$ -	$ 66,000	$ -	$ -	$ -	$ 72,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	In-House project. BI01 must be completed first	
Subtotal							***$ 7,007,630***	***$ 666,000***	***$ 1,038,000***	***$ 1,226,000***	***$ 1,110,000***	***$ 1,133,000***	***$ 827,000***	***$ 332,000***	***$ 233,000***	***$ 17,000***	***$ 18,000***	***$ 1,191,000***		

								Project Value in Future Year Dollars													
ID	**Pipeline Length (ft)/ Size/ Quantity/ Name**	**Capital or Expense**	**Rate Funded %**	**Connection Fee %**	**Construction Subtotal (2021 Dollars)**	**Construction Total (2021 Dollars)**	**Project Total (2021 Dollars)**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Beyond Year 10**	**Notes**	**Project #**
Other CIP Items							***Annual Average Cost***													
Machinery, Equipment & Vehicles	-	Capital	100%	0%	$ -	$ -	$ 572,000	$ 770,000	$ 616,000	$ 392,000	$ 112,700	$ 502,800	$ 618,000	$ 649,400	$ 667,000	$ 686,000	$ 706,000			Various
ROW/ Utility Location	-	Capital	100%	0%	$ -	$ -	$ 175,000	$ 234,345	$ 145,000	$ 152,300	$ 152,300	$ 159,900	$ 167,900	$ 176,300	$ 182,000	$ 187,000	$ 193,000		Right of Way Relocations & Other Minor Rate Funded Pipelines	74390, 60083, 74020
IT	-	Capital	100%	0%	$ -	$ -	$ 115,000				$ 100,000	$ 105,000	$ 110,000	$ 116,000	$ 120,000	$ 124,000	$ 128,000		Equipment - Emergency Backup	36025, 74315
Planning	-	Expense	100%	0%	$ -	$ -	$ -					$ 150,000	$ 250,000				$ 150,000		UWMP, WMP and RRA/ERP updates every 5 years. Moved to Expense	
Meter - AMI	-	Capital	100%	0%	$ -	$ -	$ -	$ 1,500,000	$ 750,000	$ 750,000										74339, 74379
Subtotal							***$ 862,000***	***$ 2,504,345***	***$ 1,511,000***	***$ 1,294,300***	***$ 365,000***	***$ 917,700***	***$ 1,145,900***	***$ 941,700***	***$ 969,000***	***$ 997,000***	***$ 1,177,000***	***$ -***		
						PROJECTS TOTAL	**$ 128,291,630**	**$ 11,128,345**	**$ 10,035,000**	**$ 9,815,300**	**$ 9,523,000**	**$ 10,322,700**	**$ 10,636,900**	**$ 9,842,700**	**$ 12,340,000**	**$ 10,293,000**	**$ 13,646,000**	**$ 59,116,000**		
						Expense Subtotal	***$ 41,993,330***	***$ 1,221,000***	***$ 2,192,000***	***$ 2,610,000***	***$ 2,545,000***	***$ 3,596,000***	***$ 4,436,000***	***$ 3,355,000***	***$ 3,705,000***	***$ 3,345,000***	***$ 5,383,000***	***$ 20,806,000***		
						Capital Subtotal	***$ 86,298,300***	***$ 9,907,345***	***$ 7,843,000***	***$ 7,205,300***	***$ 6,978,000***	***$ 6,726,700***	***$ 6,200,900***	***$ 6,487,700***	***$ 8,635,000***	***$ 6,948,000***	***$ 8,263,000***	***$ 38,310,000***		
						Connection Fee Funded Capital		$ 373,500	$ -	$ -	$ -	$ -	$ -	$ 1,664,000	$ 6,833,000	$ -	$ -	$ 2,247,000		
						Rate Funded Capital		$ 9,533,845	$ 7,843,000	$ 7,205,300	$ 6,978,000	$ 6,726,700	$ 6,200,900	$ 4,823,700	$ 1,802,000	$ 6,948,000	$ 8,263,000	$ 36,063,000		

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References

1. **Water Systems Consulting, Inc. .** *2015 Urban Water Management Plan.* 2016.

2. **City of Victorville.** *2016 Consumer Confidence Report.*

3. **Daniel B. Stephens & Associates, Inc.** *Study to Evaluate Long-Term Trends and Variations in the Average Total Dissolved Solids Concentration in Wastewater and Recycled Water .* 2018.

4. **American Water Works Association.** Buried No Longer: Confronting America's Water Infrastructure Challenge. *AWWA.* [Online]

5. —. *AWWA Manual M19, Fourth Edition. Emergency Planning for Water Utilities.* 2001.

6. **David Evans and Associates, Inc.** *Sewer Master Plan.* 2016.