APPENDIX B

SCWA (2020) Water Supply Master Plan

DRAFT

Zone 40 Water Supply Master Plan Amendment

For the Multi-Sport Complex and Grant Line Industrial Annexation Area

Prepared for
Sacramento County Water Agency
Sacramento, CA
October 8, 2020

DRAFT

Zone 40 Water Supply Master Plan Amendment

For the Multi-Sport Complex Project and Grant Line Industrial Annexation Area

Prepared for
Sacramento County Water Agency, Sacramento, CA
October 8, 2020

152999

Project Participants

Sacramento County Water Agency

Michael Grinstead

Esther Kinyua

City of Elk Grove

Keith Rhodes, CIP Support Manager

Alicia Brundage

John Griffin

Christopher Jordan

Brown and Caldwell

Paul Selsky, Project Manager

Micaela Nino, Engineer

Dawn Schock, Document Preparation

This page intentionally left blank.

Table of Contents

List of Figures

List of Tables

This page intentionally left blank.

List of Abbreviations

AACE	Association for the Advancement Cost Engineering International
ac-ft/yr	acre-feet per year
Agency Act	Sacrament County Water Agency Act
ASR	aquifer storage and recovery
bgs	below ground surface
BMO	basin management objectives
Cal Am	California American Water Company
CIP	capital improvement plan
City	City of Sacramento
CSA	Central Service Area
CMID	Construction Management and Inspection Division
CSCGMP	Central Sacramento County Groundwater Management Plan
CVP	Central Valley Project
DPR	direct potable reuse
DU	dwelling units
EBMUD	East Bay Municipal Utility District
fps	feet per second
FRWA	Freeport Regional Water Authority
FY	fiscal year
GET	groundwater extraction and treatment
GPCD	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
GIS	geographic information system
GSWC	Golden State Water Company
GWTP	groundwater treatment plant
HGL	hydraulic grade line
in	inch
IPR	indirect potable reuse
JPA	joint powers authority
LAFCo	Local Agency Formation Commission
lf	linear feet
MDD	maximum day demand
MFR	Multi-family residential
MG	million gallons
mgd	million gallons per day
M&I	municipal and industrial
MSC	Multi-Sport Complex
NSA	North Service Area
OHWD	Omochumne-Hartnell Water District
Plan Area	Grant Line Industrial Annexation Area
PL	Public Law
POU	Place of Use
PSA	purveyor specific agreement
Reclamation	U.S. Bureau of Reclamation
SACOG	Sacramento Area Council of Governments
SB	Senate Bill
SCGA	Sacramento Central Groundwater Authority
SCWA	Sacramento County Water Agency
SFR	Single family residential
SRCSD	Sacramento Regional County Sanitation District
SSA	South Service Area
SMUD	Sacramento Municipal Utility District
SWRCB	State Water Resources Control Board
SWTP	Surface Water Treatment Plant
TDS	total dissolved solids
UWDF	unit water demand factors
UWMP	urban water management plan
WFA	Water Forum Agreement
WRPP	Water Recycling Pilot Program
WSIP	Water System Infrastructure Plan
WSMP	Water Supply Master Plan
WTP	Water Treatment Plant

This page intentionally left blank.

Section 1

Introduction

This amendment to the Zone 40 Water Supply Master Plan (WSMP) has been prepared for the proposed Multi-Sport Complex (MSC) and Grant Line Industrial Annexation Area. The MSC is part of the Grant Line Industrial Annexation Area. The Grant Line Industrial Annexation Area is known as the Plan Area (Plan Area). This amendment is developed at the request of the City of Elk Grove Planning Department (Local Agency Formation Commission (LAFCo) # 04-15). This section describes Sacramento County Water Agency (SCWA) and Zone 40, the purpose of this amendment, linkage to the 2005 WSMP (SCWA, 2005), the Zone 40 service area, and the report organization.

1.1 SCWA and Zone 40

SCWA was formed in 1952 by a special legislative act of the State of California called the Sacramento County Water Agency Act (Agency Act). SCWA is governed by a Board of Directors. Under the Agency Act, the Board may contract with the federal government and the State of California with respect to the purchase, sale, and acquisition of water. SCWA may also construct and operate any required capital facilities.

Zone 40 was created by among other things SCWA Resolution No. 663 in May 1985, which described the boundaries of the zone and the types of projects to be undertaken. Zone 40 is a benefit zone created for the acquisition, construction, maintenance, and operation of facilities for the production, conservation, transmittal, distribution, and sale of ground or surface water or both for the present and future beneficial use of lands or inhabitants within the zone. Ordinance No. 18, adopted in 1986, empowered SCWA to establish fees, charges, credits, and regulations for the supply of water and required the development of a water supply master plan. The boundaries and scope of Zone 40's activities were expanded in April 1999 by Resolution WA-2331 to include the use of recycled water in conjunction with surface and groundwater. The Zone 40 boundary was further amended for Cordova Hills in 2011 as described in the SCWA Board of Directors Resolution WA-2844 dated March 26, 2013.

SCWA provides retail water supply within Zone 40 to portions of unincorporated Sacramento County, the City of Rancho Cordova, and the City of Elk Grove. SCWA also provides wholesale water supply to a portion of the service area of Elk Grove Water District. Elk Grove Water District operates a retail water system serving customers within a portion of the City of Elk Grove and is a department of the Florin Resource Conservation District. SCWA will also provide wholesale water supply in the future to California American Water Company's (Cal Am) service area in Rio del Oro.

1.2 Purpose

The purpose of this WSMP Amendment is to address the sufficiency of water supply for the 2030 study area that is updated to include the Plan Area, which includes the proposed MSC, and to update relevant assumptions contained within the WSMP (February 2005). Significant changes such as water supply variations, County General Plan Amendments, annexations, incorporations, or new major programs are treated through formal updates or amendments to the WSMP.

The 2005 WSMP was developed to provide a flexible program of water management alternatives that could be implemented as the availability and feasibility of water supply sources change. It

presented recommendations to meet future water demands in Zone 40 through the year 2030 (identified as the 2030 Study Area) with a regional conjunctive use program balancing the use of groundwater, surface water, and recycled water supplies. The Freeport Regional Water Project alternative was selected as the preferred alternative.

- Subsequently, SCWA developed the following documents:
- 2006 Zone 40 Water System Infrastructure Plan (WSIP) (SCWA, September 2006)
- 2006 Central Sacramento County Groundwater Management Plan
- 2010 Urban Water Management Plan (UWMP) (SCWA, July 2011)
- 2011 Water Supply Master Plan Amendment for the Cordova Hills Project (SCWA, December 2011)
- Draft WSMP Amendments for Jackson Township, NewBridge, and West Jackson Projects created at the request of the Sacramento County Office of Planning and Environmental Review (SCWA, three reports, February 2016)
- 2015 UWMP (SCWA, June 2016)
- 2016 Zone 40 WSIP (SCWA, September 2016)

Since the completion of these documents, the Plan Area has been proposed. The completion of this WSMP amendment is a necessary component for the approval of the proposed Plan Area as required by LAFCo# 04-15. The proposed Plan Area is located just outside of the City of Elk Grove's southern city limit, east of Highway 99 and the railroad and south of Grant Line Road. Because the Plan Area is located outside of the 2005 WSMP study area, SCWA is required to develop and approve an amendment to the WSMP to serve the area with potable water.

This WSMP amendment presents an evaluation of the water demands, water supplies, water system facilities, and costs for two scenarios, as follows:

- Baseline. This scenario consists of Zone 40 with the land uses as currently approved plus three other previously planned projects known as West Jackson, Jackson Township, and NewBridge.
- Plan Area. This scenario consists of the Baseline scenario plus the proposed Plan Area, which is described in Section 8.

1.3 Linkage to 2005 Zone 40 Water Supply Master Plan

This WSMP Amendment contains updates and additions to substantial portions of the 2005 WSMP and the 2011 Cordova Hills Amendment. The items that have been updated include buildout land use acreages, unit water demand factors, recent historical demographics and water demands, projected water demands, growth rate projection, projected water supply availability, groundwater supply description, needed future facilities, and the capital improvement plan (CIP). New items that are presented in this Amendment that were not included in the 2005 WSMP and the 2011 Cordova Hills include existing water facilities descriptions; buildout population, connections, and dwelling units by service area; water demand factors expressed as demand per dwelling unit and per type of customer; projected maximum day and annual use of surface water and groundwater for dry and wet/average years; evaluation of storage and pump station capacity; and cost estimates for each proposed facility.

1.4 Service Area Description

The Zone 40 boundary and service areas as well as the Plan Area are shown on Figure 1-1. The study area for this analysis is the same as for the WSMP and the Cordova Hills Master Plan Amendment

and only revised to include the Plan Area. The study area is further described and illustrated in Section 3.

The Zone 40 has three service areas as follows:

- North Service Area (NSA)
- Central Service Area (CSA)
- South Service Area (SSA)

1.4.1 North Service Area

The NSA is located south of the American River and includes part of the City of Rancho Cordova. Historically, the NSA was supplied exclusively by groundwater. In recent years, SCWA has supplied surface water supply to the NSA, from the Vineyard WTP, as part of the conjunctive use program. The NSA is the least developed of the three service areas, with currently less than 10 percent of the projected build out population. This service area includes the old Mather and Sunrise Corridor systems, as well as the newer Sunridge system. SCWA assumed ownership of the Mather System shortly after the County of Sacramento took over the old Mather Air Force Base after it was shut down by the US Air Force in the mid-1990s. In the case of the Sunrise Corridor System, SCWA was asked to take ownership and provide water service after the system was constructed through an assessment district in the late 1980's. The majority of the land within the NSA boundary is rural and undeveloped.

1.4.2 Central Service Area

The CSA is located to the south of the NSA and is supplied by surface water from the Vineyard Surface Water Treatment Plant (SWTP) and groundwater. The Plan Area will be part of the CSA. The CSA is partially developed with approximately 27 percent of the projected build out population. SCWA provides wholesale water to Elk Grove Water District within the CSA. This service area includes the old Grantline-99 system, as well as the newer Vineyard, Vineyard Springs, and North Vineyard Station areas. The CSA is predominately residential with a small amount of commercial and institutional customers and a large rural component to the east. The Plan Area is located adjacent to the existing CSA.

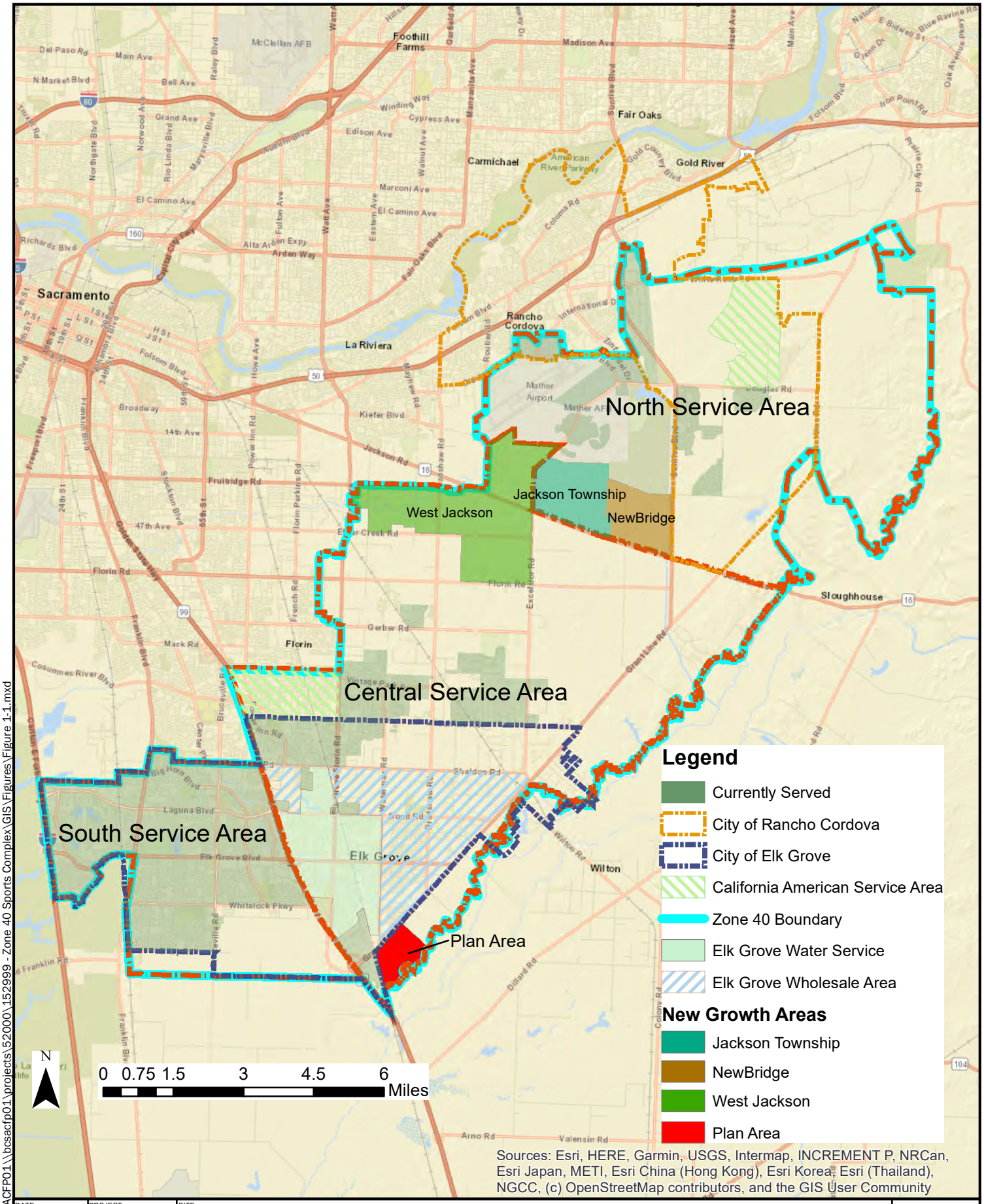
1.4.3 South Service Area

The SSA is located south of the CSA and to the west of Highway 99. The SSA is the most developed of the three service areas, with currently 60 percent of the projected build out population. The SSA is supplied by a mix of surface water, groundwater, and recycled water. The surface water comes from the Vineyard SWTP and conveyed through the CSA. The Franklin Intertie can also supply surface water but has not been operated in recent years. This service area currently supplies the Laguna, East Franklin, and Laguna Ridge areas. The SSA is predominantly residential with some commercial and institutional customers as well.

1.5 Report Organization

The WSMP contains the following nine sections plus appendices, as follows:

- Section 2 presents a description of the existing water system and its facilities.
- Section 3 presents the methodology used to develop future water demands, the connection growth projection, and the water demand factors.
- Section 4 describes the water supplies.
- Section 5 describes the approach to quantify the amount of needed supply and storage capacity.
- Section 6 describes the approach used to identify the needed water system facilities, the resulting CIP, and the cost estimates.
- Section 7 develops the water demands, required water facilities, and their costs for the Baseline scenario.
- Sections 8 develops the same information for the Plan Area scenario.
- Appendix A contains back up information for the development of the demand factors.
- Appendices B, and C contain the supply capacity, use of supply, comparison to demand, and storage evaluations for the Baseline and Plan Area scenarios.
- Appendix D has the cost estimate tables for each CIP project.



Document Path: BCSACFP01\\bcsacfp01\projects\52000\152999 - Zone 40 Sports Complex\GIS\Figures\Figure 1-1.mxd

DATE	PROJECT	SITE	
8/6/2020	152999	**Zone 40 Water Supply Master Plan Amendment**	**Figure 1-1**
Brown AND Caldwell / Department of Water Resources Sacramento County Water Agency		TITLE **Zone 40 Service Area**	

This page intentionally left blank.

Section 2

Existing Water System Description

This section describes SCWA's existing Zone 40 water system. It contains a description of the water supply facilities including surface water facilities, groundwater wells, storage tanks, pressure zones, and the piping system. Recycled water facilities are also described.

2.1 Surface Water Facilities

SCWA surface water supplies for Zone 40 are diverted from the Sacramento River at Freeport and through the City of Sacramento's (City) Sacramento River SWTP.

Surface water diverted from the Sacramento River at the Freeport diversion structure is conveyed through the Freeport Regional Water Authority (FRWA) pipeline, treated at the Vineyard SWTP, and then delivered to the Zone 40 service area. FRWA was created as a joint powers authority (JPA) between SCWA and East Bay Municipal Utility District (EBMUD) in 2002, to increase surface water supply to the southern part of Sacramento County to reduce the county's dependence on groundwater through the implementation of a conjunctive use program and to provide a dry year surface water supply for EBMUD.

In 2011, FRWA completed the Sacramento River diversion at Freeport and a conveyance pipeline. The 84-inch (in) diameter pipeline with a capacity of 170 million gallons per day (mgd) starts at the Freeport intake, crosses Interstate 5 and Highway 99 to the east, and then parallels Gerber Road to a bifurcation at Vineyard Road. A SCWA owned 60-in diameter pipeline with a capacity of 70 mgd then conveys water north from this point to the Vineyard SWTP, which is located in the CSA. An EBMUD owned 66-in diameter pipeline with a capacity of 100 mgd continues further east to the Folsom South Canal.

The current permitted capacity of the Vineyard SWTP is 60 mgd with an ultimate capacity of 100 mgd. Treatment facilities include coagulation, flocculation, sedimentation, filtration, and chlorine disinfection. The plant is also provided with solids-handling facilities. Other facilities include a clear well / chlorine contact tank, an electrical building, and treated water pump station.

The Vineyard SWTP currently provides treated surface water to customers in the CSA, SSA, and NSA. Three pipelines cross Highway 99 and hydraulically connect the CSA and the SSA at Sheldon Road, Bond Road, and Grant Line Road. The Sheldon Road pipeline was constructed in 2010. Treated water from the Vineyard SWTP is conveyed to the NSA through the Phase A NSA pipeline that was constructed in 2018.

Surface water can also be provided to the SSA through the Franklin Intertie, but this intertie has not been used as a source of surface water supply in recent years. The City could divert and treat a portion of SCWA's surface water at their Sacramento River SWTP, and then wheel that water through their distribution system to the Franklin Intertie to Zone 40. The Franklin Intertie has a capacity of 11.1 mgd. Water from the intertie can flow into the SSA though two routes. A dedicated transmission main connects to SCWA's Dwight Road facility where the supply can be pumped into the SSA. Water from the intertie can also be supplied to the SSA through an in-line booster pump that connects directly to the SSA distribution system.

Table 2-1 summarizes the surface water facilities' capacities.

Table 2-1. Zone 40 Surface Water Facilities

Facility	Treated Water Capacity, mgd	Storage Tank Volume, MG	Pump Station Capacity, mgd
Vineyard SWTP	50/100 ultimate	20	75 mgd
Franklin Intertie	11.1	--	1.6[a]

a. *This is the capacity of the in-line booster pump near the intertie. Franklin Intertie supply can be pumped to the SSA through either the Dwight Road GWTP booster pump station facility or the in-line booster pump.*

2.2 Groundwater Facilities

Groundwater is supplied to Zone 40 from wells that that are connected to groundwater treatment plants (GWTPs) and from wells that pump directly into the distribution system (direct feed).

Each GWTP facility consists of wells that are manifolded into a treatment plant, a ground level storage tank, and a pump station. Most GWTPs are supplied by more than one well. The existing GWTPs use oxidation and filtration with a manganese zeolite (greensand) filter media for iron and manganese treatment. Treated water from the GWTPs flows into the ground level storage tanks and is subsequently pumped into the distribution system. The pump stations are typically sized larger than the GWTP capacities so that peak hour or fire flow supply can be pumped to the distribution system from the storage tanks. In the case of the Dwight Road GWTP in the SSA, the pump station is sized larger than the GWTP to also pump the Franklin Intertie supply into the SSA. Storage tanks that are not located at a GWTP facility are described in Section 2.3.3.

The direct feed wells pump directly into the distribution system and do not require treatment. Direct feed wells are located in some areas of the CSA and SSA. SCWA also has some wells that were drilled and planned to be equipped in the future. Because these wells are not currently equipped to provide a groundwater supply to the system, they are not included in this section.

The wells used to feed the Anatolia GWTP are located in the CSA near the Vineyard SWTP, while the GWTP is located in the NSA and the treated water is supplied to the NSA. The wells that supply the GWTPs, storage tanks at the GWTPs, and pump stations in the NSA are listed in Table 2-2. There are no direct feed wells in the NSA. The locations of these facilities are shown on Figure 2-1.

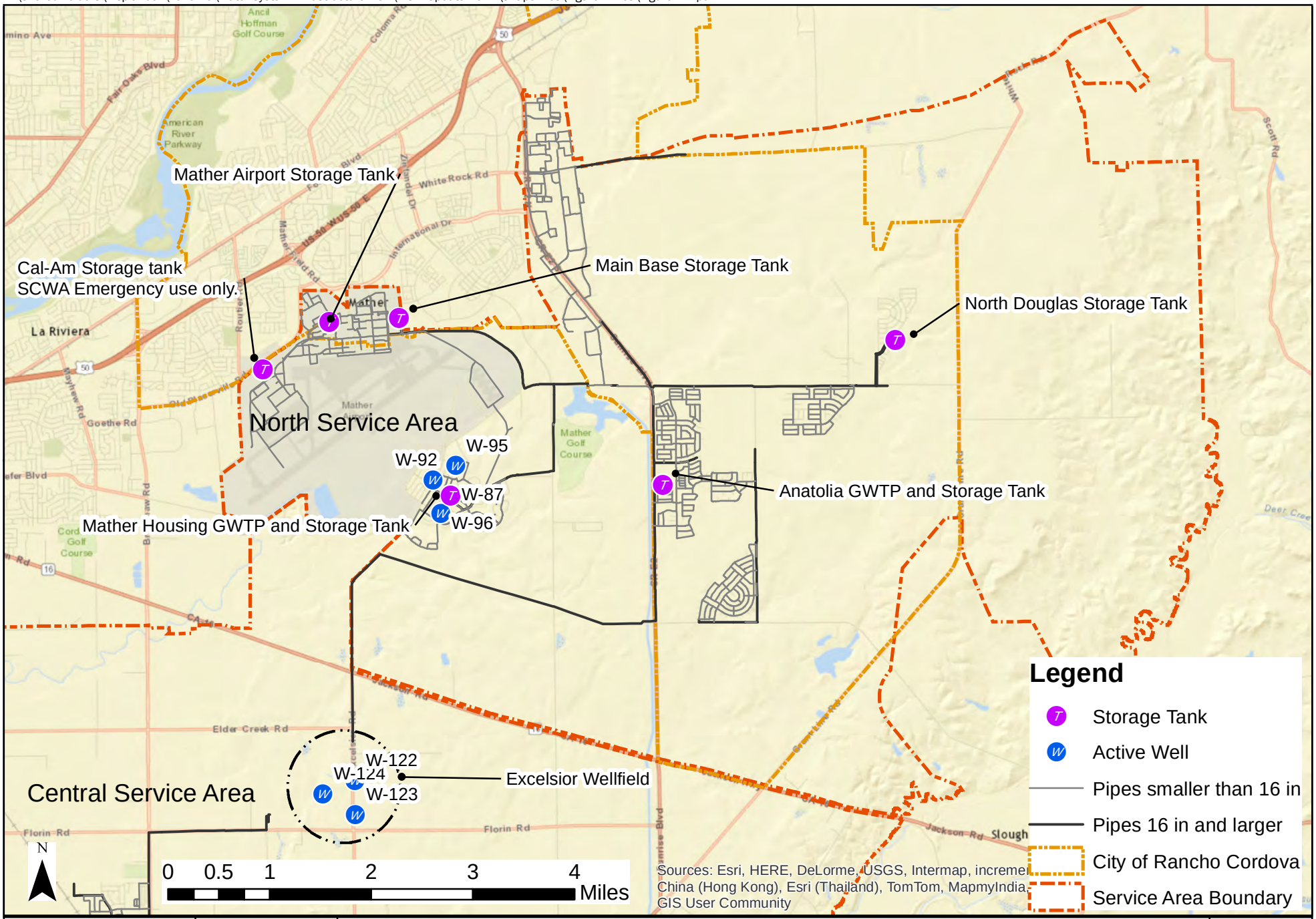
Table 2-2. NSA Groundwater Facilities

Facility	GWTP Capacity, mgd	Well Capacity		Storage Tank Volume, MG	Pump Station Capacity, gpm
		Wells to GWTP, gpm	Direct Feed Wells, gpm		
Mather Housing GWTP					
W-096 McRoberts Well	--	750			
W-095 Pittsfield Well	--	1,600			
W-087 Plant Well	--	1,200			
W-092 Veterans Park Well	--	1,200			
Subtotal	6.0	4,750		0.5	3,600 (5.2 mgd)[a]
WT-08 Anatolia GWTP					
W-122 Excelsior Well #1		1,800			
W-123 Excelsior Well #2		1,800			
W-124 Excelsior Well #3		1,800			
Subtotal	6.5	5,400		4.0	7,800 (11.2 mgd)
Total	12.5	10,150	--	4.5	11,400 (16.4 mgd)

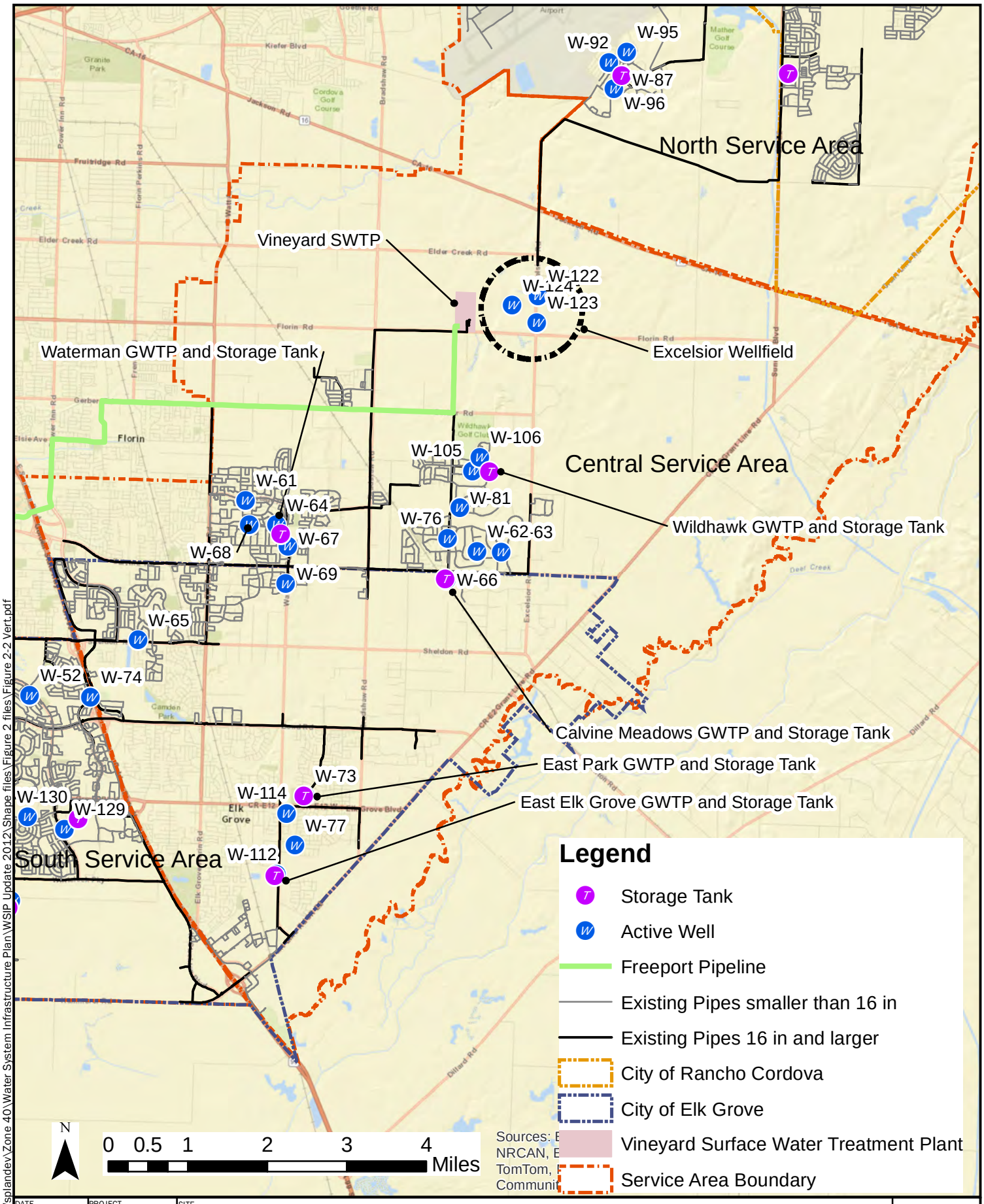
a. The pump station pumps a portion of the supply from the tank. The remaining supply is fed by gravity to Mather Housing.

The CSA is supplied water from the Vineyard SWTP and five groundwater treatment plants. There are also three direct feed wells that supply the CSA. The GWTPs, wells that supply the GWTPs, direct feed wells, storage tanks at the GWTPs, and pump stations in the CSA are listed in Table 2-3. The locations of these facilities are shown on Figure 2-2.

P:\Shared Folders\Wsplandev\Zone 40\Water System Infrastructure Plan\WSIP Update 2012\Shape files\Figure 2 files\Figure 2-1.pdf



Brown AND Caldwell DEPARTMENT OF WATER RESOURCES SACRAMENTO COUNTY WATER AGENCY	PROJECT 152999 DATE 4/2/2020	SITE **Zone 40 Water Supply Master Plan Amendment** TITLE **Existing Supply Facilities - NSA**	**Figure 2-1**



P:\Shared Folders\Wsplandev\Zone 40\Water System Infrastructure Plan\WSIP Update 2012\Shape files\Figure 2 files\Figure 2-2 Vert.pdf

DATE	PROJECT	SITE	
4/2/2020	152999	Zone 40 Water Supply Master Plan Amendment	Figure 2-2

Brown AND Caldwell

DEPARTMENT OF WATER RESOURCES SACRAMENTO COUNTY WATER AGENCY

TITLE

Existing Supply Facilities - CSA

Table 2-3. CSA Groundwater Facilities

Facility	GWTP Capacity, mgd	Well capacity		Storage Tank Volume, MG	Pump Station Capacity, gpm
		Wells to GWTP, gpm	Direct Feed Wells, gpm		
WF-01 Calvine Meadows GWTP					
W-066 Calvine Meadows Well		1,700			
W-076 Legends Well		1,750			
Subtotal	5.0	3,450		0.35	6,100 (8.8 mgd)
WT-05 East Elk Grove GWTP					
W-112 East Elk Grove On Site Well		1,500			
W-077 Waterman Ranch Well		1,500			
W-114 Windsor Downs Well		1,500			
Subtotal	6.5	4,500		3.5	9,000 (13.0 mgd)
WF-03 East Park GWTP					
W-073 East Park Well		1,915			
Subtotal	2.9	1,915		0.5	2,400 (3.5 mgd)
WT-02 Waterman GWTP					
W-061 Caymus Well		1,600			
W-069 Perry Ranch Well		1,500			
W-068 Tillotson Well		1,500			
W-067 Waterman Road Well		1,500			
W-064 Westray Well		1,500			
Subtotal	8.6	7,600		7.0	18,000 (25.9 mgd)
WT-03 Wildhawk GWTP					
W-105 Azinger Well		1,800			
W-106 Rodriguez Well		1,800			
W-081 Saddle Creek Well		1,500			
Subtotal	7.5	5,100		3.0	13,200 (19.0 mgd)
Direct feed wells					
W-062 Andalusian Well			1,100		
W-063 Equine Well			1,000		
W-065 Sheldon North Well			608		
Total	30.5		2,700	14.4	48,700 (70.1 mgd)

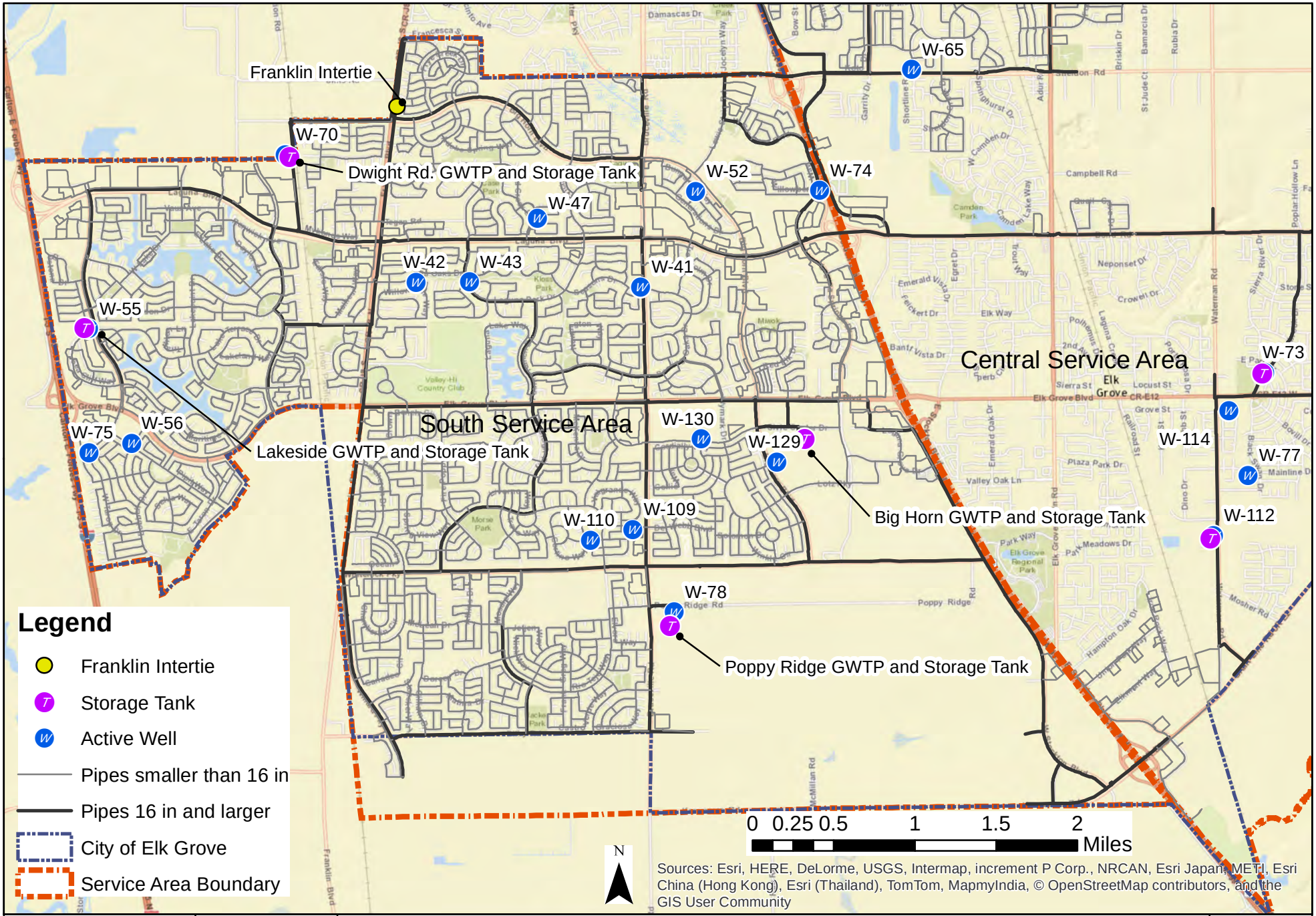
The SSA is supplied water from four GWTPs and from the Franklin Intertie. There are also six direct feed wells that supply the SSA. The SSA also receives some supply from the CSA. The GWTPs, wells that supply the GWTPs, direct feed wells, storage tanks at the GWTPs, and pump stations in the SSA are listed in Table 2-4. The locations of these facilities are shown on Figure 2-3.

Table 2-4. SSA Groundwater Facilities

Facility	GWTP Capacity, mgd	Well Capacity		Storage Tank Volume, MG	Pump Station Capacity, gpm
		Wells to GWTP, gpm	Direct Feed Wells, gpm		
Big Horn GWTP					
W-130 Big Horn Blvd #5 Well Civic Center Dr.		1,500			
W-129 Big Horn offsite Well #4 Big Horn Blvd.		1,500			
Subtotal	4.5	3,000		2.0	6,000 (8.6 mgd)
Dwight Road GWTP					
W-070 Dwight Road Raw Water Well		1,500			
Subtotal	2.1	1,500		7.0	18,000 (25.9 mgd)[a]
Lakeside GWTP					
W-055 Lakeside Well		1,700			
W-056 Riparian Well		1,500			
W-075 West Taron Well		1,600			
Subtotal	6.5	4,800		0.5	5,000 (7.2 mgd)
Poppy Ridge GWTP					
W-110 Ferragamo Well		1,500			
W-078 Poppy Ridge On-Site Well		1,500			
W-109 Terrazo Well		1,500			
Subtotal	6.5	4,500		3.5	7,200 (10.4 mgd)
Direct feed wells					
W-042 Banyon Well			760		
W-052 Big Horn North Well			940		
W-043 Duck Slough Well			1,000		
W-047 Feather Creek Well			800		
W-041 Seasons Well			650		
W-74 Stockton (Park Meadows)			500		
Total	19.6	--	4,650	13.0	36,200 (52.1 mgd)

a. Dwight Road GWTP pump station capacity is sized to also pump the supply from the Franklin intertie into the SSA distribution system.

P:\Shared Folders\Wsplandev\Zone 40\Water System Infrastructure Plan\WSIP Update 2012\Shape files\Figure 2 files\Figure 2-3 update.pdf



Brown AND Caldwell

DEPARTMENT OF WATER RESOURCES SACRAMENTO COUNTY WATER AGENCY

PROJECT	SITE	
152999	**Zone 40 Water Supply Master Plan Amendment**	**Figure 2-3**
DATE	TITLE	
4/2/2020	**Existing Supply Facilities - SSA**	

2.3 Water Distribution Facilities

Existing water distribution facilities within Zone 40 include storage tanks and pipelines. The system is also comprised of several pressure zones.

2.3.1 Pressure Zones

Zone 40 consists of two pressures zones, as described below. Figure 2-4 provides a hydraulic schematic of the Zone 40 system that illustrates the pressure zones and ground elevations of key water distribution and supply facilities. Table 2-5 summarizes the ground elevation and maximum day pressure range by pressure zone from SCWA's hydraulic model.

- NSA Main Zone – The NSA Main Zone is the largest pressure zone within the NSA. The NSA Upper Zone will be added in the future.
- CSA/SSA Zone - The CSA and SSA form one pressure zone that is hydraulically connected by three pipelines that cross Highway 99.

Table 2-5. Pressure Zones

Pressure zone	Ground Elevation Range, ft	Maximum Day Pressure, psi
NSA Main Zone	74 to 215	40 to 85
CSA/SSA Zone	10 to 96	50 to 75

2.3.2 Pipelines

Table 2-6 summarizes the existing transmission and distribution pipeline length by pipe diameter in each of the service areas. SCWA defines transmission pipe to be those 16 inches in diameter and greater. This includes SCWA pipelines within the Elk Grove wholesale area and raw water pipelines that connect the groundwater wells to the GWTPs.

Table 2-6. Distribution Pipeline Length by Diameter by Service Area

Diameter, inch	Pipe Length, linear feet			
	NSA	CSA	SSA	Total
Distribution				
<8-in	54,200	200	10,600	65,000
8 to 10-in	264,300	421,700	1,080,200	1,766,200
12 to 14-in	128,800	175,700	344,100	648,500
Transmission				
16 to 24-in	52,300	167,600	231,800	451,600
30 to 36-in	47,100	34,300	16,200	97,500
> 36-in	11,800	24,800	1,300	37,800
Total	558,300	824,000	1,684,000	3,066,200

2.3.3 Storage Facilities

Zone 40 has fourteen active storage tanks. Eleven of the storage tanks are located at GWTPs and described in Section 2.2. The three storage tanks that are independent storage facilities that are not part of a GWTP facility are listed in Table 2-7. These tanks are used to meet the peak hour increment of demand that is greater than the maximum day demand as well as emergency and fire flow demands. Cal Am has a 3 MG storage tank in the NSA that is available to SCWA for emergency purposes.

Table 2-7. Stand-alone Storage Facilities

Name	Volume, MG	Pump Station Capacity, gpm	Pressure Zone
Mather 1 storage (Main Base)	1.0	3,600 (5.2 mgd)	NSA Main Zone
Mather 2 storage (Mather Airport)	0.3	Elevated tank	NSA Main Zone
North Douglas	3.0	13,500 (19.4 mgd)	NSA Upper Zone
Total	4.3		

2.4 Recycled Water Facilities

Beginning in 2003, the Sacramento Regional County Sanitation District (SRCSD) started wholesaling recycled water to SCWA for the Phase I SRCSD/SCWA Water Recycling Pilot Program (WRPP). The Phase 1 recycled water service area consists of the Laguna West, Lakeside, and Laguna Stonelake communities that are located in the western third of the Laguna planning subarea in the SSA. In these areas SCWA retails the recycled water to large commercial irrigation customers, industrial customers, right-of-way landscaping, schools, and parks.

Some of the Phase 2 recycled water conveyance facilities have been constructed in the East Franklin and Laguna Ridge planning subareas in the SSA. The portions of the system that are operational are using potable water as a supply source.

SRCSD is responsible for the collection, treatment, and disposal of wastewater throughout most of the urbanized areas of Sacramento County. SRCSD operates a 5 mgd tertiary treatment facility at their regional wastewater treatment plant that includes a pump station. Recycled water is conveyed from the treatment facility via a single 24-inch transmission main than then drops to a 20-inch pipeline to the Phase 1 service area. The recycled water is then conveyed through a branched network of recycled water distribution pipelines ranging from 8-inch to 14-inch diameter in size.

Legend

Pressure Zone | Service Area | Volume: Storage Tank | Booster Pump Station | Well(s) | Surface Water Treatment Plant (WTP) | Groundwater Treatment Plant (GWTP) | PRV | Normally Closed Valve | Check Valve | Altitude Valve | Customer Water Use | Intertie

MG = million gallons
mgd = million gallons per day

Elevation (ft)

350
300
250
200
150
100
50

North Service Area

3 MG **North Douglas** 19.4 mgd
0.5 MG **Mather Housing** 6 mgd GWTP
0.3 MG **Mather Airport (2)** 215 ft
McRoberts, Pittsfield, Veterans Park Plant
Douglas Rd & American Blvd
Upper 212 ft / 201 ft
4 MG **Anatolia**
5.2 mgd
11.2 mgd
6.5 mgd GWTP
Excelsior raw water pipeline
Main Zone
1 MG **Main Base (1)**
130 ft **Mather Housing** 90 ft
Main Base Booster (5.2 mgd)
3 MG **CalAM (emergency)**
4.3 mgd
Mercantile Intertie (from GSWC)
Vineyard Surface Water Treatment Plant 50 MGD (Permitted capacity 60 MGD)
WTP
CSA Booster (75 mgd)
74 ft
Excelsior No. 1, 2, 3

CSA/SSA Zone

96 ft
South Service Area
6.5 mgd GWTP
0.5 MG **Lake-side** 7.2 mgd
Lakeside Onsite, West Taron, Riparian Dr.
2.1 mgd GWTP
7 MG **Dwight Rd** 25.9 mgd
Dwight Rd Well
6.5 mgd GWTP
Poppy Ridge Onsite, Terrazzo, Ferragamo
3.5 MG **Poppy Ridge** 10.4 mgd
Franklin Intertie (from City of Sacramento) 11.1 mgd
Franklin Booster Station (1.6 mgd)
4.5 mgd GWTP
2 MG **Big Horn** 8.6 mgd
Big Horn Offsite 4, 5
Banyon, Duck Slough, Feather Creek, Seasons Dr, West Stockton Blvd, Big Horn North

Central Service Area

6.5 mgd GWTP
3.5 MG **East Elk Grove** 13 mgd
East Elk Grove Onsite, Waterman Ranch, Windsor Downs
Andalusian Drive, Equine Drive
2.9 mgd GWTP
0.5 MG **East Park** 3.5 mgd
East Park Well
8.6 mgd GWTP
7 MG 25.9 mgd
Perry Ranch, Caymus, Westray, Waterman Rd, Tillotson Parkway
Waterman
5 mgd GWTP
Calvine Rd, Legends Well
0.35 MG **Calvine Meadows** 8.8 mgd
Sheldon North
Wildhawk
3 MG 19 mgd
7.5 mgd GWTP
Creekview, Saddle Creek, Azinger 1, Rodriguez 2
10 ft

Brown AND Caldwell

DRAFT

Sacramento County Water Agency Zone 40
Figure 2-4. Existing System Hydraulic Schematic

This page intentionally left blank.

Section 3
Water Demands

This section presents the historical water use, the methodology used to develop future water demands, the connection growth projection, and the water demand factors. The projected water demands for the various scenarios are presented later in this document.

3.1 Historical Connections and Water Production

This section describes the historical number of connections, and the analysis to develop the projected demographics at buildout as well as the resulting projected growth rates of connections and population for Zone 40. Following the completion of SCWA's 2010 UWMP, the 2010 census data became available. An analysis of the 2010 population served by Zone 40 based on the 2010 census was performed (Brown and Caldwell, 2012). The historical number of connections by service area within Zone 40 is shown on Figure 3-1.

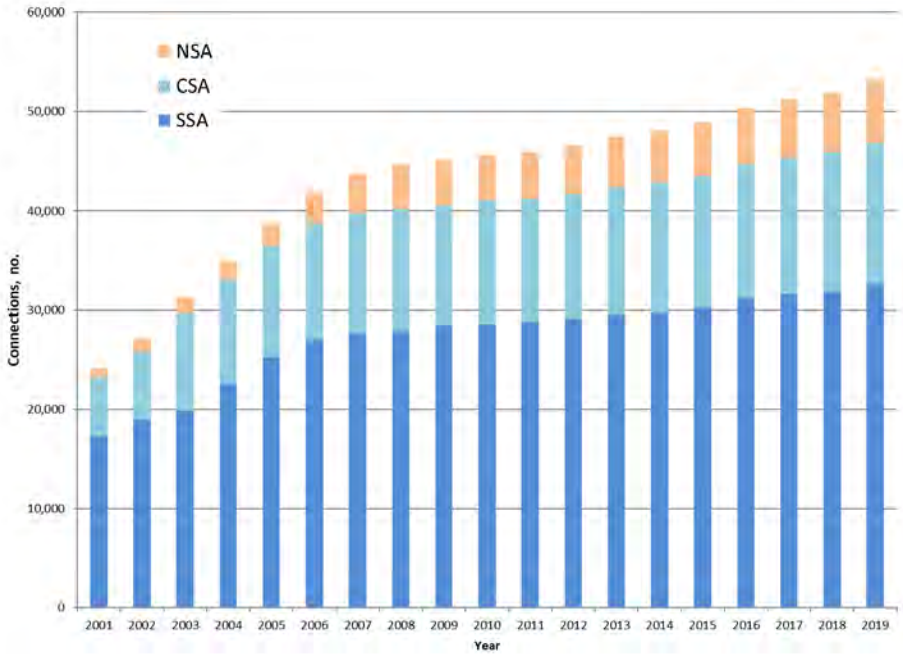


Figure 3-1. Historical connections by service area

Note: Connections in Elk Grove wholesale area are not included on this figure because of unavailable historical information for all of the years depicted.

Historical potable and recycled water production in Zone 40 from 2001 to 2019 by service area is shown in Table 3-1 and illustrated on Figure 3-2. The production quantities presented in Table 3-1 for the three service areas differ from the water demands in these service areas since some of the water produced in the CSA is utilized in the SSA. Portions of the SSA's and NSA's water demands have been supplied by water from the CSA that has increased with the start-up of the Vineyard SWTP in 2011 and the construction of the Phase A NSA pipeline in 2018, as described in Section 2.1.

Table 3-1. Zone 40 Historical Water Production, ac-ft/yr[a]

Area	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NSA	2,666	2,550	2,505	2,314	3,066	3,951	4,270	4,619	4,295	4,150	4,353	5,020	4,804	4,029	3,531	3,946	1,992	1,988	1,553
CSA	5,342	6,072	6,578	8,891	9,260	9,817	10,287	11,038	11,941	13,616	13,803	18,527	20,520	16,497	13,642	16,513	18,623	17,235	20,111
CSA (wholesale to Elk Grove)	900	1,707	1,973	2,638	3,018	3,304	3,420	3,219	2,870	3,487	2,366	2,575	2,719	2,322	1,901	2,107	2,262	2,327	2,304
SSA	13,386	14,071	13,558	15,346	17,980	17,104	18,453	18,875	16,610	12,411	12,974	9,185	7,338	8,154	8,017	6,658	6,777	8,994	6,461
SSA (recycled water)	-	-	609	786	695	596	837	915	866	794	829	870	922	636	746	720	845	861	901
Total	22,294	24,399	25,223	29,975	34,019	34,773	37,267	38,666	36,583	34,458	34,325	36,177	36,303	31,639	27,836	29,943	30,499	31,404	31,330

a. Historical production provided by SCWA staff.

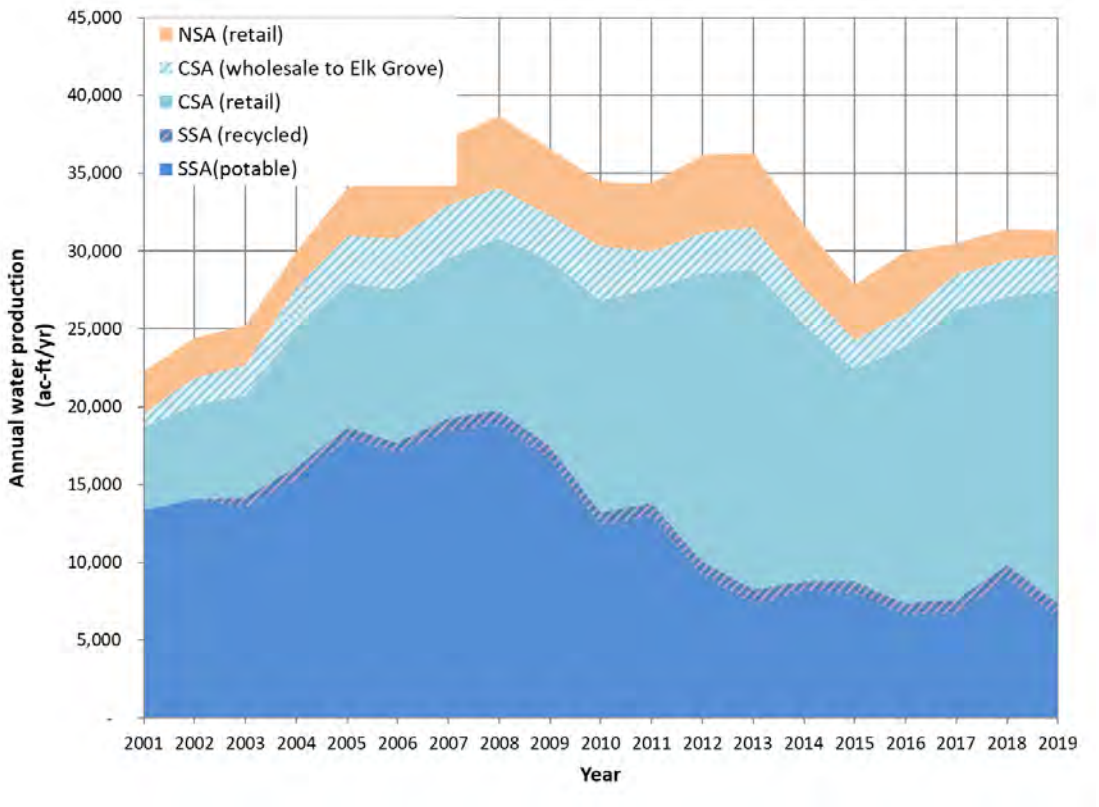


Figure 3-2. Historical annual water production by service area

3.2 Water Demand Projection Methodology

Water demands are estimated based on the water demand estimate analysis progression shown on Figure 3-3. The approach has two components, which are the demographics and the water demands.

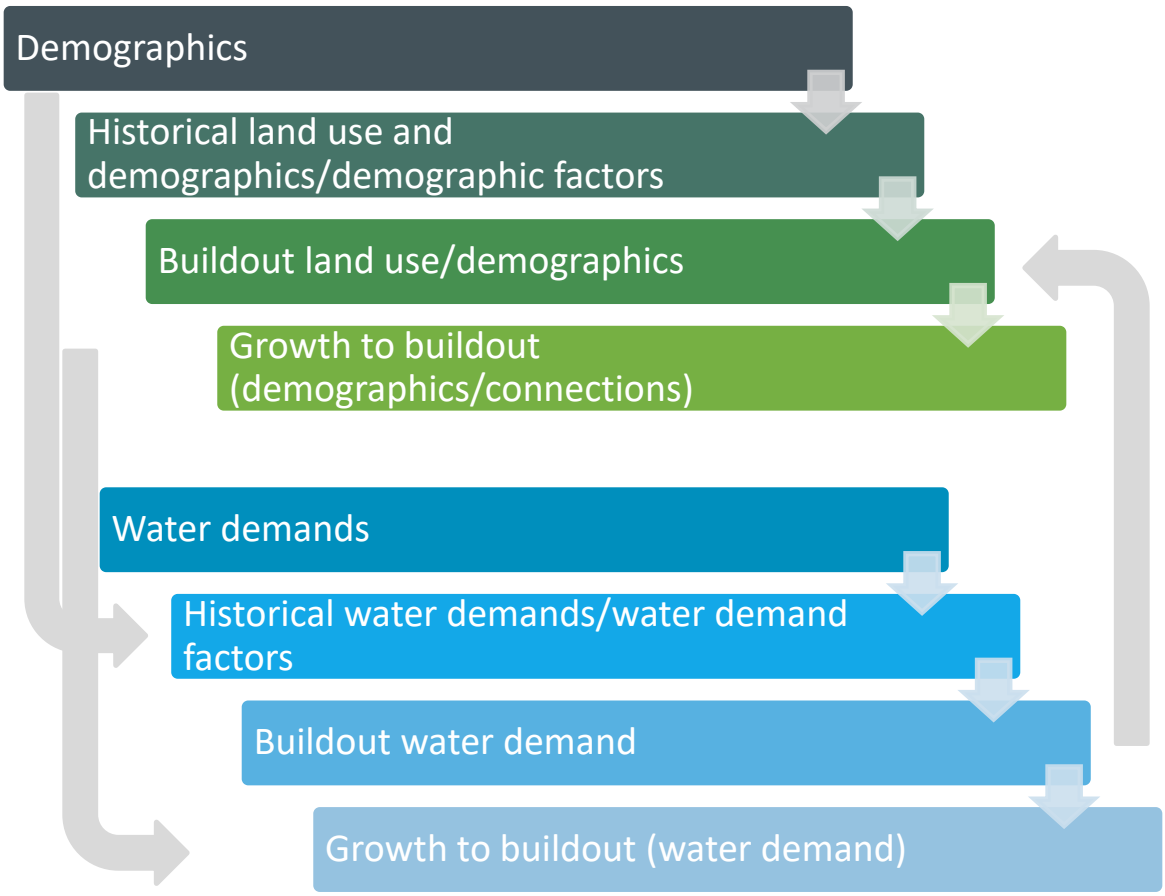


Figure 3-3. Water demand estimate analysis progression

The first part of the process is focused on land use and demographics. Demographics consist of population, connections, and dwelling units (DUs). The 2010 developed land use acreage by type of use is used to establish demographic factors such as connections and dwelling units per acre. The buildout developed land use acreage is then used to estimate buildout demographics. Buildout is considered to be reached when the available land is fully developed up to the maximum allowed for each land use category.

The number of dwelling units at buildout is estimated based on the maximum number of DUs allowed per acre in each of the general plan residential land use categories multiplied by the number of acres. The projected number of DUs at buildout is used to estimate the number of buildout residential connections and population. The buildout population for Zone 40 is estimated using a population per DU factor from the 2010 population and DU census data. Following the completion of SCWA's 2010 UWMP, the 2010 census data became available. An analysis of the 2010 population served by Zone 40 based on the 2010 census was performed (Brown and Caldwell, 2012). The number of residential connections at buildout is based on the maximum DUs /acre allowed for residential land uses and assumed DUs per connection factors. The estimate of the Zone 40 buildout population was used in SCWA's 2015 Urban Water Management Plan.

For non-residential land uses, the number of connections at buildout is more speculative because of the uncertainty of the mix of types and land area sizes of industries, businesses, parks, and other public facilities. For public land uses the size of parks and public facilities will influence the number of connections in that category. The number of connections at buildout is estimated assuming that the number of connections per acre would be 20 percent higher than the 2010 value. The projected annual connection growth for each service area is estimated.

The second part of the process consists of developing water demand factors based on the historical water use compared to the amount of developed areas, population, and DUs. These historical demand factors are used to develop the demand factors projected for buildout. The buildout demand factors are then used together with the buildout land use and demographics to estimate the buildout water use. The increase in demand to buildout for each service area is based on the projected increase in connections for each service area.

The information presented in this report typically includes all of SCWA's retail service area, the Elk Grove wholesale area, and the future Cal Am wholesale area in Rio del Oro. In the instances where the information excludes the Elk Grove wholesale area, it is so noted.

3.3 Land Use

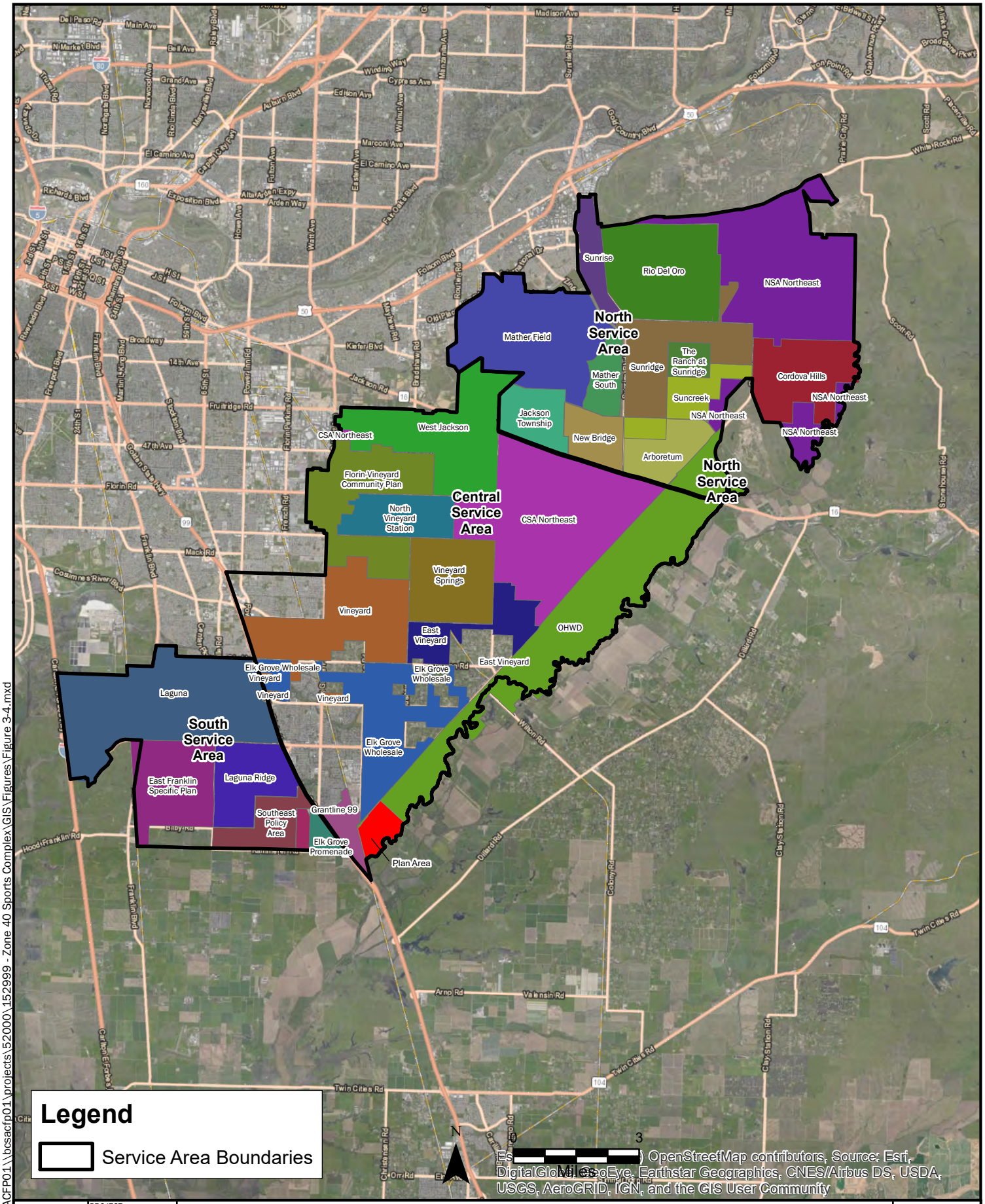
This section describes the planning subareas, land use, and residential density.

3.3.1 Planning Subareas

The study area is divided into planning subareas. The boundaries of the subareas correlate to current city boundaries, unincorporated areas, communities, and new growth areas defined by future development plans. The subareas are grouped into the three Zone 40 service areas: NSA, CSA, and SSA. The location of these subareas is illustrated on Figure 3-4.

3.3.2 Land Use

The area of land that was served by SCWA in 2010 is illustrated on Figure 3-5. The shaded areas on Figure 3-5 represent the area of land developed in 2010 and served retail water by SCWA. Figure 3-5 does not include the portion of Elk Grove Water District that is served by SCWA wholesale water supply. The 2010 developed acreage was estimated based on the location of SCWA's existing retail water distribution piping system. The 2010 land use was used as the basis of developing the population and water demands in SCWA's 2015 Urban Water Management Plan and the pending Water Supply master Plans for the new growth areas. The amount of development since 2010 was smaller then previously predicted due to the recession.

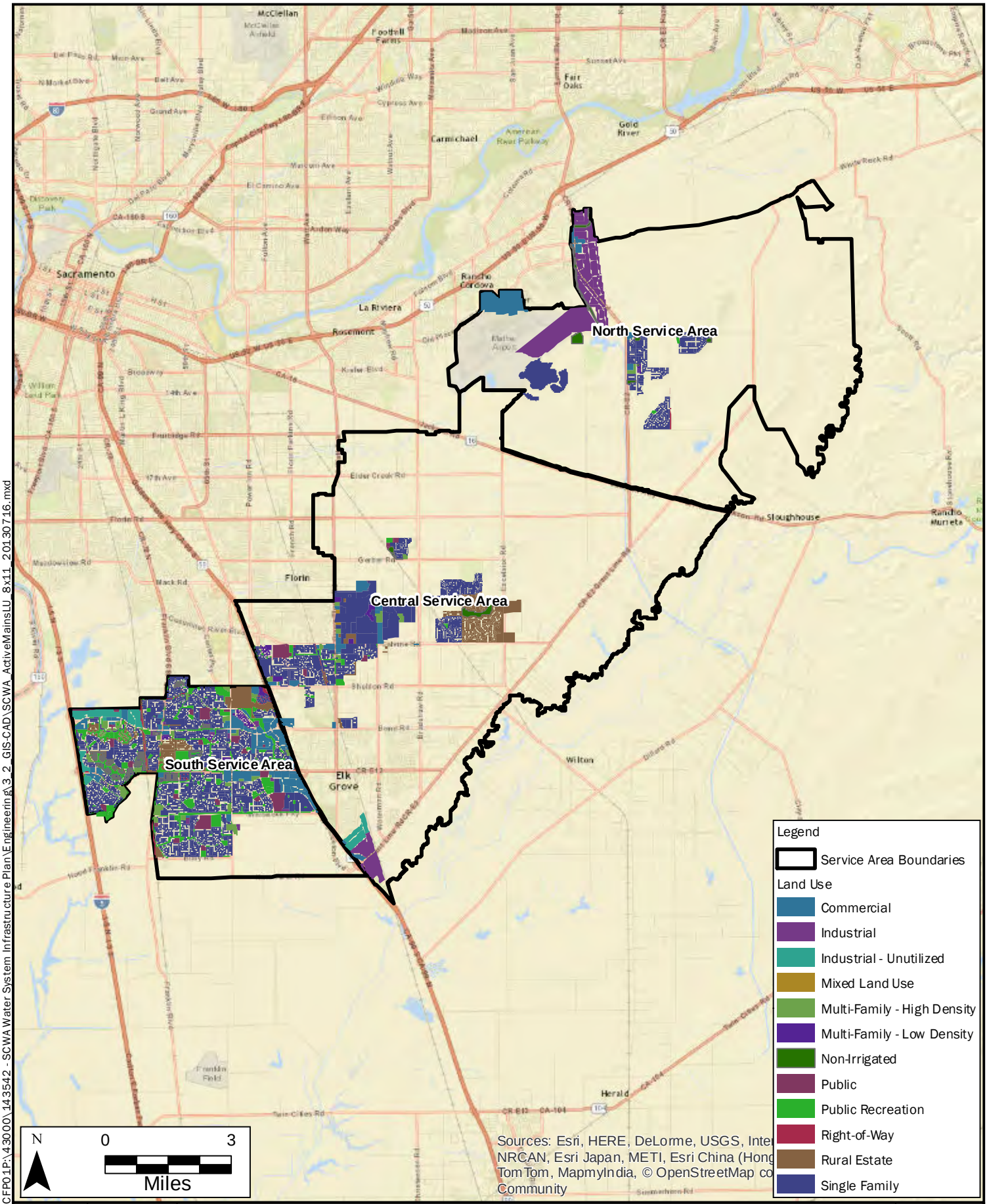


Document Path: BCSACFP01\bcsacfp01\projects\52000\152999 - Zone 40 Sports Complex\GIS\Figures\Figure 3-4.mxd

DATE	PROJECT	SITE	
8/6/2020	152999	Zone 40 Water Supply Master Plan Amendment	Figure 3-4
		TITLE: Water Planning Subareas	

Brown AND Caldwell

DEPARTMENT OF WATER RESOURCES SACRAMENTO COUNTY WATER AGENCY



Document Path: BCSACFP01P:\43000\143542 - SCWA Water System Infrastructure Plan\Engineering\3_2_GIS-CAD\SCWA_ActiveMainsLU_8x11_20130716.mxd

DATE 4/2/2020 | PROJECT 152999

Brown AND Caldwell

DEPARTMENT OF WATER RESOURCES
SACRAMENTO COUNTY WATER AGENCY

SITE

Zone 40 Water Supply Master Plan Amendment

TITLE

Developed Area Currently Served by SCWA

Figure 3-5

GIS maps of the land uses defined by the most recent land use planning information for Sacramento County, the City of Elk Grove, and the City of Rancho Cordova, as well as maps of the proposed developments in the new growth areas were used to quantify the area of each land use category within each planning subarea. The land use categories presented in the general plans have been collapsed into a reduced set for the purposes of this analysis. The 2010 land use acreages by land use category are summarized in Table 3-2.

Gross acres are defined as the total land area for each land use category including streets and right of way areas. Net acres exclude the area occupied by streets and right of ways. It is assumed that streets and right of ways cover 20 percent of the gross area within the residential, commercial, and industrial land use categories. All other land use categories are assumed to not have streets and right of ways, so their net and gross acreages are the same. The acreages presented in Table 3-2 are net acres.

The buildout gross acreage presented later in this report was estimated based on GIS data that included areas of both net and gross acreage. For those areas where the GIS data was provided as net acreage, the quantity of net acres was converted to gross acres.

Table 3-2. 2010 Area By Land Use

Land Use Category	2010 Developed Area, Net Acres
Rural estate	1,380
Single family	6,970
Multi-family - low density	220
Multi-family - high density	390
Commercial	1,520
Industrial	1,110
Industrial-unutilized	340
Public	920
Public recreation	1,270
Mixed land use	20
Right-of-way	70
Subtotal, municipal water supply land area	14,210
Self-supported/supplied by others	-
Non-irrigated	500
Agricultural	-
Total	14,710

Note: Elk Grove wholesale area is not included in the 2010 developed area acreage because it was not available.

3.3.3 Residential Land Use Density

The general plan residential land use categories each have a DU density range in terms of the minimum and maximum allowed number of DUs per acre. The buildout DUs and resulting residential water connections developed in this analysis are based on the maximum density allowed within each land use category (i.e. 7 dwelling units/acre for the RD 5-7 land use category). Each of the four residential land use categories defined for this analysis represent several general plan residential land use categories. The average and maximum dwelling unit densities established for each of the four residential land use categories were developed using the weighted average by buildout acreage of the several land use types represented in each category. Actual land use density at buildout may vary from what is assumed in this document.

Another density variable is bonus density. In general, bonus density is an increased DU density above and beyond the maximum allowable residential density under the local zoning ordinance. Section 65915 of the Government Code requires that local government provide a developer with incentives or concessions for increasing the production of housing units and child care facilities when an applicant seeks a density bonus for a housing development or for the donation of land for housing within the county. In 2004, Senate Bill (SB) 1818 amended section 65915 of the Government Code, pertaining to the density bonus law. The purpose of SB 1818 is to encourage developers to build affordable housing by requiring local governments to provide meaningful incentives. The projected number of DUs has not been adjusted for the possibility of bonus density being provided.

3.4 Connection Growth Projection

The future growth rate of Zone 40 is expressed as the growth in the number of water system connections. The growth in water system connections is projected based on an evaluation of the range of historical growth trends that have occurred in each service area. Figure 3-1 depicts the number of historical connections for the 2001 to 2019 period. Because of the uncertainty in the future rate of growth, three growth rates were developed in the 2016 WSIP and expressed as low, medium, and high. The medium growth rate is used for the projections in this document. The low and high connection growth rates are approximately the same as the lowest (1,300 connections per year) and highest (3,600 connections per year) historical 5-year moving average growth rate for the 9 year period from 2001 to 2010. The medium growth rate begins at 1,000 new connections per year increasing to 1,500 new connections per year in 2020 and thereafter until buildout. The connection growth rate projection is not revised for this WSMP amendment. The number of new connections estimated to occur each year for each service area is presented in Table 3-3. The connection growth rate to 2024 was provided by SCWA staff. Any change in the growth of new connections to the water system will change the water demand projection.

Table 3-3. Projected Annual Connection Growth (new connections)[a] [b]

Year	NSA	CSA	SSA	Total
2020	500	500	500	1,500
2021	500	500	500	1,500
2022	500	500	500	1,500
2023	500	500	500	1,500
2024	500	500	500	1,500
2025	500	500	500	1,500
2030	500	500	500	1,500
2031	600	600	299	1,499
2035	750	750	-	1,500
2040	750	750	-	1,500
2045	750	750	-	1,500
2050	750	750	-	1,500
2051	750	15	-	765
2052	659	-	-	659

Note: Annual growth is shown from 2020 to 2025. Years after 2025 are shown in 5-year intervals and for years when buildout within a service area occurs. Annual growth for years not shown between 5-year intervals is constant.

a. New connections include the Elk Grove wholesale subarea, Cal Am portion of Rio Del Oro subarea, and recycled water connections.

b. Connection growth rate to 2024 was provided by SCWA staff.

3.5 Unit Water Demand Factors

Buildout unit water demand factors (UWDFs) are developed using a water demand per land area approach expressed as ac-ft/yr per acre. The buildout water demands are estimated by combining the buildout land use acreage for each type of land use with the applicable buildout UWDFs. This land area based approach for developing the buildout water demands is the same methodology used in the 2006 WSMP and the subsequent Cordova Hills amendment. Due to changes in water use characteristics, the 2016 WSIP included an update of the UWDFs. The updated UWDFs were used for the demand projections presented for Zone 40 in SCWA's 2015 Urban Water Management Plan. The UWDFs are not revised for this WSMP amendment. The buildout UWDFs were updated in the 2016 WSIP based on consideration of several sources of information as described below.

- 2005 WSMP UWDFs: The UWDFs in the 2005 WSMP, which are assumed to be gross factors (applied to gross acreage) (SCWA, 2005).
- Cordova Hills WSMP Amendment: The UWDFs for buildout in the 2005 WSMP were verified with limited meter data (SCWA, 2011).
- SCWA analysis of residential water use: SCWA conducted an analysis of metered residential connections in Zone 40 and developed UWDFs for rural residential, single family, multi-family low density, and multi-family high density land uses for the years 2005 through 2012 (SCWA, 2013). The analysis showed a reduction in the UWDFs since the previous work was completed. This analysis is presented in Appendix A.

- Analysis of SCWA 2010 Water Use Factors: UWDFs representing 2010 using 2010 estimated developed acreage in Zone 40 and SCWA water use data by customer category.
- 2010 UWDFs of other water agencies: The water demands per acre for other local water agencies were analyzed to use as a point of comparison.
- Gallons per capita per day (GPCD): In July 2011, SCWA adopted the 2010 UWMP, which included an analysis and selection of the SBx7-7 GPCD goal for all of SCWA's service areas. To meet SCWA's GPCD goal established in the 2010 UWMP of 222 GPCD for all of its service areas, the Zone 40 GPCD target for 2020 was 196 GPCD. The Zone 40 per capita demand was less than the target in 2010.
- In June 2016, SCWA adopted the 2015 UWMP, which included revising SCWA's 2020 target for all of its service areas from 222 GPCD to 236 GPCD. Therefore, the Zone 40 portion of the 2020 target would be a value greater than 196 GPCD.

It's recognized that unit water use on a per capita basis has been trending downward for several years. The analysis of 2005 to 2012 residential water use by SCWA showed marked reductions in the water use per acre, which was also evident in the analysis of 2010 demand conducted for this study. Water use declined further from 2014 to 2016 as a result of the Governor's drought declaration. Although water use has increased in recent years since the end of the drought, it has not returned to pre-drought levels. The evaluation of water demand characteristics has not been updated for this WSMP amendment.

The UWDFs for the non-residential water use categories have some uncertainty due to the unknown water use characteristics of future non-residential development. There can be a wide range in water use by different types of non-residential development. It is recommended that as non-residential development occurs in the future, the water use of that new development be monitored and tracked along with the specific type of development and the amount of acreage occupied. Table 3-4 compares historical and projected water use metrics including demand per capita, per dwelling unit, per connection, and per acre for Zone 40. Below are some observations regarding some of the factors with the larger change ratios between 2010 and buildout.

- Non-residential water use/dwelling unit factor almost doubles from 2010 to buildout. This reflects the large increase in the amount of non-residential land area and resulting water use compared to the projected increase in residential land area.
- Non-residential use/non-residential connection factor increases by 20 percent from 2010 to buildout. This reflects the change in the mix of non-residential land use categories. One example is the proportionally large increase in public land use acreage at buildout. The public recreation land use category has connections that serve larger parcels and have a higher UWDF compared to the other non-residential land use categories.

Table 3-4. Zone 40 Comparison of 2010 to Buildout Water Use Metrics			
	2010	Buildout	Change ratio
Gallons per capita per day[a]	186	189	1.02
Total use/total DU, gpd/DU	570	572	1.00
SFR use/ SFR DU, gpd/DU	490	474	0.97
MFR use/MFR DU, gpd/DU	119	174	1.46
Non-res use/DU, gpd/DU	102	188	1.84
Total use/total con, gpd/connection	606	870	1.43
SFR use/SFR con, gpd/connection	490	474	0.97
MFR use/MFR con, gpd/connection	2,734	2,003	0.73
Non-res use/non res con, gpd/connection	2,856	3,457	1.21
Total demand per developed acre, ac-ft/ac	2.10	2.20	1.05
Potable demand per developed acre (recycled water removed), ac-ft/ac	2.05	2.13	1.04

SFR=single family residential
MFR=multi-family residential
Note: Water loss of 7.5% of water sales is included in this table.
a. *Includes recycled water. Therefore, the GPCD value excluding recycled water is a smaller value. GPCD for purposes of reporting to the California Department of Water Resources does not include recycled water.*

The gross unit water demand factors are listed in Table 3-5. These UWDFs should be applied to gross acreage that has not been adjusted to remove streets or right-of-way. Water system loss is not included in the UWDFs.

Table 3-5. Buildout Unit Water Demand Factors	
Land use	Gross Unit Water Demand Factors[a], ac-ft/acre/yr
Rural estate	1.37
Single family	2.13
Multi-family - low density	2.44
Multi-family - high density	3.33
Commercial	2.02
Industrial	2.02
Public	0.81
Public recreation	2.80
Mixed land Use	2.15
Right-of-way	0.18
Self-supported/supplied by others	
Non-irrigated	--
Industrial-unutilized	--
Agricultural	--

a. *Water loss is not included in the unit water demand factors.*

Water loss includes water loss due to leaks, breaks, storage overflows, water use for firefighting, line flushing, and other authorized, but unbilled uses. Since SCWA is not completely metered, data are unavailable for determining the current percent of water loss. Water loss is assumed to 7.5 percent of water sales.

3.6 Recycled Water Demands

Recycled water use is currently approximately 900 ac-ft/yr. Recycled water use is projected to increase to a total of 3,300 ac-ft/yr when the planned Phase 2 recycled water system for the East Franklin and Laguna Ridge areas is completed.

The potential for additional recycled water use in areas in close proximity to the existing and planned Phase 1 and 2 areas are estimated to be approximately 500 ac-ft/yr based on serving public and public recreation land use categories in the adjacent subareas. This analysis of additional potential recycled water demand is not a recommendation to supply recycled water to these areas.

This page intentionally left blank.

Section 4
Water Supply

The sources of water for SCWA's Zone 40 consist of surface water, groundwater, and recycled water. The existing water supply sources are described and quantified in this section. The adequacy and reliability of each supply for normal and dry hydrological conditions are presented.

4.1 Water Forum Agreement

SCWA is a stakeholder in the Water Forum, a Sacramento regional water management initiative. The Water Forum Agreement (WFA) was the result of the efforts of a diverse group of community organizations formed in 1994 to formulate principles for a regional solution for protecting the lower American River and providing for future water supply. The WFA was designed to achieve the two coequal objectives of providing a reliable and safe water supply for the region's economic health and planned development to the year 2030 and preserving the fishery, wildlife, recreational, and aesthetic values of the lower American River.

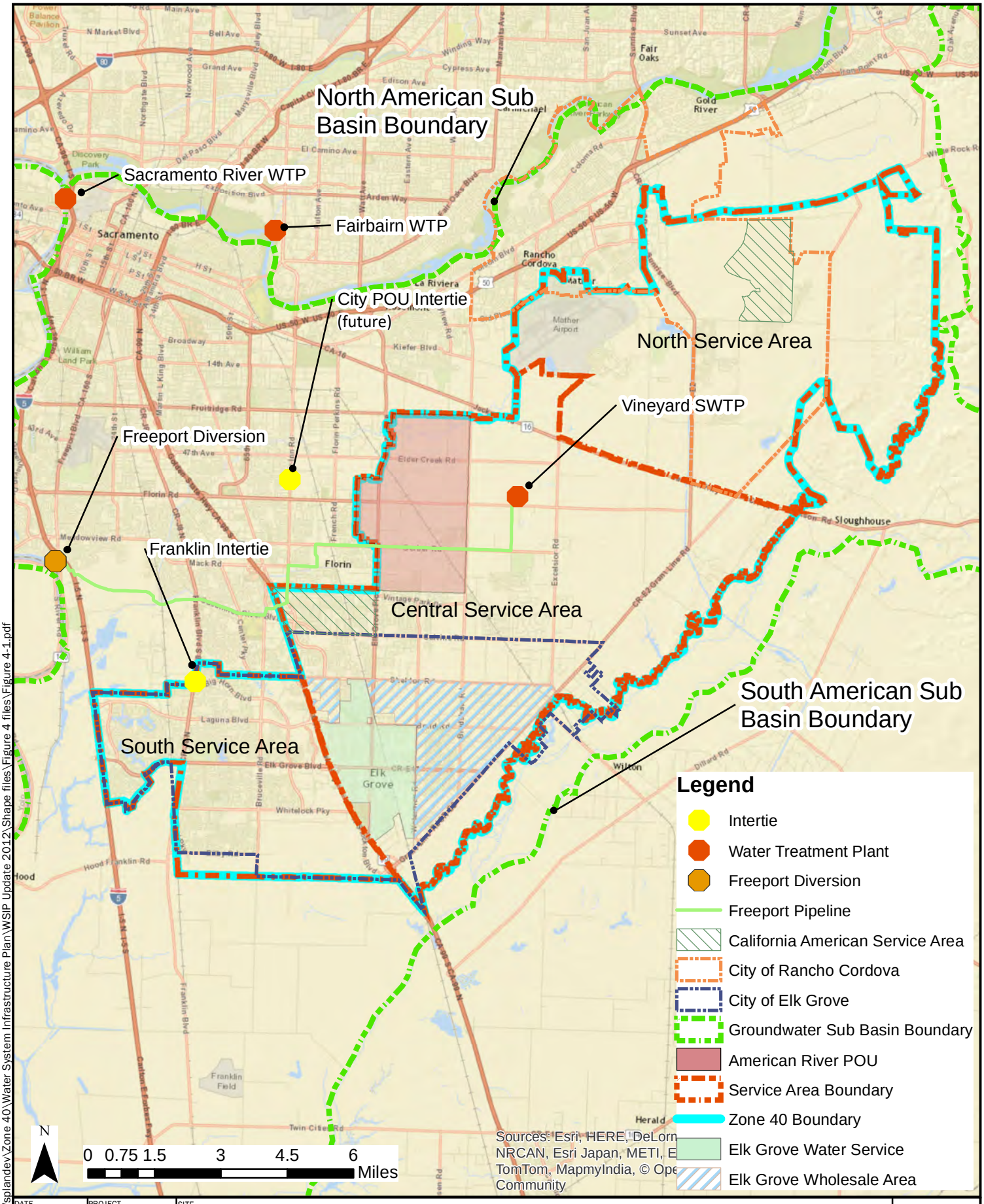
The WFA includes purveyor specific agreements (PSA) that define the benefits each water purveyor will receive as a stakeholder and actions each water purveyor must take to receive these benefits. The PSA for SCWA discusses the planned surface water supplies as part of a conjunctive use program to meet SCWA's water needs for planned growth. The PSA says that SCWA will divert surface water at or near the mouth of the American River or from the Sacramento River. Pertinent elements of the PSA for SCWA are discussed in the surface water and groundwater supply descriptions in this section.

The WFA was most recently updated in October 2015. Major changes include: incorporation of Arcade and Northridge Water Districts into the Sacramento Suburban Water District PSA, execution of the Golden State Water Company PSA (formerly Arden Cordova Water Services), renegotiation and ratification of the California American Water Company PSA, and changes to the Water Conservation Element and Water Forum Successor Effort Decision-Making Process as a result of a multi-year negotiation among Water Forum members. The Water Forum initiated a process to renegotiate the WFA in 2020.

4.2 Surface Water

Zone 40 surface water supplies consist of Central Valley Project (CVP) water, appropriative water, American River Place of Use (POU) water, and other surface water sources. Figure 4-1 illustrates the location of the major surface water facilities.

The quantities of surface water available to SCWA in wet/average, drier, and driest years and the frequency of their occurrence are important aspects for the planning of a conjunctive use system. The availability of each surface water supply source in different water year types is described below.



P:\Shared Folders\Wsplandev\Zone 40\Water System Infrastructure Plan\WSIP Update 2012\Shape files\Figure 4 files\Figure 4-1.pdf

DATE	PROJECT	SITE
4/2/2020	152999	**Zone 40 Water Supply Master Plan Amendment**

Brown AND Caldwell

SACRAMENTO COUNTY WATER AGENCY

TITLE

Zone 40 Water Supply

Figure 4-1

4.2.1 Central Valley Project Water

SCWA has two repayment contracts with Reclamation - the "Fazio" Contract which is for 15,000 ac-ft/yr and the Sacramento Municipal Utilities District (SMUD) Contract which is for 30,000 ac-ft/yr with the recent renegotiation which was completed in early 2020. The CVP water is diverted at the Freeport diversion on the Sacramento River and treated at the Vineyard SWTP. The CVP supplies can also be diverted from the Sacramento River and treated at the City's Sacramento River SWTP and delivered to SCWA at the Franklin Intertie.

SCWA's total CVP supply is subject to reductions in dry years. The water supply allocations are defined by Reclamation on a year to year basis and are expressed as a percentage of either the contract amount or amount of the most recent three year average use, whichever is the lower value. SCWA does not divert its full contract amount, so the supply allocation is applied to the amount of average annual use. For the 20 year period of 1995 to 2014, the lowest allocation was 50 percent in 2014. In 2015, the north of Delta allocation to urban contractors was 25 percent of historical use, which was the lowest allocation on record. The consequence for SCWA was that the CVP supply was fully curtailed for several months during the summer.

The water supply allocations are based on a draft policy that defines water shortage terms and conditions. Reclamation initiated the development of a Municipal and Industrial (M&I) Water Shortage Policy in 1992, with several proposals prepared through 2001. The 2001 draft water shortage policy states that Reclamation would reduce M&I water to a contractor once irrigation water allocations are reduced below 75 percent of the contract amount. Reclamation has a provision in the draft policy for a minimum M&I shortage allocation of 75 percent that is applied to the last three years of historical use with certain adjustments, although the actual allocation in 2014 was 50 percent of historical use (US, 2001). In 2010, Reclamation convened several workshops that will lead to the development of an Environmental Impact Statement that could potentially modify the existing policy or develop a new policy (US, 2011).

Supply allocations of 100 percent in a wet and average year, 75 percent for a drier year, and 50 percent of the historical use in the driest year are assumed. This WSMP amendment does not revise the driest year supply allocation to reflect the 2015 experience.

4.2.2 Appropriative Water

In February 2008, the State Water Resources Control Board (SWRCB) approved SCWA's appropriative right permit application to divert water from the American and Sacramento Rivers (Permit 21209). The amount of appropriated water available for use could range up to 71,000 ac-ft/yr in wet years, primarily during the winter months. This water would be diverted at the Freeport diversion on the Sacramento River. Since SCWA's demands are low in the winter months, SCWA would likely have to construct storage to utilize the full amount. It is possible that 35,000 ac-ft/yr of this supply could be utilized without the ability to store the water. No supply from this source is assumed for the drier and driest years.

4.2.3 City of Sacramento's American River Place of Use Water Supply

A portion of Zone 40 lies within the City's American River POU. The City has a pre-1914 water right to the American River with a POU boundary that extends beyond the City's boundary and includes a

portion of Zone 40, as shown on Figure 4-1. The amount of water available to serve the POU area within Zone 40 is estimated to be 9,300 ac-ft/yr (SCWA, July 2011).

The Water Forum PSA for SCWA assumes that the City's American River water entitlements would be a source of supply for Zone 40. This is consistent with the City's PSA. The City is planning for the wholesale delivery of American River water within the POU including areas outside of the City limits. A connection would be constructed to supply the Florin Vineyard Community Plan area in the CSA, with the timing based on when the supply is actually needed.

The City's diversions from the American River at the Fairbairn Water Treatment Plant are reduced when American River flows are less than the Hodge Flow Criteria, which would likely result in no POU water being available for SCWA in these circumstances. The City may decide to divert water during these restricted times at their Sacramento River diversion, although additional infrastructure might need to be constructed by the City to be able to convey this water to SCWA. It might be possible for SCWA to divert the POU water at the Freeport diversion. Given the uncertainty of the availability of POU water during dry periods, a supply allocation of zero percent in the driest year and drier year, and 100 percent in the wet and average year is assumed.

4.2.4 Other Water Supplies

Other water supplies are water transfers that would be obtained from various water users that hold surface water rights on the Sacramento River and the American River upstream of SCWA's point of diversion. To obtain these supplies, SCWA would enter into purchase and transfer agreements with other entities that hold surface water rights. There are Sacramento River water supplies available for transfer in dry years, although the costs of these dry year supplies can exceed $500 per ac-ft.

The assumed quantity of other water supplies is 9,600 ac-ft/yr in dry years and no supplies transferred in wet years. The annual supply to demand comparison presented in Section 5.2 indicates that these other water supplies would not be needed at all if the CVP, POU, and groundwater supply amounts are not less than assumed. Therefore, the amount of other water supplies that would be needed would vary depending on the water supply situation.

SCWA has a Memorandum of Understanding dated April 2000 with GSWC to purchase up to 1,000 gpm of water through the Mercantile Intertie located within the NSA. The intertie between the two systems currently serves as an emergency connection for both water purveyors. No routine water supply from GSWC is assumed.

4.2.5 Summary of Surface Water Supplies

Table 4-1 presents SCWA's surface water supplies for the wet/average years, drier years, and driest years assuming no constraint on supply capacity. The long-term average supply values presented in Table 4-1 assume that the supplies are all fully utilized with no infrastructure capacity constraints for all of the water year types, except for the amount of appropriative water as described in Section 4.2.2. The frequency of occurrence of these water year types are assumed to be 64 percent, 28 percent, 8 percent of the years respectively, based on an analysis of a historical 70-year hydrologic period (SCWA, 2006, Pg. 7-3). The frequency of occurrence of different water year types may change in the future, such as due to the impacts of climate change.

Table 4-1. Summary of Surface Water Supplies, ac-ft/yr					
Water Supply Sources	Contract Water Right Transfer Amount	Wet Average Year	Drier Year	Driest Year	Long-Term Average[a]
U.S. Bureau of Reclamation – CVP supply (SMUD 1, SMUD 2, and Fazio Water)	45,000	45,000	33,750[b]	22,500[b]	40,050
Appropriative water – SWRCB Permit 21209	71,000	35,000	0	0	22,400
City of Sacramento's American River POU Water Rights	9,300	9,300	0	0	5,952
Other water supplies	9,600	0	9,600	9,600	3,456
Total	134,900	89,300	43,350	32,100	71,858

a. *Based on full use of all supplies for each water year type, which is different than the projected actual use of supplies. The frequency of occurrence for the wet/average, drier, and driest years assumed to be 64 percent, 28 percent, 8 percent of the years respectively, based on an analysis of a 70-year hydrologic period (SCWA, 2006, Pg. 7-3).*

b. *CVP drier and driest year supplies are the lesser of these values or 75 and 50 percent of the three year historical average, respectively. The driest year CVP supply may be as low as 13,100 ac-ft/yr since the average year of use of the CVP supply will be lower than the contract amount for a number of years. The 25 percent allocation in 2015 is not reflected in the driest year value.*

4.2.6 Historical Use of Surface Water Supplies

The use of surface water in Zone 40 started in 1995 through a contract with Browns Valley Irrigation District. In 1999, delivery of the CVP contract water was started through a wheeling agreement with the City. Surface water has historically been a minor portion of the supply for Zone 40, as shown on an annual basis on Figure 4-2 and a monthly basis on Figure 4-3. The water supplies on Figure 4-2 are identified by the service area where the water production occurs. Some of the surface water and CSA groundwater produced in the CSA are used in the SSA. Surface water use in Zone 40 has increased starting in 2011 with the startup of the Vineyard SWTP.

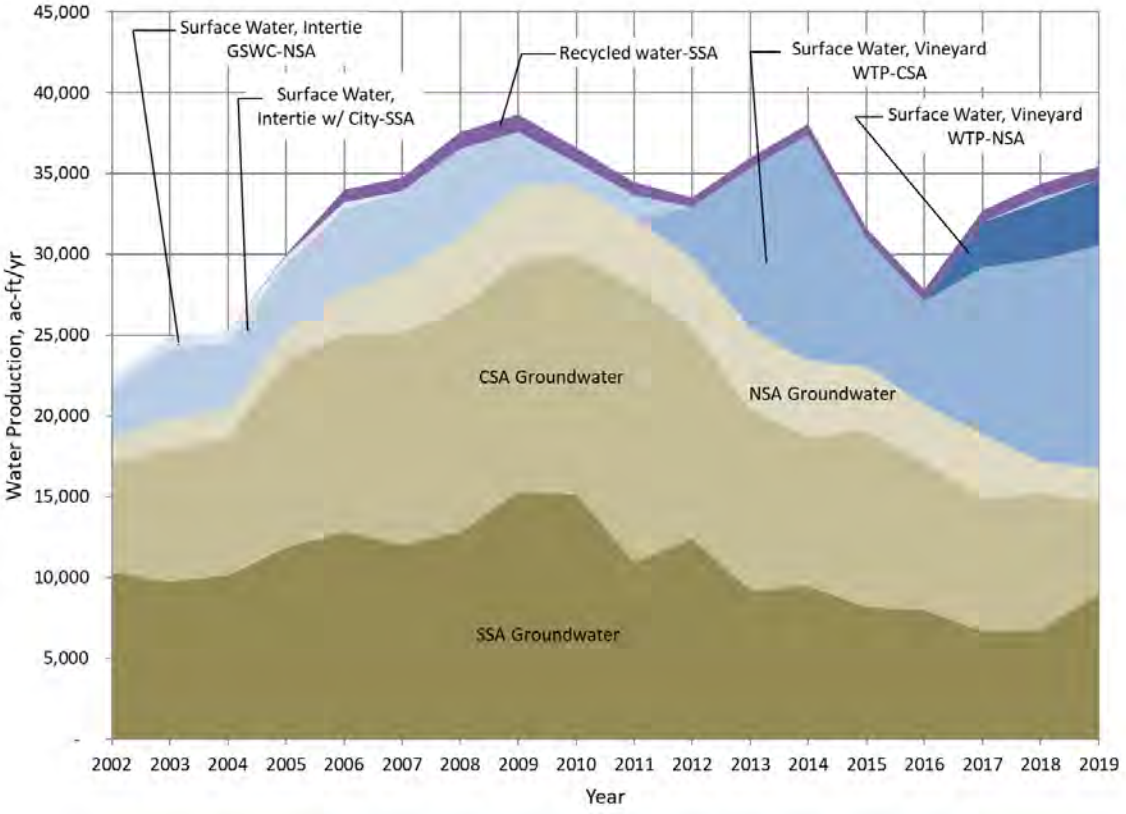


Figure 4-2. Historical annual water supply

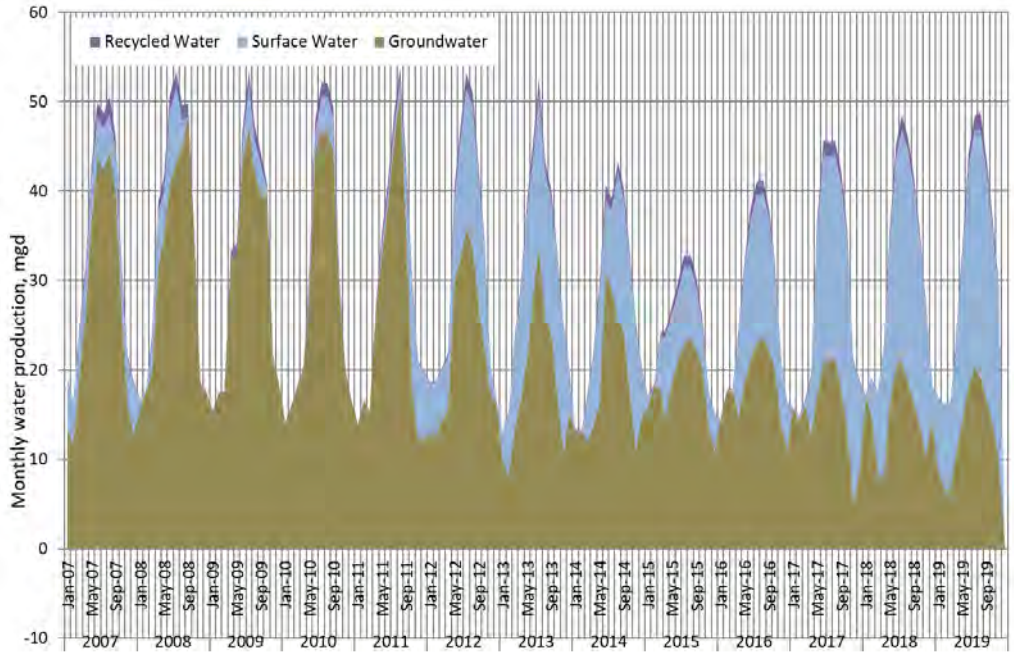


Figure 4-3. Monthly water production by type of supply

4.3 Groundwater

Groundwater is a major source of supply for Zone 40. This section describes the groundwater basin, the Sacramento Central Groundwater Authority (SCGA), historical groundwater use, and the remediated groundwater supply.

4.3.1 Groundwater Basin Description

Zone 40 is supplied groundwater from the South American Subbasin (5-21.65) that covers an area of 248,000 acres. The WFA, discussed in Section 4.1, divided the groundwater basin in Sacramento County into three portions as shown on Figure 4-4. The Central Basin's boundaries are similar to the boundaries of the South American Subbasin (5-21.65), although there are some differences. At this time there are active basin boundary modifications being considered by the state.

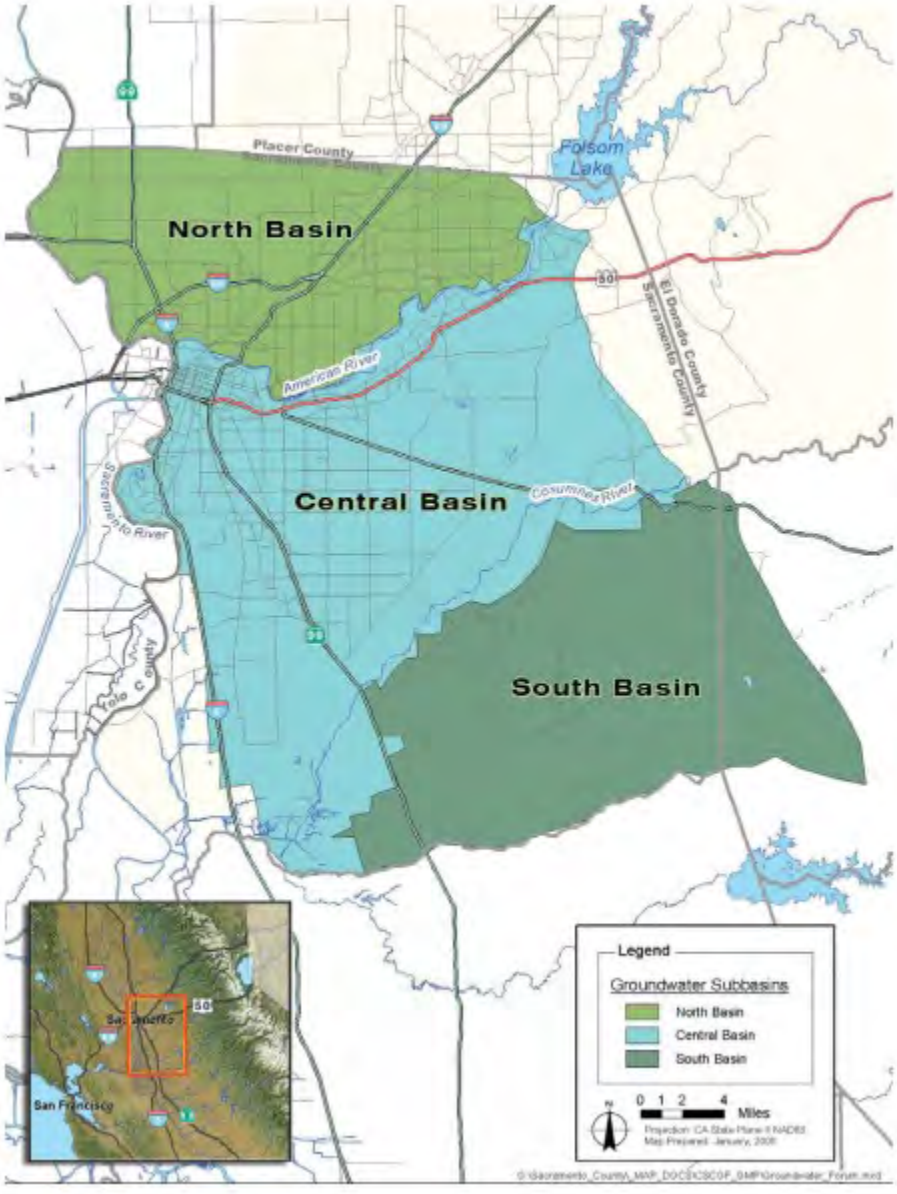


Figure 4-4. Sacramento County groundwater basins

The Central Basin is defined as the area bounded on the west by the Sacramento River, on the north by the American River, on the south by the Cosumnes River, and on the east by the foothills of the Sierra Nevada Range. The Water Forum defined the long-term sustainable average annual yield of the Central Basin to be 273,000 ac-ft/yr. Zone 40 lies within a portion of the Central Basin.

Groundwater in the Central Basin is generally classified as occurring in a shallow or upper unconfined aquifer zone (Laguna or Modesto Formation) and in an underlying deeper semi-confined aquifer zone (Mehrten Formation). These formations are typically composed of lenses of inter-bedded sand, silt, and clay, interlaced with coarse-grained stream channel deposits. The shallow aquifer extends approximately 200 to 300 feet below ground surface (bgs). The deep aquifer is separated from the shallow aquifer by a discontinuous clay layer that serves as a semi-confining layer for the deep aquifer. The base of the potable water portion of the deep aquifer averages approximately 1,400 feet bgs. Groundwater used in the Central Basin is supplied from both the shallow and deeper aquifer systems.

Intensive groundwater extraction from the Central Basin in the past has resulted in a general lowering of groundwater elevations near the center of the basin away from the sources of recharge. These depressions have grown and coalesced into a single cone of depression centered near Elk Grove. In recent years this depression has filled due in some part to the introduction of surface water into the area from the Vineyard SWTP. In general, the rest of the Central Basin does not show any distinctive patterns with respect to regional groundwater elevations, and the water table tends to mimic the local topography. Groundwater levels in the Central Basin have improved in recent years due to implementation of the conjunctive use program.

Groundwater in the upper aquifer system is of higher quality than that found in the lower aquifer system, although there are some occurrences of arsenic and nitrate. The lower aquifer system contains higher concentrations of iron and manganese and total dissolved solids (TDS). Water from the upper aquifer generally does not require treatment other than disinfection for public drinking water systems, unless high arsenic or nitrate values are encountered. Wells that pump from the lower aquifer often require treatment for iron and manganese. Most of SCWA's Zone 40 wells have iron and manganese treatment facilities.

Groundwater contamination plumes exist in the NSA that have migrated from the Aerojet/Boeing and Mather properties. SCWA has four operating wells (Mather Housing) in the vicinity of these plumes. There are several other smaller contamination plumes located in other areas of Zone 40. Significant remediation efforts/programs by federal, state, and local government agencies are in progress to clean up the contaminated groundwater and to confine the contaminant plumes from further spreading.

4.3.2 Sacramento Central Groundwater Authority (SCGA) and Groundwater Management Plan

SCGA was formed in 2006 through a joint powers agreement signed by the Cities of Elk Grove, Folsom, Rancho Cordova, and Sacramento, and the County of Sacramento. SCGA was formed for several purposes including maintaining the long-term sustainable yield of the Central Basin, managing the use of groundwater in the Central Basin, and facilitating the implementation of a conjunctive use program

The Central Sacramento County Groundwater Management Plan (CSCGMP), which was adopted in 2006 by SCGA, establishes a framework for maintaining sustainable groundwater resources in the Central Basin. This framework includes specific goals, objective, and an action plan to manage the basin and provides guidance to various stakeholders and negotiations for groundwater use. The

SCGA Groundwater Management Plan includes a detailed groundwater management implementation plan to comply with the requirements of their basin management objectives. Additionally, SCGA prepares a biennial report to evaluate progress on Groundwater Management Plan implementation and to report on basin conditions.

The Sustainable Groundwater Management Act (SGMA) was enacted by the legislature in 2014, with subsequent amendments in 2015. SGMA requires groundwater management in priority groundwater basins, which includes the formation of Groundwater Sustainability Agencies (GSAs) and the development of Groundwater Sustainability Plans (GSPs) for groundwater basins or subbasins that are designated by DWR as medium or high priority.

The designation of the priority of groundwater basins was done as part of the California Statewide Groundwater Elevation Monitoring (CASGEM) Program. CASGEM was developed in response to legislation enacted in California's 2009 Comprehensive Water package. The CASGEM Groundwater Basin Prioritization is a statewide ranking of groundwater basin importance that incorporates groundwater reliance and focuses on basins producing greater than 90 percent of California's annual groundwater. The CASGEM Program ranked the South American Subbasin (5-21.65) as high priority.

SGMA directs DWR to identify groundwater basins and subbasins in conditions of critical overdraft. DWR initially identified such basins in Bulletin-118, 1980 and Bulletin 118, Update 2003. DWR issued an updated draft list of critically overdrafted basins in July 2015 and in the most recent version in February 2018. The South American subbasin (5-21.65), that supplies Zone 40, is not on the list.

Groundwater basins designated as high or medium priority and critically overdrafted were required to be managed under a GSP by January 31, 2020. All other high and medium priority basins, including the South American subbasin, must be managed under a GSP by January 31, 2022. A GSA was required to be formally established by June 30, 2017. The GSA has enforcement authority over their designated portion of the basin.

SGMA also allows groundwater management agencies, within basins compliant with the CASGEM program, to prepare and submit an “alternative” to DWR instead of a GSP. An “alternative”, in accordance with Section 10733.6 of the SGMA, was required to be submitted to DWR by January 1, 2017. In December 2016, the SCGA prepared and submitted an alternative submittal for the South American Subbasin in compliance with SGMA. The alternative was denied and SCGA is currently developing a GSP.

4.3.3 Historical Use of Groundwater Supplies

Groundwater historically has been a substantial portion of the supply for Zone 40, as shown on an annual basis on Figure 4-2 and a monthly basis on Figure 4-3. Completion of the FRWA project and the Vineyard SWTP and the resulting increased use of surface water have resulted in a reduction in the annual use of groundwater in Zone 40 since 2009.

The current groundwater pumping to meet agricultural demands within Zone 40 and each of the new growth areas is estimated at 12,730 ac-ft/yr for 4,050 acres based an inspection of aerial photographs to determine existing agricultural acreage for field and row crops and pasture.

4.3.4 Remediated Groundwater

SCWA has a remediated groundwater supply of 8,900 ac-ft/yr in accordance with the terms and conditions in the agreement entitled “Agreement between Sacramento County, SCWA, and Aerojet-General Corporation With Respect To Transfer of GET Water” dated May 18, 2010. The timing and

amount of remediated groundwater available is subject to change as a result of on-going negotiations with water purveyors affected by groundwater contamination and with Aerojet/Boeing as their remediation plans may change as directed by various regulatory agencies. The remediated groundwater is discharged into the American River from Aerojet's Groundwater Extraction and Treatment (GET) facilities located in the Rancho Cordova area that are used for groundwater clean-up operations. This remediated groundwater supply is diverted by SCWA from the Sacramento River at Freeport along with SCWA's surface water supplies. A supply allocation of 100 percent in the driest year, drier year, and in a wet and average year is assumed.

4.4 Recycled Water

Recycled water is tertiary treated wastewater obtained from SRCSD that is supplied to the SSA in Zone 40 as a source of non-potable water for irrigation of parks, schools, and rights-of-way. Currently, SCWA provides recycled water in the SSA as part of a pilot project in the Laguna West, Lakeside, and Laguna Stonelake service areas (Phase 1 Area) that are located in the western portion of the Laguna subarea. Recycled water has historically been a small portion of the supply for Zone 40, as shown on an annual basis on Figure 4-2 and a monthly basis on Figure 4-3.

Recycled water supply availability will increase in the future when SRCSD completes the Echo Water Project in 2023. Recycled water use would increase to a total of 3,300 ac-ft/yr when the Phase 2 recycled water system is completed in the East Franklin and Laguna Ridge areas in the SSA (Phase 2 Area). SCWA is not planning on the addition of purple pipe for recycled water beyond what is planned as part of its long term recycled water strategy. Recycled water supply is assumed to be available at 100 percent of full supply in wet/average, drier, and driest years.

There is an emerging trend in California to use recycled water as an indirect source of potable water, known as indirect potable reuse. There are a limited number of water suppliers in California that are introducing recycled water into their potable water supplies through groundwater recharge. The City of San Diego is implementing a program that will result in augmenting one of their surface water supply reservoirs with recycled water. Studies are ongoing to develop requirements for direct potable reuse of recycled water. The attractiveness of these approaches is that the enormous costs of recycled water pipeline distribution systems can be avoided. SCWA developed a long term recycled water strategy that was approved by the Board that includes possible consideration of these options.

4.5 Water Supply Portfolio

The various water supplies available to SCWA combine to form Zone 40's water supply portfolio. SCWA has implemented a conjunctive use program within Zone 40 that optimizes the use of groundwater and surface water based on hydrologic conditions.

Historically, SCWA relied primarily on groundwater to provide water service to its customers. Existing groundwater pumping capacity plus a relatively small amount of surface water through the Franklin Intertie had been sufficient to meet system wide water demands. With the completion the Freeport project and the Vineyard SWTP, SCWA has been able to more fully implement a conjunctive use program that results in a variation of the mix of supplies based on the water year type. Conjunctively using surface water and groundwater allows SCWA to reduce surface water diversions and increase groundwater use in dry years. In wet and average years SCWA can increase surface water use and decrease groundwater use, thereby not exceeding the long term sustainable yield of the underlying groundwater basin.

Table 4-2 presents SCWA's unconstrained water supply portfolio for wet/average, drier, and driest years. Table 4-2 also presents the long-term average use on an annual basis of each supply source assuming that all of the available water supplies are fully used for each climate year type. SCWA would have to construct additional supply, treatment, and conveyance facilities to fully access the available water supplies presented in Table 4-2. Figure 4-5 illustrates the Zone 40 available water supply in each year type assuming that supply facilities with adequate capacities are available. The long-term average supply availability may change if the frequency of occurrence of different water year types changes in the future, such as due to the impacts of climate change. Section 5 presents the annual supplies that are available with the constraint of the capacity of the facilities and the projected use of the supplies.

Table 4-2. Zone 40 Water Supply Portfolio, ac-ft/yr[a]

Supply Source	Wet/Average Year	Drier Year	Driest Year	Long-Term Average[b]
Surface water[c]	89,300	43,350	32,100	71,858
Groundwater[d]	34,900	64,900	71,900	46,260
Recycled water	3,300	3,300	3,300	3,300
Total	127,500	111,550	107,300	121,418

a. *These water supply values are not constrained by water supply facility capacities. SCWA would have to construct additional supply, treatment, and conveyance facilities to fully access the available water supplies presented in this table.*

b. *Based on full use of all supplies for each water year type. The frequency of occurrence for the wet/average, drier, and driest years assumed to be 64 percent, 28 percent, 8 percent of the years respectively, based on an analysis of a 70-year hydrologic period (SCWA, 2006, Pg. 7-3).*

c. *The surface water drier and driest year supplies could be less if the prior 3-year historical CVP use is less than the CVP contract amount. See Table 4-1 and text. The 25 percent surface water supply allocation from Bureau of Reclamation in 2015 is not reflected in the driest year value.*

d. *Includes the 8,900 ac-ft/yr remediated groundwater supply. Groundwater supply amounts are the projected annual groundwater use at buildout presented in Section 5.*

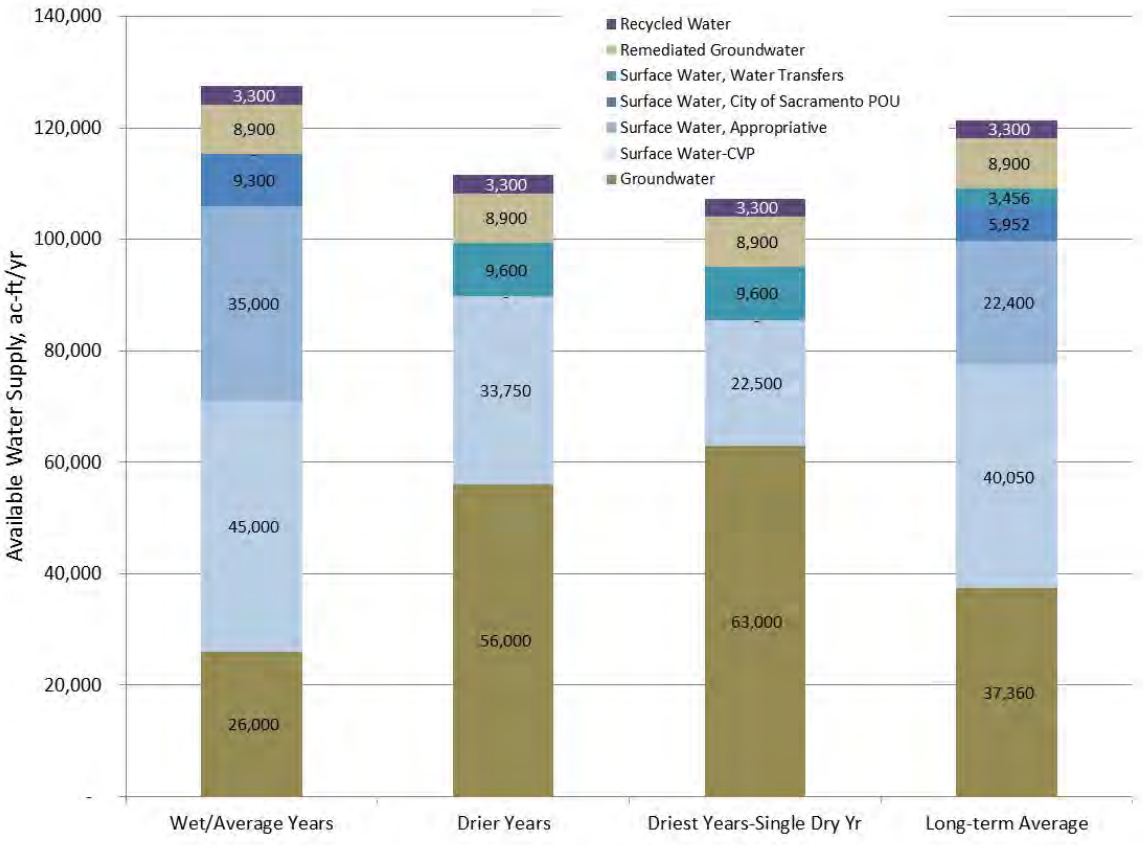


Figure 4-5. Available Water Supplies

Section 5
Water Supply Capacity Approach

This section describes the approach to quantify the amount of supply capacity that would be needed to meet Zone 40 demands through buildout. This information is needed to properly size the future water supply facilities. The capacity of the current system to supply current water demands is evaluated. The approach to evaluate storage requirements is presented.

5.1 Maximum Day Demand Supply Capacity and Use

Zone 40 needs enough water supply capacity to meet the projected future maximum day demand for both wet and dry climate years. The maximum day demand condition is important because the water supply facilities are sized to meet and exceed that condition. The planned future water supply capacity is based on the construction of new groundwater, surface water, and recycled water supply and conveyance facilities that are described in subsequent sections of this report for each of the scenarios. The maximum day demand is estimated using a maximum day demand peaking factor of 2.0.

Both wet year and dry year scenarios are considered in quantifying the needed water supply capacity. The total capacity of all water supply facilities must significantly exceed the maximum day demand because of the requirements of the conjunctive use program. The future water supply capacity is developed to meet the projected maximum day demands while allowing SCWA to vary the mix of supplies based on water year type. The water supply capacity is developed with the approach to increase the use of surface water in wet/average years and groundwater in dry years (conjunctive use program). The supply capacities include the supply for the Elk Grove and Rio del Oro wholesale areas as well as the Zone 40 retail area.

The remediated groundwater is categorized as part of the surface water supply capacity and use since it is conveyed through the surface water facilities. The groundwater capacity and use only reflects groundwater produced from wells owned and operated by SCWA.

The timing of the supply capacities is developed based on three phases. The period to December 2025 is considered Phase 1, January 2026 to December 2035 is considered Phase 2, and Phase 3 is the period from January 2036 through buildout.

Figure 5-1 presents a comparison of the total capacity of the existing water supply facilities to the 2013 maximum day demand for each of the service areas. The 2013 demand data is used because it is not influenced by the drought, making it higher than current demands. The detailed supply capacity to demand tables for each service area are presented in Appendix B for 2013. As shown on Figure 5-1, the capacities of all of the existing water supply facilities exceed the maximum day demands for each service area. All three of the service areas currently have adequate groundwater supply capacity to meet their current maximum day demand without the use of surface water. There is enough surface water supply capacity in the CSA to meet the CSA's current maximum day demand without the use of groundwater. The NSA and the SSA currently have a more limited supply of surface water that cannot fully supply the maximum day demand.

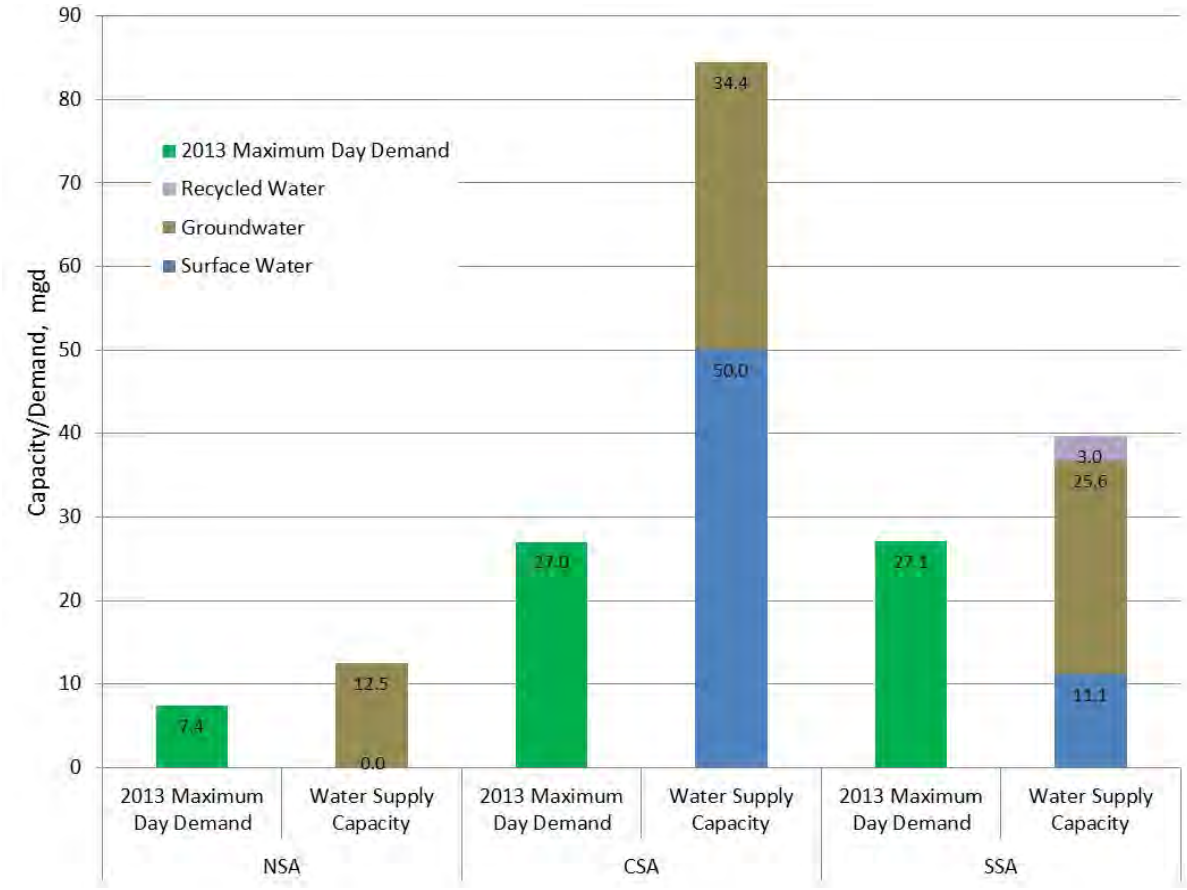


Figure 5-1. 2013 Maximum day demand and supply capacity by service area

5.1.1 North Service Area

The NSA is currently supplied primarily by surface water from the existing Vineyard SWTP conveyed using the newly constructed Phase A NSA pipeline. The existing groundwater supply and treatment facilities in the NSA have the capacity to meet the maximum day demand. The Anatolia GWTP and Mather Housing GWTP are the major groundwater facilities. The Mercantile interconnection with Golden State Water Company is only used for emergency purposes.

5.1.2 Central Service Area

The CSA is currently supplied by groundwater from existing groundwater treatment plants and some direct feed wells and surface water from the Vineyard SWTP. The existing groundwater facilities have the capacity to supply all of the current maximum day demand. Similarly, the Vineyard SWTP's current 50 mgd capacity is more than adequate to supply all of the CSA's current maximum day demand.

Water supplies produced in the CSA can be delivered to the SSA through the three connections between the CSA and SSA. These connections are located along Highway 99 at Sheldon Road, Bond Road, and Grant Line Road. The total capacity of these connections is approximately 30 mgd.

5.1.3 South Service Area

The SSA is currently supplied by surface water from the Franklin intertie and the Vineyard SWTP, groundwater from three existing groundwater treatment plants and some direct feed wells, and a small amount of recycled water. The existing groundwater facilities in the SSA have the capacity to supply all of the current maximum day demand.

As described previously, the three existing connections between the CSA and SSA can be used to supply surface water or groundwater to the SSA from the CSA.

5.2 Annual Water Supply Capacity and Use

The available supply capacity and use of supply are developed for each scenario on an annual basis because the values are directly useable for the development of water supply assessments and urban water management plans. The available water supply amounts that are described in Section 4 represent the full amount of available supply assuming there are no facility capacity constraints. The supply capacities and use of supplies are constrained by the supply and conveyance facility capacities.

The annual supply capacity and use are determined using the maximum day supply capacity and use. The proportional capacity and use of each water supply type on an annual basis is assumed to be the same as the mix of supplies on the day of maximum day. The annual supply capacity and use of supply is determined by assuming that the annual average day capacity or use is 50 percent of the capacity or use on the day of maximum demand. For example, a water supply capacity of 50 mgd equates to an annual average day capacity of 25 mgd or an annual capacity of 28,000 ac-ft/yr.

The actual annual use of supplies could differ from the values presented in this section if SCWA took an operational approach that would result in the annual mix of supplies being different than the mix of supplies used during the day of maximum demand. For example, in a dry year groundwater could be used to meet all of the demands in the winter, spring, and fall months. This would result in less surface water and more groundwater being used annually than what is presented in this section. Similarly, in a wet year surface water could be used to meet all demands in the winter, spring, and fall months. This would result in less groundwater and more surface water being used annually than what is presented in this section.

The remediated groundwater is included in the annual surface water values since it is conveyed through the surface water facilities. The annual groundwater amounts are only for the wells owned and operated by SCWA and exclude the groundwater remediation extraction.

One of the climate year types is expressed as multiple dry years to be consistent with the climate year types used for water supply assessments and urban water management plans. The multiple dry three year period is assumed to mimic the hydrology of 1989, 1990, and 1991 (SCWA, 2011). The CVP allocations for those three years were 100, 75, and 50 percent, respectively. The dry year CVP allocations are based on a percentage of the last three year historical use.

5.3 Storage and Pumping Station Capacity Evaluation Approach

This section presents the approach used to conduct the storage analysis that establishes the sizing and timing of future water storage facilities. Since it is not cost effective to size groundwater and surface water supply facilities to supply demands that occur above the maximum day demand rate, water storage is used to supply these short term demands. The short term demands that can last for a few hours are the peak hour demands and fire flow demands.

Since Zone 40 does not have high enough terrain to locate tanks that can provide adequate pressure with gravity flow, ground level tanks must be used in conjunction with pump stations to pump the stored water into the distribution system. The use of elevated storage tanks is typically not cost effective in the larger storage volumes required for Zone 40. The storage evaluation has two elements, consisting of the storage volume and pump station capacity.

5.3.1 Storage Volume

The required minimum storage volume is the sum of the following three components:

Equalization Storage. Water is provided for equalization storage to meet the increment of peak demands that exceed the maximum day demand. Equalization storage is assumed to be 20 percent of the maximum day demand.

Emergency Storage. Volume is also required for emergency supplies in the event normal supplies are not available. Emergency storage is assumed to be 1/3 of the average day demand. Many water agencies have criteria to provide greater amounts of emergency storage such as one average day demand. However, since SCWA can utilize the underlying groundwater basin to provide additional volume, the sizing assumption is reasonable.

Fire Flow Storage. Water is stored to provide fire flow. Fire flow storage is assumed as the volume for two fires for each service area, with each fire requiring 3,000 gpm for 3 hours. SCWA also has storage provided by the groundwater basin that can provide a large volume of water. Some building types can have fire flow requirements that are higher. The assumption of having fire storage for two simultaneous fires in each service area provides enough storage for one larger fire flow rate or longer duration fire flow.

5.3.2 Pump Station Capacity

Pump stations must have the capacity to supply peak hour demand. The peak hour demand is estimated using a peak hour factor of 2.0 applied to the maximum day demand. There are two situations in Zone 40 that govern the sizing of the pump stations that are used with storage tanks. A pump station that pumps from a standalone storage tank can use its entire pumping capacity to draw water from storage. A pump station that pumps from a tank that is supplied by a GWTP or a SWTP must be sized large enough to be able to pump the supply from both the GWTP and from the storage facility. Only the portion of the pump station capacity that is larger than the GWTP or SWTP capacity is considered to be able to utilize the stored water. Both situations are considered in the storage pump station evaluation.

In situations where a GWTP or SWTP has surplus maximum day capacity, some of that surplus could be used to help supply demands that are greater than the average rate on the maximum demand day. In these types of situations, the required pump station capacity to meet peak hour demand would be less than presented in this analysis.

Section 6

Water System Facilities and Capital Improvement Plan Approach

This section describes the approach used to identify the needed water system facilities and develop the resulting CIP.

6.1 Needed Water System Facilities

The water supply facilities are sized to provide the maximum day surface water and groundwater supply capacities for each scenario (e.g. dry year or wet year and Baseline or Plan Area). The storage tank and pumping station facilities are defined based on the storage evaluation developed for each scenario. The water supply, storage, pump station, and pipeline improvements have been identified by SCWA staff and are defined based on water system modeling performed by SCWA staff that is documented in the WSIP.

The sizing and timing of the water supply facilities are developed based on several general conjunctive use guidelines, as described below.

1. The groundwater supply should be able to provide enough maximum day supply in dry years to mitigate the reductions in surface water supply that could occur. The guideline is to be able to provide enough groundwater supply assuming a surface water supply that is reduced during the day of maximum demand in dry years by up to approximately 50 percent of its maximum day use in wet/average years.
2. The surface water supply should be able to supply a significant portion of the maximum day demand in a wet/average year while only using a portion of the groundwater supply capacity. The guideline is to provide enough surface water supply capacity to be able to supply approximately 50 percent or more of the maximum day demand.

6.2 Capital Improvement Plan

The CIP is developed based upon the water facilities identified in Section 6.1. The CIP is presented in three phases as follows:

- Phase 1. 2020 to 2025
- Phase 2. 2026 to 2035
- Phase 3. 2036 to buildout

The CIP projects are categorized as surface water projects, groundwater projects, pipeline projects, and storage projects. Each of the planned facilities for each scenario (e.g. dry year or wet year) is identified by a CIP project identification number. Groundwater treatment projects are identified as GWTP followed by a number. Groundwater well projects are identified as GW. Surface water projects are identified as SW, storage projects as S, and pipeline projects as P.

The projects presented in the CIP are limited to projects that expand the water supply capacity and the conveyance of water supplies to future customers. Not included in the CIP are the following types of projects and items:

- Projects that rehabilitate or replace existing water system facilities.
- Projects that correct existing system deficiencies, such as areas of inadequate pressure or fire flow.
- Land acquisition.
- Projects that provide for groundwater treatment for constituents other than iron and manganese. For example, projects needed to treat constituents that are found to a limited extent in the Central Basin such as Chromium VI, Arsenic, and Radon are not included.
- Projects that would plan and implement aquifer storage and recovery (ASR).
- Projects that would plan and implement an expanded recycled water supply beyond the project RW-1. For example, not included are projects that consist of indirect potable reuse (IPR) or direct potable reuse (DPR) of treated wastewater.
- Special fees or payments.
- Water system connection fees, such as for future interties with other water agencies.

The CIP projects included in each phase are presented in Section 7.

6.3 Basis of Cost Estimates

The cost estimates represent conceptual estimates of the capital costs to construct the water system facilities. Costs should be refined from this conceptual phase as the projects are better defined and proceed into the pre-design and design phases. The cost estimates represent 2014 dollars. Capital cost estimate tables are presented for most of the CIP projects in Appendix D with several exceptions. SCWA provided the cost estimates for the Phase B NSA Project (S-1). The Vineyard SWTP expansion project (SW-1) and recycled water project (RW-1) do not have individual cost estimate tables developed.

Capital costs represent the construction and other costs necessary to get a project completed. Construction costs cover the material, labor, and services necessary to build the identified project. Changes during the design of the project, in the cost of materials, labor, and equipment, and in the bidding environment will cause changes in the estimated cost.

The contingency cost item addresses the uncertainties that are associated with the preliminary sizing of projects. Factors such as unexpected construction conditions, the need for unforeseen construction items, and variations in quantities are some of the items that can increase project cost. An allowance of 25 percent of the construction cost is included to cover such contingencies for the groundwater, surface water, and storage projects.

The engineering, administrative, and legal cost item covers engineering services and items such as legal fees, administrative costs that are typically associated with a project. It is estimated that these costs would be 25 percent of the total of the construction cost plus contingency.

The environmental and permitting cost item is intended to cover services necessary to meet the requirements of the California Environmental Quality Act and services and fees associated with obtaining the necessary permits that would be required. It is estimated that these costs would be 10 percent of the total of the construction cost plus contingency.

The cost estimates for the Phase 1 pipeline projects, which are developer projects, are developed with a different approach. The cost estimates for the developer projects represent the amount that

SCWA would pay a developer for a project and do not necessarily represent the total cost of a project. The cost estimates for the pipeline projects are based on the unit costs presented in Schedule C that was issued by SCWA on April 9, 2014. The pipeline projects are characterized as being either in undeveloped areas or under existing pavement to utilize the appropriate Schedule C unit pipeline cost. The Schedule C unit costs are values that have been escalated from unit costs that were developed in 2007 for the development of the Ordinance 18 Schedule C Unit Prices for Zone 40 Credits. The cost estimates for the developer projects include 15 percent for contingency, 8 percent for engineering, and 10 percent for the Construction Management and Inspection Division (CMID).

It is assumed that all future groundwater supply facilities would require groundwater treatment for iron and manganese. The groundwater treatment plant projects each include wells, pipelines from the wells to the treatment plant, treatment facility, storage reservoir, pumping station, and pipeline conveyance to the water distribution system. It is assumed that treatment facilities will not be required for the existing direct feed wells.

The cost for the expansion of the Vineyard SWTP (SW-1) is based on a unit cost of $4 million per mgd capacity. The cost estimate for the recycled water project (RW-1) is assumed to be $20 million, but no recycled water facility project description has been developed for this study. As a comparison, the 2005 WSMP estimated the cost of the recycled water facilities to be $15 million and the 2006 WSIP presented a cost of $11.6 million.

This page intentionally left blank.

Section 7
Baseline

This section describes the demographics, water demands, water supplies, and needed water system improvements for the Baseline scenario. The Baseline scenario includes the existing approved Zone 40 and the NewBridge, West Jackson, and Jackson Township growth areas.

7.1 Water Demands

This section describes the future land use, demographics, and demand projections for the Baseline scenario.

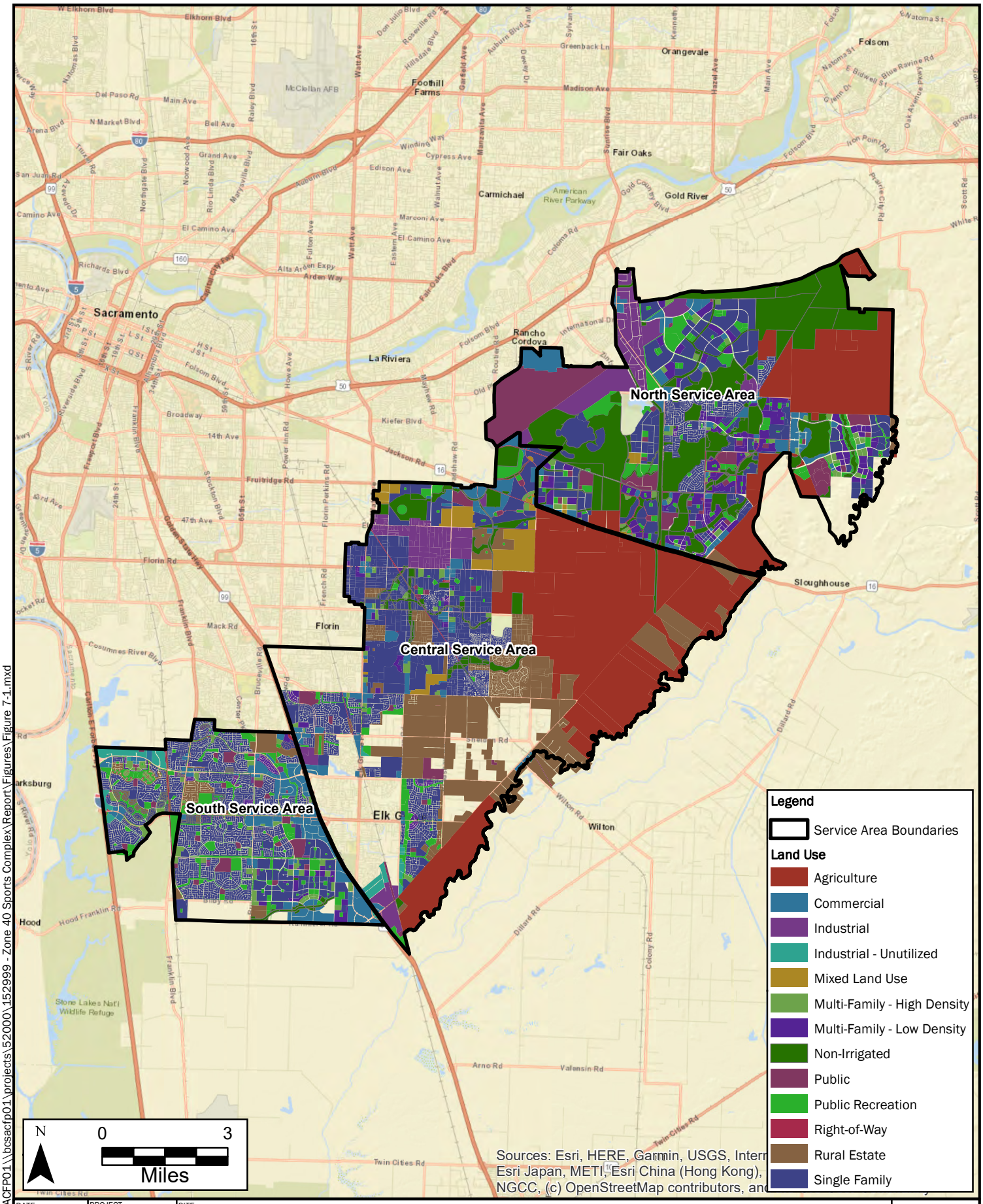
7.1.1 Buildout Demographics

The buildout developed land use acreages by land use category for the Baseline Scenario are summarized in Table 7-1. The acreages presented in Table 7-1 are net acres for 2010 and gross acres for the study area at buildout. The buildout land use for the study area is illustrated on Figure 7-1.

Table 7-1. 2010 and Buildout Area By Land Use - Baseline

Land Use Category	2010 Developed Area, Net Acres	Buildout Area, Gross Acres
Rural estate	1,380	6,870
Single family	6,970	18,140
Multi-family - low density	220	3,750
Multi-family - high density	390	1,310
Commercial	1,520	4,330
Industrial	1,110	3,470
Industrial-unutilized	340	580
Public	920	2,120
Public recreation	1,270	4,820
Mixed land use	20	1,230
Right-of-way	70	580
Subtotal, municipal water supply land area	14,210	47,200
Self-supported/supplied by others	-	870
Non-irrigated	500	9,800
Agricultural	-	11,620
Total	14,710	69,490

Note: Elk Grove wholesale area is not included in the 2010 developed area acreage and is included in the buildout acreage because it was not available.



Document Path: BCSACFP01\\bcsacfp01\projects\52000\152999 - Zone 40 Sports Complex\Report\Figures\Figure 7-1.mxd

DATE	PROJECT	SITE
4/2/2020	152999	Zone 40 Water Supply Master Plan Amendment

Brown AND Caldwell

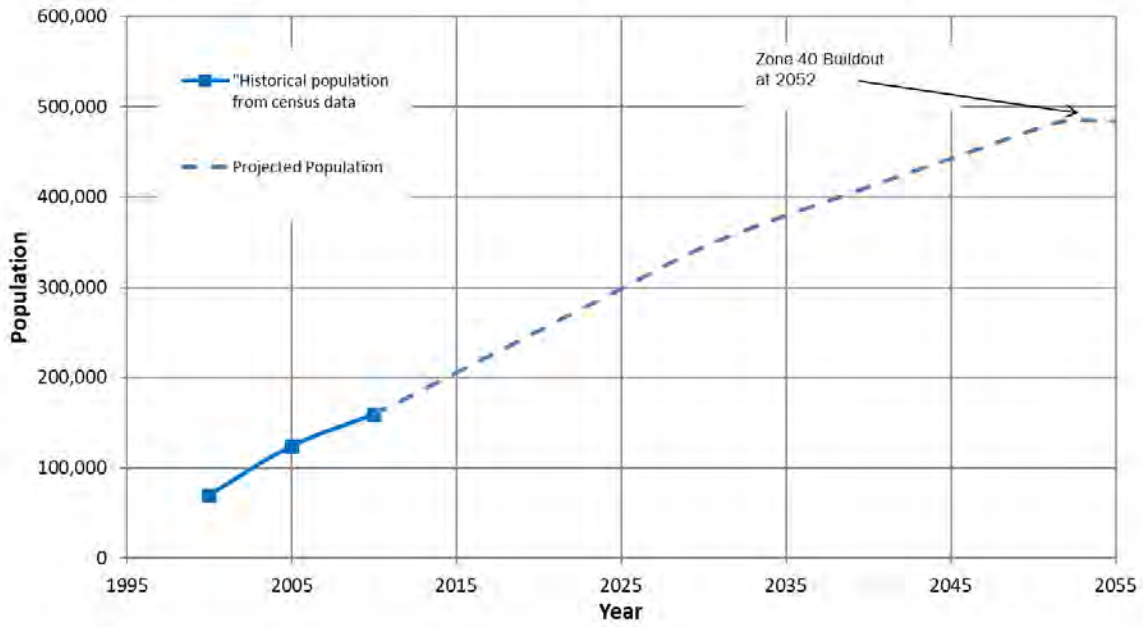
DEPARTMENT OF WATER RESOURCES
SACRAMENTO COUNTY WATER AGENCY

TITLE

Buildout Landuse - Baseline

Figure 7-1

The historical and projected population for existing approved Zone 40 is shown on Figure 7-2. The projected DUs, population, and connections at buildout by land use category are presented in Table 7-2. Population per DU and per connection, DUs per connection, and connections per acre by land use category are also shown in this table. The number of people per connection projected at buildout is significantly higher than the 2010 value because of the proportionally large increase in multi-family land use area compared to single family land use area from 2010 to buildout. A larger proportion of the residential dwelling units and connections will be multifamily at buildout compared to 2010, which will result in a higher number of people per connection.



Elk Grove wholesale population is included. 2010 Elk Grove wholesale population is estimated to equal 10,144 people based on 3,210 Elk Grove wholesale connections and 3.16 people per connection in 2010. The historical population has not been updated for this WSMP amendment.

Figure 7-2. Historical and projected population in zone 40 - baseline

Table 7-2. Buildout Dwelling Units, Population, and Connections by Land Use Category - Baseline

Land Use Category	Dwelling Units	Population	Connections	Population Dwelling Unit	Population Connection	Dwelling Units Connection	Connections Acre
Rural estate	3,300	11,000	3,300	3.3	3.3	1 .0	0.5
Single family	87,100	287,500	87,100	3.3	3.3	1 .0	4.8
Multi-family - low density	41,800	115,000	4,200	2.8	27.4	10.0	1.1
Multi-family - high density	27,700	70,700	1,800	2.6	39.3	15.0	1.4
Commercial			1,900				0.4
Industrial			1,400				0.4
Industrial-unutilized							-
Public			200				0.1
Public recreation			4,100				0.9
Mixed land use			500				0.4
Right-of-way			700				1.2
Self-supported/ supplied by others			-				
Non-irrigated			-				
Agricultural			-				
Total	159,900	484,200	105,200	3.0	4.6	1.5	1.5

a. Totals are rounded to the 100's place.

The baseline scenario DUs, population, and connections by service area are shown in Table 7-3. The projected buildout number of DUs and population for the NSA, CSA, and SSA are very similar; however the numbers of connections in the NSA are significantly less than the CSA and SSA. This is because there is a greater number of multi-family DUs in the NSA than the CSA and SSA. Since there are several multi-family dwelling units per connection, a lower number of connections is projected in the NSA to serve the similar number of dwelling units.

Table 7-3. 2010, 2019, and Buildout Dwelling Units, Population, and Connections by Service Area - Baseline

	2010			2019	Buildout		
Service Area	Dwelling Units	Population	Connections	Connections	Dwelling Units	Population	Connections
NSA	4,000	11,700	4,600		54,300	159,600	28,800
CSA	17,400	56,600	15,600		54,300	166,200	38,300
SSA	30,600	91,300	28,900		51,300	158,400	38,100
Total Zone 40	52,000	159,600	49,100	55,200	159,900	484,200	105,200

Note: 2010 dwelling units, population, and connections in Elk Grove wholesale area are estimated and included in the CSA values. Elk Grove wholesale area service connections in 2010 are estimated to be 3,200 connections and the DUs are estimated to be 3,500 based on a 1.1 DU per connection factor. The population is estimated to equal 10,144 people. 2019 connections are per data provided by SCWA.

Table 7-4. Projected Connections in 5-Year Increments - Baseline								
Service area	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
NSA	7,500	10,000	12,500	16,100	19,800	23,600	27,300	28,800
CSA	18,400	20,900	23,400	27,000	30,800	34,500	38,300	38,300
SSA	32,800	35,300	37,800	38,100	38,100	38,100	38,100	38,100
Total	58,800	66,300	73,800	81,300	88,800	96,300	103,800	105,200

Note: 55,200 connections in 2019. The projection of future connections has not been revised for this WSMP amendment.

Table 7-4 shows the projected number of connections by service area in five-year increments through 2050 and at buildout. The projected number of connections through buildout for each of the growth scenarios is illustrated on Figure 7-4. The projection number of connections in Table 7-4 and Figure 7-3 has not been updated for this WSMP amendment. As shown in Figure 7-3, the actual 2019 number of connections is tracking at low growth scenario. If this trend continues, the buildout year would be after 2055.

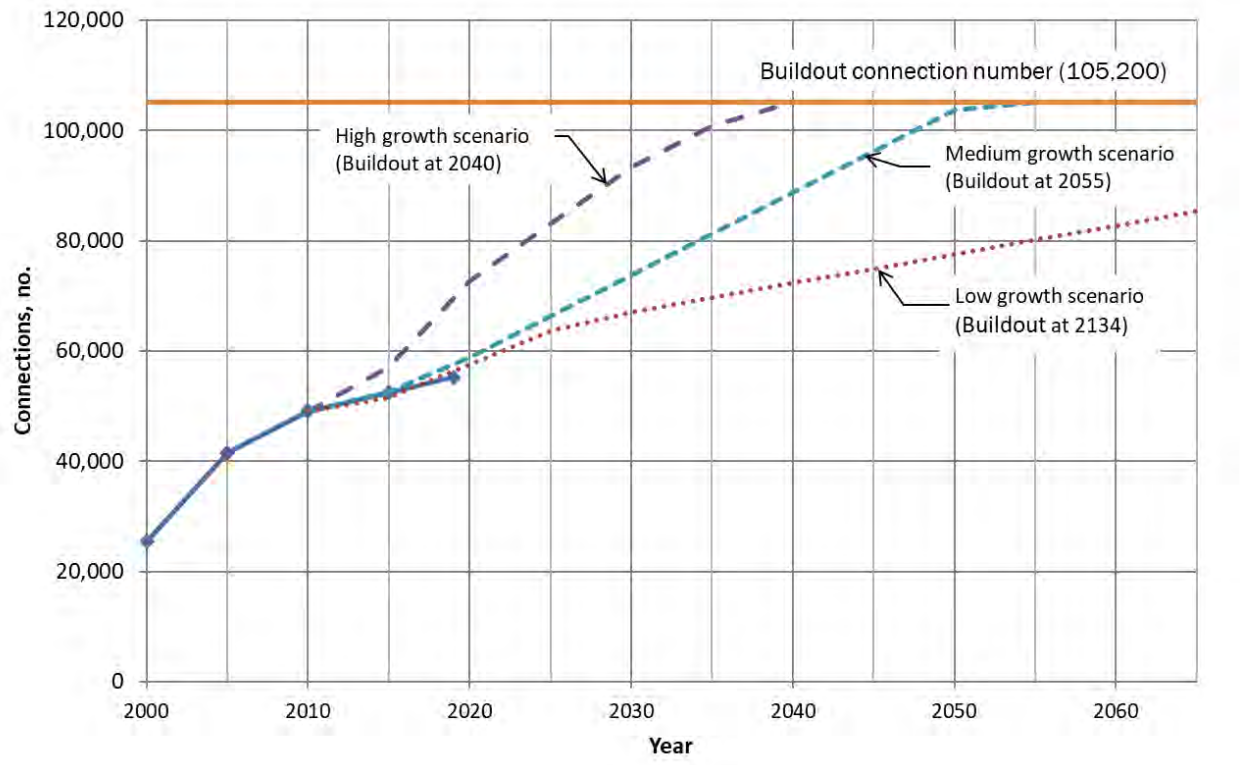


Figure 7-3. Historical and projected Zone 40 connections at High, Medium, and Low growth rates - baseline

Note: The projection of future connections has not been revised for this WSMP amendment.

7.1.2 Buildout Water Demands

This section presents the buildout water demand for the Baseline scenario. The buildout water demand by land use category for the Baseline scenario is shown in Table 7-5. The recycled water demand in the SSA is included in the demand projections in Table 7-5 to provide the total water

demand for this scenario. The buildout water demand for the baseline scenario has not been updated for this amendment. As described in the following Section 7.1.3, the actual 2019 Zone 40 water use was significantly less than the 2020 demand projection presented in Table 7-6. The lower 2019 demand may be partially due to changed water use characteristics by customers as a consequence of the severe 204 to 2015 drought. Therefore, it might be possible that an updated evaluation of the projected Zone 40 demand at buildout may result in a smaller buildout demand for this scenario.

Table 7-5. Buildout Water Demand by Land Use Category - Baseline

Land Use Category	Water Demand, ac-ft/yr
Rural estate	9,400
Single family	38,600
Multi-family - low density	9,200
Multi-family - high density	4,400
Commercial	8,700
Industrial	7,000
Public	1,700
Public recreation	13,500
Mixed land use	2,600
Right-of-way	100
Subtotal (land use with water demand)	95,300
Water system losses (7.5% of water sales)	7,100
Self-supplied/supported by others	0
Industrial-unutilized	0
Non-irrigated	0
Agricultural	0
Total production	102,400

7.1.3 Water Demand Growth Projection

The projected water demands by service area for the medium growth scenario are shown in Table 7-6 and illustrated on Figure 7-4. The water demand projection has not been revised for this WSMP amendment. The 2019 water demand was 31,330 ac-ft/yr, which is 31 percent lower than the demand projected for 2020. As indicated this 2019 water demand and by the actual number of connections in 2019 presented on Figure 7-3, the projected water demands for the medium growth scenario in Table 7-6 and Figure 7-4 may overstate the projected demands.

Table 7-6. Projected Water Demand in 5-Year Increments - Baseline, ac-ft/yr

Service Area	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
NSA	7,300	10,100	13,100	17,500	22,400	27,500	32,800	34,900
CSA	18,400	21,200	24,100	28,100	32,400	36,800	41,300	41,400
SSA	19,700	22,600	25,600	26,100	26,100	26,100	26,100	26,100
Total	45,500	53,900	62,800	71,800	80,900	90,400	100,300	102,400

Note: The water demand in 2019 was 31,330 ac-ft/yr. The water demand projection has not been revised for this WSMP amendment.

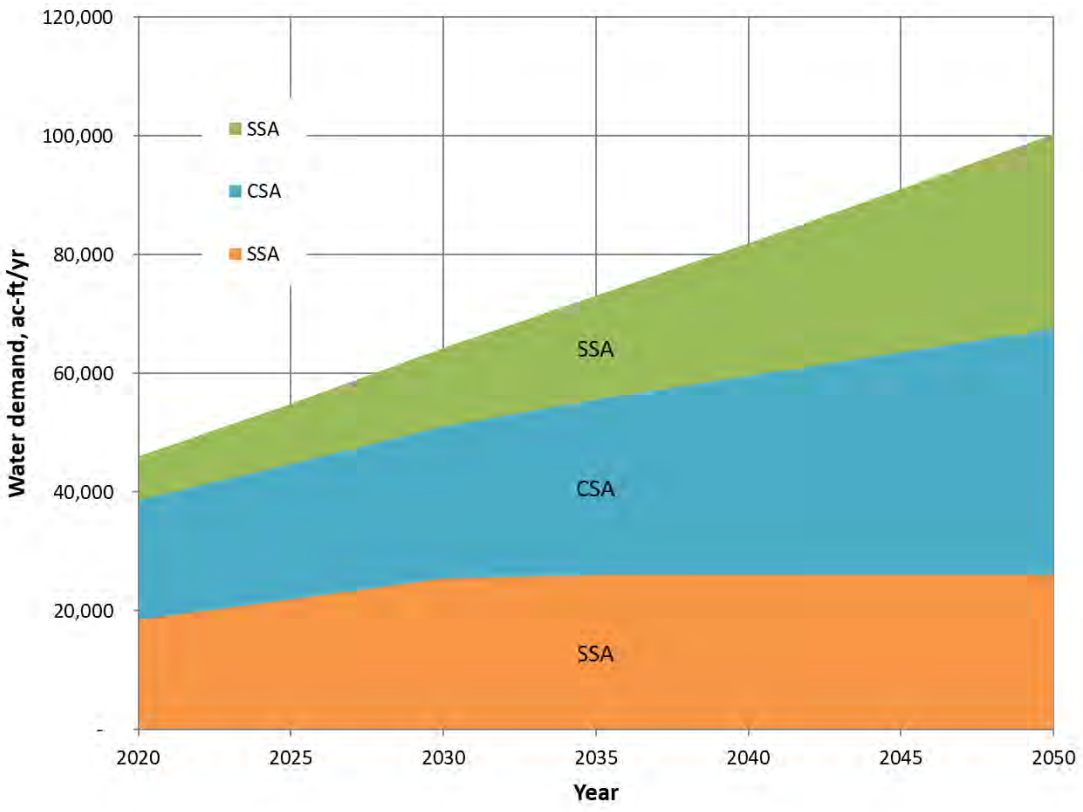


Figure 7-4. Water demand projection – baseline

Note: The water demand in 2019 was 31,330 ac-ft/yr. The water demand projection has not been revised for this WSMP amendment.

7.2 Water Supply Capacity

This section quantifies the amount of supply capacity that would be needed to meet demands through buildout. The supply capacity and the use of the supply are presented on both a maximum day basis and an annual basis.

7.2.1 Maximum Day Demand Supply Capacity and Use

This section compares the projected maximum day demand to supply capacity for each of the three service areas through buildout. The maximum day demand to supply capacity comparison tables for each of the three service areas are presented in Appendix B. The future supply capacity is based on the proposed supply and conveyance facilities that are presented in Section 7.3. The maximum day use of each type of supply is quantified for the wet/average years and dry years.

7.2.1.1 North Service Area

Surface water supply from the existing Vineyard SWTP is being conveyed to the NSA to supplement the current groundwater supply. The construction of the Phase B NSA Project (S-1) will allow for more of the Vineyard SWTP's existing capacity to be used to supply the NSA. It is assumed that 65 percent of the Vineyard SWTP would be used to supply the NSA. The Mather wells are used below their capacities in dry years since SCWA operational staff prefer to minimize their use due to the possible impact to nearby contamination plumes.

7.2.1.2 Central Service Area

Once several projects are constructed, including the Phase B NSA Project (S-1), more of the Vineyard SWTP's existing capacity will be used to supply the NSA. The future West Jackson GWTP will be used to supply the CSA, although it will be connected to the transmission system such that it could also provide supply to the NSA.

7.2.1.3 South Service Area

New groundwater supply capacity would be needed during Phase 1. Additional groundwater supply capacity would be added in Phases 2 and 3. No new surface water supply capacity is specifically planned for the SSA, although the planned Phase 3 expansion of the Vineyard SWTP would provide some additional surface water. The proposed GWTPs for Phase 3 would provide a maximum day groundwater supply capacity that exceeds the SSA's projected buildout maximum day demand. These Phase 3 GWTPs could be used to provide dry year groundwater supply to other areas or groundwater storage, or function as additional backup facilities.

7.2.1.4 Zone 40 Summary

Table 7-7 and Figure 7-5 present the maximum day demand and supply capacity comparison for Zone 40 from 2013 through buildout. The maximum day use of each type of supply is quantified for the wet/average years and dry years. As can be seen in Table 7-7 and consistent with the established conjunctive use program, the total supply capacity exceeds the maximum day demand for each phase, but neither the groundwater nor surface water supply capacity alone can meet the maximum day demand.

As shown in Table 7-7, Zone 40 will utilize a varying mixture of groundwater and surface water supplies on the maximum demand day based on whether it is a wet/average year or a dry year. The ability to practice conjunctive use by maximizing the use of surface water in wet and average years and minimizing the use of surface water in dry years is limited by the available surface water and groundwater supply capacities and to some extent by distribution system constraints. Several observations are made regarding the maximum day supply capacity and use that pertains to all three phases:

1. In dry years, there is sufficient groundwater capacity to be able to significantly reduce the amount of surface water use on the maximum day compared to wet/average years.
2. In dry years, most of the groundwater capacity will be utilized on the maximum demand day.

3. In wet years, there is sufficient surface water capacity to be able to supply over half of the maximum day demand.
4. In wet years, up to half of the groundwater capacity will be used to help supply the maximum day demand.

Table 7-7 Maximum Day Demand to Supply Comparison for Zone 40 - Baseline, mgd

	Phase 1				Phase 2		Phase 3			
Zone 40	2013	2015	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Maximum day demand										
Zone 40 total	61.5	69.2	81.2	96.3	112.2	128.1	144.4	161.4	179.0	183.0
Existing supply capacity[a]										
Groundwater[b]	72.5	72.5	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0
Surface water	61.1	61.1	45.1	28.6	28.6	28.6	28.6	28.6	28.6	28.6
Recycled water	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Total	136.6	136.6	114.1	97.6	97.6	97.6	97.6	97.6	97.6	97.6
Planned future supply capacity										
Groundwater	0.0	0.0	0.0	6.5	15.5	33.0	33.0	33.0	53.0	66.0
surface water[b]	0.0	0.0	16.0	32.5	32.5	32.5	32.5	32.5	82.5	101.6
Recycled water									2.9	2.9
Total supply capacity										
Groundwater	72.5	72.5	66.0	72.5	81.5	99.0	99.0	99.0	119.0	132.0
Surface water	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	111.1	130.2
Recycled water	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.9	5.9
Total	136.6	136.6	130.1	136.6	145.6	163.1	163.1	163.1	236.0	268.1
Use of supply: average/wet years										
Groundwater	20.4	25.8	21.1	46.6	57.1	65.2	72.9	80.7	68.4	49.5
Surface water	38.1	40.3	57.1	46.7	52.1	59.9	68.5	77.6	104.7	127.6
Recycled water	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.9	5.9
Total	61.5	69.2	81.2	96.3	112.2	128.1	144.4	161.4	179.0	183.0
Use of supply: dry years										
Groundwater	58.5	64.3	60.5	68.5	77.1	92.8	100.5	108.3	108.2	108.2
Surface water	0.0	1.9	17.7	24.8	32.1	32.3	40.9	50.0	65.0	69.0
Recycled water	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.9	5.9
Total	61.5	69.2	81.2	96.3	112.2	128.1	144.4	161.4	179.0	183.0

Note: The projected maximum day water demand has not been revised for this WSMP amendment.

a. Groundwater supply decrease in 2020 due to Anatolia GWTP removed from service.

b. Reduction in existing capacity and added future surface water supply capacity in 2020 and 2025 because planned delivery to NSA from existing Vineyard SWTP accounted as future supply capacity as requested by SCWA staff.

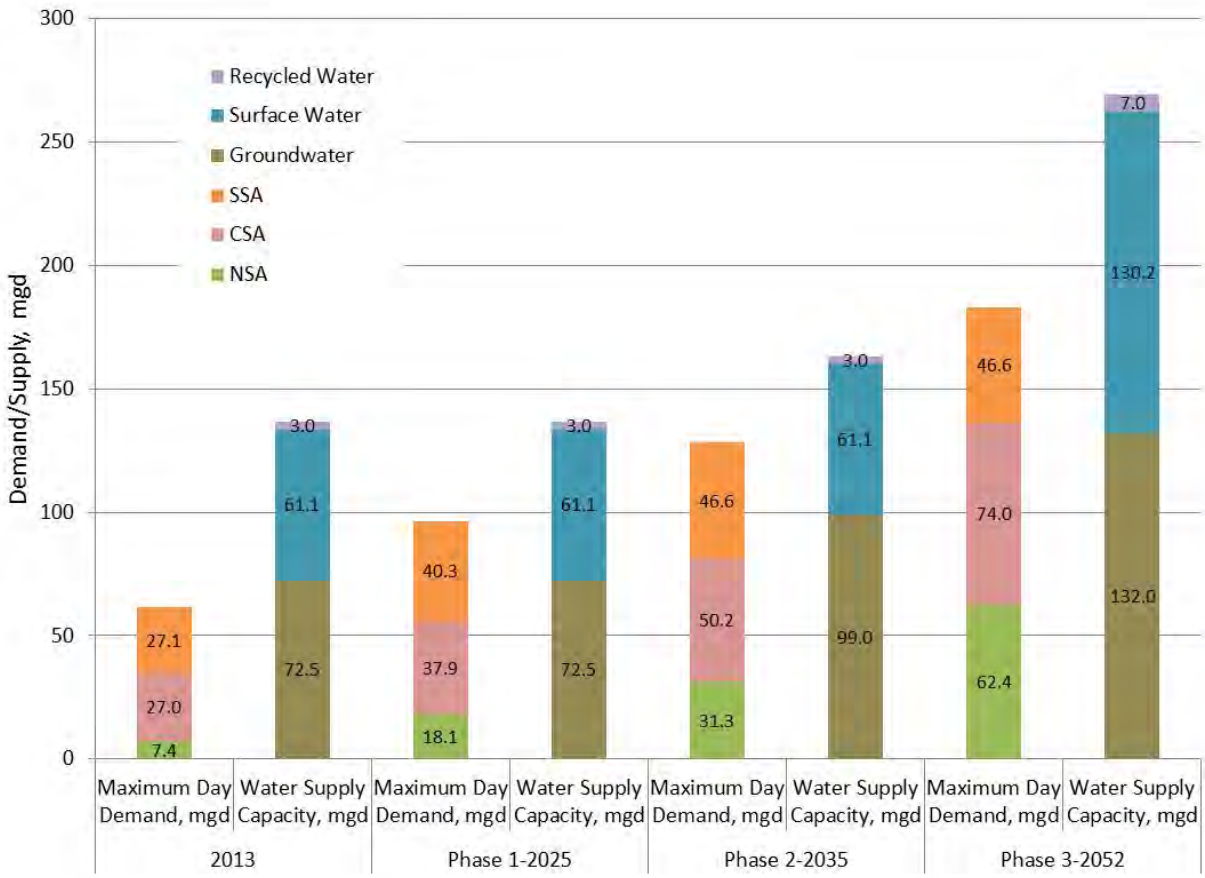


Figure 7-5. Maximum day demand to supply capacity comparison by phase - baseline

Figure 7-6 presents the maximum day use of the water supplies by type for wet/average years and dry years for 2013, Phase 1, Phase 2, and Phase 3.

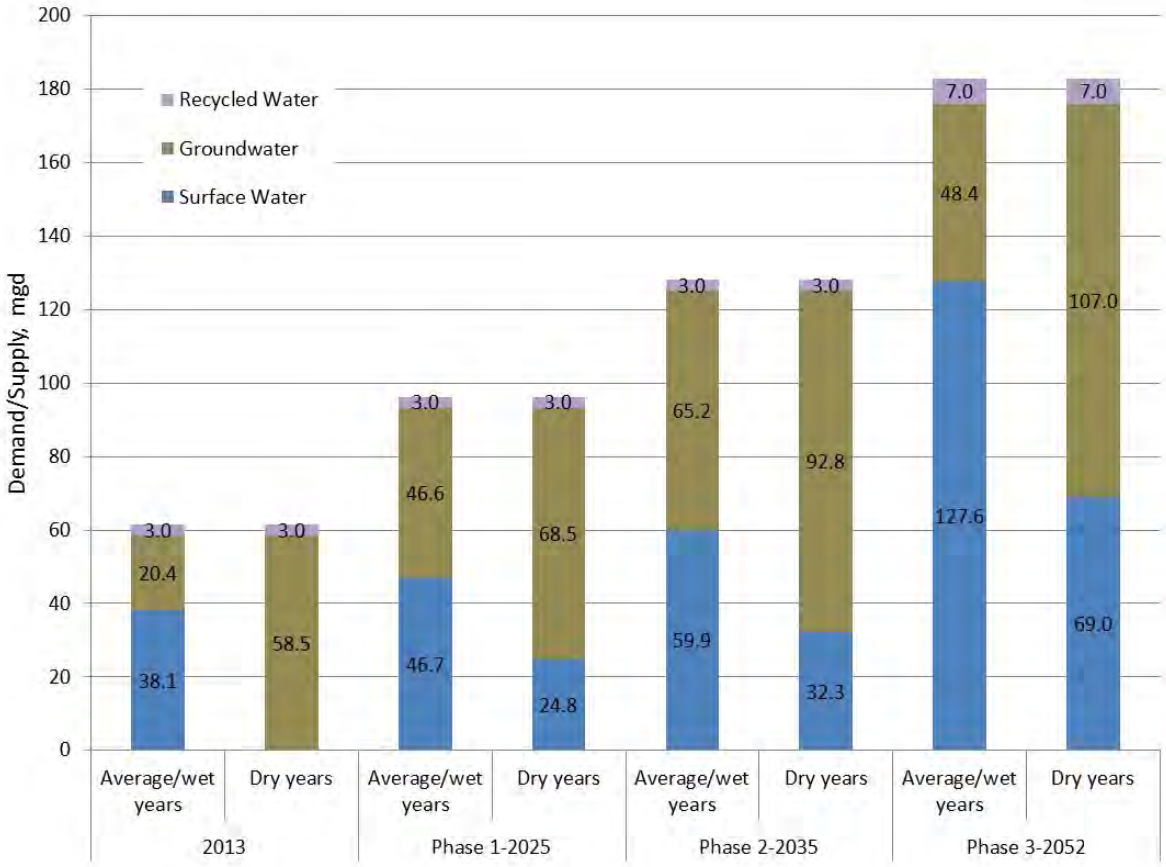


Figure 7-6. Maximum day use of water supplies by phase and climate year type - baseline

7.2.2 Annual Water Supply

Table 7-8 presents the annual supply to demand comparison for a normal climate year. Table 7-9 presents the annual supply to demand comparison for a single dry year and Table 7-10 presents the comparison for a multiple dry year. The presented supply values are the supplies available to Zone 40 assuming there are no facility supply capacity constraints. The facility improvements needed to expand existing supply capacity are presented in Section 7.3. Projections of the use of each supply source that consider supply facility capacity constraints for each service area for normal and dry years are presented in Appendix B. Figure 7-7 presents the projected use of water supplies by phase and climate year type.

As can be seen in Tables 7-8, 7-9, and 7-10, as well as in Appendix B, the total water supply is greater than the projected demands. This analysis verifies the sufficiency of the water supply for the Baseline scenario.

Table 7-8. Supply and Demand Comparison-Normal Year, ac-ft/yr – Baseline

	2015	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Supplies, no facility constraints									
US Bureau of Reclamation-CVP supply	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000
Appropriative water[a]	71,000	71,000	71,000	71,000	71,000	71,000	71,000	71,000	71,000
City of Sacramento American River POU water rights	9,300	9,300	9,300	9,300	9,300	9,300	9,300	9,300	9,300
Other surface water supplies	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
Groundwater	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Remediated groundwater	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
Supply total	185,500	185,500	185,500	185,500	185,500	185,500	185,500	187,100	187,100
Demand	38,700	45,500	53,900	62,800	71,800	80,900	90,400	100,300	102,500
Difference	146,800	140,000	131,600	122,700	113,700	104,600	95,100	86,800	84,600

Note: The water demand projection has not been revised for this WSMP amendment.

a. Only 35,000 ac-ft/yr assumed to be available without the construction of seasonal storage, as described in Section 4.2.2.

Table 7-9. Supply and Demand Comparison-Single Dry Year - Baseline, ac-ft/yr

	2015	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Supplies, no facility constraints									
US Bureau of Reclamation-CVP supply allocation	11,300	16,000	13,100	14,600	16,800	19,200	21,800	22,500	22,500
Appropriative water									
City of Sacramento American River POU water rights									
Other surface water supplies	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
Groundwater	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
Remediated groundwater	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
Supply total	101,500	106,200	103,300	104,800	107,000	109,400	112,000	114,300	114,300
Demand	38,700	45,500	53,900	62,800	71,800	80,900	90,400	100,300	102,500
Difference	62,800	60,700	49,400	42,000	35,200	28,500	21,600	14,000	11,800

Note: The water demand projection and the dry year CVP supply allocation have not been revised for this WSMP amendment.

Table 7-10. Supply and Demand Comparison-Multiple Dry Years - Baseline, ac-ft/yr

Year		2015	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
First year	Supplies									
	US Bureau of Reclamation-CVP supply	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000
	Appropriative water [(a)]	71,000	71,000	71,000	71,000	71,000	71,000	71,000	71,000	71,000
	City of Sacramento American River POU water rights	9,300	9,300	9,300	9,300	9,300	9,300	9,300	9,300	9,300
	Other surface water supplies	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
	Groundwater	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
	Remediated groundwater	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
	Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
	Supply totals	185,500	185,500	185,500	185,500	185,500	185,500	185,500	187,100	187,100
	Demand	38,700	45,500	53,900	62,800	71,800	80,900	90,400	100,300	102,500
	Difference	146,800	140,000	131,600	122,700	113,700	104,600	95,100	86,800	84,600
Second year	Supplies									
	US Bureau of Reclamation-CVP supply	17,000	24,000	19,700	21,900	25,100	28,800	32,600	33,800	33,800
	Appropriative water	-	-	-	-	-	-	-	-	-
	City of Sacramento American River POU water rights	-	-	-	-	-	-	-	-	-
	Other surface water supplies	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
	Groundwater	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
	Remediated groundwater	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
	Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
	Supply totals	107,200	114,200	109,900	112,100	115,300	119,000	122,800	125,600	125,600
	Demand	38,700	45,500	53,900	62,800	71,800	80,900	90,400	100,300	102,500
	Difference	68,500	68,700	56,000	49,300	43,500	38,100	32,400	25,300	23,100

Table 7-10. Supply and Demand Comparison-Multiple Dry Years - Baseline, ac-ft/yr										
Year		2015	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Third year	Supplies									
	US Bureau of Reclamation-CVP supply	11,300	16,000	13,100	14,600	16,800	19,200	21,800	22,500	22,500
	Appropriative water	-	-	-	-	-	-	-	-	-
	City of Sacramento American River POU water rights	-	-	-	-	-	-	-	-	-
	Other surface water supplies	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
	Groundwater	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
	Remediated groundwater	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
	Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
	Supply totals	101,500	106,200	103,300	104,800	107,000	109,400	112,000	114,300	114,300
	Demand	38,700	45,500	53,900	62,800	71,800	80,900	90,400	100,300	102,500
	Difference	62,800	60,700	49,400	42,000	35,200	28,500	21,600	14,000	11,800

Note: The water demand projection and the third year CVP supply allocation have not been revised for this WSMP amendment.

a. Only 35,000 ac-ft/yr assumed to be available without the construction of seasonal storage, as described in Section 4.2.2.

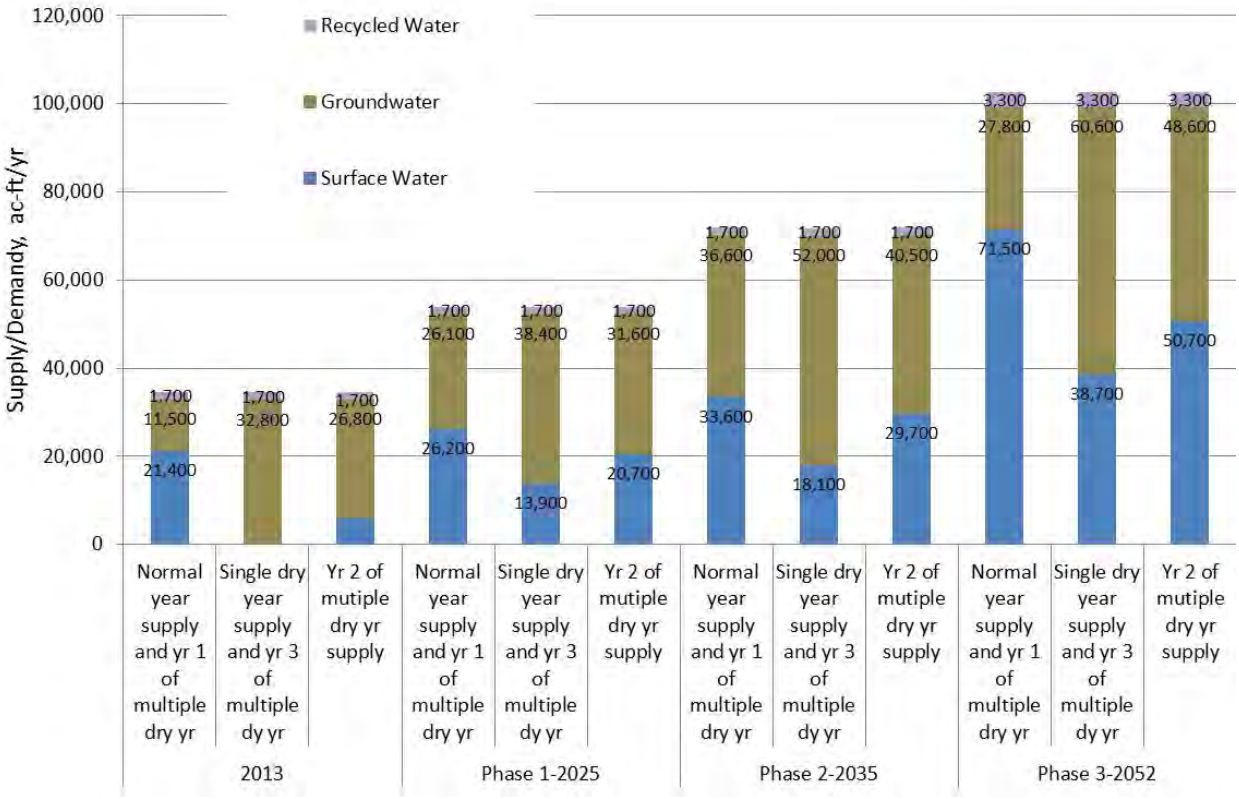


Figure 7-7. Zone 40 Annual use of water supplies by phase and climate year type

7.2.3 Storage and Pumping Station Capacity Evaluation

Table 7-11 and 7-12 presents a summary comparison of the planned to required storage volume and pumping station capacities for this scenario. As shown in Tables 7-11 and 7-12, the planned storage facilities provide more than the required storage volumes and pump station capacities. The detailed storage evaluation tables for each pressure zone are presented in Appendix B.

Table 7-11. Zone 40 Storage Capacity Evaluation Summary- Baseline				
	2013	Phase 1 (2020-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2052)
Provided storage volume, MG				
Existing	42.2	42.2	42.2	42.2
Future	0.0	13.5	17.5	36.0
Total	42.2	55.7	59.7	78.2
Required storage volume, MG				
Equalization	12.3	19.0	25.2	32.9
Fire	3.8	3.8	3.8	3.8
Emergency	10.3	15.8	21.0	27.4
Total	26.4	38.6	50.1	64.2
Difference (provided minus required)	15.8	17.1	9.6	14.0

Table 7-12. Zone 40 Pump Station Capacity Evaluation Summary- Baseline				
	2013	Phase 1 (2020-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2052)
Provided pump station capacity from storage, mgd				
Existing	107.6	118.2	112.3	101.3
Future	0.0	20.5	32.6	88.1
Total	107.6	138.7	144.9	189.4
Required pump station capacity from storage, mgd	65.8	96.6	126.2	164.6
Difference (provided minus required)	41.8	42.1	18.7	24.8

7.3 Water System Facilities and Capital Improvement Program

This section describes the water system facilities needed to supply the Cumulative scenario, develops the costs, and presents the CIP for Phases 1, 2, and 3.

7.3.1 Needed Water System Facilities

The water system facilities needed to serve the Baseline scenario through buildout are defined in this section.

7.3.1.1 Phase 1 (2020 to 2025)

The water system facilities needed to serve the Phase 1 demands are described for the NSA, CSA, and SSA.

North Service Area

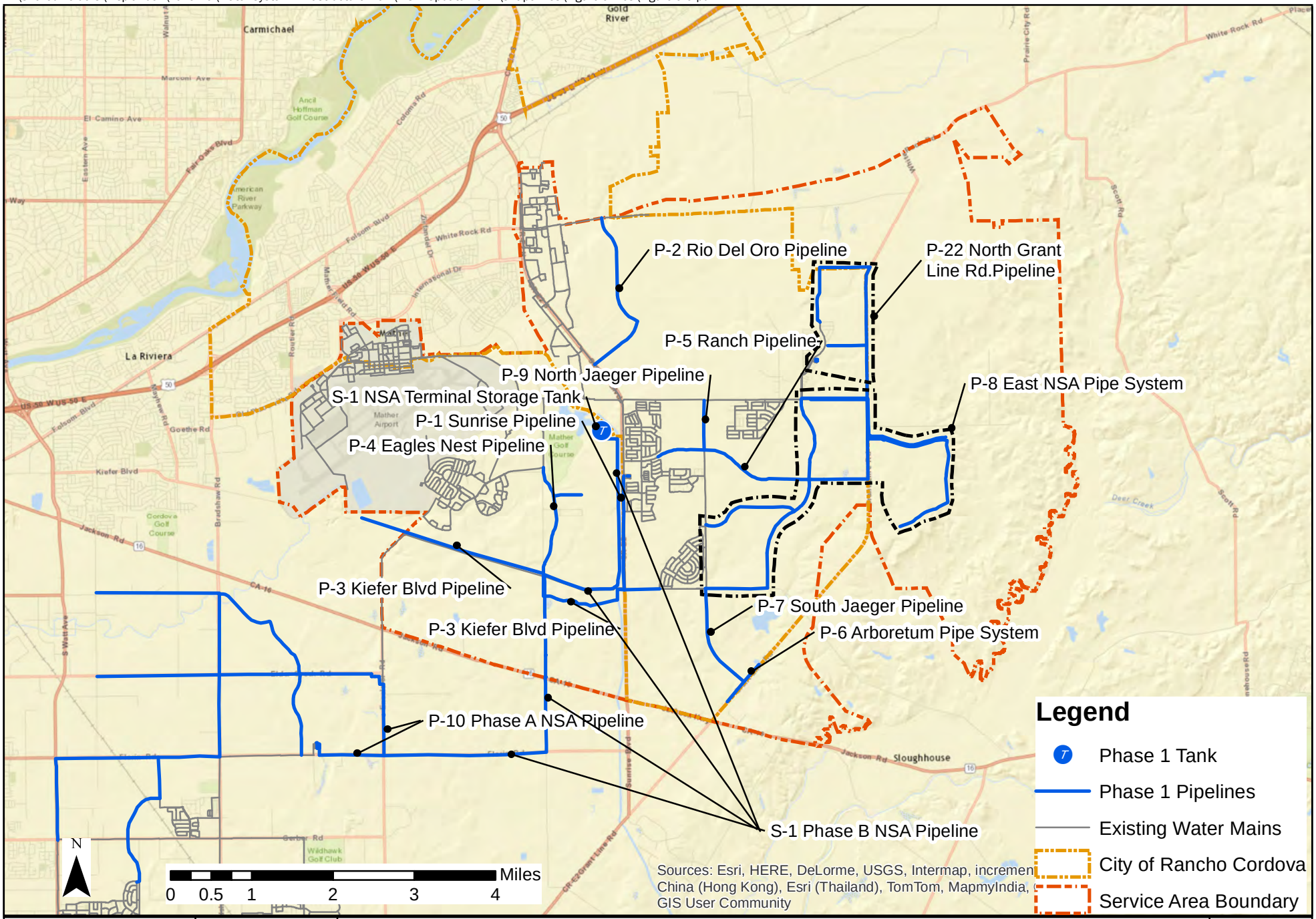
As water demand continues to grow in the NSA, new water supply capacity will be needed to keep up with the demand growth. The Phase A NSA Pipeline was recently constructed by SCWA in order to increase the surface water use in Zone 40 as part of the conjunctive use program. The existing Vineyard SWTP has additional capacity beyond what is needed to supply the CSA's current maximum

day demand. The Phase A NSA Pipeline has the capacity to deliver up to 11,000 gpm (or 15.8 MGD) to the NSA.

Once the demand for surface water in the NSA exceeds the capacity of the Phase A NSA Pipeline, a new pipeline would be constructed. This new pipeline would be part of the Phase B NSA Project (S-1), which would also include the NSA terminal storage and pumping facility. The planning and project initiation is expected to begin in Phase 1, with project completion currently anticipated in 2029 in Phase 2. The Phase B NSA Project (S-1) would provide for conveyance of surface water supply from the Vineyard SWTP to the NSA terminal storage and pumping facility from which the surface water supply would be distributed to the NSA, including peak hour and fire flow needs. The Phase B NSA Pipeline (54-inch in diameter) starts from Florin Road at Excelsior Road, extending east on Florin Road and then turning north in Eagles Nest Road, Kiefer Road, and the west bank of Folsom South Canal, and ultimately ending at the NSA terminal tanks (10 MG) located in Mather South. There may be approaches to optimize the Phase B NSA Project (S-1) by not having all of the Vineyard SWTP surface water supply conveyed to the NSA terminal storage and pumping facility. For example, additional storage facilities could be located in the southern portions of the NSA to be supplied off of either the Phase A or B NSA Project pipelines that would provide the maximum day as well as the peak hour and fire flow supplies for their local areas instead of having to deliver it all from the NSA terminal storage and pumping facility.

During Phase 1, several other pipeline projects would be constructed to deliver water to several areas within the NSA that are likely to experience growth, including the Cordova Hills, Rio del Oro, and Mather South subareas, as well as subareas located in the Sunrise/Douglas region. The locations of the Phase 1 projects in the NSA are shown on Figure 7-8.

P:\Shared Folders\Wsplandev\Zone 40\Water System Infrastructure Plan\WSIP Update 2012\Shape files\Figure 9 files\Figure 9-9.pdf



Brown AND Caldwell DEPARTMENT OF WATER RESOURCES SACRAMENTO COUNTY WATER AGENCY	PROJECT 152999 DATE 4/2/2020	SITE **Zone 40 Water Supply Master Plan Amendment** TITLE **Phase 1 CIP Projects - NSA - Cumulative**	**Figure** 7-8

Central Service Area

During Phase 1, several pipeline projects would be constructed in the CSA to improve the interconnectedness and looping of the transmission system. No new storage facilities are planned for the CSA in Phase 1. The locations of the Phase 1 projects in the CSA are shown on Figure 7-9.

South Service Area

New groundwater supply facilities will be needed once the max day demand for the SSA reaches the existing groundwater and recycled water capacity. The water supply and storage in the SSA would be increased with the expansion of the Poppy Ridge GWTP (GWTP-1). Several pipeline projects would be constructed to deliver water to the Southeast Policy area and improve interconnectivity. The locations of the Phase 1 projects in the SSA are shown on Figure 7-9.

7.3.1.2 Phase 2 (2026 to 2035)

The water system facilities needed to serve the Phase 2 demands are described for the NSA, CSA, and SSA. The timing for the Phases 2 and 3 pipelines cannot be accurately defined into either Phase 2 or 3 due to the uncertainty about the specific locations and timing of development. Therefore, the pipeline projects for Phases 2 and 3 are not specifically identified by project number.

North Service Area

Additional pipelines would be constructed within the NSA to supply increased demand in the NSA. The locations of the Phase 2 projects in the NSA are shown on Figure 7-10.

Central Service Area

The next water supply facility in the CSA would be the 18 mgd West Jackson GWTP (GWTP-2) that would use the Excelsior well field as its source of groundwater supply. The West Jackson GWTP would be located in the northern part of the CSA. The Excelsior well field would be reactivated to supply the West Jackson GWTP with some additional wells added as part of the GWTP-2 project.

Additional pipelines would be constructed within the CSA to supply increased demand in the CSA. The locations of the Phase 2 projects in the CSA are shown on Figure 7-11.

South Service Area

The Big Horn GWTP Expansion (GWTP-7) would be constructed in the SSA in Phase 2. Additional pipelines would be constructed within the SSA. The locations of the Phase 2 projects in the SSA are shown on Figure 7-11.

7.3.1.3 Phase 3 (2036 to Buildout)

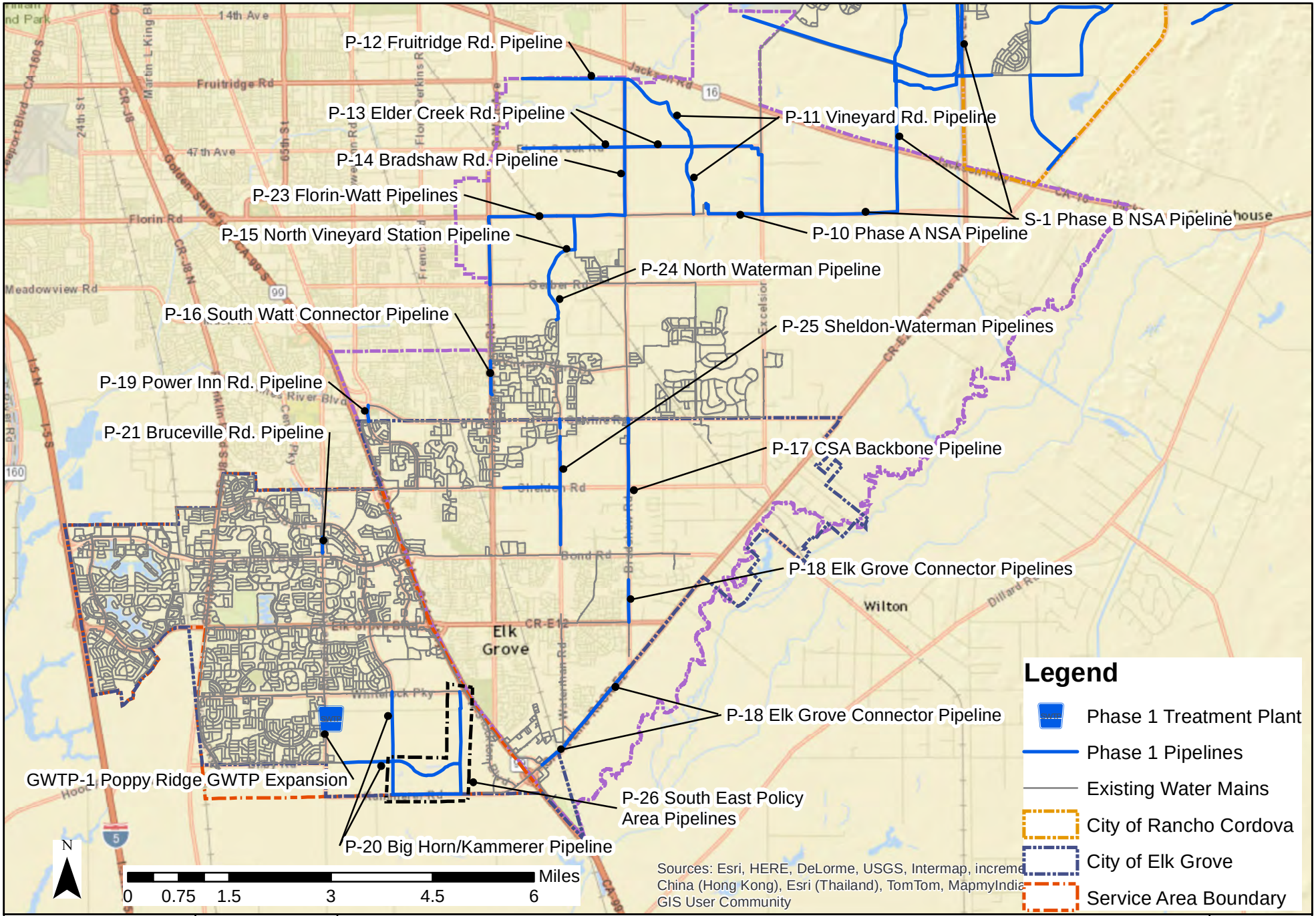
The water system facilities needed to serve Phase 3 demands are described for the NSA, CSA, and SSA.

North Service Area

In Phase 3, the Vineyard WTP would be expanded to 100 mgd from its present capacity of 50 mgd (SW-1). This added surface water supply capacity would be used to supply both the NSA and the CSA, with some supply for the SSA.

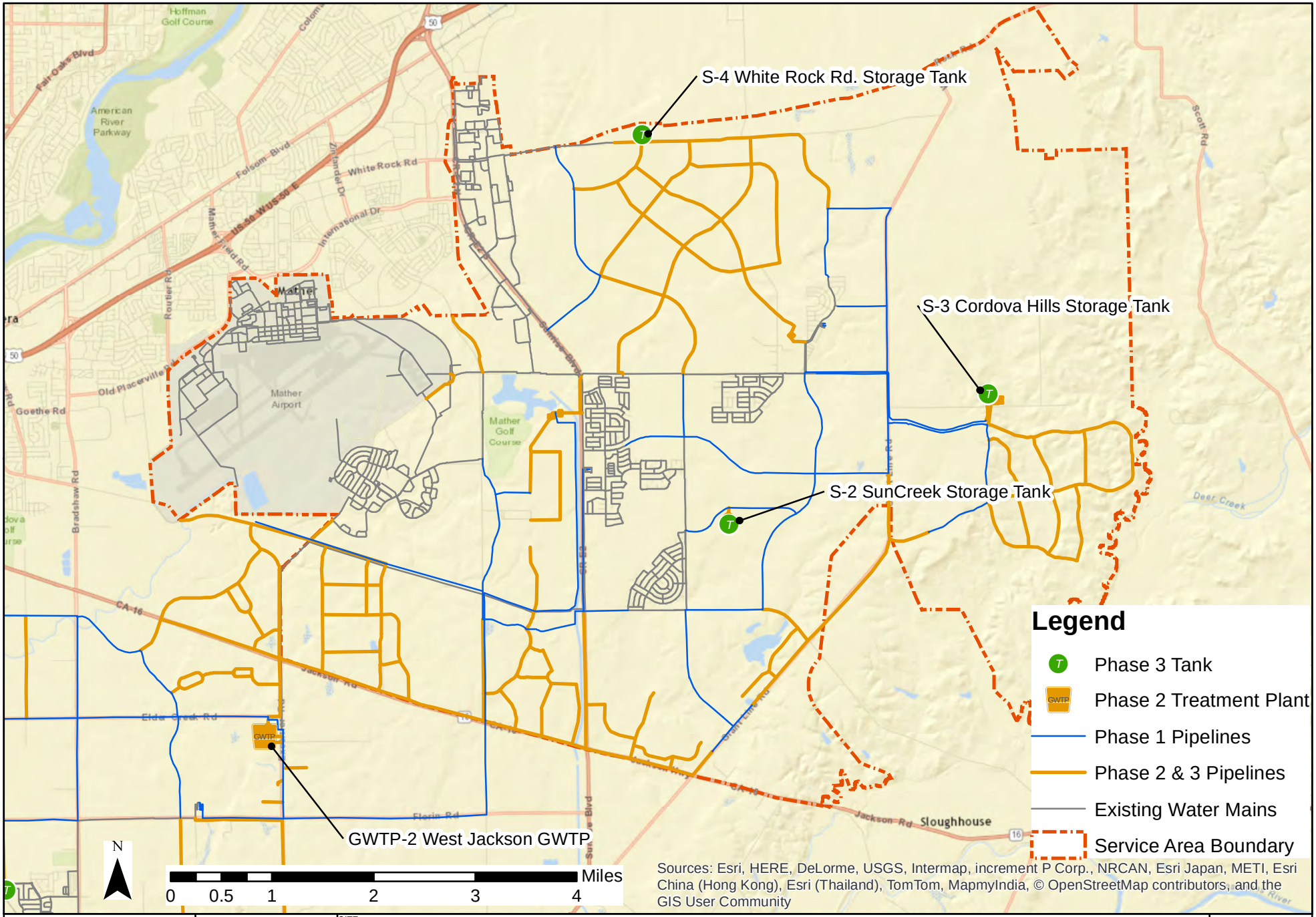
Additional storage facilities would be constructed in the NSA in Phase 3 consisting two storage facilities (S-3 and S-4). Additional pipelines would be constructed within the NSA to supply increased demands. The locations of the Phase 3 projects in the NSA are shown on Figure 7-10.

P:\Shared Folders\Wsplandev\Zone 40\Water System Infrastructure Plan\WSIP Update 2012\Shape files\Figure 9 files\Figure 9-10.pdf



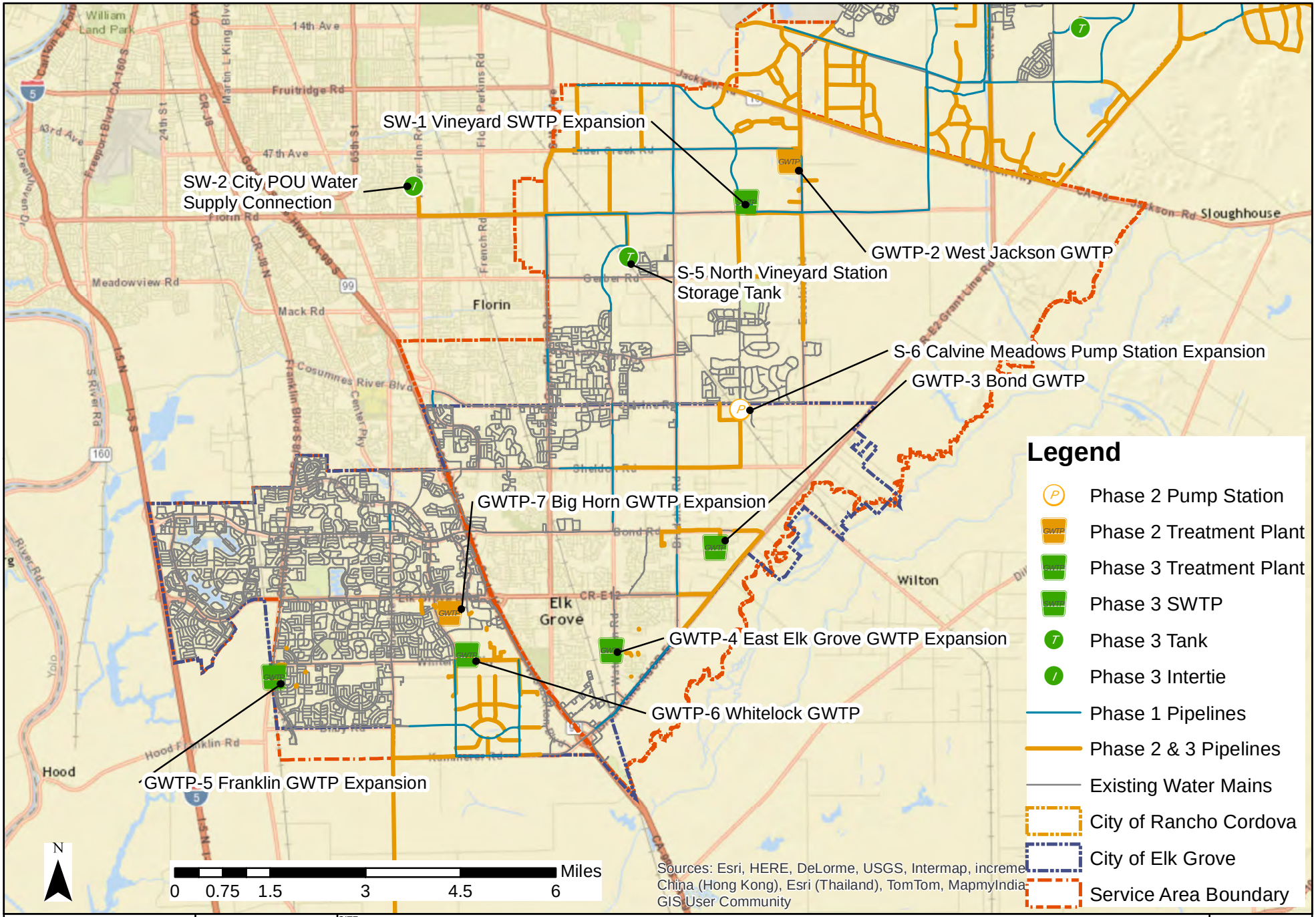
Brown AND Caldwell / DEPARTMENT OF WATER RESOURCES SACRAMENTO COUNTY WATER AGENCY	PROJECT 152999	SITE **Zone 40 Water Supply Master Plan Amendment**	**Figure** 7-9
	DATE 4/2/2020	TITLE **Phase 1 CIP Projects - CSA & SSA - Cumulative**	

P:\Shared Folders\Wsplandev\Zone 40\Water System Infrastructure Plan\WSIP Update 2012\Shape files\Figure 9 files\Figure 9-11.pdf



Brown AND Caldwell / DEPARTMENT OF WATER RESOURCES SACRAMENTO COUNTY WATER AGENCY	PROJECT 152999	SITE **Zone 40 Water Supply Master Plan Amendment**	**Figure** 7-10
	DATE 4/2/2020	TITLE **Phase 2 & 3 CIP Projects - NSA - Cumulative**	

P:\Shared Folders\Wsplandev\Zone 40\Water System Infrastructure Plan\WSIP Update 2012\Shape files\Figure 9 files\Figure 9-12.pdf



Brown AND Caldwell

DEPARTMENT OF WATER RESOURCES SACRAMENTO COUNTY WATER AGENCY

PROJECT	SITE	Figure
152999	**Zone 40 Water Supply Master Plan Amendment**	7-11
DATE	TITLE	
4/2/2020	**Phase 2 & 3 CIP Projects - CSA & SSA - Cumulative**	

Central Service Area

The surface water supply capacity for the CSA would be increased with the expansion of the Vineyard SWTP (SW-1) from 50 mgd to 100 mgd. The groundwater supply capacity would be increased in the CSA by the construction of one new GWTP and the expansion of one of the existing GWTPs (GWTP 3 and GWTP-4). In addition to the storage that would be constructed at these two GWTPs, one additional storage reservoir would be constructed in the CSA (S-5) and the pump station at a storage facility would be expanded (S-6). Additional pipelines would be constructed within the NSA to supply increased demands.

Facilities would also be added to deliver the POU surface water (19.1 mgd at maximum day) wholesaled by the City (SW-2). In the 2006 WSIP, it was assumed that the POU would be diverted and treated at the City's Fairbairn WTP, and then conveyed to the City's Florin Reservoir through the transmission main in Power Inn Road. The POU water connection to the City would be established at the Florin Reservoir. The water would be pumped out of Florin Reservoir by low-heard pumps; then it would be conveyed in a dedicated transmission main (POU Water Pipeline), and finally the water would fill the North Vineyard Station Storage tank. From there, the water would be pumped out to the CSA.

The delivery of POU water would be significantly impacted by the Hodge flow standard. Recent studies by the City indicated that the POU water for Zone 40 would be subject to cutbacks under certain hydrologic conditions as opposed to being a highly reliable surface water supply as previously thought. Future study and update would be needed once the availability of the POU water is determined.

The locations of the Phase 3 projects in the CSA are shown on Figure 7-11.

South Service Area

The groundwater supply capacity would be increased in the SSA by the construction of two new GWTPs (GWTP-5 and GWTP-6). As shown in Table B-3 in Appendix B, these two GWTPs would provide a total groundwater supply capacity for the SSA that exceeds the SSA's projected maximum day demand at buildout. Consideration should be given to locating these two proposed GWTPs closer to where there is a need for dry year groundwater supply capacity, such as the CSA.

Facilities would also be added to increase the recycled water supply (RW-1). The recycled water project (RW-1) consists of the construction of pipelines, storage, and pumping capacity to deliver recycled water to new customers in the SSA. New storage would consist of the storage provided at the two GWTPs. Additional pipelines would be constructed within the SSA during Phase 3. The locations of the Phase 3 projects in the SSA are shown on Figure 7-11, except for the recycled water project. The specific configuration of the recycled water project has not been defined.

7.3.1.4 Summary

The future water system facilities are categorized as supply facilities, storage facilities, and pipelines. Table 7-13 presents the water supply facilities planned for Zone 40. Each GWTP project consists of wells, a groundwater treatment facility, a storage tank, and a pump station that pumps from the storage tank into the distribution system. Some of the GWTP projects already have wells that were previously drilled but not equipped and some would require the equipping and drilling of new wells. Table 7-13 presents the number of wells that would be equipped and/or drilled and equipped for the pertinent GWTP projects.

Table 7-14 presents the storage facility projects planned for Zone 40. Table 7-15 presents the pipeline projects that are 16 inches in diameter or larger planned for Phase 1 for all of Zone 40. Table 7-16 presents the pipelines that would be needed during Phases 2 and 3 for all of Zone 40.

Table 7-13. Additional Supply Facilities - Baseline

	Supply Facility	Treatment/ Supply Capacity, mgd	Wells		Storage, MG	Pumping Station Capacity, mgd	Area Served	Phase Added
			Wells to be Drilled and Equipped	Wells to be Equipped only (already drilled)				
GWTP-1	Poppy Ridge GWTP expansion	6.5		3	3.5	17.0	SSA	Phase 1
GWTP-2	West Jackson GWTP	18.0	5		4.0	21.6	CSA	Phase 2
SW-1	Vineyard WTP expansion	50.0					NSA/CSA	Phase 3
GWTP-3	Bond GWTP	6.5	3		0.5	10.8	CSA	Phase 3
GWTP-4	East Elk Grove GWTP expansion	6.5	2	1		13.0	CSA	Phase 3
SW-2	City POU water supply facilities	19.1					CSA	Phase 3
GWTP-5	Franklin GWTP	7.0	1	3	2.0	21.6	SSA	Phase 3
GWTP-6	Whitelock GWTP	13.0	6		3.0	14.4	SSA	Phase 3
GWTP-7	Big Horn GWTP expansion	8.5	4			17.0	SSA	Phase 2
RW-1	Recycled water supply	4.0					SSA	Phase 3
	Total	139.1	21	7	13.0	115.4		

Table 7-14. Additional Storage Facilities - Baseline

	Storage Facility	Capacity, MG	Pumping Station, mgd	Area Served	Phase Added
S-1	Phase B NSA Project	10.0	64.0	NSA	1
S-2	Suncreek	3.0	18.0	NSA	3
S-3	Cordova Hills	3.0	21.6	NSA	3
S-4	White Rock	3.0	14.4	NSA	3
S-5	North Vineyard Station	4.0	21.6	CSA	3
S-6	Calvine Meadows Pump Station Expansion		7.2	CSA	3
	Total	23.0	146.8		

Table 7-15. Phase 1 Pipelines - Baseline				
	Pipeline	Size, in	Length, ft	Area Served
P-1	Sunrise Blvd. Pipeline	16	7,371	NSA
P-2	Rio del Oro Pipeline	24	11,593	NSA
P-3	Kiefer Blvd. Pipeline	16-20	22,446	NSA
P-4	Eagles Nest Road Pipeline	20-30	7,239	NSA
P-5	Ranch Pipeline	24	7,000	NSA
P-6	Arboretum Pipe System	16	3,167	NSA
P-7	South Jaeger Pipeline	16	5,238	NSA
P-8	East NSA Pipeline System	16-30	61,389	NSA
P-9	North Jaeger Pipeline	24	6,365	NSA
P-11	Vineyard Road Pipeline	16	13,600	CSA
P-12	Fruitridge Road Pipeline	16	7,982	CSA
P-13	Elder Creek Pipeline	16-36	21,343	CSA
P-14	Bradshaw Road Pipeline	16-24	10,599	CSA
P-15	North Vineyard Station (Florin to Gerber) Pipeline	24-36	11,847	CSA
P-16	South Watt Connect Pipeline	24	2,693	CSA
P-17	CSA Backbone Pipeline	24-30	9,948	CSA
P-18	Elk Grove Loop Connector Pipelines	16-24	11,322	CSA
P-19	Power Inn Road Pipeline	24	1,273	CSA
P-20	Big Horn to Kammerer Pipeline	20	7,832	SSA
P-21	Bruceville Road Pipeline	18	1,267	SSA
P-22	North Grant Line Road Pipeline	20-24	17,000	NSA
P-23	Florin-Watt Pipelines	20-24	10,000	CSA
P-24	North Waterman Pipeline	16	3,000	CSA
P-25	Sheldon-Waterman Pipelines	18-24	15,000	CSA
P-26	South East Policy Area Pipelines	18-24	22,000	SSA
	Total	--	343,176	--

Table 7-16. Phase 2 and 3 Pipelines - Baseline	
Pipeline Size, in	Length, ft
16	165,716
18	14,351
20	0
24	67,876
30	5,305
36	29,502
42	3,371
54	40,704
Total	326,825

7.3.2 Capital Improvement Plan

This section presents the CIP for Phases 1, 2, and 3.

7.3.2.1 Phase 1 CIP – 10 Year Plan (FY 2020-21 to 2024-25)

The Phase 1 CIP represents the projects that will be constructed over the near term time period and provides the basis for the development of the capacity charge. The development of the Phase 1 CIP requires consideration of the timing and duration of each project. The Phase 1 CIP consists of groundwater, storage, and pipeline projects. No surface water and stand alone storage projects are planned for Phase 1, other than the storage that is part of the GWTP project.

Table 7-17 presents the estimated costs of the Phase 1 water facilities for all of Zone 40. Included in the Phase 1 CIP is an item for non-specific project costs that cover the labor costs of SCWA's planning, development, and development sections.

The timing of the Phase 1 projects presented in Table 7-17 are based on information SCWA has received from developers' engineers regarding the timing of development projects and keeping a somewhat consistent rate of annual expenditure over the duration of Phase 1. The cost of each project would occur over a duration of several years. All of the projects would be completed by the time the end of Phase 1 is reached.

Table 7-17. Phase 1 CIP Cost Estimate - Baseline

Projects		Service Area	Capital Cost	Project Timing	
No.	Name			Start, FY	End, FY
Groundwater projects (SCWA projects)					
GWTP-1	Poppy Ridge GWTP Expansion	SSA	$13,832,800	2016	2018
	Well site acquisitions	CSA/SSA	$180,000	2018	2023
	subtotal		$14,012,800		
Regional transmission and storage projects (SCWA projects)					
S-1	Phase B NSA Project[a]	NSA	$84,586,140	2016	2023
	Tank site acquisition	NSA	$800,000	2017	2018
	subtotal		$85,386,140		
Pipeline projects (Developer projects)					
P-1	Sunrise Blv. Pipeline[a]	NSA	$2,527,900	2018	2020
P-2	Rio del Oro Pipeline	NSA	$3,663,200	2016	2018
P-3	Kiefer Boulevard Pipeline[a]	NSA	$7,282,700	2020	2022
P-4	Eagles Nest Road Pipeline	NSA	$3,779,200	2019	2021
P-5	Ranch Pipeline	NSA	$2,202,300	2023	2025
P-6	Arboretum Pipe System	NSA	$1,104,300	2021	2023
P-7	South Jaeger Pipeline	NSA	$1,145,500	2020	2022
P-8	East NSA Pipeline System	NSA	$18,212,400	2016	2021
P-9	North Jaeger Pipeline	NSA	$2,027,300	2017	2018
P-11	Vineyard Road Pipeline[a]	CSA	$2,923,000	2021	2023
P-12	Fruitridge Road Pipeline[a]	CSA	$2,716,100	2022	2024

Table 7-17. Phase 1 CIP Cost Estimate - Baseline					
Projects				Project Timing	
No.	Name	Service Area	Capital Cost	Start, FY	End, FY
P-13	Elder Creek Pipeline[a]	CSA	$9,142,600	2021	2025
P-14	Bradshaw Road Pipeline[a]	CSA	$4,515,400	2017	2019
P-15	North Vineyard Station (Florin to Gerber) Pipeline	CSA	$5,025,600	2018	2020
P-16	South Watt Connect Pipeline	CSA	$1,742,400	2019	2021
P-17	CSA Backbone Pipeline	CSA	$5,008,300	2023	2025
P-18	Elk Grove Loop Connector Pipelines	CSA	$4,715,500	2023	2025
P-19	Power Inn Road Pipeline	CSA	$584,300	2024	2025
P-20	Big Horn to Kammerer Pipeline	SSA	$2,494,500	2017	2019
P-21	Bruceville Road Pipeline	SSA	$509,400	2024	2025
P-22	North Grant Line Road Pipeline	NSA	$4,588,800	2022	2024
P-23	Florin-Watt Pipelines	CSA	$4,150,400	2023	2025
P-24	North Waterman Pipeline	CSA	$568,900	2019	2020
P-25	Sheldon-Waterman Pipelines	CSA	$5,685,700	2022	2025
P-26	South East Policy Area Pipelines	SSA	$5,868,800	2021	2024
	subtotal		$102,184,500		
Non-specific project costs			$30,000,000	2016	2025
Studies					
	Recycled Water Master Plan		$250,000	2016	2025
	Water Master Plan		$400,000	2016	2025
	EIR		$500,000	2016	2025
	subtotal		$1,150,000		
Total			$232,733,440		

Note: SCWA to verify status of Phase 1 CIP projects.

a. Projects relevant to the three growth areas.

7.3.2.2 Phase 2 CIP – 10 Year Plan (2026 to 2035)

Phase 2 represents the 10 year period following the end of Phase 1. Since Phase 2 is further in the future, the timing of projects is more speculative and less precise. The level of precision provided in the Phase 1 CIP is not needed for Phase 2 since the capacity charges are developed using the Phase 1 CIP costs and not the CIP costs from the subsequent phases.

The new pipelines that are needed for Zone 40 during Phases 2 and 3 are defined. However, the timing of when each pipeline project is needed is dependent on the location and timing of development. Therefore, this document does not identify the specific pipe segments that would need to be constructed in either Phase 2 or 3. The approach used for the development of the CIP is to assume that approximately half the cost of the Phases 2 and 3 pipelines would occur in Phase 2 and half would occur in Phase 3. Table 7-18 presents the cost estimate for the Phases 2 and 3 pipelines for all of Zone 40.

Table 7-19 presents the cost estimate for the Phase 2 CIP projects for all of Zone 40. The Phase 2 CIP consists of groundwater and pipeline projects. No surface water projects are planned for Phase 2.

Table 7-18. Phases 2 and 3 Pipeline Cost Estimate - Baseline

Diameter, in	Length, ft	Capital Cost
16	165,716	$68,859,035
18	14,351	$6,751,465
20	-	$ -
24	67,876	$36,404,178
30	5,305	$3,592,897
36	29,502	$23,653,481
42	3,371	$3,147,171
54	40,704	$57,148,073
Total	326,825	$199,556,300

Table 7-19. Phase 2 CIP - Baseline

Projects		Service Area	Capital Cost
No.	Name		
Groundwater projects			
GWTP-2	West Jackson GWTP	CSA	$28,932,200
GWTP-7	Big Horn GWTP Expansion	SSA	$14,744,100
Pipeline projects		NSA/CSA/SSA	$99,778,150
Total			$143,454,450

7.3.2.3 Phase 3 CIP – 17 Year Plan (2036 – Buildout)

The Phase 3 CIP consists of surface water, groundwater, recycled water, storage, and pipeline projects. Table 7-20 presents the cost estimate for the Phase 3 CIP projects for all of Zone 40. The cost estimate for the City POU supply connection (SW-2) is for the construction of the interconnection and the pipeline to convey the water into the CSA's water transmission system. It does not include the City's capacity buy-in cost that was estimated in 2005 to be $32 million.

Table 7-20. Phase 3 CIP - Baseline			
Projects		Service Area	Capital Cost
No.	Name		
Surface Water Projects			
SW-1	Vineyard WTP Expansion	NSA/CSA	$200,000,000
SW-2	City POU Supply Connection [a]	CSA	$2,034,400
	subtotal		$202,034,400
Groundwater Projects			
GWTP-3	Bond GWTP	CSA	$14,725,800
GWTP-4	East Elk Grove GWTP Expansion	CSA	$13,687,000
GWTP-5	Franklin GWTP	SSA	$18,544,000
GWTP-6	Whitelock GWTP	SSA	$26,143,800
	subtotal		$73,100,600
Recycled Water Projects			
RW-1	Recycled Water Project	SSA	$20,000,000
Storage Projects			
S-2	Suncreek Storage	NSA	$11,864,500
S-3	Cordova Hills Storage	NSA	$12,848,700
S-4	White Rock Road Storage	NSA	$10,880,400
S-5	North Vineyard Station Storage	CSA	$5,467,500
S-6	Calvine Meadows Pump Station Expansion	CSA	$5,084,800
	subtotal		$46,145,900
Pipeline Projects		NSA/CSA/SSA	$99,778,150
Total			$441,059,050

a. Does not include the City's capacity buy-in cost

7.3.2.4 CIP Summary

Table 7-21 and Figure 7-12 summarize the Zone 40 CIP costs by project category and phase. The Phases A and B NSA projects in Phase 1 have been categorized as storage projects for the purposes of Table 7-21 and Figure 7-12.

Table 7-21. Zone 40 CIP Cost Summary - Baseline				
Project Categories	Phase 1	Phase 2	Phase 3	Total
Surface Water Projects			$202,034,400	$202,034,400
Groundwater Projects	$14,012,800	$43,676,300	$73,100,600	$130,789,700
Recycled Water Projects			$20,000,000	$20,000,000
Storage Projects	$85,386,140		$46,145,900	$131,532,040
Pipeline Projects	$102,184,500	$99,778,150	$99,778,150	$301,740,800
Non-Specific Project Costs	$30,000,000			$30,000,000
Studies	$1,150,000			$1,150,000
Total	$232,733,440	$143,454,50	$441,059,050	$817,246,940

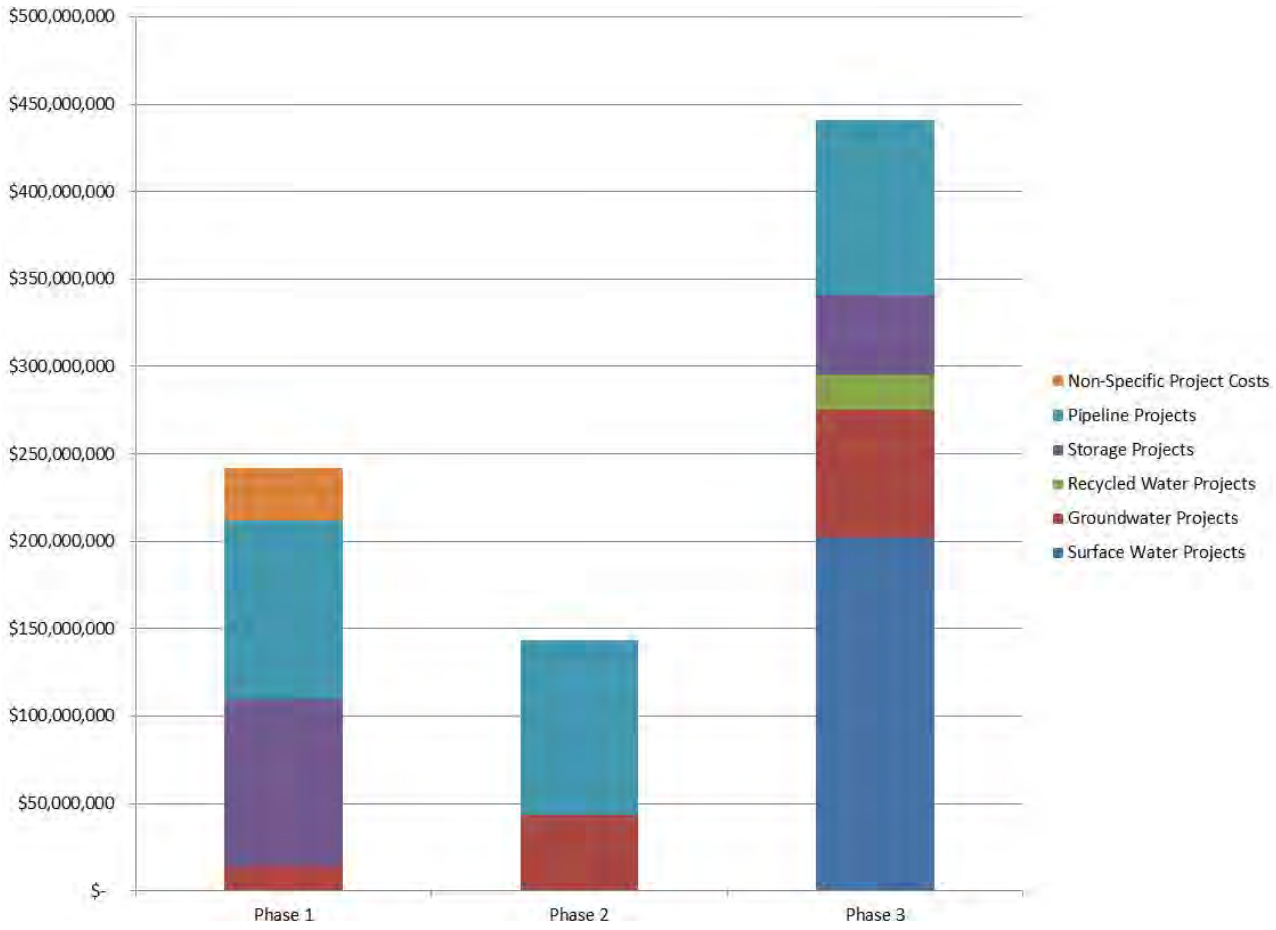


Figure 7-12. CIP summary by phase

Section 8

Multi-Sport Complex and Grant Line Industrial Annexation Area

This section describes the water demands, water supplies, and needed water system improvements for the Plan Area scenario.

8.1 Water Demands

This section describes the land use, demographics, and demand projections for the Plan Area scenario.

8.1.1 Buildout Land Use

This section describes the projected developed area and demographics for the Plan Area and for the overall Plan Area scenario.

8.1.1.1 Plan Area

The source of land use information and water demand projections for the Plan Area is shown below in Table 8-1.

Table 8-1. Source of Land Use Information and Water Demand Projections for the Plan Area

Subarea Name	Agency Providing Land Use Data and Date
Plan Area	Wood Rodgers, 12/19/19

The City of Elk Grove has acquired two parcels totaling approximately 104 acres of property to develop an MSC. The property is located just outside of the southern City of Elk Grove limit and requires annexation into the City of Elk Grove. The City of Elk Grove has initiated the annexation process with LAFCo. One of the LAFCo conditions to annex the 104 acre City of Elk Grove-owned parcels is that adjacent properties also be annexed into the City of Elk Grove's Sphere of Influence. The adjacent properties are located to the west and east of the City of Elk Grove owned parcels, with a total combined area of approximately 572 acres in size (Plan Area). The 572 acre Plan Area, also known as the Elk Grove Multi-Sport Complex and Grant Line Industrial Annexation Area, includes the 104 acre City of Elk Grove owned property.

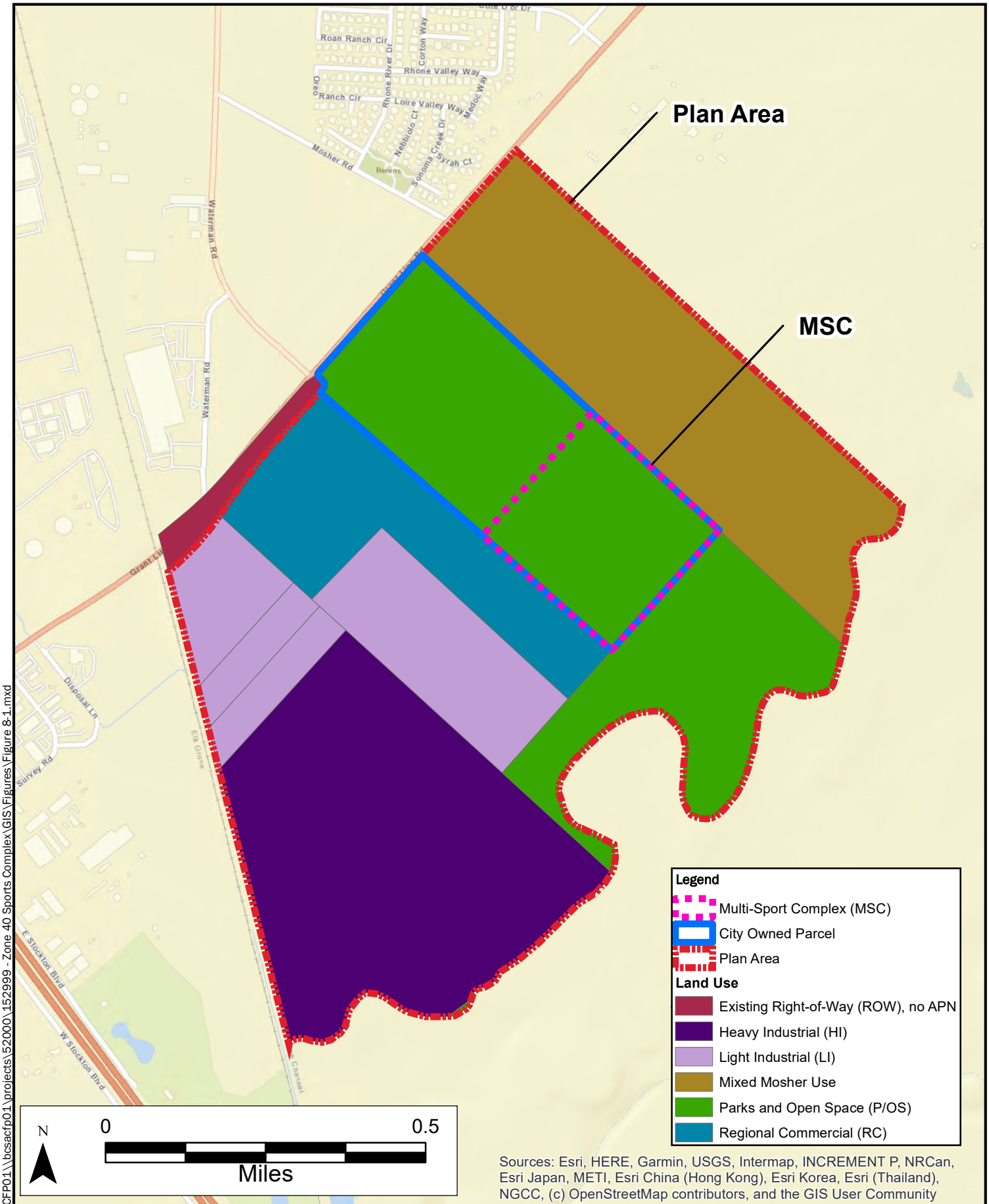
In general, the project area is located east of Highway 99 and the railroad and south of Grant Line Road. The majority of the existing site is currently being used for agriculture purposes. The existing topography of the project area is flat with elevations varying from 55 feet to 48 feet, and generally falls east to west.

The proposed land uses will consist of mixed use, parks and open space, regional commercial, light industrial, and heavy industrial. Proposed land uses for the Plan Area assumed for this analysis are shown in Table 8-2 (Elk Grove, 2020).

Table 8-2. Land Use Areas for the Plan Area

Land Use Category	Proposed Land Use Area, Acres
Mixed Mosher Use	118.9
Parks and Open Space (P/OS)	169.0
Light Industrial (LI)	112.2
Regional Commercial (RC)	20.0
Heavy Industrial (HI)	143.2
Right-of-Way (ROW)	8.2
Total	571.5

Source: Elk Grove, 2020.



Document Path: BCSACFP01\\bcsacfp01\projects\52000\152999 - Zone 40 Sports Complex\GIS\Figures\Figure 8-1.mxd

DATE	PROJECT	SITE	
8/6/2020	152999	Zone 40 Water Supply Master Plan Amendment	Figure 8-1
		TITLE	
		Land Use - Plan Area	

Brown AND Caldwell

DEPARTMENT OF WATER RESOURCES
SACRAMENTO COUNTY WATER AGENCY

8.1.1.2 Plan Area Scenario

The 2010 and buildout developed land use acreages by land use category for Zone 40 with Plan Area are summarized in Table 8-3. The acreages presented in Table 8-3 are net acres for 2010 and gross acres for this scenario at buildout.

Table 8-3. 2010 and Buildout Area by Land Use – Plan Area

Land Use Category	2010 Developed Area, Net Acres	Buildout Area, Gross Acres
Rural estate	1,380	6,870
Single family	6,970	18,140
Multi-family - low density	220	3,750
Multi-family - high density	390	1,310
Commercial	1,520	4,352
Industrial	1,110	3,729
Industrial-unutilized	340	575
Public	920	2,130
Public recreation	1,270	4,980
Mixed land use	20	1,350
Right-of-way	70	580
Subtotal, municipal water supply land area	14,210	47,770
Self-supported/supplied by others	-	870
Non-irrigated	500	9,800
Agricultural	-	11,620
Total	14,710	70,060

Note: Elk Grove wholesale area is not included in the 2010 developed area acreage because it was not available. It is included in the buildout acreage.

As there is no residential land use associated with the Plan Area, the projected DUs and population for the Plan Area scenario are consistent with the Baseline scenario. The number of customer connections for the Plan Area scenario at buildout are currently unknown.

8.1.2 Buildout Water Demands

This section presents the buildout water demand for the Plan Area and for the overall Plan Area scenario. Table 8-4 presents the buildout water demand projection for the Plan Area developed by Wood Rodgers.

Table 8-4. Plan Area Buildout Water Demands[a]

Land Use	Proposed Land Use Area, Acres	UWDF, ac-ft/yr/ac [(a)]	Water Demand, ac-ft/yr
Mixed Mosher Use	118.9	2.31	275
Parks and Open Space (P/OS)	169.0	3.01	509
Light Industrial (LI)	112.2	2.17	244
Regional Commercial (RC)	20.0	2.17	43
Heavy Industrial (HI)	143.2	2.17	311
Right-of-Way (ROW)	8.2	0.19	2
Total			1,383

Source: Elk Grove, 2020.

a. Includes 7.5% system losses.

It is anticipated that the land use plan for the Plan Area will possibly be revised, perhaps several times, before final approval. It is anticipated that these revisions would not significantly change the overall total buildout water demand for Zone 40 from the projections presented in this report, as well as the planned water system improvements. The potential demands of a significant water user (e.g., beverage producer) is not included in the demand projection. Additional analysis would be necessary should a project that includes a significant water user be proposed. If the land use changes and resulting demographics, water demands, and facility needs are determined to be significant, the report would be amended as necessary.

Tables 8-5 present the total buildout Zone 40 water demand for the Plan Area scenario. The recycled water demand in the SSA is included in the demand projections in Table 8-5 to provide the total water demand for this scenario. There is no recycled water demand assumed for the Plan Area. The total Zone 40 demand at buildout for this Plan Area scenario would be 1,400 ac-ft/yr greater than the buildout demand estimated for the Baseline scenario in Table 7-5 of 102,400 ac-ft, or a 1.4 percent increase.

As mentioned in Section 7.1.2, the buildout water demand factors and the total demand for the baseline scenario has not been updated for this amendment. Due to recent reductions in per capita water use, it might be possible that an updated evaluation of the projected Zone 40 demand at buildout may result in a smaller buildout demand for the Baseline and Plan Area scenarios.

Table 8-5. Buildout Water Demand by Land Use Category – Plan Area

Land Use Category	Water Demand, ac-ft/yr
Rural estate	9,400
Single family	38,600
Multi-family - low density	9,200
Multi-family - high density	4,400
Commercial	8,900
Industrial	7,500
Public	1,700
Public recreation	14,000
Mixed land use	2,900
Right-of-way	100
Subtotal (land use with water demand)	96,600
Water system losses (7.5% of water sales)	7,200
Self-supplied/supported by others	0
Industrial-unutilized	0
Non-irrigated	0
Agricultural	0
Total	103,800

8.1.3 Water Demand Growth Projection

Water demand growth projections are determined assuming the Plan Area will be constructed as early as 2025. The projected water demands by service area are shown in Table 8-6 and illustrated on Figure 8-2.

Table 8-6. Projected Water Demand in 5-Year Increments – Plan Area, ac-ft/yr

Service Area	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
NSA	7,300	10,100	13,100	17,500	22,400	27,500	32,800	34,900
CSA								
Plan Area	-	1,400	1,400	1,400	1,400	1,400	1,400	1,400
Remaining CSA	18,400	21,200	24,100	28,100	32,400	36,800	41,300	41,400
CSA subtotal	18,400	22,600	25,500	29,500	33,800	38,200	42,700	42,800
SSA	19,700	22,600	25,600	26,100	26,100	26,100	26,100	26,100
Total study area	45,400	55,300	64,200	73,100	82,300	91,800	101,600	103,800

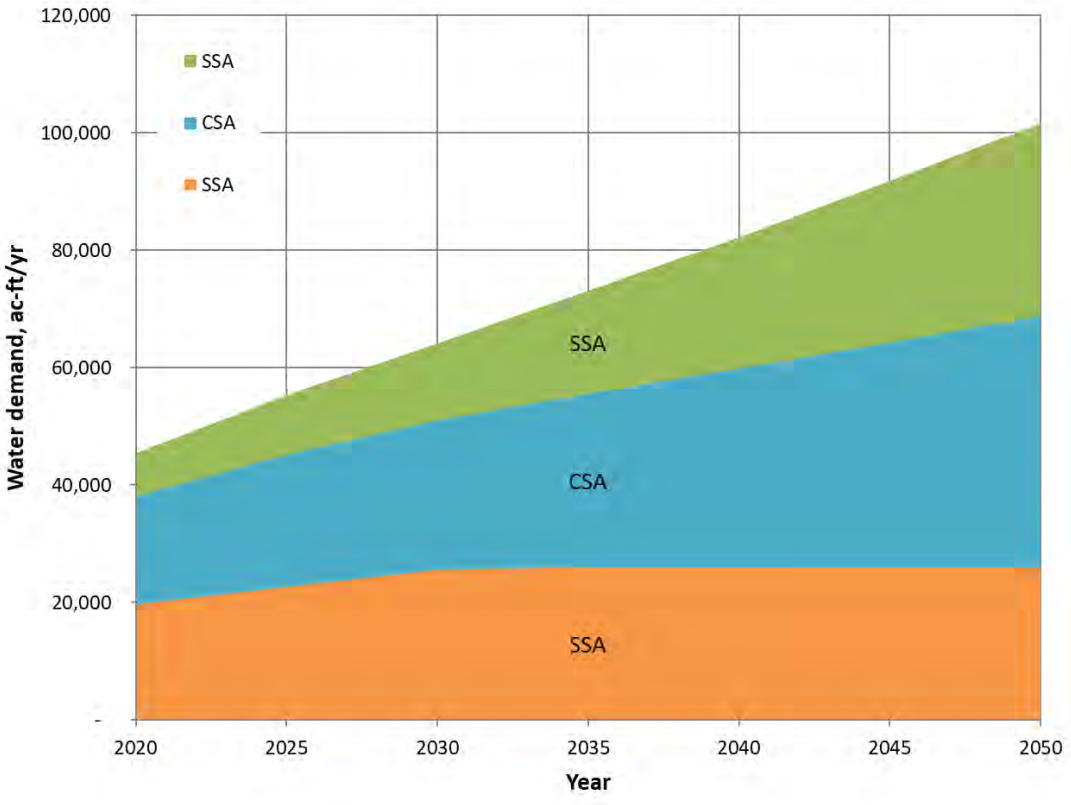


Figure 8-2. Water demand projection – Plan Area

8.2 Water Supply Capacity

This section quantifies the amount of supply capacity that would be needed to meet demands through buildout. The supply capacity and the use of the supply is presented on both a maximum day basis and an annual basis.

8.2.1 Maximum Day Demand Supply Capacity and Use

This section compares the projected maximum day demand to supply capacity for each of the three service areas through buildout. The maximum day demand to supply capacity comparison tables for each of the three service areas are presented in Appendix C. The future supply capacity is based on the proposed supply and conveyance facilities that are presented for the Baseline scenario in Section 7. The maximum day use of each type of supply is quantified for the wet/average years and dry years.

Table 8-11 presents the maximum day demand and supply capacity comparison for Zone 40 from 2020 through buildout. The maximum day use of each type of supply is quantified for the wet/average years and dry years. As can be seen in Table 8-7 and consistent with the established conjunctive use program, the total supply capacity exceeds the maximum day demand for each phase, but neither the groundwater nor surface water supply capacity alone can meet the maximum day demand. The 1.4 percent increase in total Zone 40 demand for the Plan Area scenario compared to the baseline scenario can be supplied with the same supply capacity assumed for the baseline scenario.

As shown in Table 8-7, Zone 40 will utilize a varying mixture of groundwater and surface water supplies on the maximum demand day based on whether it is a wet/average year or a dry year. The observations made for the Baseline scenario in Section 7.2.1.4 pertain to the Plan Area scenario.

Table 8-7. Maximum Day Demand to Supply Comparison for Zone 40 – Plan Area, mgd

Zone 40	Phase 1		Phase 2		Phase 3	
	2020	2025	2020	2025	2050	Buildout (2052)
Maximum day demand						
Plan Area	0	2.5	2.5	2.5	2.5	2.5
Remaining Zone 40	81.1	96.2	112.1	128.0	178.9	182.8
Zone 40 total	81.1	98.7	114.6	130.5	181.4	185.3
Existing supply capacity						
Groundwater[a]	66.0	66.0	66.0	66.0	66.0	66.0
Surface water[b]	45.1	28.6	28.6	28.6	28.6	28.6
Recycled water	3.0	3.0	3.0	3.0	3.0	3.0
Total	114.1	97.6	97.6	97.6	97.6	97.6
Planned future supply capacity						
Groundwater	0.0	6.5	15.5	33.0	53.0	66.0
Surface water[b]	16.0	32.5	32.5	32.5	82.5	101.6
Recycled water					2.9	2.9
Total supply capacity						
Groundwater	66.0	72.5	81.5	99.0	119.0	132.0
Surface water	61.1	61.1	61.1	61.1	111.1	130.2
Recycled water	3.0	3.0	3.0	3.0	5.9	5.9
Total	130.1	136.6	145.6	163.1	236.0	268.1
Use of supply: average/wet years						
Groundwater	21.1	36.6	52.1	67.7	70.9	52.0
Surface water	57.0	59.1	59.5	59.8	104.7	127.5
Recycled water	3.0	3.0	3.0	3.0	5.9	5.9
Total	81.1	98.7	114.6	130.5	181.4	185.3
Use of supply: dry years						
Groundwater	60.5	68.5	79.6	95.3	108.1	108.1
Surface water	17.6	27.2	32.0	32.2	67.4	71.3
Recycled water	3.0	3.0	3.0	3.0	5.9	5.9
Total	81.1	98.7	114.6	130.5	181.4	185.3

a. *Groundwater supply decrease in 2020 due to Anatolia GWTP removed from service.*

b. *Reduction in existing capacity and added future surface water supply capacity in 2020 and 2025 because planned delivery to NSA from existing Vineyard SWTP accounted as future supply capacity as requested by SCWA staff.*

8.2.2 Annual Water Supply

Table 8-8 presents the annual supply to demand comparison for a normal climate year. Table 8-9 presents the annual supply to demand comparison for a single dry year and Table 8-10 presents the comparison for a multiple dry year period. The presented supply values are the supplies available to Zone 40 regardless of the capacities of existing supply facilities. The needed facility improvements needed to expand existing supply capacity are presented in Section 8.3. Projections of the use of each supply source that consider supply facility capacity constraints for each service area for normal and dry years are presented in Appendix C.

Table 8-8. Supply and Demand Comparison-Normal Year – Plan Area, ac-ft/yr

	2020	2025	2030	2035	2040	2045	2050	Buildout (2051)
Supplies, no facility constraints								
US Bureau of Reclamation-CVP supply	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000
Appropriative water[a]	71,000	71,000	71,000	71,000	71,000	71,000	71,000	71,000
City of Sacramento American River POU water rights	9,300	9,300	9,300	9,300	9,300	9,300	9,300	9,300
Other surface water supplies	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
Groundwater	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Remediated groundwater	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
Supply total	185,500	185,500	185,500	185,500	185,500	185,500	187,100	187,100
Demand	45,400	55,300	64,200	73,100	82,300	91,800	101,600	103,800
Difference	140,100	130,200	121,300	112,400	103,200	93,700	85,500	83,300

a. Only 35,000 ac-ft/yr assumed to be available without the construction of seasonal storage, as described in Section 4.2.2.

Table 8-9. Supply and Demand Comparison-Single Dry Year – Plan Area, ac-ft/yr

	2020	2025	2030	2035	2040	2045	2050	Buildout (2051)
Supplies, no facility constraints								
US Bureau of Reclamation-CVP supply allocation	16,000	13,100	14,700	16,900	19,400	22,000	22,500	22,500
Appropriative water								
City of Sacramento American River POU water rights								
Other surface water supplies	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
Groundwater	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
Remediated groundwater	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
Supply total	106,300	103,400	105,000	107,300	109,800	112,500	114,300	114,300
Demand	45,400	55,300	64,200	73,100	82,300	91,800	101,600	103,800
Difference	60,900	48,100	40,800	34,200	27,500	20,700	12,700	67,500

a. Only 35,000 ac-ft/yr assumed to be available without the construction of seasonal storage, as described in Section 4.2.2.
Note: The water demand projection and the dry year CVP supply allocation have not been revised for this WSMP amendment.

Table 8-10. Supply and Demand Comparison-Multiple Dry Years – Plan Area, ac-ft/yr

Year		2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
First year	Supplies								
	US Bureau of Reclamation-CVP supply	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000
	Appropriative water [a]	71,000	71,000	71,000	71,000	71,000	71,000	71,000	71,000
	City of Sacramento American River POU water rights	9,300	9,300	9,300	9,300	9,300	9,300	9,300	9,300
	Other surface water supplies	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
	Groundwater	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
	Remediated groundwater	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
	Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
	Supply totals	185,500	185,500	185,500	185,500	185,500	185,500	187,100	187,100
	Demand	45,400	55,300	64,200	73,100	82,300	91,800	101,600	103,800
	Difference	140,100	130,200	121,300	112,400	103,200	93,700	85,500	83,300
Second year	Supplies								
	US Bureau of Reclamation-CVP supply	24,000	19,700	21,900	25,100	28,800	32,600	33,800	33,800
	Appropriative water	-	-	-	-	-	-	-	-
	City of Sacramento American River POU water rights	-	-	-	-	-	-	-	-
	Other surface water supplies	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
	Groundwater	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
	Remediated groundwater	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
	Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
	Supply totals	114,200	109,900	112,100	115,300	119,000	122,800	125,600	125,600
	Demand	45,400	55,300	64,200	73,100	82,300	91,800	101,600	103,800
	Difference	68,900	54,700	48,100	42,700	37,300	31,900	24,000	21,800
Third year	Supplies								
	US Bureau of Reclamation-CVP supply	16,000	13,100	14,600	16,800	19,200	21,800	22,500	22,500
	Appropriative water	-	-	-	-	-	-	-	-
	City of Sacramento American River POU water rights	-	-	-	-	-	-	-	-
	Other surface water supplies	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
	Groundwater	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
	Remediated groundwater	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
	Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
	Supply totals	106,200	103,300	104,800	107,000	109,400	112,000	114,300	114,300
	Demand	45,400	55,300	64,200	73,100	82,300	91,800	101,600	103,800
	Difference	60,900	48,100	40,800	34,200	27,500	20,700	12,700	10,500

Note: The water demand projection and the dry year CVP supply allocation have not been revised for this WSMP amendment.
a. Only 35,000 ac-ft/yr assumed to be available without the construction of seasonal storage, as described in Section 4.2.2.

As can be seen in Tables 8-8, 8-9, and 8-10, as well as in Appendix C, the total water supply capacity is greater than the projected demands. This analysis verifies the sufficiency of the water supply for the Plan Area scenario.

8.2.3 Storage and Pumping Station Capacity Evaluation

Table 8-11 and 8-12 presents a summary comparison of the planned to required storage volume and pumping station capacities for this scenario. As shown in Tables 8-11 and 8-12, the planned storage facilities provide more than the required storage volumes and pump station capacities. No additional storage and/or pump station projects are required to support the Plan Area scenario compared to the Baseline scenario. The detailed storage evaluation tables for each pressure zone are presented in Appendix C.

Table 8-11. Zone 40 Storage Capacity Evaluation Summary – Plan Area

	Phase 1 (2020-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2052)
Provided storage volume, MG			
Existing	42.2	42.2	42.2
Future	13.5	17.5	36.0
Total	55.7	59.7	78.2
Required storage volume, MG			
Equalization	19.0	25.5	34.7
Fire	3.8	3.8	3.8
Emergency	15.8	21.3	28.9
Total	38.6	50.6	67.4
Difference (provided minus required)	17.1	9.1	10.8

Table 8-12. Zone 40 Pump Station Capacity Evaluation Summary – Plan Area

	Phase 1 (2020-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2052)
Provided pump station capacity from storage, mgd			
Existing	118.2	112.3	103.4
Future	20.5	32.6	88.1
Total	138.7	144.9	191.5
Required pump station capacity from storage, mgd	96.6	127.9	173.1
Difference (provided minus required)	42.1	17.0	18.4

8.3 Water System Facilities and Capital Improvement Program

This section describes the water modeling analysis performed and the water system facilities needed to supply the Plan Area scenario.

8.3.1 Evaluation of System Feasibility to Supply Plan Area

This section evaluates the Zone 40 supply and distribution system infrastructure capacity to convey water to the Plan Area. The Plan Area would be connected to the existing distribution system in the CSA on Grant Line Road as described in the Wood Rogers report (Elk Grove, July 2020).

The maximum day, peak hour, and fire flow demands for the Plan Area will be primarily supplied from the East Elk Grove GWTP and to some extent from the East Park GWTP. Both of these facilities have ground level storage and pump stations. Water is conveyed from these facilities to the Plan Area south down Waterman Road with an existing 24-inch diameter pipeline. This pipeline has a peak hour flow capacity of 14 mgd and a fire flow capacity of 20 mgd. A future 16-inch pipeline is planned for Grant Line Road that will provide additional supply capacity to the Plan Area from a future Bond GWTP that will be located to the north.

Table 8-13 compares the supply capacities from these to two GWTPs to the buildout demands for the two planning subareas in the southern part of the CSA and the Plan Area. As shown in Table 8-13, there is adequate supply capacity to meet the demands of the Plan Area.

Table 8-13. Supply to Demand Comparison, mgd

	Maximum day	Peak hour	Maximum Day Plus Fire Flow
Supplies			
East Elk Grove GWTP			
Existing	6.5	13.0	13.0
Future	6.5	13.0	13.0
East Park GWTP	2.9	3.5	3.5
Total	15.9	29.5	29.5
Demands			
Elk Grove Wholesale	6.0	12.0	12.0
Grantline 99	0.5	1.0	1.0
Plan Area	2.5	5.0	8.3
Total	9.0	18.0	21.3

SCWA's buildout water model was used to evaluate the water system's ability to supply additional water demands associated with the Plan Area. The buildout water model includes all improvements included in the Baseline scenario as discussed in Section 7.

As the Plan Area is proposed to be located within the CSA, it would be supplied by the SSA-CSA pressure zone. There are two proposed connection points to the existing mains in Grant Line Road.

Water performance was analyzed using a water system model provided by SCWA to ensure the Plan Area can be adequately supplied while meeting design requirements set by the 2016 WSIP. A minimum pressure of 35 psi for distribution mains and 40 psi for transmission mains and a maximum velocity of 7 feet/second (fps) is required under peak hour demand conditions to meet operating goals. A minimum pressure of 20 psi for distribution mains and 25 psi for transmission mains and a maximum velocity of 10 fps is required under maximum day plus fire flow conditions (4,000 gpm).

The following modeling scenarios were prepared and analyzed:

1. Phase 1
    a. Maximum Day Demand
    b. Peak Hour Demand
    c. Maximum Day Demand plus Fire flow (4,000 gpm)
2. Phase 2
    a. Maximum Day Demand
    b. Peak Hour Demand
    c. Maximum Day Demand plus Fire flow (4,000 gpm)
3. Buildout
    a. Maximum Day Demand
    b. Peak Hour Demand
    c. Maximum Day Demand plus Fire flow (4,000 gpm)

Modeling results for these scenarios indicate all operating goals are satisfied. The water system facilities needed to serve the buildout demands are the same as the facilities defined for the Baseline scenario. The expansion of the East Elk Grove GWTP and the extension of the proposed watermain in Grant Line Road are the major CIP projects that impact the Plan Area at buildout. They are both already included in Phase 3 CIP to support the Baseline scenario.

Water modeling results are not included in this report but were presented to SCWA and the City of Elk Grove as a separate technical memorandum.

8.3.2 Capital Improvement Program

The water system improvements defined for the Baseline scenario in Section 7.3 are the same as required for the Plan Area scenario. The exception is that additional water transmission pipelines will be needed to convey water from the interconnections in Grant Line Road to within the Plan Area. A total of 6,645 feet of 16-in transmission main will be required. This Plan Area transmission main will add $3 million to the total Phase 1 CIP cost presented in Table 7-17 (Elk Grove, 2020).

Section 9

References

Brown and Caldwell. 2010 Census Analysis. February 2012.

California Department of Water Resources. California's Groundwater. Bulletin 118. Update 2003. October.

California Department of Water Resources. California's Groundwater. Bulletin 118. Update 2003. October.

Davis Engineering. Sacramento Central Groundwater Authority 2011-2012 Agricultural Demand and Groundwater Pumping Estimates. May 2014.

Elk Grove, City of, and Sacramento County Water Agency. Elk Grove Multi-Sport Complex & Grant Line Industrial Annexation Area Final Water Study. Prepared by Wood Rogers. October 1, 2020.

Freeport Regional Water Authority and US Department of the Interior, Bureau of Reclamation. Freeport Regional Water Project Draft Environmental Impact Report/Environmental Impact Statement. July 2003.

Luhdorff and Scalmanini. Sutter Pointe Specific Plan Groundwater Supply Assessment. 2008.

Sacramento, City of. 2015 Urban Water Management Plan. June 2016.

Sacramento Central Groundwater Authority. Basin Management Report 2009-2010.

Sacramento County Water Agency and Water Forum. Central Sacramento County Groundwater Management Plan. February 2006.

Sacramento County Water Agency. First Amended and Restated Master Water Agreement between Sacramento County Water Agency and Florin Resource Conservation District/Elk Grove Water Service, Successors-in-Interest to Elk Grove Water Works. June 2002.

Sacramento County Water Agency. Zone 40 Water Supply Master Plan. February 2005.

Sacramento County Water Agency. Zone 40 Water Supply Master Plan Amendment for the Cordova Hills Project. December 2011.

Sacramento County Water Agency. Zone 40 Water System Infrastructure Plan. April 2006.

Sacramento County Water Agency. 2010 SCWA Urban Water Management Plan. 2011.

Sacramento County Water Agency. 2015 SCWA Urban Water Management Plan. June 2016.

Sacramento County Water Agency. Zone 40 Residential Unit Water Demand Factors. August 2013.

Sacramento County Water Agency. Zone 40 Water Supply Master Plan Amendment for the Jackson Township Project. February 2016.

Sacramento County Water Agency. Zone 40 Water Supply Master Plan Amendment for the NewBridge Project. February 2016.

Sacramento County Water Agency. Zone 40 Water Supply Master Plan Amendment for the West Jackson Project. February 2016.

Sacramento County Water Agency. Zone 40 Water System Infrastructure Plan Update. September 2016.

Sacramento Suburban Water District, Water System Master Plan. July 2009.

Sutter Pointe Specific Plan Groundwater Supply Assessment, Table 5-2.

US Department of the Interior, Bureau of Reclamation. Central Valley Project Municipal and Industrial Water Shortage Policy Scoping Report. July 2011.

US Department of the Interior, Bureau of Reclamation. Draft Central Valley Project, M&I Water Shortage Policy. September 2001.

US Department of the Interior, Bureau of Reclamation. Summary of Water Supply Allocations. 2013.

US Department of the Interior, Bureau of Reclamation. Water Supply and Yield Study. March 2008.

Water Forum Agreement. January 2000.

Appendix A: Zone 40 Residential Unit Water Demand Factors Technical Memorandum

This page intentionally left blank.

SACRAMENTO COUNTY WATER AGENCY
INTER-OFFICE CORRESPONDENCE
Department Of Water Resources

TECHINICAL MEMORANDUM

TO: Kerry Schmitz, Principal Civil Engineer; Darrell Eck, Senior Civil Engineer

FROM: SCWA Staff

DATE: 08/30/2013

SUBJECT: Zone 40 Residential Unit Water Demand Factors

This memo documents an evaluation of current Zone 40 residential unit demand factors based on multiple years of historical water meter data.

BACKGROUND

Water demands based on land use data is the preferred approach in developing water demand projections for existing and new growth areas in Zone 40. Combining land use and historical water demand information links water use and land use to a specific geographic location. This linkage of geography and water demand data becomes more apparent when modeling the water distribution system.

During the Water Forum negotiations (1993 to 2000), Boyle Engineering provided stakeholders with a technical methodology for deriving unit water demand factors based on water use data and county land use data. As a result of this effort a set of unit water demand factors (UWDF) were developed for SCWA and other water purveyors that were based on the Sacramento County regional average water use as described in the "Estimate of Annual Water Demand within Sacramento-Wide Area", (Boyle, May 1995). In this report water demand factors were determined based on 1990 land and water use data rather than actual retail customer data. The report goes on to state:

"To overcome the general incompleteness of the water use information, a methodology was developed wherein the ratio of water demand factors from the 1991 City (of Sacramento) Study was utilized as a basis for apportionment of water use to the specific land use categories in the urban water agencies...the water demand factors were then proportionately scaled up or down to balance the total 1990 water usage with the particular district."

The Water Forum average annual UWDFs were used in determining the unit water demand factors identified in the 2005 Zone 40 Water Supply Master Plan (WSMP), as shown in Table 1. The left column (Land Use Category) identifies the broad land use categories used at the time of the development of the WSMP. The middle column represents the UWDFs for year 2000. The right-hand column represents the UWDFs for Water Forum Buildout – year 2030 which shows reduced unit water demands of 25.6 percent as a result of water conservation measures mandated in the WFA.

Table 1. Zone 40 Unit Water Demand Factors for Year 2000 and Year 2030 in Ac-Ft/Acre

Land UseCategory	2000	2030
Rural Estate	1.57	1.33
Single Family	3.4	2.89
Multi-Family - Low Density	4.36	3.7
Multi-Family - High Density	4.85	4.12
Commercial	3.24	2.75
Industrial	3.19	2.71
Industrial - Unutilized	0	0
Public	1.22	1.04
Public Recreation	4.08	3.46
Mixed Land Use	2.95	2.51
Right-of-Way	0.25	0.21
Vacant	0	0
Agriculture	0	0

Source: 2005 Zone 40 Water Supply Mater Plan, Tables 2-1 and Table 2-2.

HISTORICAL METER DATA

Since the late 90s and early 2000, meters have been installed increasingly on SCWA's existing and new retail customers. Currently, approximately 90% of SCWA's retail customers have active water meters. Meters for the balance of SCWA's retail customers continue to be added/retrofitted, it is projected that nearly all customers will be metered by 2015. For those meters already in use, a large volume of water usage data has been collected for the purpose of billing (for older metered accounts a considerable amount of water usage data is available). For the purposes of this analysis historical meter data was obtained from the County Utilities Billing System (CUBS).

SCWA collects water usage data every two months. Accordingly, annual water use for each customer should be the total of the six readings recorded each year. In addition to water usage data, Assessor's Parcel Number (APN), and the zoning (land use) information are also available as part of the meter data set.

The historical meter data set was then used to evaluate the Zone 40 UWDFs. Specifically,

1) to develop UWDFs based on the SCWA's actual water usage data rather than the Sacramento regional average water usage developed more than a decade ago.
2) to validate the 2030 UWDFs that assume a 25.6 percent (relative to year 2000) reduction in water demand when implementing the water conservation practices recommendated in the WFA.

The resulting UWDF's from this analysis should provide SCWA staff with information relative to meeting the conservation targets set by the WFA and an ability to decide if changes should be made to the UWDFs represented in the water supply master plan.

METHODOLOGY

The meter data set was processed using Microsoft Access (Access). **Figure 1** shows a sample of the meter database. The first column is "ID", containing the sequence number for each record. The second column is "APN" number associated with each customer. APN number is also a field used to filter out customers that are not inside Zone 40. The third column is "ReadingDate" that shows the reading date for each record. The fourth column is "Reading" that shows the actual meter reading for each record in hundred cubic feet (ccf). The fifth column is "Consumption" that shows the water usage in cubic feet. The last column contains the Zoning information for each customer's property.

ID	APN	ReadingDc	Reading	Consumpti	Zoning
668679	12108001590000	10/10/2011	1959	1200	RD 7
668680	12108001590000	10/11/2011	1959	0	RD 7
668681	12108001590000	11/21/2011	1987	2800	RD 7
668682	12108001590000	1/18/2012	2006	1900	RD 7
668683	12108001590000	3/19/2012	2016	1000	RD 7
668684	12108001590000	5/18/2012	2035	1900	RD 7
668685	12108001590000	7/19/2012	2074	3900	RD 7
668686	12108001590000	9/19/2012	2111	3700	RD 7
668687	12108001590000	11/20/2012	2138	2700	RD 7
668688	12108001600000	8/10/2004	1393	0	RD 7
668689	12108001600000	11/19/2004	1463	7000	RD 7
668690	12108001600000	1/21/2005	1478	1500	RD 7
668691	12108001600000	3/17/2005	1501	2300	RD 7
668692	12108001600000	5/17/2005	1534	3300	RD 7
668693	12108001600000	7/20/2005	1599	6500	RD 7
668694	12108001600000	9/15/2005	1650	5100	RD 7
668695	12108001600000	11/17/2005	1693	4300	RD 7
668696	12108001600000	1/19/2006	1717	2400	RD 7
668697	12108001600000	3/16/2006	1731	1400	RD 7
668698	12108001600000	5/19/2006	1760	2900	RD 7
668699	12108001600000	7/20/2006	1822	6200	RD 7
668700	12108001600000	9/19/2006	1880	5800	RD 7
668701	12108001600000	11/16/2006	1917	3700	RD 7
668702	12108001600000	1/16/2007	1937	2000	RD 7
668703	12108001600000	3/13/2007	1954	1700	RD 7
668704	12108001600000	5/19/2007	1985	3100	RD 7
668705	12108001600000	7/20/2007	2043	5800	RD 7
668706	12108001600000	9/24/2007	2115	7200	RD 7
668707	12108001600000	11/20/2007	2150	3500	RD 7

Record: 1 of 2069208 No Filter Search

Figure 1. Sample of Meter Database

There are over 2 million records in the meter database. The meter data needs to be processed properly to assess the water usage of each land use category in a particular year. This was achieved by creating queries in Access. **Figure 2** shows an example of a query created for water ususage for property zoned RD 7 in 2012. For each meter account the query results shows its APN number, lot size, zoning, and total water usage. Average water usage and lot size are then calculated for all the filtered records. The UWDF is then calculated by diving the average water ususage by the average lot size. Figure 3 provides a screenshot of the above referenced query.

Similarily, the UWDFs for each residential land use catagory were calculated for 2005 through 2012. The UWDFs for non-residential land use were not calculated for this TM.

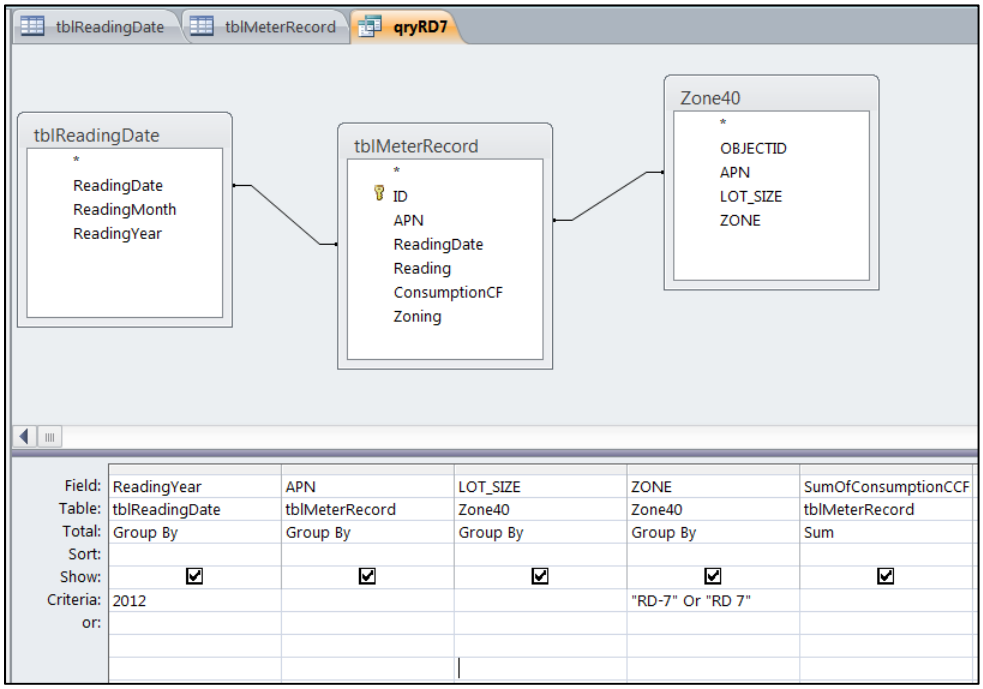


Figure 2. Example of Establishing A Query in the Meter Database

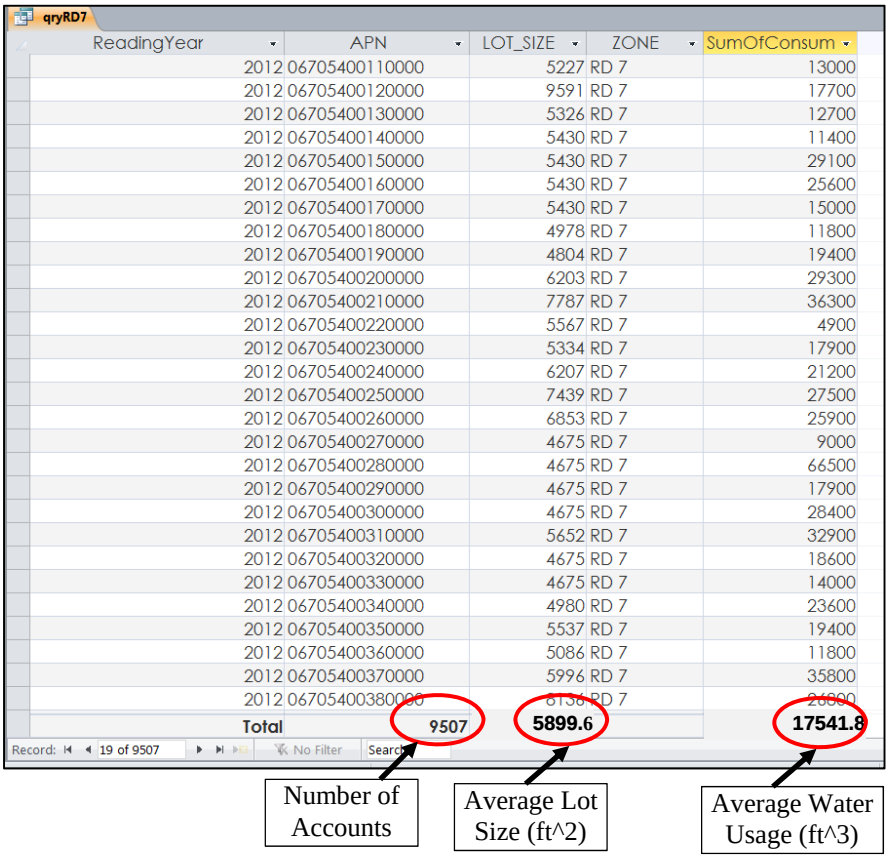


Figure 3. Sample Screenshot of the Query Result for RD 7 in 2012

UNIT WATER DEMAND FACTORS BASED ON METER DATA

The UWDF for each residential land use category for each year are shown in **Table 2** below. **Table 2** indicates that there is a significant variation in UWDFs which generally increase with dwelling density. For example, the UWDF is 1.31 Ac-Ft/Acre for RD 1, 2.66 Ac-Ft/Acre for RD 5, and 3.82 Ac-Ft/Acre for RD 20.

Another observation from **Table 2**, despite the varation certain dwelling density groups have UWDFs that are relatively close in value. Based on this "closeness" four residential categories were identified. They include:

1) Very low density residential (VLDR), for RD 1 and RD 2.
2) Low density residential (LDR), for RD 3 to RD 5.
3) Midium density residential (MDR), for RD 7 to RD 15, and
4) High density residential (HDR), for RD 20.

The UWDFs for these four categories are shown **in Figures 4 to 7**, respectively. **Figures 4** to **6** show that for lower density residential categories (MDR and below) the UWDFs increased from 2005 to

2008 and then trended down over the next four years. The trend generally coincides with impacts to the broad national and regional economy, but also could be attributed to the weather, rising water rates, as well as water conservation measures implemented by property owners. For higher density residential (see **Figure 7)** this trend is not repeated. In fact, the UWDF for higher density residential actually increased slightly over the past couple of years.

Table 2. Zone 40 Unit Water Demand Factors Based on Meter Data, Unit: Ac-Ft/Acre

Year	Very Low Density Residential (VLDR)		Low Density Residential (LDR)			Medium Density Residential (MDR)			High Density Residential (HDR)
	RD 1	RD 2	RD 3	RD 4	RD 5	RD 7	RD 10	RD 15	RD 20
2005	1.47	2.06	2.74	2.64	2.95	3.42	2.39	3.70	3.07
2006	1.62	2.10	2.69	3.01	3.22	3.76	3.43	3.66	3.77
2007	1.72	2.33	3.04	3.19	3.43	3.97	3.93	4.13	3.74
2008	1.72	2.35	2.97	3.14	3.34	3.86	3.83	3.11	4.07
2009	1.43	1.99	2.66	2.83	2.98	3.43	3.44	3.19	3.76
2010	1.35	1.86	2.45	2.57	2.73	3.13	3.22	3.20	3.60
2011	1.23	1.80	2.37	2.51	2.66	3.04	3.13	3.16	4.38
2012	1.31	1.99	2.55	2.54	2.66	2.97	2.93	2.96	3.82

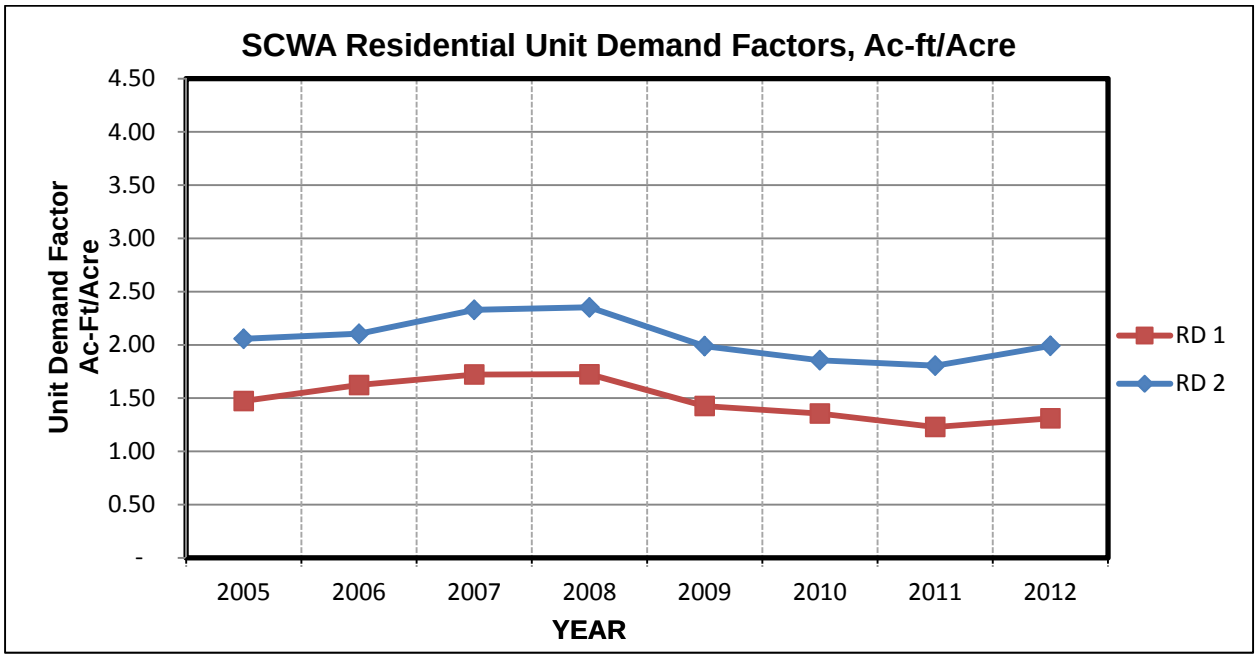


Figure 4. Unit Water Demand Factors for VLDR

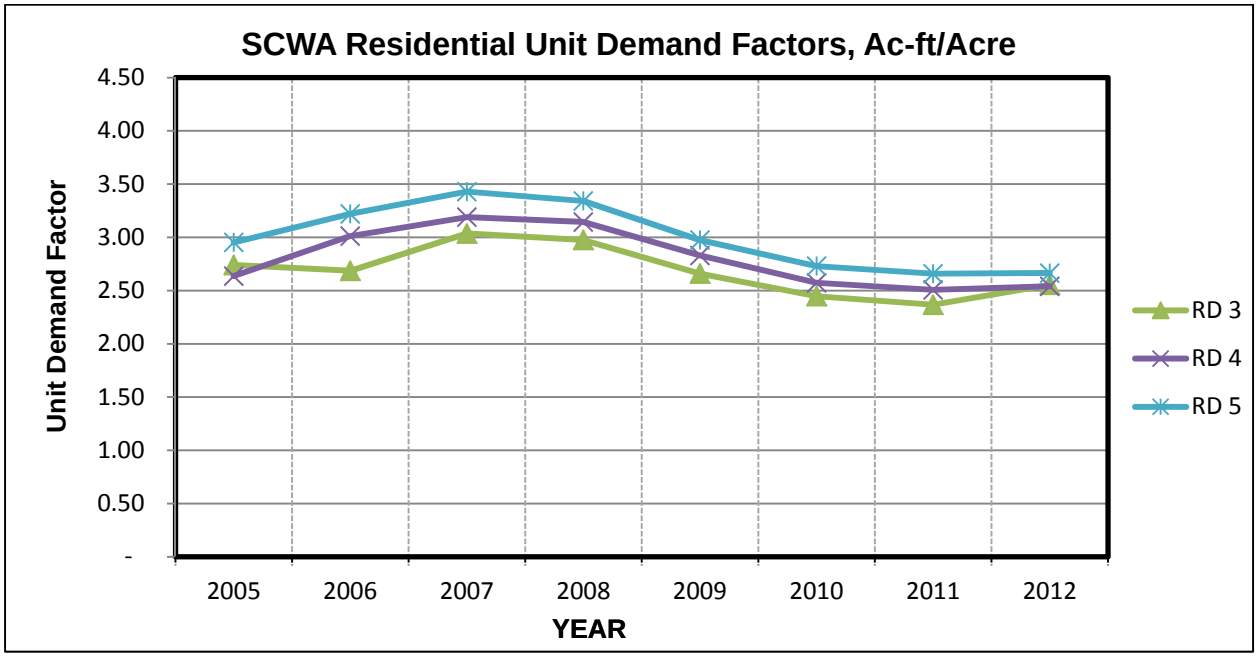


Figure 5. Unit Water Demand Factors for LDR

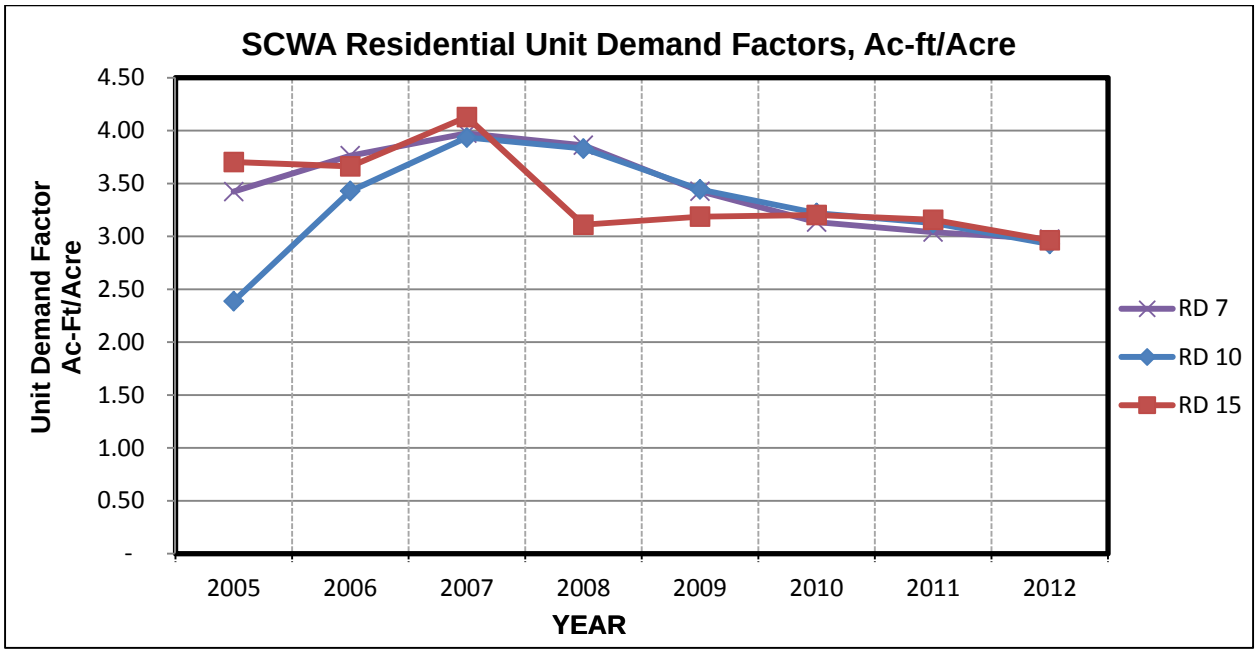


Figure 6. Unit Water Demand Factors for MDR

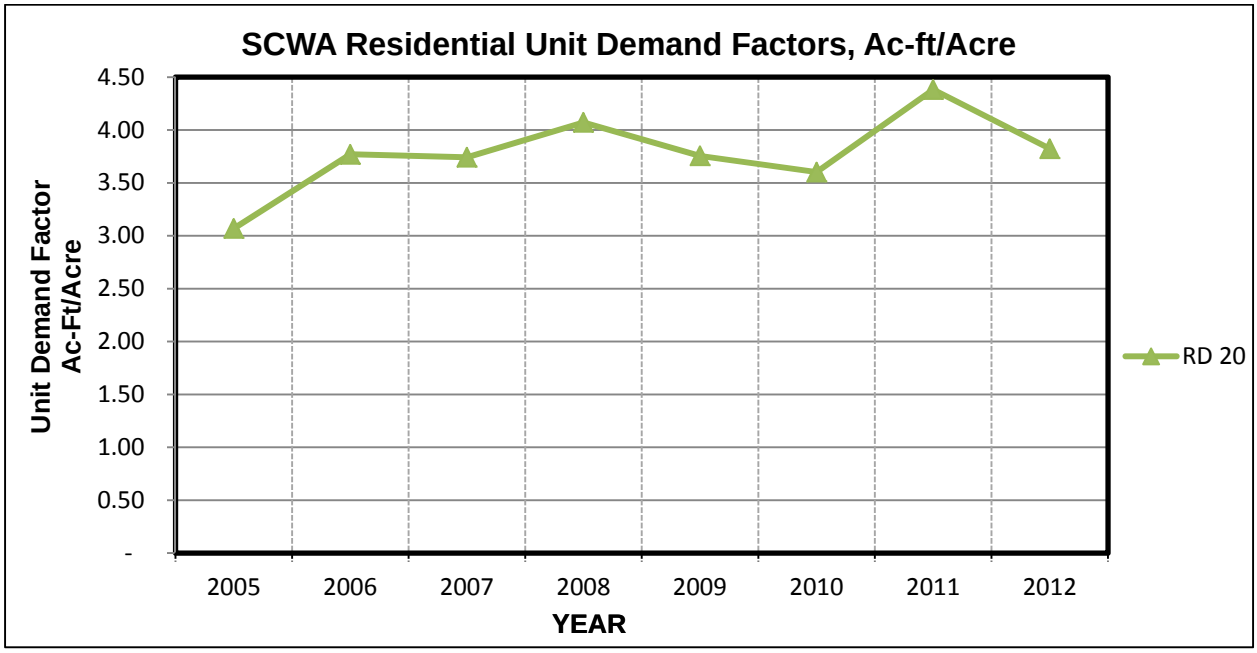


Figure 7. Unit Water Demand Factors for High Density Residential

Table 3 shows the total number of meter accounts for each zoning type from 2005 to 2012. The large majority of meter accounts are associated with RD 4, RD 5, and RD 7 zoning. In 2012, there were 32,930 meter accounts in Zone 40 that were used for this analysis. Of these accounts 0.5% were very low density residential, 64.4% were low density residential, 32.3% were medium density, and 2.7% were high density residential. **Table 4** shows the average lot size in square feet of each residential zoning type.

Table 3. Total Number of Residential Meter Accounts in Zone 40

Year	RD 1	RD 2	RD 3	RD 4	RD 5	RD 7	RD 10	RD 15	RD 20
2005	47	114	179	2,130	13,807	8,120	412	197	684
2006	48	116	200	2,441	15,385	8,853	773	228	737
2007	48	118	202	2,638	16,303	9,071	831	229	765
2008	48	118	209	2,782	16,808	9,302	875	235	868
2009	49	118	209	2,820	17,086	9,377	884	239	881
2010	48	118	209	2,894	17,421	9,423	893	239	887
2011	49	118	209	2,955	17,665	9,445	897	239	897
2012	49	118	209	3,024	17,983	9,507	899	239	902

Table 4. Average Residential Lot Size in Zone 40, 2005 – 2012 in Square Feet

Year	RD 1	RD 2	RD 3	RD 4	RD 5	RD 7	RD 10	RD 15	RD 20
2005	46,044	22,692	11,897	9,592	7,992	5,860	5,803	5,376	11,862
2006	46,292	22,685	11,750	9,720	7,952	5,846	5,267	5,281	11,653
2007	46,292	22,682	11,767	9,717	7,966	5,837	5,375	5,277	12,804
2008	46,292	22,682	11,888	9,738	7,956	5,841	5,380	6,681	11,814
2009	47,036	22,682	11,888	9,752	7,948	5,838	5,385	6,649	11,973
2010	46,292	22,682	11,888	9,777	7,928	5,898	5,372	6,649	11,913
2011	47,036	22,682	11,888	9,775	7,916	5,900	5,371	6,649	11,803
2012	47,036	22,682	11,888	9,770	7,897	5,900	5,373	6,649	12,453

In water supply planning, water demand estimates are typically performed by applying the UWDF to the acreage of a certain land use category. Most often, the density information (dwelling units per acre) are not specified in a land use map, particularly in the general plan process or early planning stages of a development project. Parcels planned for development are generally identified as “very low density residential”, “low density residential”, “medium density residential”, or “high density residential”. This necessitates the development of a composite UWDF to represent each category.

By using the information provided in **Tables 2** to **4**, a weighted average UWDF was developed for each category. Further, a three-year moving average was calculated for these composite UWDFs to take into account various hydrologic conditions and weather (see **Table 5)**. An average of the previous three years (as opposed to a longer period) is preferred because it is more representative of the current water use pattern as well as reflective of water conservation measures taken. Therefore, the numbers shown in the last row (highlighted) of **Table 5** are recommended as the current UWDF for each residential category.

Table 5. Three-Year Moving Average Unit Water Demand Factors in Ac-Ft/Acre

Year	Very Low Density Residential (VLDR)	Low Density Residential (LDR)	Midium Density Residential (MDR)	High Density Residential (HDR)
2005				
2006				
2007	2.00	3.15	3.70	3.53
2008	2.10	3.29	3.85	3.86
2009	2.05	3.21	3.75	3.86
2010	1.90	2.98	3.47	3.81
2011	1.72	2.76	3.20	3.91
2012	1.71	2.66	3.05	3.94

NET ACREAGE AND GROSS ACREAGE BASED UNIT WATER DEMAND FACTORS

Net acreage is defined as the acreage of all residential lots in a subdivision excluding minor streets. Gross acreage is defined as the total acreage of a subdivision including all residential lots and minor streets. Typically, approximately 20% of the land is dedicated to minor streets in a subdivision.

To calculate projected water demand for a subdivision, the UWDF corresponding to the planned land use category is multiplied by the acreage of a subdivision. If net acreage is used, then a net acreage based UWDF should be applied. Similarily, if the gross acreage is used then a gross acreage based UWDF should be applied.

The UWDFs developed from meter data and shown in **Table 5** are net acreage based. To convert to gross net acreage based value, the net acreage based UWDF should be reduced by 20% to take into account acreage for minor streets. **Table 6** shows the net acreage and gross acreage based UWDFs.

Table 6. Net Acreage and Gross Acreage Based Water Demand Factors in Ac-Ft/Acre

Land Use Category	Net Acreage Based	Gross Acreage Based
Very Low Density Residential (VLDR)	1.71	1.37
Low Density Residential (LDR)	2.66	2.13
Midium Density Residential (MDR)	3.05	2.44
High Density Residential (HDR)	3.94	3.15

COMPARISION TO WSMP

As mentioned earlier, the UWDF in the WSMP for build-out was developed based on a combination of regional water and land use data and an assumption of a 25.6% demand reduction as a result of conservation measures mandated by the WFA. By using extensive historical meter data, the UWDFs developed in this TM should give staff a higher level of confidence when evaluating future water demands and water supply reliablity. **Table 7** shows how UWDFs developed based on meter data in this TM compared to those in the current WSMP. It should be noted that the UWDFs in the WSMP are gross acreage based values.

As shown in **Table 7**, the UWDFs developed in this TM are lower than those in the WSMP, with the exception of the “very low density residential” category, which is only slightly higher. The UWDF of 2.89 Ac-Ft/Acre for “Single Family Residential” in the WSMP (corresponding ot “Low Density

Residential") is now 2.13 Ac-Ft/Acre based on meter data. The value for "Multi-Family Low Density" (corresponding to "Medium Density Residential") is 3.70 Ac-Ft/Acre in the WSMP as opposed to 2.44 Ac-Ft/Acre based on meter data. For "Multi-Family High Density" (corresponding to "High Density Residential") the value is 4.12 Ac-Ft/Acre in the WSMP compared to 3.15 Ac-ft/Acre based on meter data.

Table 7. Comparison of Unit Water Demand Factors between WSMP and This TM, in Ac-Ft/Acre

Land Use Category in WSMP	Land Use Category in This TM	2030 Unit Water Demand Factor in WSMP	Unit Water Demand Factor Based on Meter Data (Gross Acreage Based)
Rural Estate	Very Low Density Residential (VLDR)	1.33	1.37
Single Family	Low Density Residential (LDR)	2.89	2.13
Multi-Family - Low Density	Midium Density Residential (MDR)	3.70	2.44
Multi-Family - High Density	High Density Residential (HDR)	4.12	3.15

RECOMMENDATIONS

SCWA's meter database provides a extensive historical water use record of its customers. Using a sound statistical approach, along with the land use information in the meter database, a UWDF was developed for each residential density category. This process when compared to the approach taken in the 2005 WSMP has the following advantages:

- The meter data is unique to Zone 40
- The meter data covers a long period of time
- The UWDFs for buildout in the WSMP are projected or targeted numbers assuming a reduction of 25.6% of water use (relative to year 2000) due to improved conservation practices. The UWDFs based on meter data are not projected or targeted numbers instead, they represent the actual historical water use.

The resulting UWDFs indicate that those referenced in the WSMP were overestimated. It also indicates that SCWA has been moving in the right direction with regard to water conservation and demand management. It is recommended that the results documented in this TM should be considered for incorporation in future water supply master plan updates and other water planning documents.

For non-residential/commercial customers, the UWDFs have not been evaluated based on meter data in this TM, primarily due to low number of meter accounts and a greater variation in water use

because of significant differences in commercial activities. It is recommended that the UWDFs currently described in the WSMP continue to be used for non-residential/commercial applications until more data becomes available.

Appendix B: Baseline Supply and Demand Comparison Tables

This page intentionally left blank.

Table B-1. Maximum Day Demand to Supply Comparison for NSA, mgd

NSA			Phase 1			Phase 2		Phase 3			
		2013	2015	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Demand											
	Maximum day	7.4	9.5	13.1	18.1	23.5	31.3	39.9	49.0	58.6	62.4
Existing supply capacity											
	Mather Housing GWTP	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	Anatolia GWTP	6.5	6.5								
	total groundwater	12.5	12.5	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	Vineyard SWTP										
	Total	12.5	12.5	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Planned future supply capacity											
	surface water, Vineyard SWTP			16.0	32.5	32.5	32.5	33.9	65.0	65.0	65.0
Total supply capacity											
	groundwater	12.5	12.5	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	surface water	0.0	0.0	16.0	32.5	32.5	32.5	33.9	65.0	65.0	65.0
	Total	12.5	12.5	22.0	38.5	38.5	38.5	39.9	71.0	71.0	71.0
Use of supply: average/wet years											
	groundwater	7.4	9.5	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0
	surface water	0.0	0.0	13.1	18.1	23.5	31.3	33.9	49.0	58.6	62.4
	Total	7.4	9.5	13.1	18.1	23.5	31.3	39.9	49.0	58.6	62.4
Use of supply: dry years											
	groundwater	7.4	9.5	2.0	2.0	2.0	2.0	6.0	6.0	2.0	2.0
	surface water	0.0	0.0	11.1	16.1	21.5	29.3	33.9	43.0	56.6	60.4
	Total	7.4	9.5	13.1	18.1	23.5	31.3	39.9	49.0	58.6	62.4

Table B-2. Maximum Day Demand to Supply Comparison for CSA, mgd

CSA			Phase 1			Phase 2		Phase 3			
		2013	2015	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Demand											
	Maximum day	27.0	29.2	32.9	37.9	43.0	50.2	57.9	65.7	73.8	74.0
Existing supply capacity											
	Calvine Meadows GWTP	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	East Elk Grove GWTP	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
	East Park GWTP	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
	Waterman GWTP	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6
	Wildhawk GWTP	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
	CSA DirectFeed	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
	total groundwater	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4
	Vineyard SWTP	50.0	50.0	34.0	17.5	17.5	17.5	16.1	17.5	17.5	17.5
	Total	84.4	84.4	68.4	51.9	51.9	51.9	50.5	51.9	51.9	51.9
Planned future supply capacity											
	West Jackson GWTP					9.0	18.0	18.0	18.0	18.0	18.0
	Bond GWTP									6.5	6.5
	East Elk Grove GWTP expansion									6.5	6.5
	total groundwater					9.0	18.0	18.0	18.0	31.0	31.0
	Vineyard SWTP expansion								17.5	17.5	17.5
	City POU supply										19.1
	total surface water								17.5	17.5	36.6
Total supply capacity											
	groundwater	34.4	34.4	34.4	34.4	43.4	52.4	52.4	52.4	65.4	65.4
	surface water	50.0	50.0	34.0	17.5	17.5	17.5	16.1	35.0	35.0	54.1
	Total	84.4	84.4	68.4	51.9	60.9	69.9	68.5	87.4	100.4	119.5
Use of supply: average/wet years											
	groundwater	0.0	0.0	0.0	20.4	25.5	32.7	41.8	30.7	38.8	19.9
	surface water	27.0	29.2	32.9	17.5	17.5	17.5	16.1	35.0	35.0	54.1
	Total	27.0	29.2	32.9	37.9	43.0	50.2	57.9	65.7	73.8	74.0
Use of supply: dry years											
	groundwater	27.0	29.2	32.9	34.4	43.0	50.2	52.4	52.4	65.4	65.4
	surface water	0.0	0.0	0.0	3.5	0.0	0.0	5.5	13.3	8.4	8.6
	Total	27.0	29.2	32.9	37.9	43.0	50.2	57.9	65.7	73.8	74.0

Table B-3. Maximum Day Demand to Supply Comparison for SSA, mgd

SSA			Phase 1			Phase 2		Phase 3			
		2013	2015	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Demand											
	Maximum day	27.1	30.5	35.2	40.3	45.7	46.6	46.6	46.6	46.6	46.6
Existing supply capacity											
	Big Horn GWTP	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
	Dwight Road GWTP	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
	Lakeside GWTP	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
	Poppy Ridge GWTP	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
	SSA Direct Feed	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	total groundwater	25.6	25.6	25.6	25.6	25.6	25.6	25.6	25.6	25.6	25.6
	Franklin Intertie to City	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1
	SSA Recycled Water	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	Total	65.3	65.3	65.3	65.3	65.3	65.3	65.3	65.3	65.3	65.3
Planned future supply capacity											
	Poppy Ridge GWTP expansion				6.5	6.5	6.5	6.5	6.5	6.5	6.5
	Big Horn GWTP expansion						8.5	8.5	8.5	8.5	8.5
	Franklin GWTP									7.0	7.0
	Whitelock GWTP										13.0
	total groundwater			0.0	6.5	6.5	15.0	15.0	15.0	22.0	35.0
	recycled water									2.9	2.9
Total supply capacity											
	groundwater	25.6	25.6	25.6	32.1	32.1	40.6	40.6	40.6	47.6	60.6
	surface water	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1
	recycled water	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.9	5.9
	Total	39.7	39.7	39.7	46.2	46.2	54.7	54.7	54.7	64.6	64.6
Use of supply: average/wet years											
	groundwater	13.0	16.4	21.1	26.2	31.6	32.5	32.5	32.5	29.7	29.7
	surface water	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1
	recycled water	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.9	5.9
	Total	27.1	30.5	35.2	40.3	45.7	46.6	46.6	46.6	46.6	46.6
Use of supply: dry years											
	groundwater	24.1	25.6	25.6	32.1	32.1	40.6	40.6	40.6	40.8	40.8
	surface water	0.0	1.9	6.6	5.2	10.6	3.0	3.0	3.0	0.0	0.0
	recycled water	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.9	5.9
	Total	27.1	30.5	35.2	40.3	45.7	46.6	46.6	46.6	46.6	46.6

Table B-4. Maximum Day Demand to Supply Comparison for Zone 40, mgd

Zone 40			Phase 1			Phase 2			Phase 3		
		2013	2015	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Maximum day demand											
	Zone 40 total	61.5	69.2	81.2	96.3	112.2	128.1	144.4	161.4	179.0	183.0
Existing supply capacity											
	groundwater	72.5	72.5	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0
	surface water	61.1	61.1	45.1	28.6	28.6	28.6	27.2	28.6	28.6	28.6
	recycled water	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	Total	136.6	136.6	114.1	97.6	97.6	97.6	96.2	97.6	97.6	97.6
Planned future supply capacity											
	groundwater	0.0	0.0	0.0	6.5	15.5	33.0	33.0	33.0	53.0	66.0
	surface water	0.0	0.0	16.0	32.5	32.5	32.5	33.9	82.5	82.5	101.6
	recycled water									2.9	2.9
Total supply capacity											
	groundwater	72.5	72.5	66.0	72.5	81.5	99.0	99.0	99.0	119.0	132.0
	surface water	61.1	61.1	61.1	61.1	61.1	61.1	61.1	111.1	111.1	130.2
	recycled water	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.9	5.9
	Total	136.6	136.6	130.1	136.6	145.6	163.1	163.1	213.1	236.0	268.1
Use of supply: average/wet years											
	groundwater	20.4	25.8	21.1	46.6	57.1	65.2	80.3	63.2	68.4	49.5
	surface water	38.1	40.3	57.1	46.7	52.1	59.9	61.1	95.1	104.7	127.6
	recycled water	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.9	5.9
	Total	61.5	69.2	81.2	96.3	112.2	128.1	144.4	161.3	179.0	183.0
Use of supply: dry years											
	groundwater	58.5	64.3	60.5	68.5	77.1	92.8	99.0	99.0	108.2	108.2
	surface water	0.0	1.9	17.7	24.8	32.1	32.3	42.4	59.3	65.0	69.0
	recycled water	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.9	5.9
	Total	61.5	69.2	81.2	96.3	112.2	128.1	144.4	161.3	179.0	183.0

Table B-5. Conjunctive Use Metrics

		Phase 1			Phase 2			Phase 3		
Parameter	2013	2015	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Provided Capacity										
surface water, % of demand	99.3%	88.3%	75.2%	63.4%	54.5%	47.7%			62.1%	71.2%
groundwater, % of demand	117.8%	104.8%	81.3%	75.3%	72.7%	77.3%			66.5%	72.1%
Total	217.2%	193.1%	156.5%	138.7%	127.1%	125.0%			128.6%	143.3%
Use in wet/average years										
surface water, % of demand	62.0%	58.3%	70.3%	48.5%	46.4%	46.8%			58.5%	69.7%
groundwater, % of demand	33.1%	37.3%	26.0%	48.4%	50.9%	50.9%			38.2%	27.1%
surface water, % of surface water capacity	62.4%	66.0%	93.5%	76.4%	85.2%	98.0%			94.3%	98.0%
groundwater, % of groundwater capacity	28.1%	35.6%	32.0%	64.3%	70.1%	65.9%			57.5%	37.5%
Use in dry years										
surface water, % of demand	0.0%	2.7%	21.8%	25.8%	28.6%	25.2%			36.3%	37.7%
groundwater, % of demand	95.1%	93.0%	74.5%	71.1%	68.7%	72.4%			60.4%	59.1%
surface water, % of wet/average year use	0.0%	4.6%	31.0%	53.1%	61.6%	53.9%			62.0%	54.0%
groundwater, % of groundwater capacity	80.7%	88.7%	91.7%	94.5%	94.6%	93.7%			90.9%	81.9%

Note: Recycled water values not presented.

Table B-6. Annual Supply Capacity and Use - NSA

NSA			Phase 1			Phase 2		Phase 3			
		2013	2015	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Demand											
	Annual, ac-ft/yr	4,200	5,300	7,300	10,100	13,100	17,500	22,400	27,500	32,800	35,000
Supply capacity, ac-ft/yr											
	groundwater	7,000	7,000	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400
	surface water	-	-	9,000	18,200	18,200	18,200	18,200	18,200	36,400	36,400
	Total	7,000	7,000	12,300	21,600	21,600	21,600	21,600	21,600	39,800	39,800
Use of supply: average/wet years											
	groundwater	4,100	5,300	-	-	-	-	-	-	-	-
	surface water	-	-	7,300	10,100	13,100	17,500	22,300	27,400	32,800	34,900
	Total	4,100	5,300	7,300	10,100	13,100	17,500	22,300	27,400	32,800	34,900
Use of supply: dry years											
	groundwater	4,100	5,300	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100
	surface water	-	-	6,200	9,000	12,000	16,400	21,200	26,300	31,700	33,800
	Total	4,100	5,300	7,300	10,100	13,100	17,500	22,300	27,400	32,800	34,900

Table B-7. Annual Supply Capacity and Use - CSA

CSA			Phase 1			Phase 2		Phase 3			
		2013	2015	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Demand											
	Annual, ac-ft/yr	15,100	16,400	18,400	21,200	24,100	28,100	32,400	36,800	41,300	41,400
Supply capacity, ac-ft/yr											
	groundwater	19,300	19,300	19,300	19,300	24,300	29,300	29,300	29,300	36,600	36,600
	surface water	28,000	28,000	19,000	9,800	9,800	9,800	9,800	9,800	19,600	30,300
	Total	47,300	47,300	38,300	29,100	34,100	39,100	39,100	39,100	56,200	66,900
Use of supply: average/wet years											
	groundwater	-	-	-	11,400	14,300	18,300	22,600	27,000	21,700	11,100
	surface water	15,100	16,400	18,400	9,800	9,800	9,800	9,800	9,800	19,600	30,300
	Total	15,100	16,400	18,400	21,200	24,100	28,100	32,400	36,800	41,300	41,400
Use of supply: dry years											
	groundwater	15,100	16,400	18,400	19,300	24,100	28,100	32,400	36,800	36,600	36,600
	surface water	-	-	-	2,000	-	-	-	-	4,700	4,800
	Total	15,100	16,400	18,400	21,200	24,100	28,100	32,400	36,800	41,300	41,400

Table B-8. Annual Supply Capacity and Use - SSA

SSA			Phase 1			Phase 2		Phase 3			
		2013	2015	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Demand											
	Annual, ac-ft/yr	15,200	17,100	19,700	22,600	25,600	26,100	26,100	26,100	26,100	26,100
Supply capacity, ac-ft/yr											
	groundwater	14,300	14,300	14,300	18,000	18,000	22,700	22,700	22,700	26,700	33,900
	surface water	6,200	6,200	6,200	6,200	6,200	6,200	6,200	6,200	6,200	6,200
	recycled water	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
	Total	22,200	22,200	22,200	25,900	25,900	30,600	30,600	30,600	36,200	43,400
Use of supply: average/wet years											
	groundwater	7,300	9,200	11,800	14,700	17,700	18,200	18,200	18,200	16,600	16,600
	surface water	6,200	6,200	6,200	6,200	6,200	6,200	6,200	6,200	6,200	6,200
	recycled water	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
	Total	15,200	17,100	19,700	22,600	25,600	26,100	26,100	26,100	26,100	26,100
Use of supply: dry years											
	groundwater	13,500	14,300	14,300	18,000	18,000	22,700	22,700	22,700	22,800	22,800
	surface water	-	1,000	3,700	2,900	6,000	1,700	1,700	1,700	-	-
	recycled water	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
	Total	15,200	17,100	19,700	22,600	25,600	26,100	26,100	26,100	26,100	26,100

Table B-9. Annual Supply Capacity and Use - Total

Total Zone 40			Phase 1			Phase 2		Phase 3			
		2013	2015	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Demand											
	Annual, ac-ft/yr	34,500	38,700	45,500	53,900	62,800	71,800	80,900	90,400	100,300	102,500
Supply capacity, ac-ft/yr											
	groundwater	40,600	40,600	37,000	40,600	45,600	55,400	55,400	55,400	66,600	73,900
	surface water	34,200	34,200	34,200	34,200	34,200	34,200	34,200	34,200	62,200	72,900
	recycled water	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
	Total	76,500	76,500	72,900	76,500	81,600	91,400	91,400	91,400	132,200	150,100
Use of supply: average/wet years											
	groundwater	11,400	14,500	11,800	26,100	32,000	36,500	40,800	45,200	38,300	27,700
	surface water	21,400	22,600	32,000	26,200	29,200	33,500	38,400	43,500	58,600	71,500
	recycled water	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
	Total	34,500	38,700	45,500	53,900	62,800	71,700	80,900	90,400	100,200	102,500
Use of supply: dry years											
	groundwater	32,800	36,000	33,900	38,400	43,200	52,000	56,300	60,700	60,600	60,600
	surface water	-	1,000	9,900	13,900	18,000	18,100	22,900	28,000	36,400	38,600
	recycled water	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
	Total	34,500	38,700	45,500	53,900	62,800	71,700	80,900	90,400	100,200	102,500

Table B-10. Supply and Demand Comparison-Normal Year, ac-ft/yr

	2015	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Supplies, no facility constraints									
US Bureau of Reclamation-CVP supply	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000
Appropriative water	71,000	71,000	71,000	71,000	71,000	71,000	71,000	71,000	71,000
City of Sacramento American River POU water rights	9,300	9,300	9,300	9,300	9,300	9,300	9,300	9,300	9,300
Other surface water supplies	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
Groundwater	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Remediated groundwater	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
Supply total	185,500	185,500	185,500	185,500	185,500	185,500	185,500	187,100	187,100
Demand	38,700	45,500	53,900	62,800	71,800	80,900	90,400	100,300	102,500
Difference	146,800	140,000	131,600	122,700	113,700	104,600	95,100	86,800	84,600

Table B-11. Use of Supply-Normal Year, ac-ft/yr

	2015	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Use of supplies									
Surface water, no remediated gw	22,600	32,000	26,200	29,200	33,500	34,200	53,300	58,600	71,500
Remediated groundwater									
Groundwater	14,500	11,800	26,100	32,000	36,500	45,000	35,400	38,300	27,700
Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
Total	38,800	45,500	54,000	62,900	71,700	80,900	90,400	100,200	102,500
Surface water use breakdown									
US Bureau of Reclamation-CVP supply	22,600	32,000	26,200	29,200	33,500	34,200	45,000	45,000	45,000
Appropriative water	-	-	-	-	-	-	8,300	13,600	26,500
mum City of Sacramento American River POU water rights									
Other surface water supplies									
Surface water plus remediated groundwater	22,600	32,000	26,200	29,200	33,500	34,200	53,300	58,600	71,500

Table B-12. Supply and Demand Comparison-Single Dry Year, ac-ft/yr

	2015	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Supplies, no facility constraints									
US Bureau of Reclamation-CVP supply allocation	5,700	8,000	6,600	7,300	8,400	8,600	11,300	11,300	11,300
Appropriative water									
City of Sacramento American River POU water rights									
Other surface water supplies	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
Groundwater	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
Remediated groundwater	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
Supply total	95,900	98,200	96,800	97,500	98,600	98,800	101,500	103,100	103,100
Demand	38,700	45,500	53,900	62,800	71,800	80,900	90,400	100,300	102,500
Difference	57,200	52,700	42,900	34,700	26,800	17,900	11,100	2,800	600

Table B-13. Use of Supply-Single Dry Year, ac-ft/yr

	2015	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Use of supplies									
Surface water (no remediated gw)	1,000	9,900	8,900	9,600	10,600	14,800	24,300	27,500	29,700
Remediated groundwater			5,000	8,400	7,500	8,900	8,900	8,900	8,900
Groundwater	36,000	33,900	38,400	43,200	52,000	55,400	55,400	60,600	60,600
Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
Total	38,700	45,500	54,000	62,900	71,800	80,800	90,300	100,300	102,500
Surface water use breakdown									
US Bureau of Reclamation-CVP supply	1,000	7,700	6,600	7,300	8,400	8,600	11,300	11,300	11,300
Appropriative water									
City of Sacramento American River POU water rights									
Other surface water supplies	-	2,200	2,300	2,300	2,200	6,200	13,000	16,200	18,400
Surface water plus remediated groundwater	1,000	9,900	13,900	18,000	18,100	23,700	33,200	36,400	38,600

Table B-14. Supply and Demand Comparison-Multiple Dry Years

Year			2015	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
First year	Supplies										
		US Bureau of Reclamation-CVP supply	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000
Table B-3. Maximum		Appropriative water	71,000	71,000	71,000	71,000	71,000	71,000	71,000	71,000	71,000
		City of Sacramento American River POU water rights	9,300	9,300	9,300	9,300	9,300	9,300	9,300	9,300	9,300
		Other surface water supplies	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
		Groundwater	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
		Remediated groundwater	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
		Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
		Supply totals	185,500	185,500	185,500	185,500	185,500	185,500	185,500	187,100	187,100
	Demand		38,700	45,500	53,900	62,800	71,800	80,900	90,400	100,300	102,500
	Difference		146,800	140,000	131,600	122,700	113,700	104,600	95,100	86,800	84,600
Second year	Supplies										
		US Bureau of Reclamation-CVP supply	17,000	24,000	19,700	21,900	25,100	25,700	33,800	33,800	33,800
		Appropriative water	-	-	-	-	-	-	-	-	-
		City of Sacramento American River POU water rights	-	-	-	-	-	-	-	-	-
		Other surface water supplies	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
		Groundwater	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
		Remediated groundwater	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
		Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
		Supply totals	107,200	114,200	109,900	112,100	115,300	115,900	124,000	125,600	125,600
	Demand		38,700	45,500	53,900	62,800	71,800	80,900	90,400	100,300	102,500
	Difference		68,500	68,700	56,000	49,300	43,500	35,000	33,600	25,300	23,100
Third year	Supplies										
		US Bureau of Reclamation-CVP supply	5,700	8,000	6,600	7,300	8,400	8,600	11,300	11,300	11,300
		Appropriative water	-	-	-	-	-	-	-	-	-
		City of Sacramento American River POU water rights	-	-	-	-	-	-	-	-	-
		Other surface water supplies	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
		Groundwater	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
		Remediated groundwater	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
		Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
		Supply totals	95,900	98,200	96,800	97,500	98,600	98,800	101,500	103,100	103,100
	Demand		38,700	45,500	53,900	62,800	71,800	80,900	90,400	100,300	102,500
	Difference		57,200	52,700	42,900	34,700	26,800	17,900	11,100	2,800	600

Table B-15. NSA Upper Zone Storage Capacity Evaluation

	2013	Phase 1 (2015-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2052)	Notes
Maximum day demand, mgd	0.0	2.5	5.0	7.9	Cordova Hills (4,451 ac-ft/yr)
Peak hour demand, mgd	0.0	5.0	10.0	15.8	
Provided storage volume, MG					
Existing					
North Douglas	3.0	3.0	3.0	3.0	
Future					
Cordova Hills				3.0	
Total	3.0	3.0	3.0	6.0	
Required storage volume, MG					
Equalization	0.0	0.5	1.0	1.6	Assume 20% MDD.
Fire	0.5	0.5	0.5	0.5	Assume volume for one fire at 3,000 gpm for 3 hours.
Emergency	0.0	0.4	0.8	1.3	Assume 1/3 average day.
Total	0.5	1.4	2.3	3.4	
Difference (provided minus required)	2.5	1.6	0.7	2.6	Could downsize Cordova Hills tank.

Table B-16. NSA Upper Zone Pump Station Capacity Evaluation

	2013	Phase 1 (2015-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2052)	Notes
Provided pumping capacity, mgd					
Existing					
North Douglas	19.4	19.4	19.4	19.4	Very large capacity for such a small demand.
Upper zone max day supply	0.0	2.5	5.0	7.9	
from storage	19.4	16.9	14.4	11.5	
Future					
Cordova Hills				21.6	
Total from storage	19.4	16.9	14.4	33.1	
Required peak hour capacity from storage, mgd	0.0	2.5	5.0	7.9	Capacity increment above maximum day demand capacity.
Required fire flow from storage, mgd	4.3	4.3	4.3	4.3	4.3 mgd for one fire, max day supply accounted for above.
Required capacity from storage	4.3	4.3	5.0	7.9	Greater of pk hr or fire.
Difference (provided minus required)	15.1	12.6	9.4	25.2	Substantial surplus capacity.
Summary					
Total provided pump station capacity, mgd	38.8	36.3	33.8	52.5	
Total required pump station capcity					
from storage, mgd	4.3	4.3	5.0	7.9	
for max day supply capacity, mgd	0.0	2.5	5.0	7.9	
Total	4.3	6.8	10.0	15.8	

Table B-17. NSA Main Zone Storage Capacity Evaluation

	2013	Phase 1 (2015-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2052)	Notes
Maximum day demand, mgd	7.4	14.1	24.4	48.6	NSA 62.4 mgd minus Cordova Hills (7.9 mgd) and half of Rio del Oro (5.9 m
Peak hour demand, mgd	14.8	28.2	48.8	97.2	
Provided storage volume, MG					
Existing					
Mather Housing GWTP	0.5	0.5	0.5	0.5	
Anatolia GWTP	4.0	4.0	4.0	4.0	
Mather 1 Main Base	1.0	1.0	1.0	1.0	
Mather 2	0.3	0.3	0.3	0.3	
subtotal	5.8	5.8	5.8	5.8	
Future					
Phase B NSA Project		10.0	10.0	10.0	
White Rock				3.0	
Suncreek				3.0	
subtotal	0.0	10.0	10.0	16.0	
Total	5.8	15.8	15.8	21.8	
Required storage volume, MG					
Equalization	1.5	2.8	4.9	9.7	Assume 20% MDD.
Fire	1.1	1.1	1.1	1.1	Assume volume for two fires at 3,000 gpm for 3 hours.
Emergency	1.2	2.4	4.1	8.1	Assume 1/3 average day.
Total	3.8	6.3	10.0	18.9	Could phase in the Phase B NSA Project storage.
Difference (provided minus required)	2.0	9.5	5.8	2.9	

Table B-18. NSA Main Zone Pump Station Capacity Evaluation

	2013	Phase 1 (2015-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2052)	Notes
Provided pumping capacity, mgd					
Existing					
Mather Housing GWTP	5.2	5.2	5.2	5.2	
GWTP	3.0	3.0	3.0	3.0	Assume half of GWTP supplies pump station.
from storage	2.2	2.2	2.2	2.2	
Anatolia GWTP/Storage (a)	11.2	22.5	22.5	22.5	
GWTP/part of MD supply from Vineyard SWTP	6.5	4.7	8.1	16.2	Assume 2/3 of main zone MD demand through NSA terminal and 1/3 through Anatolia tanks.
from storage	4.7	17.8	14.4	6.3	
Mather 1 Main Base	5.2	5.2	5.2	5.2	
Mather 2	2.0	2.0	2.0	2.0	Elevated tank, assumed flow.
subtotal from storage	14.1	27.2	23.8	15.7	
Future					
White Rock				14.4	
Suncreek				18.0	
Phase B NSA-total capacity (b)		64.0	64.0	64.0	Total pump station capacity.
max day supply for Cal Am Rio del Oro		1.0	3.0	5.9	Max day supply for Cal Am tank. Not from storage.
max day supply for upper zone		2.5	5.0	7.9	Supply to North Douglas and Cordova Hills tanks. Not from storage.
part of max day supply from Vineyard SWTP for main zone		9.4	16.3	32.4	Assume 2/3 through NSA terminal and 1/3 through Anatolia tanks.
subtotal, pumping not from Phase B NSA storage		12.9	24.3	46.2	
subtotal, capacity available to pump from Phase B NSA Project storage		51.1	39.7	17.8	
subtotal from storage		51.1	39.7	50.2	
Total from storage	14.1	78.3	63.5	65.9	
Required peak hour capacity from storage, mgd	7.4	14.1	24.4	48.6	
Difference (provided minus required)	6.7	64.2	39.1	17.3	Could phase in the NSA terminal storage pump station capacity.
Summary					
Total provided pump station capacity, mgd	23.6	98.9	98.9	131.3	
Total required pump station capacity					
from storage, mgd	7.4	14.1	24.4	48.6	
for max day supply capacity, mgd	9.5	20.6	35.4	65.4	
Total	16.9	34.7	59.8	114.0	
(a) When Phase A NSA is completed, Anatolia awill pump through supply from Vineyard SWTP.					
(b) Calculation of Phase B NSA pump station capacity available to supply from storage the main zone's pk hr increment.					

Table B-19. CSA Storage Capacity Evaluation

	2013	Phase 1 (2015-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2051)	Notes
Maximum day demand, mgd	27.0	37.9	50.2	74.0	
Peak hour demand, mgd	54.1	75.8	100.4	147.9	
Provided storage volume, MG					
Existing					
Calvine Meadows GWTP	0.35	0.35	0.35	0.35	
East Elk Grove GWTP	3.5	3.5	3.5	3.5	
East Park GWTP	0.5	0.5	0.5	0.5	
Waterman GWTP	7.0	7.0	7.0	7.0	
Wildhawk GWTP	3.0	3.0	3.0	3.0	
Vineyard SWTP clearwell	6.0	6.0	6.0	6.0	Assumed equalization storage available from 20 mgd clear well.
subtotal	20.4	20.4	20.4	20.4	
Future					
West Jackson GWTP			4.0	4.0	
East Elk Grove GWTP expansion				0.0	
Bond GWTP				0.5	
North Vineyard Station				4.0	
Calvine Meadows GWTP expansion				0.0	
subtotal			4.0	8.5	
Total	20.4	20.4	24.4	28.9	Planned storage volume.
Required storage volume, MG					
Equalization	5.4	7.6	10.0	14.8	Assume 20% MDD.
Fire	1.1	1.1	1.1	1.1	Assume volume for two fires at 3,000 gpm for 3 hours.
Emergency	4.5	6.3	8.4	12.3	Assume 1/3 average day.
Total	11.0	15.0	19.5	28.2	
Difference (provided minus required)	9.3	5.4	4.8	0.6	

Table B-20. CSA Pump Station Capacity Evaluation					
	2013	Phase 1 (2015-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2051)	Notes
Provided pumping capacity, mgd					
Existing					
Calvine Meadows GWTP, total	8.8	8.8	8.8	8.8	
GWTP	5.0	5.0	5.0	5.0	
from storage	3.8	3.8	3.8	3.8	
East Elk Grove GWTP, total	13.0	13.0	13.0	13.0	
GWTP	6.5	6.5	6.5	6.5	
from storage	6.5	6.5	6.5	6.5	
East Park GWTP, total	3.5	3.5	3.5	3.5	
GWTP	2.9	2.9	2.9	2.9	
from storage	0.6	0.6	0.6	0.6	
Waterman GWTP, total	25.9	25.9	25.9	25.9	
GWTP	8.6	8.6	8.6	8.6	
from storage	17.3	17.3	17.3	17.3	
Wildhawk GWTP, total	19.0	19.0	19.0	19.0	
GWTP	7.5	7.5	7.5	7.5	
from storage	11.5	11.5	11.5	11.5	
Vineyard SWTP pump station	13.0	13.0	13.0	13.0	Assume capacity provided from clear well.
subtotal from storage	52.7	52.7	52.7	52.7	
Future					
West Jackson GWTP			21.6	21.6	
GWTP			18.0	18.0	
from storage			3.6	3.6	
East Elk Grove GWTP expansion, total				13.0	
GWTP				6.5	
from storage				6.5	
Bond GWTP, total				10.8	
GWTP				6.5	
from storage				4.3	
North Vineyard Station, total				21.6	Pumps through City POU supply.
City POU supply				19.1	
from storage				2.5	
Calvine Meadows GWTP expansion				7.2	Pump all from storage.
Vineyard SWTP pump station expansion				10.0	Assume future capacity from clear well.
subtotal from storage			3.6	34.1	
Total from storage	52.7	52.7	56.3	86.8	
Required peak hour capacity from storage, mgd	27.0	37.9	50.2	74.0	
Difference (provided minus required) (a)	25.7	14.8	6.1	12.8	Pumping capacity could be reduced in Phase 3.
Summary					
Total provided pump station capacity, mgd	83.2	83.2	104.8	167.4	
Total required pump station capacity					
from storage, mgd	27.0	37.9	50.2	74.0	
for max day supply capacity, mgd	30.5	30.5	48.5	61.5	
Total	57.5	68.4	98.7	135.5	
(a) Peak hour pumping surplus used to supply the SSA.					

Table B-21. SSA Storage Capacity Evaluation

	2013	Phase 1 (2015-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2051)	Notes
Maximum day demand, mgd	27.1	40.3	46.6	46.6	
Peak hour demand, mgd	54.2	80.6	93.2	93.2	
Provided storage volume, MG					
Existing					
Big Horn GWTP	2.0	2.0	2.0	2.0	
Dwight Road GWTP	7.0	7.0	7.0	7.0	
Lakeside GWTP	0.5	0.5	0.5	0.5	
Poppy Ridge GWTP	3.5	3.5	3.5	3.5	
subtotal	13.0	13.0	13.0	13.0	
Future					
Poppy Ridge GWTP expansion		3.5	3.5	3.5	
Big Horn GWTP expansion					
Franklin GWTP				2.0	
Whitelock GWTP				3.0	
subtotal	0.0	3.5	3.5	8.5	
Total	13.0	16.5	16.5	21.5	Planned storage volume.
Required storage volume, MG					
Equalization	5.4	8.1	9.3	9.3	Assume 20% MDD.
Fire	1.1	1.1	1.1	1.1	Assume volume for two fires at 3,000 gpm for 3 hours.
Emergency	4.5	6.7	7.8	7.8	Assume 1/3 average day.
Total	11.0	15.9	18.2	18.2	
Difference (provided minus required)	2.0	0.6	-1.7	3.3	Phase 2 deficit supplied by CSA storage surplus.

Table B-22. SSA Pump Station Capacity Evaluation

	2013	Phase 1 (2015-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2050)	Notes
Provided pumping capacity, mgd					
Existing					
Big Horn GWTP, total	8.6	8.6	8.6	8.6	
GWTP	4.5	4.5	4.5	4.5	
from storage	4.1	4.1	4.1	4.1	
Dwight Road GWTP, total	25.9	25.9	25.9	25.9	
GWTP and Franklin Intertie	13.2	13.2	13.2	13.2	
from storage	12.7	12.7	12.7	12.7	
Lakeside GWTP, total	7.2	7.2	7.2	7.2	
GWTP	6.5	6.5	6.5	6.5	
from storage	0.7	0.7	0.7	0.7	
Poppy Ridge GWTP, total	10.4	10.4	10.4	10.4	
GWTP	6.5	6.5	6.5	6.5	
from storage	3.9	3.9	3.9	3.9	
subtotal from storage	21.4	21.4	21.4	21.4	
Future					
Poppy Ridge GWTP expansion, total		17.0	17.0	17.0	
GWTP		6.5	6.5	6.5	
from storage		10.5	10.5	10.5	
Big Horn GWTP expansion, total			17.0	17.0	
GWTP			8.5	8.5	
from storage			8.5	8.5	
Franklin GWTP, total				21.6	
GWTP				7.0	
from storage				14.6	
Whitelock GWTP, total				14.4	
GWTP				13.0	
from storage				1.4	
subtotal from storage	0.0	10.5	19.0	35.0	
Total from storage	21.4	31.9	40.4	56.4	
Required peak hour capacity from storage, mgd	27.1	40.3	46.6	46.6	
Difference (provided minus required) (a)	-5.7	-8.4	-6.2	9.8	Phase 1 and 2 deficit supplied by CSA.
Summary					
Total provided pump station capacity, mgd	52.1	69.1	86.1	122.1	
Total required pump station capacity					
from storage, mgd	27.1	40.3	46.6	46.6	
for max day supply capacity, mgd	30.7	37.2	45.7	65.7	
Total	57.8	77.5	92.3	112.3	
(a) Peak hour pumping deficit to be supplied by surplus in CSA.					

Table B-23. Zone 40 Storage Capacity Evaluation Summary- Baseline				
	2013	Phase 1 (2020-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2052)
Provided storage volume, MG				
Existing	42.2	42.2	42.2	42.2
Future	0.0	13.5	17.5	36.0
Total	42.2	55.7	59.7	78.2
Required storage volume, MG				
Equalization	12.3	19.0	25.2	32.9
Fire	3.8	3.8	3.8	3.8
Emergency	10.3	15.8	21.0	27.4
Total	26.4	38.6	50.1	64.2
Difference (provided minus required)	15.8	17.1	9.6	14.0

Table B-24. Zone 40 Pump Station Capacity Evaluation Summary- Baseline				
	2013	Phase 1 (2020-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2052)
Provided pump station capacity from storage, mgd				
Existing	107.6	118.2	112.3	101.3
Future	0.0	20.5	32.6	88.1
Total	107.6	138.7	144.9	189.4
Required pump station capacity from storage, mgd	65.8	96.6	126.2	164.6
Difference (provided minus required)	41.8	42.1	18.7	24.8

Appendix C: Multi-Sport Complex and Grant Line Road Industrial Annexation Area Supply and Demand Comparison Tables

This page intentionally left blank.

Table C-1. Maximum Day Demand to Supply Comparison for NSA, mgd

NSA		Phase 1		Phase 2		Phase 3			
		2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Demand									
	Maximum day	13.0	18.0	23.4	31.2	40.0	49.1	58.6	62.3
Existing supply capacity									
	Mather Housing GWTP	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	Anatolia GWTP								
	total groundwater	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	Vineyard SWTP								
	Total	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Planned future supply capacity									
	surface water, Vineyard SWTP	16.0	20.0	25.0	32.5	34.0	65.0	65.0	65.0
Total supply capacity									
	groundwater	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	surface water	16.0	20.0	25.0	32.5	34.0	65.0	65.0	65.0
	Total	22.0	26.0	31.0	38.5	40.0	71.0	71.0	71.0
Use of supply: average/wet years									
	groundwater	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0
	surface water	13.0	18.0	23.4	31.2	34.0	49.1	58.6	62.3
	Total	13.0	18.0	23.4	31.2	40.0	49.1	58.6	62.3
Use of supply: dry years									
	groundwater	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	surface water	11.0	16.0	21.4	29.2	38.0	47.1	56.6	60.3
	Total	13.0	18.0	23.4	31.2	40.0	49.1	58.6	62.3

Table C-2. Maximum Day Demand to Supply Comparison for CSA, mgd

CSA		Phase 1		Phase 2		Phase 3			
		2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Demand									
	Maximum day	32.9	40.3	45.5	52.7	60.3	68.2	76.2	76.4
Existing supply capacity									
	Calvine Meadows GWTP	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	East Elk Grove GWTP	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
	East Park GWTP	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
	Waterman GWTP	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6
	Wildhawk GWTP	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
	CSA DirectFeed	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
	total groundwater	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4
	Vineyard SWTP	34.0	30.0	25.0	17.5	16.1	17.5	17.5	17.5
	Total	68.4	64.4	59.4	51.9	50.5	51.9	51.9	51.9
Planned future supply capacity									
	West Jackson GWTP			9.0	18.0	18.0	18.0	18.0	18.0
	Bond GWTP							6.5	6.5
	East Elk Grove GWTP expansion							6.5	6.5
	total groundwater			9.0	18.0	18.0	18.0	31.0	31.0
	Vineyard SWTP expansion						17.5	17.5	17.5
	City POU supply								19.1
	total surface water						17.5	17.5	36.6
Total supply capacity									
	groundwater	34.4	34.4	43.4	52.4	52.4	52.4	65.4	65.4
	surface water	34.0	30.0	25.0	17.5	16.1	35.0	35.0	54.1
	Total	68.4	64.4	68.4	69.9	68.5	87.4	100.4	119.5
Use of supply: average/wet years									
	groundwater	0.0	10.3	20.5	35.2	44.2	33.2	41.2	22.3
	surface water	32.9	30.0	25.0	17.5	16.1	35.0	35.0	54.1
	Total	32.9	40.3	45.5	52.7	60.3	68.2	76.2	76.4
Use of supply: dry years									
	groundwater	32.9	34.4	45.5	52.7	52.4	52.4	65.4	65.4
	surface water	0.0	5.9	0.0	0.0	7.9	15.8	10.8	11.0
	Total	32.9	40.3	45.5	52.7	60.3	68.2	76.2	76.4

Table C-3. Maximum Day Demand to Supply Comparison for SSA, mgd

SSA		Phase 1		Phase 2		Phase 3			
		2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Demand									
	Maximum day	35.2	40.3	45.7	46.6	46.6	46.6	46.6	46.6
Existing supply capacity									
	Big Horn GWTP	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
	Dwight Road GWTP	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
	Lakeside GWTP	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
	Poppy Ridge GWTP	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
	SSA Direct Feed	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	total groundwater	25.6	25.6	25.6	25.6	25.6	25.6	25.6	25.6
	Franklin Intertie to City	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1
	SSA Recycled Water	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	Total	65.3	65.3	65.3	65.3	65.3	65.3	65.3	65.3
Planned future supply capacity									
	Poppy Ridge GWTP expansion		6.5	6.5	6.5	6.5	6.5	6.5	6.5
	Big Horn GWTP expansion				8.5	8.5	8.5	8.5	8.5
	Franklin GWTP							7.0	7.0
	Whitelock GWTP								13.0
	total groundwater	0.0	6.5	6.5	15.0	15.0	15.0	22.0	35.0
	recycled water							2.9	2.9
Total supply capacity									
	groundwater	25.6	32.1	32.1	40.6	40.6	40.6	47.6	60.6
	surface water	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1
	recycled water	3.0	3.0	3.0	3.0	3.0	3.0	5.9	5.9
	Total	39.7	46.2	46.2	54.7	54.7	54.7	64.6	64.6
Use of supply: average/wet years									
	groundwater	21.1	26.2	31.6	32.5	32.5	32.5	29.6	29.6
	surface water	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1
	recycled water	3.0	3.0	3.0	3.0	3.0	3.0	5.9	5.9
	Total	35.2	40.3	45.7	46.6	46.6	46.6	46.6	46.6
Use of supply: dry years									
	groundwater	25.6	32.1	32.1	40.6	40.6	40.6	40.7	40.7
	surface water	6.6	5.2	10.6	3.0	3.0	3.0	0.0	0.0
	recycled water	3.0	3.0	3.0	3.0	3.0	3.0	5.9	5.9
	Total	35.2	40.3	45.7	46.6	46.6	46.6	46.6	46.6

Table C-4. Maximum Day Demand to Supply Comparison for Zone 40, mgd

Zone 40	Phase 1		Phase 2		Phase 3			
	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Maximum day demand								
MSC	0	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Remaining CSA	81.1	96.2	112.1	128.0	144.4	161.4	178.9	182.8
Zone 40 total	81.1	98.7	114.6	130.5	146.9	163.9	181.4	185.3
Existing supply capacity								
groundwater	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0
surface water	45.1	41.1	36.1	28.6	27.2	28.6	28.6	28.6
recycled water	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Total	114.1	110.1	105.1	97.6	96.2	97.6	97.6	97.6
Planned future supply capacity								
groundwater	0.0	6.5	15.5	33.0	33.0	33.0	53.0	66.0
surface water	16.0	20.0	25.0	32.5	34.0	82.5	82.5	101.6
recycled water							2.9	2.9
Total supply capacity								
groundwater	66.0	72.5	81.5	99.0	99.0	99.0	119.0	132.0
surface water	61.1	61.1	61.1	61.1	61.2	111.1	111.1	130.2
recycled water	3.0	3.0	3.0	3.0	3.0	3.0	5.9	5.9
Total	130.1	136.6	145.6	163.1	163.2	213.1	236.0	268.1
Use of supply: average/wet years								
groundwater	21.1	36.6	52.1	67.7	82.7	65.7	70.9	52.0
surface water	57.0	59.1	59.5	59.8	61.2	95.2	104.7	127.5
recycled water	3.0	3.0	3.0	3.0	3.0	3.0	5.9	5.9
Total	81.1	98.7	114.6	130.5	146.9	163.9	181.4	185.3
Use of supply: dry years								
groundwater	60.5	68.5	79.6	95.3	95.0	95.0	108.1	108.1
surface water	17.6	27.2	32.0	32.2	48.9	65.9	67.4	71.3
recycled water	3.0	3.0	3.0	3.0	3.0	3.0	5.9	5.9
Total	81.1	98.7	114.6	130.5	146.9	163.9	181.4	185.3

Table C-5. Conjunctive Use Metrics

Parameter	Phase 1		Phase 2		Phase 3			
	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Provided Capacity								
surface water, % of demand	75.4%	61.9%	53.3%	46.8%			61.2%	70.3%
groundwater, % of demand	81.4%	73.4%	71.1%	75.9%			65.6%	71.2%
Total	156.8%	135.3%	124.4%	122.7%			126.9%	141.5%
Use in wet/average years								
surface water, % of demand	70.3%	59.9%	51.9%	45.9%			57.7%	68.8%
groundwater, % of demand	26.0%	37.1%	45.5%	51.8%			39.1%	28.0%
surface water, % of surface water capacity	93.3%	96.8%	97.4%	97.9%			94.2%	97.9%
groundwater, % of groundwater capacity	31.9%	50.5%	64.0%	68.3%			59.6%	39.4%
Use in dry years								
surface water, % of demand	21.7%	27.6%	27.9%	24.7%			37.2%	38.5%
groundwater, % of demand	74.6%	69.4%	69.5%	73.0%			59.6%	58.4%
surface water, % of wet/average year use	30.9%	46.1%	53.8%	53.9%			64.4%	55.9%
groundwater, % of groundwater capacity	91.6%	94.5%	97.7%	96.2%			90.9%	81.9%

Note: Recycled water values not presented.

Table C-6. Annual Supply Capacity and Use - NSA

NSA		Phase 1		Phase 2		Phase 3			
		2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Demand									
	Annual, ac-ft/yr	7,300	10,100	13,100	17,500	22,400	27,500	32,800	34,900
Supply capacity, ac-ft/yr									
	groundwater	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400
	surface water	9,000	11,200	14,000	18,200	19,000	36,400	36,400	36,400
	Total	12,300	14,600	17,400	21,600	22,400	39,800	39,800	39,800
Use of supply: average/wet years									
	groundwater	-	-	-	-	3,400	-	-	-
	surface water	7,300	10,100	13,100	17,500	19,000	27,500	32,800	34,900
	Total	7,300	10,100	13,100	17,500	22,400	27,500	32,800	34,900
Use of supply: dry years									
	groundwater	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100
	surface water	6,200	9,000	12,000	16,400	21,300	26,400	31,700	33,800
	Total	7,300	10,100	13,100	17,500	22,400	27,500	32,800	34,900

Table B-7. Annual Supply Capacity and Use - CSA

CSA		Phase 1		Phase 2		Phase 3			
		2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Demand									
	Annual, ac-ft/yr	18,400	22,600	25,500	29,500	33,800	38,200	42,700	42,800
Supply capacity, ac-ft/yr									
	groundwater	19,300	19,300	24,300	29,300	29,300	29,300	36,600	36,600
	surface water	19,000	16,800	14,000	9,800	9,000	19,600	19,600	30,300
	Total	38,300	36,100	38,300	39,100	38,400	48,900	56,200	66,900
Use of supply: average/wet years									
	groundwater	-	5,800	11,500	19,700	24,800	18,600	23,100	12,500
	surface water	18,400	16,800	14,000	9,800	9,000	19,600	19,600	30,300
	Total	18,400	22,600	25,500	29,500	33,800	38,200	42,700	42,800
Use of supply: dry years									
	groundwater	18,400	19,300	25,500	29,500	29,300	29,300	36,600	36,600
	surface water	-	3,300	-	-	4,400	8,800	6,100	6,200
	Total	18,400	22,600	25,500	29,500	33,800	38,200	42,700	42,800

Table C-8. Annual Supply Capacity and Use - SSA

SSA		Phase 1		Phase 2		Phase 3			
		2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Demand									
	Annual, ac-ft/yr	19,700	22,600	25,600	26,100	26,100	26,100	26,100	26,100
Supply capacity, ac-ft/yr									
	groundwater	14,300	18,000	18,000	22,700	22,700	22,700	26,700	33,900
	surface water	6,200	6,200	6,200	6,200	6,200	6,200	6,200	6,200
	recycled water	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
	Total	22,200	25,900	25,900	30,600	30,600	30,600	36,200	43,400
Use of supply: average/wet years									
	groundwater	11,800	14,700	17,700	18,200	18,200	18,200	16,600	16,600
	surface water	6,200	6,200	6,200	6,200	6,200	6,200	6,200	6,200
	recycled water	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
	Total	19,700	22,600	25,600	26,100	26,100	26,100	26,100	26,100
Use of supply: dry years									
	groundwater	14,300	18,000	18,000	22,700	22,700	22,700	22,800	22,800
	surface water	3,700	2,900	5,900	1,700	1,700	1,700	-	-
	recycled water	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
	Total	19,700	22,600	25,600	26,100	26,100	26,100	26,100	26,100

Table C-9. Annual Supply Capacity and Use - Total

Total Zone 40		Phase 1		Phase 2		Phase 3			
		2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Demand									
	Annual, ac-ft/yr	45,400	55,300	64,200	73,100	82,300	91,800	101,600	103,800
Supply capacity, ac-ft/yr									
	groundwater	37,000	40,600	45,600	55,400	55,400	55,400	66,600	73,900
	surface water	34,200	34,200	34,200	34,200	34,300	62,200	62,200	72,900
	recycled water	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
	Total	72,900	76,500	81,600	91,400	91,400	119,400	132,200	150,100
Use of supply: average/wet years									
	groundwater	11,800	20,500	29,200	37,900	46,300	36,800	39,700	29,100
	surface water	31,900	33,100	33,300	33,500	34,300	53,300	58,600	71,400
	recycled water	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
	Total	45,400	55,300	64,200	73,100	82,300	91,800	101,600	103,800
Use of supply: dry years									
	groundwater	33,900	38,400	44,600	53,400	53,200	53,200	60,600	60,600
	surface water	9,900	15,300	17,900	18,100	27,400	36,900	37,700	39,900
	recycled water	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
	Total	45,400	55,300	64,200	73,100	82,300	91,800	101,600	103,800

Table C-10. Supply and Demand Comparison-Normal Year, ac-ft/yr

	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Supplies, no facility constraints								
US Bureau of Reclamation-CVP supply	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000
Appropriative water	71,000	71,000	71,000	71,000	71,000	71,000	71,000	71,000
City of Sacramento American River POU water rights	9,300	9,300	9,300	9,300	9,300	9,300	9,300	9,300
Other surface water supplies	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
Groundwater	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Remediated groundwater	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
Supply total	185,500	185,500	185,500	185,500	185,500	185,500	187,100	187,100
Demand	45,400	55,300	64,200	73,100	82,300	91,800	101,600	103,800
Difference	140,100	130,200	121,300	112,400	103,200	93,700	85,500	83,300

Table C-11. Use of Supply-Normal Year, ac-ft/yr

	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Use of supplies								
Surface water, no remediated gw	31,900	33,100	33,300	33,500	34,300	53,300	58,600	71,400
Remediated groundwater								
Groundwater	11,800	20,500	29,200	37,900	46,300	36,800	39,700	29,100
Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
Total	45,400	55,300	64,200	73,100	82,300	91,800	101,600	103,800
Surface water use breakdown								
US Bureau of Reclamation-CVP supply	31,900	33,100	33,300	33,500	34,300	45,000	45,000	45,000
Appropriative water	-	-	-	-	-	8,300	13,600	26,400
City of Sacramento American River POU water rights								
Other surface water supplies								
Surface water plus remediated groundwater	31,900	33,100	33,300	33,500	34,300	53,300	58,600	71,400

Table C-12. Supply and Demand Comparison-Single Dry Year, ac-ft/yr

	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Supplies, no facility constraints								
US Bureau of Reclamation-CVP supply allocation	16,000	13,100	14,700	16,900	19,400	22,000	22,500	22,500
Appropriative water								
City of Sacramento American River POU water rights								
Other surface water supplies	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
Groundwater	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
Remediated groundwater	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
Supply total	106,300	103,400	105,000	107,300	109,800	112,500	114,300	114,300
Demand	45,400	55,300	64,200	73,100	82,300	91,800	101,600	103,800
Difference	60,900	48,100	40,800	34,200	27,500	20,700	12,700	10,500

Table C-13. Use of Supply-Single Dry Year, ac-ft/yr

	2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
Use of supplies								
Surface water (no remediated gw)	9,900	10,300	9,500	10,600	18,500	28,000	28,800	31,000
Remediated groundwater		5,000	8,400	7,500	8,900	8,900	8,900	8,900
Groundwater	33,900	38,400	44,600	53,400	53,200	53,200	60,600	60,600
Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
Total	45,500	55,400	64,200	73,200	82,300	91,800	101,600	103,800
Surface water use breakdown								
US Bureau of Reclamation-CVP supply	7,700	13,100	14,700	16,900	19,400	22,000	22,500	22,500
Appropriative water								
City of Sacramento American River POU water rights								
Other surface water supplies	2,200	(2,800)	(5,200)	(6,300)	(900)	6,000	6,300	8,500
Surface water plus remediated groundwater	9,900	15,300	17,900	18,100	27,400	36,900	37,700	39,900

Table C-14. Supply and Demand Comparison-Multiple Dry Years

Year			2020	2025	2030	2035	2040	2045	2050	Buildout (2052)
First year	Supplies									
		US Bureau of Reclamation-CVP supply	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000
		Appropriative water	71,000	71,000	71,000	71,000	71,000	71,000	71,000	71,000
		City of Sacramento American River POU water rights	9,300	9,300	9,300	9,300	9,300	9,300	9,300	9,300
		Other surface water supplies	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
		Groundwater	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
		Remediated groundwater	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
		Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
		Supply totals	185,500	185,500	185,500	185,500	185,500	185,500	187,100	187,100
	Demand		45,400	55,300	64,200	73,100	82,300	91,800	101,600	103,800
	Difference		140,100	130,200	121,300	112,400	103,200	93,700	85,500	83,300
Second year	Supplies									
		US Bureau of Reclamation-CVP supply	24,100	19,800	22,100	25,600	29,400	33,500	33,800	33,800
		Appropriative water	-	-	-	-	-	-	-	-
		City of Sacramento American River POU water rights	-	-	-	-	-	-	-	-
		Other surface water supplies	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
		Groundwater	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
		Remediated groundwater	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
		Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
		Supply totals	114,300	110,000	112,300	115,800	119,600	123,700	125,600	125,600
	Demand		45,400	55,300	64,200	73,100	82,300	91,800	101,600	103,800
	Difference		68,900	54,700	48,100	42,700	37,300	31,900	24,000	21,800
Third year	Supplies									
		US Bureau of Reclamation-CVP supply	16,100	13,200	14,800	17,100	19,600	22,300	22,500	22,500
		Appropriative water	-	-	-	-	-	-	-	-
		City of Sacramento American River POU water rights	-	-	-	-	-	-	-	-
		Other surface water supplies	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
		Groundwater	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
		Remediated groundwater	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
		Recycled water	1,700	1,700	1,700	1,700	1,700	1,700	3,300	3,300
		Supply totals	106,300	103,400	105,000	107,300	109,800	112,500	114,300	114,300
	Demand		45,400	55,300	64,200	73,100	82,300	91,800	101,600	103,800
	Difference		60,900	48,100	40,800	34,200	27,500	20,700	12,700	10,500

Table C-15. NSA Upper Zone Storage Capacity Evaluation					
	2013	Phase 1 (2015-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2052)	Notes
Maximum day demand, mgd	0.0	2.5	5.0	7.9	Cordova Hills (4,451 ac-ft/yr)
Peak hour demand, mgd	0.0	5.0	10.0	15.8	
Provided storage volume, MG					
Existing					
North Douglas	3.0	3.0	3.0	3.0	
Future					
Cordova Hills				3.0	
Total	3.0	3.0	3.0	6.0	
Required storage volume, MG					
Equalization	0.0	0.5	1.0	1.6	Assume 20% MDD.
Fire	0.5	0.5	0.5	0.5	Assume volume for one fire at 3,000 gpm for 3 hours.
Emergency	0.0	0.4	0.8	1.3	Assume 1/3 average day.
Total	0.5	1.4	2.3	3.4	
Difference (provided minus required)	2.5	1.6	0.7	2.6	Could downsize Cordova Hills tank.

Table C-16. NSA Upper Zone Pump Station Capacity Evaluation					
	2013	Phase 1 (2015-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2052)	Notes
Provided pumping capacity, mgd					
Existing					
North Douglas	19.4	19.4	19.4	19.4	Very large capacity for such a small demand.
Upper zone max day supply	0.0	2.5	5.0	7.9	
from storage	19.4	16.9	14.4	11.5	
Future					
Cordova Hills				21.6	
Total from storage	19.4	16.9	14.4	33.1	
Required peak hour capacity from storage, mgd	0.0	2.5	5.0	7.9	Capacity increment above maximum day demand capacity.
Required fire flow from storage, mgd	4.3	4.3	4.3	4.3	4.3 mgd for one fire, max day supply accounted for above.
Required capacity from storage	4.3	4.3	5.0	7.9	Greater of pk hr or fire.
Difference (provided minus required)	15.1	12.6	9.4	25.2	Substantial surplus capacity.
Summary					
Total provided pump station capacity, mgd	38.8	36.3	33.8	52.5	
Total required pump station capcity					
from storage, mgd	4.3	4.3	5.0	7.9	
for max day supply capacity, mgd	0.0	2.5	5.0	7.9	
Total	4.3	6.8	10.0	15.8	

Table C-17. NSA Main Zone Storage Capacity Evaluation

	2013	Phase 1 (2015-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2052)	Notes
Maximum day demand, mgd	7.4	14.1	24.4	48.6	NSA 62.4 mgd minus Cordova Hills (7.9 mgd) and half of Rio del Oro (5.9 mgd).
Peak hour demand, mgd	14.8	28.2	48.8	97.2	
Provided storage volume, MG					
Existing					
Mather Housing GWTP	0.5	0.5	0.5	0.5	
Anatolia GWTP	4.0	4.0	4.0	4.0	
Mather 1 Main Base	1.0	1.0	1.0	1.0	
Mather 2	0.3	0.3	0.3	0.3	
subtotal	5.8	5.8	5.8	5.8	
Future					
Phase B NSA Project		10.0	10.0	10.0	
White Rock				3.0	
Suncreek				3.0	
subtotal	0.0	10.0	10.0	16.0	
Total	5.8	15.8	15.8	21.8	
Required storage volume, MG					
Equalization	1.5	2.8	4.9	9.7	Assume 20% MDD.
Fire	1.1	1.1	1.1	1.1	Assume volume for two fires at 3,000 gpm for 3 hours.
Emergency	1.2	2.4	4.1	8.1	Assume 1/3 average day.
Total	3.8	6.3	10.0	18.9	Could phase in the Phase B NSA Project storage.
Difference (provided minus required)	2.0	9.5	5.8	2.9	

Table C-18. NSA Main Zone Pump Station Capacity Evaluation

	2013	Phase 1 (2015-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2052)	Notes
Provided pumping capacity, mgd					
Existing					
Mather Housing GWTP	5.2	5.2	5.2	5.2	
GWTP	3.0	3.0	3.0	3.0	Assume half of GWTP supplies pump station.
from storage	2.2	2.2	2.2	2.2	
Anatolia GWTP/Storage (a)	11.2	22.5	22.5	22.5	
GWTP/part of MD supply from Vineyard SWTP	6.5	4.7	8.1	16.2	Assume 2/3 of main zone MD demand through NSA terminal and 1/3 through Anatolia tanks.
from storage	4.7	17.8	14.4	6.3	
Mather 1 Main Base	5.2	5.2	5.2	5.2	
Mather 2	2.0	2.0	2.0	2.0	Elevated tank, assumed flow.
subtotal from storage	14.1	27.2	23.8	15.7	
Future					
White Rock				14.4	
Suncreek				18.0	
Phase B NSA-total capacity (b)		64.0	64.0	64.0	Total pump station capacity.
max day supply for Cal Am Rio del Oro		1.0	3.0	5.9	Max day supply for Cal Am tank. Not from storage.
max day supply for upper zone		2.5	5.0	7.9	Supply to North Douglas and Cordova Hills tanks. Not from storage.
part of max day supply from Vineyard SWTP for main zone		9.4	16.3	32.4	Assume 2/3 through NSA terminal and 1/3 through Anatolia tanks.
subtotal, pumping not from Phase B NSA storage		12.9	24.3	46.2	
subtotal, capacity available to pump from Phase B NSA Project storage		51.1	39.7	17.8	
subtotal from storage		51.1	39.7	50.2	
Total from storage	14.1	78.3	63.5	65.9	
Required peak hour capacity from storage, mgd	7.4	14.1	24.4	48.6	
Difference (provided minus required)	6.7	64.2	39.1	17.3	Could phase in the NSA terminal storage pump station capacity.
Summary					
Total provided pump station capacity, mgd	23.6	98.9	98.9	131.3	
Total required pump station capacity					
from storage, mgd	7.4	14.1	24.4	48.6	
for max day supply capacity, mgd	9.5	20.6	35.4	65.4	
Total	16.9	34.7	59.8	114.0	

(a) When Phase A NSA is completed, Anatolia awill pump through supply from Vineyard SWTP.

(b) Calculation of Phase B NSA pump station capacity available to supply from storage the main zone's pk hr increment.

Table C-19. CSA Storage Capacity Evaluation

	2013	Phase 1 (2015-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2051)	Notes
Maximum day demand, mgd	27.0	40.3	52.6	74.0	
Peak hour demand, mgd	54.1	80.6	105.3	147.9	
Provided storage volume, MG					
Existing					
Calvine Meadows GWTP	0.35	0.35	0.35	0.35	
East Elk Grove GWTP	3.5	3.5	3.5	3.5	
East Park GWTP	0.5	0.5	0.5	0.5	
Waterman GWTP	7.0	7.0	7.0	7.0	
Wildhawk GWTP	3.0	3.0	3.0	3.0	
Vineyard SWTP clearwell	6.0	6.0	6.0	6.0	Assumed equalization storage available from 20 mgd clearwell.
subtotal	20.4	20.4	20.4	20.4	
Future					
West Jackson GWTP			4.0	4.0	
East Elk Grove GWTP expansion				0.0	
Bond GWTP				0.5	
North Vineyard Station				4.0	
Calvine Meadows GWTP expansion				0.0	
subtotal			4.0	8.5	
Total	20.4	20.4	24.4	28.9	Planned storage volume.
Required storage volume, MG					
Equalization	5.4	8.1	10.5	14.8	Assume 20% MDD.
Fire	1.1	1.1	1.1	1.1	Assume volume for two fires at 3,000 gpm for 3 hours.
Emergency	4.5	6.7	8.8	12.3	Assume 1/3 average day.
Total	11.0	15.9	20.4	28.2	
Difference (provided minus required)	9.3	4.5	3.9	0.6	

Table C-20. CSA Pump Station Capacity Evaluation

	2013	Phase 1 (2015-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2051)	Notes
Provided pumping capacity, mgd					
Existing					
Calvine Meadows GWTP, total	8.8	8.8	8.8	8.8	
GWTP	5.0	5.0	5.0	5.0	
from storage	3.8	3.8	3.8	3.8	
East Elk Grove GWTP, total	13.0	13.0	13.0	13.0	
GWTP	6.5	6.5	6.5	6.5	
from storage	6.5	6.5	6.5	6.5	
East Park GWTP, total	3.5	3.5	3.5	3.5	
GWTP	2.9	2.9	2.9	2.9	
from storage	0.6	0.6	0.6	0.6	
Waterman GWTP, total	25.9	25.9	25.9	25.9	
GWTP	8.6	8.6	8.6	8.6	
from storage	17.3	17.3	17.3	17.3	
Wildhawk GWTP, total	19.0	19.0	19.0	19.0	
GWTP	7.5	7.5	7.5	7.5	
from storage	11.5	11.5	11.5	11.5	
Vineyard SWTP pump station	13.0	13.0	13.0	13.0	Assume capacity provided from clear well.
subtotal from storage	52.7	52.7	52.7	52.7	
Future					
West Jackson GWTP			21.6	21.6	
GWTP			18.0	18.0	
from storage			3.6	3.6	
East Elk Grove GWTP expansion, total				13.0	
GWTP				6.5	
from storage				6.5	
Bond GWTP, total				10.8	
GWTP				6.5	
from storage				4.3	
North Vineyard Station, total				21.6	Pumps through City POU supply.
City POU supply				19.1	
from storage				2.5	
Calvine Meadows GWTP expansion				7.2	Pump all from storage.
Vineyard SWTP pump station expansion				10.0	Assume future capacity from clear well.
subtotal from storage			3.6	34.1	
Total from storage	52.7	52.7	56.3	86.8	
Required peak hour capacity from storage, mgd	27.0	40.3	52.6	74.0	
Difference (provided minus required) (a)	25.7	12.4	3.7	12.8	Pumping capacity could be reduced in Phase 3.
Summary					
Total provided pump station capacity, mgd	83.2	83.2	104.8	167.4	
Total required pump station capacity					
from storage, mgd	27.0	40.3	52.6	74.0	
for max day supply capacity, mgd	30.5	30.5	48.5	61.5	
Total	57.5	70.8	101.1	135.5	

(a) Peak hour pumping surplus used to supply the SSA.

Table C-21. SSA Storage Capacity Evaluation

	2013	Phase 1 (2015-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2051)	Notes
Maximum day demand, mgd	27.1	40.3	46.6	46.6	
Peak hour demand, mgd	54.2	80.7	93.2	93.2	
Provided storage volume, MG					
Existing					
Big Horn GWTP	2.0	2.0	2.0	2.0	
Dwight Road GWTP	7.0	7.0	7.0	7.0	
Lakeside GWTP	0.5	0.5	0.5	0.5	
Poppy Ridge GWTP	3.5	3.5	3.5	3.5	
subtotal	13.0	13.0	13.0	13.0	
Future					
Poppy Ridge GWTP expansion		3.5	3.5	3.5	
Big Horn GWTP expansion					
Franklin GWTP				2.0	
Whitelock GWTP				3.0	
subtotal	0.0	3.5	3.5	8.5	
Total	13.0	16.5	16.5	21.5	Planned storage volume.
Required storage volume, MG					
Equalization	5.4	8.1	9.3	9.3	Assume 20% MDD.
Fire	1.1	1.1	1.1	1.1	Assume volume for two fires at 3,000 gpm for 3 hours.
Emergency	4.5	6.7	7.8	7.8	Assume 1/3 average day.
Total	11.0	15.9	18.2	18.2	
Difference (provided minus required)	2.0	0.6	-1.7	3.3	Phase 2 deficit supplied by CSA storage surplus.

Table C-22. SSA Pump Station Capacity Evaluation					
	2013	Phase 1 (2015-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2050)	Notes
Provided pumping capacity, mgd					
Existing					
Big Horn GWTP, total	8.6	8.6	8.6	8.6	
GWTP	4.5	4.5	4.5	4.5	
from storage	4.1	4.1	4.1	4.1	
Dwight Road GWTP, total	25.9	25.9	25.9	25.9	
GWTP and Franklin Intertie	13.2	13.2	13.2	13.2	
from storage	12.7	12.7	12.7	12.7	
Lakeside GWTP, total	7.2	7.2	7.2	7.2	
GWTP	6.5	6.5	6.5	6.5	
from storage	0.7	0.7	0.7	0.7	
Poppy Ridge GWTP, total	10.4	10.4	10.4	10.4	
GWTP	6.5	6.5	6.5	6.5	
from storage	3.9	3.9	3.9	3.9	
subtotal from storage	21.4	21.4	21.4	21.4	
Future					
Poppy Ridge GWTP expansion, total		17.0	17.0	17.0	
GWTP		6.5	6.5	6.5	
from storage		10.5	10.5	10.5	
Big Horn GWTP expansion, total			17.0	17.0	
GWTP			8.5	8.5	
from storage			8.5	8.5	
Franklin GWTP, total				21.6	
GWTP				7.0	
from storage				14.6	
Whitelock GWTP, total				14.4	
GWTP				13.0	
from storage				1.4	
subtotal from storage	0.0	10.5	19.0	35.0	
Total from storage	21.4	31.9	40.4	56.4	
Required peak hour capacity from storage, mgd	27.1	40.3	46.6	46.6	
Difference (provided minus required) (a)	-5.7	-8.4	-6.2	9.8	Phase 1 and 2 deficit supplied by CSA.
Summary					
Total provided pump station capacity, mgd	52.1	69.1	86.1	122.1	
Total required pump station capacity					
from storage, mgd	27.1	40.3	46.6	46.6	
for max day supply capacity, mgd	30.7	37.2	45.7	65.7	
Total	57.8	77.5	92.3	112.3	
(a) Peak hour pumping deficit to be supplied by surplus in CSA.					

Table C-23. Zone 40 Storage Capacity Evaluation Summary – Multi-Sport Complex			
	Phase 1 (2015-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2051)
Provided storage volume, MG			
Existing	42.2	42.2	42.2
Future	13.5	17.5	36.0
Total	55.7	59.7	78.2
Required storage volume, MG			
Equalization	19.0	25.5	34.7
Fire	3.8	3.8	3.8
Emergency	15.8	21.3	28.9
Total	38.6	50.6	67.4
Difference (provided minus required)	17.1	9.1	10.8

Table C-24. Zone 40 Pump Station Capacity Evaluation Summary – Multi-Sport Complex			
	Phase 1 (2015-2025)	Phase 2 (2026-2035)	Phase 3 (2036-2051)
Provided pump station capacity from storage, mgd			
Existing	118.2	112.3	103.4
Future	20.5	32.6	88.1
Total	138.7	144.9	191.5
Required pump station capacity from storage, mgd	96.6	127.9	173.1
Difference (provided minus required)	42.1	17.0	18.4

Appendix D: Cost Estimates for CIP Projects

This page intentionally left blank.

Sacramento County Water Agency GWTP-1 Poppy Ridge GWTP Expansion

Project Element	Quantity	Unit	Unit Cost	Total
Mobilization	1	LS	8.00%	$ 607,200
Site Grading, Paving, and Landscaping	1	LS	$ 300,000	$ 300,000
Well Drilling and Casing	0	EA	$ 550,000	$ -
Well Pumping Equipment	3	EA	$ 100,000	$ 300,000
Well Piping and Valving	3	EA	$ 150,000	$ 450,000
Well Electrical and Instrumentation	3	EA	$ 200,000	$ 600,000
Groundwater Treatment Plant, FE & Mn Pressure Filters	6.5	MGD	$ 150,000	$ 975,000
Backwash Tank	1	EA	$ 300,000	$ 300,000
Backwash Pump	1	EA	$ 75,000	$ 75,000
Chemical Feed Equipment and Enclosure	1	LS	$ 50,000	$ 50,000
Standby Generator	1	EA	$ 400,000	$ 400,000
Water Storage Tank	3.5	MG	$ 700,000	$ 2,450,000
Pump Station Building	1	LS	$ 300,000	$ 300,000
Pumps and Motors	17.0	MGD	$ 40,000	$ 680,000
Pump Station Electrical and Instrumentation	1	LS	$ 400,000	$ 400,000
Yard Piping	1	LS	$ 300,000	$ 300,000
Connection to (E) System	1	EA	$ 10,000	$ 10,000
Property Acquisition	0	ACRE		$ -
SUBTOTAL				$ 8,197,200
Contingencies	1	LS	25%	$ 2,049,300
Engineering, Admin, and Legal	1	LS	25%	$ 2,561,625
Environmental & Permitting	1	LS	10%	$ 1,024,650
TOTAL				**$ 13,832,800**

Sacramento County Water Agency P-1 NSA- Sunrise Pipeline

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume paved
16 -inch	7,371		$ 227	$ 1,673,300	
18 -inch		LF	$ 257	$ -	
20 -inch		LF	$ 264	$ -	
24 -inch		LF	$ 293	$ -	
30 -inch		LF	$ 370	$ -	
36 -inch		LF	$ 438	$ -	
42 -inch		LF	$ 510	$ -	
Butterfly Valves					
16 -inch	8	EA	$ 5,721	$ 45,800	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	0	EA	$ 7,896	$ -	
24 -inch	0	EA	$ 10,871	$ -	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	8	EA	$ 17,965	$ 143,720	
SUBTOTAL				$ 1,862,820	
Contingencies	1	LS	15%	$ 279,423	
Engineering	1	LS	8%	$ 171,379	
CMID	1	LS	10%	$ 214,224	
TOTAL				**$ 2,527,900**	

Sacramento County Water Agency P-1A NSA- Sunrise and Keifer Pipeline

Project Element		Quantity	Unit	Unit Cost	Total	Remarks
Pipelines						Assume paved
	16 -inch	9,676		$ 227	$ 2,196,500	Keifer East
	18 -inch		LF	$ 257	$ -	
	20 -inch		LF	$ 264	$ -	
	24 -inch		LF	$ 293	$ -	
	30 -inch		LF	$ 370	$ -	
	36 -inch		LF	$ 438	$ -	
	42 -inch		LF	$ 510	$ -	
Butterfly Valves						
	16 -inch	10	EA	$ 5,721	$ 57,300	
	18 -inch	0	EA	$ 6,866	$ -	
	20 -inch	0	EA	$ 7,896	$ -	
	24 -inch	0	EA	$10,871	$ -	
	30 -inch	0	EA	$20,711	$ -	
	36 -inch	0	EA	$25,061	$ -	
	42 -inch	0	EA	$34,444	$ -	
Horizontal Drilling						
	30 -inch Casing	0	LF	$ 1,361	$ -	
	36 -inch Casing	0	LF	$ 1,361	$ -	
	42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly		10	EA	$17,965	$ 179,650	
SUBTOTAL					$ 2,433,450	
Contingencies		1	LS	15%	$ 365,018	
Engineering		1	LS	8%	$ 223,877	
CMID		1	LS	10%	$ 279,847	
TOTAL					**$ 3,302,200**	

Sacramento County Water Agency P-2 NSA- Rio Del Oro Pipeline

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume not paved
16 -inch				$ -	
18 -inch		LF	$ 153	$ -	
20 -inch		LF	$ 166	$ -	
24 -inch	11,593	LF	$ 203	$ 2,353,386	
30 -inch		LF	$ 279	$ -	
36 -inch		LF	$ 342	$ -	
42 -inch		LF	$ 406	$ -	
Butterfly Valves					
16 -inch	0	EA	$ 5,721	$ -	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	0	EA	$ 7,896	$ -	
24 -inch	12	EA	$ 10,871	$ 130,452	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	12	EA	$ 17,965	$ 215,580	
SUBTOTAL				$ 2,699,418	
Contingencies	1	LS	15%	$ 404,913	
Engineering	1	LS	8%	$ 248,346	
CMID	1	LS	10%	$ 310,433	
TOTAL				**$ 3,663,200**	

Sacramento County Water Agency P-3 NSA- Kiefer Blvd Pipeline

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume not paved
16 -inch	11,078		$ 134	$ 1,484,400	
18 -inch	6,124	LF	$ 153	$ 936,937	
20 -inch	6,669	LF	$ 166	$ 1,107,100	
24 -inch	2,306	LF	$ 203	$ 468,100	
30 -inch		LF	$ 279	$ -	
36 -inch		LF	$ 342	$ -	
42 -inch		LF	$ 406	$ -	
Butterfly Valves					
16 -inch	12	EA	$ 5,721	$ 68,700	
18 -inch	7	EA	$ 6,866	$ 48,062	
20 -inch	7	EA	$ 7,896	$ 55,272	
24 -inch	3	EA	$ 10,871	$ 32,613	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	500	LF	$ 1,361	$ 680,500	Folsom Canal crossing 18" pipe
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	27	EA	$ 17,965	$ 485,055	
SUBTOTAL				$ 5,366,739	
Contingencies	1	LS	15%	$ 805,011	
Engineering	1	LS	8%	$ 493,740	
CMID	1	LS	10%	$ 617,175	
TOTAL				**$ 7,282,700**	

Sacramento County Water Agency P-3A NSA- Shortened Kiefer Blvd Pipeline

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume not paved
16 -inch	-		$ 134	$ -	
18 -inch	6,200	LF	$ 153	$ 948,600	
20 -inch	1,450	LF	$ 166	$ 240,700	
24 -inch	2,306	LF	$ 203	$ 468,100	
30 -inch		LF	$ 279	$ -	
36 -inch		LF	$ 342	$ -	
42 -inch		LF	$ 406	$ -	
Butterfly Valves					
16 -inch	0	EA	$ 5,721	$ -	
18 -inch	7	EA	$ 6,866	$ 48,062	
20 -inch	2	EA	$ 7,896	$ 15,792	
24 -inch	3	EA	$10,871	$ 32,613	
30 -inch	0	EA	$20,711	$ -	
36 -inch	0	EA	$25,061	$ -	
42 -inch	0	EA	$34,444	$ -	
Horizontal Drilling					
30 -inch Casing	500	LF	$ 1,361	$ 680,500	Folsom Canal crossing 18" pipe
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	10	EA	$17,965	$ 179,650	
SUBTOTAL				$ 2,614,017	
Contingencies	1	LS	15%	$ 392,103	
Engineering	1	LS	8%	$ 240,490	
CMID	1	LS	10%	$ 300,612	
TOTAL				**$ 3,547,300**	

Zone 40 Water System Master Plan P-3B NSA- Shortened Kiefer Pipeline for Jackson Township

Sacramento County Water Agency

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume not paved
16 -inch	3,045	LF	$ 134	$ 408,100	
18 -inch	7,571	LF	$ 153	$ 1,158,363	
20 -inch	5,220	LF	$ 166	$ 866,600	
24 -inch	2,306	LF	$ 203	$ 468,118	
30 -inch		LF	$ 279	$ -	
36 -inch		LF	$ 342	$ -	
42 -inch		LF	$ 406	$ -	
Butterfly Valves					
16 -inch	4	EA	$ 5,721	$ 22,900	
18 -inch	8	EA	$ 6,866	$ 54,928	
20 -inch	6	EA	$ 7,896	$ 47,376	
24 -inch	3	EA	$ 10,871	$ 32,613	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	500	LF	$ 1,361	$ 680,500	Folsom Canal crossing 18" pipe
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	19	EA	$ 17,965	$ 341,335	
SUBTOTAL				$ 4,080,833	
Contingencies	1	LS	15%	$ 612,125	
Engineering	1	LS	8%	$ 375,437	
CMID	1	LS	10%	$ 469,296	
TOTAL				**$ 5,537,700**	

Sacramento County Water Agency P-4 NSA- Eagles Nest Pipeline

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume not paved
16 -inch				$ -	
18 -inch		LF	$ 153	$ -	
20 -inch	2,043	LF	$ 166	$ 339,200	
24 -inch		LF	$ 203	$ -	
30 -inch	5,196	LF	$ 279	$ 1,449,900	
36 -inch	1,807	LF	$ 342	$ 618,000	
42 -inch		LF	$ 406	$ -	
Butterfly Valves					
16 -inch	0	EA	$ 5,721	$ -	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	3	EA	$ 7,896	$ 23,688	
24 -inch	0	EA	$ 10,871	$ -	
30 -inch	6	EA	$ 20,711	$ 124,266	
36 -inch	2	EA	$ 25,061	$ 50,200	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	10	EA	$ 17,965	$ 179,650	
SUBTOTAL				$ 2,784,904	
Contingencies	1	LS	15%	$ 417,736	
Engineering	1	LS	8%	$ 256,211	
CMID	1	LS	10%	$ 320,264	
TOTAL				**$ 3,779,200**	

Sacramento County Water Agency P-5 NSA-Ranch Pipeline

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines		2020			Assume not paved
16 -inch			$ 134	$ -	
18 -inch		LF	$ 153	$ -	
20 -inch		LF	$ 166	$ -	
24 -inch	7,000	LF	$ 203	$ 1,421,000	
30 -inch		LF	$ 279	$ -	
36 -inch		LF	$ 342	$ -	
42 -inch		LF	$ 406	$ -	
Butterfly Valves					
16 -inch	0	EA	$ 5,721	$ -	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	0	EA	$ 7,896	$ -	
24 -inch	7	EA	$ 10,871	$ 76,097	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	7	EA	$ 17,965	$ 125,755	
SUBTOTAL				$ 1,622,852	
Contingencies	1	LS	15%	$ 243,428	
Engineering	1	LS	8%	$ 149,302	
CMID	1	LS	10%	$ 186,628	
TOTAL				**$ 2,202,300**	

Sacramento County Water Agency P-6 NSA- Arboretum Pipe System

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume paved
16 -inch	3,167		$ 227	$ 719,000	
18 -inch		LF	$ 257	$ -	
20 -inch		LF	$ 264	$ -	
24 -inch		LF	$ 293	$ -	
30 -inch		LF	$ 370	$ -	
36 -inch		LF	$ 438	$ -	
42 -inch		LF	$ 510	$ -	
Butterfly Valves					
16 -inch	4	EA	$ 5,721	$ 22,900	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	0	EA	$ 7,896	$ -	
24 -inch	0	EA	$ 10,871	$ -	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	4	EA	$ 17,965	$ 71,860	
SUBTOTAL				$ 813,760	
Contingencies	1	LS	15%	$ 122,064	
Engineering	1	LS	8%	$ 74,866	
CMID	1	LS	10%	$ 93,582	
TOTAL				**$ 1,104,300**	

Sacramento County Water Agency P-7 NSA- South Jaeger Pipeline

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume not paved
16 -inch	5,238		$ 134	$ 701,900	
18 -inch		LF	$ 153	$ -	
20 -inch		LF	$ 166	$ -	
24 -inch		LF	$ 203	$ -	
30 -inch		LF	$ 279	$ -	
36 -inch		LF	$ 342	$ -	
42 -inch		LF	$ 406	$ -	
Butterfly Valves					
16 -inch	6	EA	$ 5,721	$ 34,400	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	0	EA	$ 7,896	$ -	
24 -inch	0	EA	$ 10,871	$ -	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	6	EA	$ 17,965	$ 107,790	
SUBTOTAL				$ 844,090	
Contingencies	1	LS	15%	$ 126,614	
Engineering	1	LS	8%	$ 77,656	
CMID	1	LS	10%	$ 97,070	
TOTAL				**$ 1,145,500**	

Sacramento County Water Agency P-8 NSA- East NSA Pipe System

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume not paved
16 -inch	27,571	LF	$ 134	$ 3,694,600	
18 -inch	3,489	LF	$ 153	$ 533,817	
20 -inch		LF	$ 166	$ -	
24 -inch	14,288	LF	$ 203	$ 2,900,464	
30 -inch	16,041	LF	$ 279	$ 4,475,500	
36 -inch		LF	$ 342	$ -	
42 -inch		LF	$ 406	$ -	
Butterfly Valves					
16 -inch	28	EA	$ 5,721	$ 160,200	
18 -inch	4	EA	$ 6,866	$ 27,464	
20 -inch	0	EA	$ 7,896	$ -	
24 -inch	15	EA	$ 10,871	$ 163,065	
30 -inch	17	EA	$ 20,711	$ 352,087	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	62	EA	$ 17,965	$ 1,113,830	
SUBTOTAL				$13,421,027	
Contingencies	1	LS	15%	$ 2,013,154	
Engineering	1	LS	8%	$ 1,234,734	
CMID	1	LS	10%	$ 1,543,418	
TOTAL				**$18,212,400**	

Sacramento County Water Agency P-9 NSA- North Jaeger Pipeline

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume not paved
16 -inch				$ -	
18 -inch		LF	$ 153	$ -	
20 -inch		LF	$ 166	$ -	
24 -inch	6,365	LF	$ 203	$ 1,292,095	
30 -inch		LF	$ 279	$ -	
36 -inch		LF	$ 342	$ -	
42 -inch		LF	$ 406	$ -	
Butterfly Valves					
16 -inch	0	EA	$ 5,721	$ -	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	0	EA	$ 7,896	$ -	
24 -inch	7	EA	$ 10,871	$ 76,097	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	7	EA	$ 17,965	$ 125,755	
SUBTOTAL				$ 1,493,947	
Contingencies	1	LS	15%	$ 224,092	
Engineering	1	LS	8%	$ 137,443	
CMID	1	LS	10%	$ 171,804	
TOTAL				**$ 2,027,300**	

Sacramento County Water Agency P-11 CSA- Vineyard Road Pipeline

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume not paved
16 -inch	13,600	LF	$ 134	$ 1,822,400	
18 -inch		LF	$ 153	$ -	
20 -inch		LF	$ 166	$ -	
24 -inch		LF	$ 203	$ -	
30 -inch		LF	$ 279	$ -	
36 -inch		LF	$ 342	$ -	
42 -inch		LF	$ 406	$ -	
Butterfly Valves				$ -	
16 -inch	14	EA	$ 5,721	$ 80,100	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	0	EA	$ 7,896	$ -	
24 -inch	0	EA	$ 10,871	$ -	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	14	EA	$ 17,965	$ 251,510	
SUBTOTAL				$ 2,154,010	
Contingencies	1	LS	15%	$ 323,102	
Engineering	1	LS	8%	$ 198,169	
CMID	1	LS	10%	$ 247,711	
TOTAL				**$ 2,923,000**	

Sacramento County Water Agency P-12 CSA- Fruitridge Road Pipeline

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume paved
16 -inch	7,982	LF	$ 227	$ 1,812,000	
18 -inch		LF	$ 257	$ -	
20 -inch		LF	$ 264	$ -	
24 -inch		LF	$ 293	$ -	
30 -inch		LF	$ 370	$ -	
36 -inch		LF	$ 438	$ -	
42 -inch		LF	$ 510	$ -	Installation in Major Arterials - Fruitridge Road
Butterfly Valves				$ -	
16 -inch	8	EA	$ 5,721	$ 45,800	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	0	EA	$ 7,896	$ -	
24 -inch	0	EA	$ 10,871	$ -	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	8	EA	$ 17,965	$ 143,720	
SUBTOTAL				$ 2,001,520	
Contingencies	1	LS	15%	$ 300,228	
Engineering	1	LS	8%	$ 184,140	
CMID	1	LS	10%	$ 230,175	
TOTAL				**$ 2,716,100**	

Sacramento County Water Agency P-13 CSA- Elder Creek Road Pipeline

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume paved
16 -inch	10,070	LF	$ 227	$ 2,285,900	
18 -inch		LF	$ 257	$ -	
20 -inch		LF	$ 264	$ -	
24 -inch	5,245	LF	$ 293	$ 1,536,785	
30 -inch	5,861	LF	$ 370	$ 2,168,600	
36 -inch	167	LF	$ 438	$ 73,200	
42 -inch		LF	$ 510	$ -	Installation in Major Arterials - Elder Creek Road
Butterfly Valves				$ -	
16 -inch	11	EA	$ 5,721	$ 63,000	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	0	EA	$ 7,896	$ -	
24 -inch	6	EA	$ 10,871	$ 65,226	
30 -inch	6	EA	$ 20,711	$ 124,266	
36 -inch	1	EA	$ 25,061	$ 25,100	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	22	EA	$ 17,965	$ 395,230	
SUBTOTAL				$ 6,737,307	
Contingencies	1	LS	15%	$ 1,010,596	
Engineering	1	LS	8%	$ 619,832	
CMID	1	LS	10%	$ 774,790	
TOTAL				**$ 9,142,600**	

Sacramento County Water Agency P-14 CSA- Bradshaw Road Pipeline

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume paved
16 -inch	5,267	LF	$ 227	$ 1,195,700	
18 -inch		LF	$ 257	$ -	
20 -inch		LF	$ 264	$ -	
24 -inch	5,332	LF	$ 293	$ 1,562,276	
30 -inch		LF	$ 370	$ -	
36 -inch		LF	$ 438	$ -	
42 -inch		LF	$ 510	$ -	Installation in Major Arterials - Bradshaw Blvd.
Butterfly Valves				$ -	
16 -inch	6	EA	$ 5,721	$ 34,400	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	0	EA	$ 7,896	$ -	
24 -inch	6	EA	$ 10,871	$ 65,226	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	200	LF	$ 1,361	$ 272,200	16" crossing under creek
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	11	EA	$ 17,965	$ 197,615	
SUBTOTAL				$ 3,327,417	
Contingencies	1	LS	15%	$ 499,113	
Engineering	1	LS	8%	$ 306,122	
CMID	1	LS	10%	$ 382,653	
TOTAL				**$ 4,515,400**	

Zone 40 Water System Master Plan P-14A CSA- Bradshaw Road Pipeline

Sacramento County Water Agency

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume paved
16 -inch		LF	$ 227	$ -	
18 -inch		LF	$ 257	$ -	
20 -inch		LF	$ 264	$ -	
24 -inch	5,332	LF	$ 293	$ 1,562,276	
30 -inch		LF	$ 370	$ -	
36 -inch		LF	$ 438	$ -	
42 -inch		LF	$ 510	$ -	Installation in Major Arterials - Bradshaw Blvd.
Butterfly Valves				$ -	
16 -inch	0	EA	$ 5,721	$ -	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	0	EA	$ 7,896	$ -	
24 -inch	6	EA	$ 10,871	$ 65,226	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	200	LF	$ 1,361	$ 272,200	16" crossing under creek
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	6	EA	$ 17,965	$ 107,790	
SUBTOTAL				$ 2,007,492	
Contingencies	1	LS	15%	$ 301,124	
Engineering	1	LS	8%	$ 184,689	
CMID	1	LS	10%	$ 230,862	
TOTAL				**$ 2,724,200**	

Sacramento County Water Agency P-15 CSA- North Vineyard Station (Florin to Gerber) Pipeline

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume not paved
16 -inch				$ -	
18 -inch		LF	$ 153	$ -	
20 -inch		LF	$ 166	$ -	
24 -inch	7,853	LF	$ 203	$ 1,594,159	
30 -inch	1,337	LF	$ 279	$ 373,100	
36 -inch	2,657	LF	$ 342	$ 908,700	
42 -inch		LF	$ 406	$ -	
Butterfly Valves					
16 -inch	0	EA	$ 5,721	$ -	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	0	EA	$ 7,896	$ -	
24 -inch	8	EA	$ 10,871	$ 86,968	
30 -inch	2	EA	$ 20,711	$ 41,422	
36 -inch	3	EA	$ 25,061	$ 75,200	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	300	LF	$ 1,361	$ 408,300	24" pipe across RR
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	12	EA	$ 17,965	$ 215,580	
SUBTOTAL				$ 3,703,429	
Contingencies	1	LS	15%	$ 555,514	
Engineering	1	LS	8%	$ 340,715	
CMID	1	LS	10%	$ 425,894	
TOTAL				**$ 5,025,600**	

Sacramento County Water Agency P-16 CSA- South Watt Connector Pipeline

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume paved
16 -inch				$ -	
18 -inch		LF	$ 257	$ -	
20 -inch		LF	$ 264	$ -	
24 -inch	2,693	LF	$ 293	$ 789,184	
30 -inch		LF	$ 370	$ -	
36 -inch		LF	$ 438	$ -	
42 -inch		LF	$ 510	$ -	Installation in Major Arterials - South Watt
Butterfly Valves					
16 -inch	0	EA	$ 5,721	$ -	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	0	EA	$ 7,896	$ -	
24 -inch	3	EA	$ 10,871	$ 32,613	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	300	LF	$ 1,361	$ 408,300	24" pipe across RR
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	3	EA	$ 17,965	$ 53,895	
SUBTOTAL				$ 1,283,992	
Contingencies	1	LS	15%	$ 192,599	
Engineering	1	LS	8%	$ 118,127	
CMID	1	LS	10%	$ 147,659	
TOTAL				**$ 1,742,400**	

Sacramento County Water Agency P-17 CSA- CSA Backbone Pipeline

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume paved
16 -inch				$ -	
18 -inch		LF	$ 257	$ -	
20 -inch		LF	$ 264	$ -	
24 -inch	4,525	LF	$ 293	$ 1,325,825	
30 -inch	5,423	LF	$ 370	$ 2,006,600	
36 -inch		LF	$ 438	$ -	
42 -inch		LF	$ 510	$ -	Installation in Major Arterials - Bradshaw
Butterfly Valves					
16 -inch	0	EA	$ 5,721	$ -	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	0	EA	$ 7,896	$ -	
24 -inch	5	EA	$ 10,871	$ 54,355	
30 -inch	6	EA	$ 20,711	$ 124,266	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	10	EA	$ 17,965	$ 179,650	
SUBTOTAL				$ 3,690,696	
Contingencies	1	LS	15%	$ 553,604	
Engineering	1	LS	8%	$ 339,544	
CMID	1	LS	10%	$ 424,430	
TOTAL				**$ 5,008,300**	

Sacramento County Water Agency P-18 CSA- Elk Grove Connector Pipelines

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume paved
16 -inch	8,340	LF	$ 227	$ 1,893,180	Add 1,700 ft per Carlos' TM figure. Bob's map shows 12 in.
18 -inch		LF	$ 257	$ -	
20 -inch		LF	$ 264	$ -	
24 -inch	2,982	LF	$ 293	$ 873,726	
30 -inch		LF	$ 370	$ -	
36 -inch		LF	$ 438	$ -	
42 -inch		LF	$ 510	$ -	Installation in Major Arterials - Bradshaw and Grantline
Butterfly Valves					
16 -inch	9	EA	$ 5,721	$ 51,500	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	0	EA	$ 7,896	$ -	
24 -inch	3	EA	$ 10,871	$ 32,613	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	300	LF	$ 1,361	$ 408,300	24" under railroad
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	12	EA	$ 17,965	$ 215,580	
SUBTOTAL				$ 3,474,899	
Contingencies	1	LS	15%	$ 521,235	
Engineering	1	LS	8%	$ 319,691	
CMID	1	LS	10%	$ 399,613	
TOTAL				**$ 4,715,500**	

Sacramento County Water Agency P-19 CSA- Power Inn Road Pipeline

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume paved
16 -inch				$ -	
18 -inch		LF	$ 257	$ -	
20 -inch		LF	$ 264	$ -	
24 -inch	1,273	LF	$ 293	$ 372,905	
30 -inch		LF	$ 370	$ -	
36 -inch		LF	$ 438	$ -	
42 -inch		LF	$ 510	$ -	
Butterfly Valves					
16 -inch	0	EA	$ 5,721	$ -	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	0	EA	$ 7,896	$ -	
24 -inch	2	EA	$ 10,871	$ 21,742	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	2	EA	$ 17,965	$ 35,930	
SUBTOTAL				$ 430,577	
Contingencies	1	LS	15%	$ 64,587	
Engineering	1	LS	8%	$ 39,613	
CMID	1	LS	10%	$ 49,516	
TOTAL				**$ 584,300**	

Sacramento County Water Agency P-20 SSA- Big Horn / Kammerer Pipeline

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume not paved
16 -inch				$ -	
18 -inch		LF	$ 153	$ -	
20 -inch	7,832	LF	$ 166	$ 1,300,200	
24 -inch	1,347	LF	$ 203	$ 273,441	
30 -inch		LF	$ 279	$ -	
36 -inch		LF	$ 342	$ -	
42 -inch		LF	$ 406	$ -	
Butterfly Valves					
16 -inch	0	EA	$ 5,721	$ -	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	8	EA	$ 7,896	$ 63,168	
24 -inch	2	EA	$ 10,871	$ 21,742	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	10	EA	$ 17,965	$ 179,650	
SUBTOTAL				$ 1,838,201	
Contingencies	1	LS	15%	$ 275,730	
Engineering	1	LS	8%	$ 169,114	
CMID	1	LS	10%	$ 211,393	
TOTAL				**$ 2,494,500**	

Sacramento County Water Agency P-21 SSA- Bruceville Road Pipeline

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume paved
16 -inch				$ -	
18 -inch	1,267	LF	$ 257	$ 325,681	
20 -inch		LF	$ 264	$ -	
24 -inch		LF	$ 293	$ -	
30 -inch		LF	$ 370	$ -	
36 -inch		LF	$ 438	$ -	
42 -inch		LF	$ 510	$ -	Installation in Major Arterials - Bruceville Road
Butterfly Valves					
16 -inch	0	EA	$ 5,721	$ -	
18 -inch	2	EA	$ 6,866	$ 13,732	
20 -inch	0	EA	$ 7,896	$ -	
24 -inch	0	EA	$ 10,871	$ -	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	2	EA	$ 17,965	$ 35,930	
SUBTOTAL				$ 375,343	
Contingencies	1	LS	15%	$ 56,301	
Engineering	1	LS	8%	$ 34,532	
CMID	1	LS	10%	$ 43,164	
TOTAL				**$ 509,400**	

Sacramento County Water Agency P-22 NSA- North Grant Line Road Pipeline

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume not paved
16 -inch				$ -	
18 -inch		LF	$ 153	$ -	
20 -inch	14,000	LF	$ 166	$ 2,324,000	
24 -inch	3,000	LF	$ 203	$ 609,000	
30 -inch		LF	$ 279	$ -	
36 -inch		LF	$ 342	$ -	
42 -inch		LF	$ 406	$ -	
Butterfly Valves					
16 -inch	0	EA	$ 5,721	$ -	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	14	EA	$ 7,896	$ 110,544	
24 -inch	3	EA	$ 10,871	$ 32,613	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	17	EA	$ 17,965	$ 305,405	
SUBTOTAL				$ 3,381,562	
Contingencies	1	LS	15%	$ 507,234	
Engineering	1	LS	8%	$ 311,104	
CMID	1	LS	10%	$ 388,880	
TOTAL				**$ 4,588,800**	

Sacramento County Water Agency P-23 CSA- Florin-Watt Pipelines

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume paved
16 -inch				$ -	
18 -inch		LF	$ 257	$ -	
20 -inch	5,000	LF	$ 264	$ 1,320,000	
24 -inch	5,000	LF	$ 293	$ 1,465,000	
30 -inch		LF	$ 370	$ -	
36 -inch		LF	$ 438	$ -	
42 -inch		LF	$ 510	$ -	
Butterfly Valves					
16 -inch	0	EA	$ 5,721	$ -	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	5	EA	$ 7,896	$ 39,480	
24 -inch	5	EA	$ 10,871	$ 54,355	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	10	EA	$ 17,965	$ 179,650	
SUBTOTAL				$ 3,058,485	
Contingencies	1	LS	15%	$ 458,773	
Engineering	1	LS	8%	$ 281,381	
CMID	1	LS	10%	$ 351,726	
TOTAL				**$ 4,150,400**	

Sacramento County Water Agency P-24 CSA- North Waterman Pipeline

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume not paved
16 -inch	3,000	LF	$ 134	$ 402,000	
18 -inch		LF	$ 153	$ -	
20 -inch		LF	$ 166	$ -	
24 -inch		LF	$ 203	$ -	
30 -inch		LF	$ 279	$ -	
36 -inch		LF	$ 342	$ -	
42 -inch		LF	$ 406	$ -	
Butterfly Valves					
16 -inch	3	EA	$ 5,721	$ 17,200	
18 -inch	0	EA	$ 6,866	$ -	
20 -inch	0	EA	$ 7,896	$ -	
24 -inch	0	EA	$ 10,871	$ -	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	0	EA	$ 17,965	$ -	
SUBTOTAL				$ 419,200	
Contingencies	1	LS	15%	$ 62,880	
Engineering	1	LS	8%	$ 38,566	
CMID	1	LS	10%	$ 48,208	
TOTAL				**$ 568,900**	

Sacramento County Water Agency P-25 CSA- Sheldon-Waterman Pipelines

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume paved
16 -inch				$ -	
18 -inch	11,000	LF	$ 257	$ 2,827,000	
20 -inch		LF	$ 264	$ -	
24 -inch	4,000	LF	$ 293	$ 1,172,000	
30 -inch		LF	$ 370	$ -	
36 -inch		LF	$ 438	$ -	
42 -inch		LF	$ 510	$ -	
Butterfly Valves					
16 -inch	0	EA	$ 5,721	$ -	
18 -inch	11	EA	$ 6,866	$ 75,526	
20 -inch	0	EA	$ 7,896	$ -	
24 -inch	4	EA	$ 10,871	$ 43,484	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	4	EA	$ 17,965	$ 71,860	
SUBTOTAL				$ 4,189,870	
Contingencies	1	LS	15%	$ 628,481	
Engineering	1	LS	8%	$ 385,468	
CMID	1	LS	10%	$ 481,835	
TOTAL				**$ 5,685,700**	

Sacramento County Water Agency P-26 SSA- South East Policy Area Pipelines

Project Element	Quantity	Unit	Unit Cost	Total	Remarks
Pipelines					Assume not paved
16 -inch				$ -	
18 -inch	3,000	LF	$ 153	$ 459,000	
20 -inch	14,000	LF	$ 166	$ 2,324,000	
24 -inch	5,000	LF	$ 203	$ 1,015,000	
30 -inch		LF	$ 279	$ -	
36 -inch		LF	$ 342	$ -	
42 -inch		LF	$ 406	$ -	
Butterfly Valves					
16 -inch	0	EA	$ 5,721	$ -	
18 -inch	3	EA	$ 6,866	$ 20,598	
20 -inch	14	EA	$ 7,896	$ 110,544	
24 -inch	5	EA	$ 10,871	$ 54,355	
30 -inch	0	EA	$ 20,711	$ -	
36 -inch	0	EA	$ 25,061	$ -	
42 -inch	0	EA	$ 34,444	$ -	
Horizontal Drilling					
30 -inch Casing	0	LF	$ 1,361	$ -	
36 -inch Casing	0	LF	$ 1,361	$ -	
42 -inch Casing	0	LF	$ 1,902	$ -	
Blow-Off Assembly	19	EA	$ 17,965	$ 341,335	
SUBTOTAL				$ 4,324,832	
Contingencies	1	LS	15%	$ 648,725	
Engineering	1	LS	8%	$ 397,885	
CMID	1	LS	10%	$ 497,356	
TOTAL				**$ 5,868,800**	

Sacramento County Water Agency GWTP-2 West Jackson GWTP

Project Element	Quantity	Unit	Unit Cost	Total
Mobilization	1	LS	8.00%	$ 1,270,000
Site Grading, Paving, and Landscaping	1	LS	$ 300,000	$ 300,000
Well Drilling and Casing	5	EA	$ 550,000	$ 2,750,000
Well Pumping Equipment	5	EA	$ 100,000	$ 500,000
Well Piping and Valving	5	EA	$ 150,000	$ 750,000
Well Electrical and Instrumentation	5	EA	$ 200,000	$ 1,000,000
Groundwater Treatment Plant, FE&Mn Pressure Filters	18	MGD	$ 150,000	$ 2,700,000
Backwash Tank	1	EA	$ 300,000	$ 300,000
Backwash Pump	1	EA	$ 75,000	$ 75,000
Chemical Feed Equipment and Enclosure	1	LS	$ 50,000	$ 50,000
Standby Generator	1	EA	$ 400,000	$ 400,000
Water Storage Tank	4	MG	$ 700,000	$ 2,800,000
Pump Station Building	1	LS	$ 300,000	$ 300,000
Pumps and Motors	21.6	MGD	$ 150,000	$ 3,240,000
Pump Station Electrical and Instrumentation	1	LS	$ 400,000	$ 400,000
Yard Piping	1	LS	$ 300,000	$ 300,000
Connection to (E) System	1	EA	$ 10,000	$ 10,000
Property Acquisition	0	ACRE		$ -
SUBTOTAL				$ 17,145,000
Contingencies	1	LS	25%	$ 4,286,250
Engineering, Admin, and Legal	1	LS	25%	$ 5,357,813
Environmental & Permitting	1	LS	10%	$ 2,143,125
TOTAL				**$ 28,932,200**

Sacramento County Water Agency GWTP-3 Bond GWTP

Project Element	Quantity	Unit	Unit Cost	Total
Mobilization	1	LS	8.00%	$ 646,400
Site Grading, Paving, and Landscaping	1	LS	$ 300,000	$ 300,000
Well Drilling and Casing	3	EA	$ 550,000	$ 1,650,000
Well Pumping Equipment	3	EA	$ 100,000	$ 300,000
Well Piping and Valving	3	EA	$ 150,000	$ 450,000
Well Electrical and Instrumentation	3	EA	$ 200,000	$ 600,000
Groundwater Treatment Plant, FE&Mn Pressure Filters	6.5	MGD	$ 150,000	$ 975,000
Backwash Tank	1	EA	$ 300,000	$ 300,000
Backwash Pump	1	EA	$ 75,000	$ 75,000
Chemical Feed Equipment and Enclosure	1	LS	$ 50,000	$ 50,000
Standby Generator	1	EA	$ 400,000	$ 400,000
Water Storage Tank	0.5	MG	$ 700,000	$ 350,000
Pump Station Building	1	LS	$ 300,000	$ 300,000
Pumps and Motors	10.8	MGD	$ 150,000	$ 1,620,000
Pump Station Electrical and Instrumentation	1	LS	$ 400,000	$ 400,000
Yard Piping	1	LS	$ 300,000	$ 300,000
Connection to (E) System	1	EA	$ 10,000	$ 10,000
Property Acquisition	0	ACRE		$ -
SUBTOTAL				$ 8,726,400
Contingencies	1	LS	25%	$ 2,181,600
Engineering, Admin, and Legal	1	LS	25%	$ 2,727,000
Environmental & Permitting	1	LS	10%	$ 1,090,800
TOTAL				**$ 14,725,800**

Sacramento County Water Agency GWTP-4 East Elk Grove GWTP Expansion

Project Element	Quantity	Unit	Unit Cost	Total
Mobilization	1	LS	8.00%	$ 600,800
Site Grading, Paving, and Landscaping	1	LS	$ 300,000	$ 300,000
Well Drilling and Casing	2	EA	$ 550,000	$ 1,100,000
Well Pumping Equipment	3	EA	$ 100,000	$ 300,000
Well Piping and Valving	3	EA	$ 150,000	$ 450,000
Well Electrical and Instrumentation	3	EA	$ 200,000	$ 600,000
Groundwater Treatment Plant, FE&Mn Pressure Filters	6.5	MGD	$ 150,000	$ 975,000
Backwash Tank	1	EA	$ 300,000	$ 300,000
Backwash Pump	1	EA	$ 75,000	$ 75,000
Chemical Feed Equipment and Enclosure	1	LS	$ 50,000	$ 50,000
Standby Generator	1	EA	$ 400,000	$ 400,000
Water Storage Tank	0	MG	$ 700,000	$ -
Pump Station Building	1	LS	$ 300,000	$ 300,000
Pumps and Motors	13	MGD	$ 150,000	$ 1,950,000
Pump Station Electrical and Instrumentation	1	LS	$ 400,000	$ 400,000
Yard Piping	1	LS	$ 300,000	$ 300,000
Connection to (E) System	1	EA	$ 10,000	$ 10,000
Property Acquisition	0	ACRE		$ -
SUBTOTAL				$ 8,110,800
Contingencies	1	LS	25%	$ 2,027,700
Engineering, Admin, and Legal	1	LS	25%	$ 2,534,625
Environmental & Permitting	1	LS	10%	$ 1,013,850
TOTAL				**$ 13,687,000**

Sacramento County Water Agency | GWTP-5 | Franklin GWTP Expansion

Project Element	Quantity	Unit	Unit Cost	Total
Mobilization	1	LS	8.00%	$ 814,000
Site Grading, Paving, and Landscaping	1	LS	$ 300,000	$ 300,000
Well Drilling and Casing	1	EA	$ 550,000	$ 550,000
Well Pumping Equipment	4	EA	$ 100,000	$ 400,000
Well Piping and Valving	4	EA	$ 150,000	$ 600,000
Well Electrical and Instrumentation	4	EA	$ 200,000	$ 800,000
Groundwater Treatment Plant, FE&Mn Pressure Filters	7	MGD	$ 150,000	$ 1,050,000
Backwash Tank	1	EA	$ 300,000	$ 300,000
Backwash Pump	1	EA	$ 75,000	$ 75,000
Chemical Feed Equipment and Enclosure	1	LS	$ 50,000	$ 50,000
Standby Generator	1	EA	$ 400,000	$ 400,000
Water Storage Tank	2.0	MG	$ 700,000	$ 1,400,000
Pump Station Building	1	LS	$ 300,000	$ 300,000
Pumps and Motors	21.6	MGD	$ 150,000	$ 3,240,000
Pump Station Electrical and Instrumentation	1	LS	$ 400,000	$ 400,000
Yard Piping	1	LS	$ 300,000	$ 300,000
Connection to (E) System	1	EA	$ 10,000	$ 10,000
Property Acquisition	0	ACRE		$ -
SUBTOTAL				$ 10,989,000
Contingencies	1	LS	25%	$ 2,747,250
Engineering, Admin, and Legal	1	LS	25%	$ 3,434,063
Environmental & Permitting	1	LS	10%	$ 1,373,625
TOTAL				**$ 18,544,000**

Sacramento County Water Agency GWTP-6 Whitelock GWTP

Project Element	Quantity	Unit	Unit Cost	Total
Mobilization	1	LS	8.00%	$ 1,147,600
Site Grading, Paving, and Landscaping	1	LS	$ 300,000	$ 300,000
Well Drilling and Casing	6	EA	$ 550,000	$ 3,300,000
Well Pumping Equipment	6	EA	$ 100,000	$ 600,000
Well Piping and Valving	6	EA	$ 150,000	$ 900,000
Well Electrical and Instrumentation	6	EA	$ 200,000	$ 1,200,000
Groundwater Treatment Plant, FE&Mn Pressure Filters	13.0	MGD	$ 150,000	$ 1,950,000
Backwash Tank	1	EA	$ 300,000	$ 300,000
Backwash Pump	1	EA	$ 75,000	$ 75,000
Chemical Feed Equipment and Enclosure	1	LS	$ 50,000	$ 50,000
Standby Generator	1	EA	$ 400,000	$ 400,000
Water Storage Tank	3.0	MG	$ 700,000	$ 2,100,000
Pump Station Building	1	LS	$ 300,000	$ 300,000
Pumps and Motors	14.4	MGD	$ 150,000	$ 2,160,000
Pump Station Electrical and Instrumentation	1	LS	$ 400,000	$ 400,000
Yard Piping	1	LS	$ 300,000	$ 300,000
Connection to (E) System	1	EA	$ 10,000	$ 10,000
Property Acquisition	0	ACRE		$ -
SUBTOTAL				$ 15,492,600
Contingencies	1	LS	25%	$ 3,873,150
Engineering, Admin, and Legal	1	LS	25%	$ 4,841,438
Environmental & Permitting	1	LS	10%	$ 1,936,575
TOTAL				**$ 26,143,800**

Sacramento County Water Agency GWTP-7 Big Horn GWTP Expansion

Project Element		Quantity	Unit	Unit Cost	Total
Mobilization		$ 1	LS	8.00%	$ 647,200
Site Grading, Paving, and Landscaping		1	LS	$ 300,000	$ 300,000
Well Drilling and Casing		4	EA	$ 550,000	$ 2,200,000
Well Pumping Equipment		4	EA	$ 100,000	$ 400,000
Well Piping and Valving		4	EA	$ 150,000	$ 600,000
Well Electrical and Instrumentation		4	EA	$ 200,000	$ 800,000
Groundwater Treatment Plant, FE&Mn Pressure Filters		8.5	MGD	$ 150,000	$ 1,275,000
Backwash Tank		1	EA	$ 300,000	$ 300,000
Backwash Pump		1	EA	$ 75,000	$ 75,000
Chemical Feed Equipment and Enclosure		1	LS	$ 50,000	$ 50,000
Standby Generator		1	EA	$ 400,000	$ 400,000
Water Storage Tank			MG	$ 700,000	$ -
Pump Station Building		1	LS	$ 300,000	$ 300,000
Pumps and Motors		17.0	MGD	$ 40,000	$ 680,000
Pump Station Electrical and Instrumentation		1	LS	$ 400,000	$ 400,000
Yard Piping		1	LS	$ 300,000	$ 300,000
Connection to (E) System		1	EA	$ 10,000	$ 10,000
Property Acquisition		0	ACRE		$ -
SUBTOTAL					$ 8,737,200
Contingencies		1	LS	25%	$ 2,184,300
Engineering, Admin, and Legal		1	LS	25%	$ 2,730,375
Environmental & Permitting		1	LS	10%	$ 1,092,150
TOTAL					**$ 14,744,100**

Sacramento County Water Agency SW-2 City POU Water Supply Connection

Project Element	Quantity	Unit	Unit Cost	Total
Mobilization	1	LS	8.00%	$ 85,072
Pipelines				
16 -inch		LF		$ -
18 -inch		LF		$ -
20 -inch		LF		$ -
24 -inch		LF		$ -
30 -inch		LF		$ -
36 -inch	13,000	LF		$ -
42 -inch		LF	$ 438	$ -
Installation in Major Arterials	1	EA	10.00%	$ -
Butterfly Valves				
16 -inch	0	EA		$ -
18 -inch	0	EA		$ -
20 -inch	0	EA		$ -
24 -inch	13	EA	$ 25,061	$ 325,793
30 -inch	0	EA		$ -
36 -inch	13	EA		$ -
42 -inch	0	EA		$ -
Horizontal Drilling				
30 -inch Casing	0	LF	$ -	$ -
36 -inch Casing	0	LF	$ -	$ -
42 -inch Casing	300	LF	$ 1,902	$ 570,600
Trench Restoration				
Paved	58,500	SF	$ 2	$ 117,000
Blow-Off Assembly	0	EA		$ -
Fire Hydrants	0	EA		$ -
Connection to (E) System	1	EA	$ 50,000	$ 50,000
Abandonment Exist Pipe	0	EA		$ -
Property Acquisition	0	ACRE		$ -
Railroad Crossing Permitting	1	EA	10%	$ 57,060
Canal Crossing Permitting	0	EA	10%	$ -
Highway Crossing Permitting	0	EA	10%	$ -
SUBTOTAL				$1,205,525
Contingencies	1	LS	25%	$ 301,381
Engineering, Admin, and Legal	1	LS	25%	$ 376,727
Environmental & Permitting	1	LS	10%	$ 150,691
TOTAL				**$2,034,400**

Sacramento County Water Agency S-2 Suncreek Storage Tank

Project Element	Quantity	Unit	Unit Cost	Total
Mobilization	1	LS	8.00%	$ 520,800
Site Grading, Paving, and Landscaping	1	LS	$ 300,000	$ 300,000
Water Storage Tank	3	MG	$ 700,000	$ 2,100,000
Pump Station Building	1	LS	$ 300,000	$ 300,000
Pumps and Motors	18.0	MGD	$ 150,000	$ 2,700,000
Standby Generator	1	EA	$ 400,000	$ 400,000
Pump Station Electrical and Instrumentation	1	LS	$ 400,000	$ 400,000
Yard Piping	1	LS	$ 300,000	$ 300,000
Connection to (E) System	1	EA	$ 10,000	$ 10,000
Property Acquisition	0	ACRE		$ -
SUBTOTAL				$ 7,030,800
Contingencies	1	LS	25%	$ 1,757,700
Engineering, Admin, and Legal	1	LS	25%	$ 2,197,125
Environmental & Permitting	1	LS	10%	$ 878,850
TOTAL				**$ 11,864,500**

Sacramento County Water Agency S-3 Cordova Hills Storage Tank

Project Element	Quantity	Unit	Unit Cost	Total
Mobilization	1	LS	8.00%	$ 564,000
Site Grading, Paving, and Landscaping	1	LS	$ 300,000	$ 300,000
Water Storage Tank	3	MG	$ 700,000	$ 2,100,000
Pump Station Building	1	LS	$ 300,000	$ 300,000
Pumps and Motors	21.6	MGD	$ 150,000	$ 3,240,000
Standby Generator	1	EA	$ 400,000	$ 400,000
Pump Station Electrical and Instrumentation	1	LS	$ 400,000	$ 400,000
Yard Piping	1	LS	$ 300,000	$ 300,000
Connection to (E) System	1	EA	$ 10,000	$ 10,000
Property Acquisition	0	ACRE		$ -
SUBTOTAL				$ 7,614,000
Contingencies	1	LS	25%	$ 1,903,500
Engineering, Admin, and Legal	1	LS	25%	$ 2,379,375
Environmental & Permitting	1	LS	10%	$ 951,750
TOTAL				**$12,848,700**

Sacramento County Water Agency S-4 White Rock Road Storage Tank

Project Element	Quantity	Unit	Unit Cost	Total
Mobilization	1	LS	8.00%	$ 477,600
Site Grading, Paving, and Landscaping	1	LS	$ 300,000	$ 300,000
Water Storage Tank	3.0	MG	$ 700,000	$ 2,100,000
Pump Station Building	1	LS	$ 300,000	$ 300,000
Pumps and Motors	14.4	MGD	$ 150,000	$ 2,160,000
Standby Generator	1	EA	$ 400,000	$ 400,000
Pump Station Electrical and Instrumentation	1	LS	$ 400,000	$ 400,000
Yard Piping	1	LS	$ 300,000	$ 300,000
Connection to (E) System	1	EA	$ 10,000	$ 10,000
Property Acquisition	0	ACRE		$ -
SUBTOTAL				$ 6,447,600
Contingencies	1	LS	25%	$ 1,611,900
Engineering, Admin, and Legal	1	LS	25%	$ 2,014,875
Environmental & Permitting	1	LS	10%	$ 805,950
TOTAL				**$ 10,880,400**

Sacramento County Water Agency S-5 North Vineyard Station Storage Tank

Project Element	Quantity	Unit	Unit Cost	Total
Mobilization	1	LS	8.00%	$ 240,000
Site Grading, Paving, and Landscaping	1	LS	$ 300,000	$ 300,000
Water Storage Tank	0	MG	$ 700,000	$ -
Pump Station Building	1	LS	$ 300,000	$ 300,000
Pumps and Motors	8.6	MGD	$ 150,000	$ 1,290,000
Standby Generator	1	EA	$ 400,000	$ 400,000
Pump Station Electrical and Instrumentation	1	LS	$ 400,000	$ 400,000
Yard Piping	1	LS	$ 300,000	$ 300,000
Connection to (E) System	1	EA	$ 10,000	$ 10,000
Property Acquisition	0	ACRE		$ -
SUBTOTAL				$ 3,240,000
Contingencies	1	LS	25%	$ 810,000
Engineering, Admin, and Legal	1	LS	25%	$ 1,012,500
Environmental & Permitting	1	LS	10%	$ 405,000
TOTAL				**$ 5,467,500**

Sacramento County Water Agency S-6 Calvine Meadows Pump Station Expansion

Project Element	Quantity	Unit	Unit Cost	Total
Mobilization	1	LS	8.00%	$ 223,200
Site Grading, Paving, and Landscaping	1	LS	$ 300,000	$ 300,000
Water Storage Tank	0	MG	$ 700,000	$ -
Pump Station Building	1	LS	$ 300,000	$ 300,000
Pumps and Motors	7.2	MGD	$ 150,000	$ 1,080,000
Standby Generator	1	EA	$ 400,000	$ 400,000
Pump Station Electrical and Instrumentation	1	LS	$ 400,000	$ 400,000
Yard Piping	1	LS	$ 300,000	$ 300,000
Connection to (E) System	1	EA	$ 10,000	$ 10,000
Property Acquisition	0	ACRE		$ -
SUBTOTAL				$ 3,013,200
Contingencies	1	LS	25%	$ 753,300
Engineering, Admin, and Legal	1	LS	25%	$ 941,625
Environmental & Permitting	1	LS	10%	$ 376,650
TOTAL				**$ 5,084,800**

Zone 40 Water System Infrastructure Plan

Phases 2 and 3 Pipelines, Baseline

Sacramento County Water Agency

Project Element		Quantity	Unit	Unit Cost	Total
Pipelines					
16 -inch		82,803	LF	$ 227	$ 18,796,400
18 -inch		4,740	LF	$ 257	$ 1,218,101
20 -inch		-	LF	$ 264	$ -
24 -inch		64,864	LF	$ 293	$ 19,005,091
30 -inch		4,681	LF	$ 370	$ 1,731,900
36 -inch		29,502	LF	$ 438	$ 12,921,900
42 -inch		3,371	LF	$ 510	$ 1,719,300
54 -inch		40,704	LF	$ 767	$ 31,220,000
Installation in Major Arterials			EA	10.00%	$ -
Butterfly Valves					
16 -inch		83	EA	$ 6,866	$ 569,900
18 -inch		5	EA	$ 7,896	$ 39,480
20 -inch		0	EA	$ 10,871	$ -
24 -inch		65	EA	$ 20,711	$ 1,346,215
30 -inch		5	EA	$ 25,061	$ 125,305
36 -inch		30	EA	$ 34,444	$ 1,033,400
42 -inch		4	EA	$ 52,409	$ 209,700
54 -inch		41	LF	$ 81,362	$ 3,335,900
Horizontal Drilling					
30 -inch Casing		0	LF	$ 1,361	$ -
36 -inch Casing		0	LF	$ 1,361	$ -
42 -inch Casing		0	LF	$ 1,902	$ -
Trench Restoration					
Paved		644,189	SF	$ 2	$ 1,288,379
Blow-Off Assembly		0	EA		$ -
Fire Hydrants		0	EA		$ -
Connection to (E) System		0	EA	$ 10,000	$ -
Abandonment Exist Pipe		0	EA		$ -
Property Acquisition		0	ACRE		$ -
Railroad Crossing Permitting		0	EA	10%	$ -
Highway Crossing Permitting		0	EA	10%	$ -
HighwayCrossing Permitting		0	EA	10%	$ -
SUBTOTAL					$ 94,560,971
Contingencies		1	LS	25%	$ 23,640,243
Engineering, Admin, and Legal		1	LS	25%	$ 29,550,303
Environmental & Permitting		1	LS	10%	$ 11,820,121
TOTAL					**$ 159,571,700**

Zone 40 Water System Infrastructure Plan

Phases 2 and 3 Pipelines,
Jackson Township

Sacramento County Water Agency

Project Element	Quantity	Unit	Unit Cost	Total
Pipelines				
16 -inch	114,351	LF	$ 227	$ 25,957,800
18 -inch	1,739	LF	$ 257	$ 447,042
20 -inch	5,689	LF	$ 264	$ 1,501,900
24 -inch	64,864	LF	$ 293	$ 19,005,091
30 -inch	4,681	LF	$ 370	$ 1,731,900
36 -inch	29,502	LF	$ 438	$ 12,921,900
42 -inch	3,371	LF	$ 510	$ 1,719,300
54 -inch	40,704	LF	$ 767	$ 31,220,000
Installation in Major Arterials		EA	10.00%	$ -
Butterfly Valves				
16 -inch	115	EA	$ 6,866	$ 789,600
18 -inch	2	EA	$ 7,896	$ 15,792
20 -inch	6	EA	$ 10,871	$ 65,226
24 -inch	65	EA	$ 20,711	$ 1,346,215
30 -inch	5	EA	$ 25,061	$ 125,305
36 -inch	30	EA	$ 34,444	$ 1,033,400
42 -inch	4	EA	$ 52,409	$ 209,700
54 -inch	41	LF	$ 81,362	$ 3,335,900
Horizontal Drilling				
30 -inch Casing	0	LF	$ 1,361	$ -
36 -inch Casing	0	LF	$ 1,361	$ -
42 -inch Casing	0	LF	$ 1,902	$ -
Trench Restoration				
Paved	742,590	SF	$ 2	$ 1,485,180
Blow-Off Assembly	0	EA		$ -
Fire Hydrants	0	EA		$ -
Connection to (E) System	0	EA	$ 10,000	$ -
Abandonment Exist Pipe	0	EA		$ -
Property Acquisition	0	ACRE		$ -
Railroad Crossing Permitting	0	EA	10%	$ -
Highway Crossing Permitting	0	EA	10%	$ -
HighwayCrossing Permitting	0	EA	10%	$ -
SUBTOTAL				$ 102,911,251
Contingencies	1	LS	25%	$ 25,727,813
Engineering, Admin, and Legal	1	LS	25%	$ 32,159,766
Environmental & Permitting	1	LS	10%	$ 12,863,906
TOTAL				**$ 173,662,800**

Zone 40 Water System Infrastructure Plan

Phases 2 and 3 Pipelines, NewBridge

Sacramento County Water Agency

Project Element		Quantity	Unit	Unit Cost	Total
Pipelines					
16 -inch		105,319	LF	$ 227	$ 23,907,600
18 -inch		7,863	LF	$ 257	$ 2,020,910
20 -inch		-	LF	$ 264	$ -
24 -inch		64,864	LF	$ 293	$ 19,005,091
30 -inch		4,681	LF	$ 370	$ 1,731,900
36 -inch		29,502	LF	$ 438	$ 12,921,900
42 -inch		3,371	LF	$ 510	$ 1,719,300
54 -inch		40,704	LF	$ 767	$ 31,220,000
Installation in Major Arterials			EA	10.00%	$ -
Butterfly Valves					
16 -inch		106	EA	$ 6,866	$ 727,800
18 -inch		8	EA	$ 7,896	$ 63,168
20 -inch		0	EA	$ 10,871	$ -
24 -inch		65	EA	$ 20,711	$ 1,346,215
30 -inch		5	EA	$ 25,061	$ 125,305
36 -inch		30	EA	$ 34,444	$ 1,033,400
42 -inch		4	EA	$ 52,409	$ 209,700
54 -inch		41	LF	$ 81,362	$ 3,335,900
Horizontal Drilling					
30 -inch Casing		0	LF	$ 1,361	$ -
36 -inch Casing		0	LF	$ 1,361	$ -
42 -inch Casing		0	LF	$ 1,902	$ -
Trench Restoration					
Paved		717,356	SF	$ 2	$ 1,434,712
Blow-Off Assembly		0	EA		$ -
Fire Hydrants		0	EA		$ -
Connection to (E) System		0	EA	$ 10,000	$ -
Abandonment Exist Pipe		0	EA		$ -
Property Acquisition		0	ACRE		$ -
Railroad Crossing Permitting		0	EA	10%	$ -
Highway Crossing Permitting		0	EA	10%	$ -
HighwayCrossing Permitting		0	EA	10%	$ -
SUBTOTAL					$ 100,802,901
Contingencies		1	LS	25%	$ 25,200,725
Engineering, Admin, and Legal		1	LS	25%	$ 31,500,907
Environmental & Permitting		1	LS	10%	$ 12,600,363
TOTAL					**$ 170,104,900**

Zone 40 Water System Infrastructure Plan

Phases 2 and 3 Pipelines,
West Jackson

Sacramento County Water Agency

Project Element		Quantity	Unit	Unit Cost	Total
Pipelines					
16 -inch		148,644	LF	$ 227	$ 33,742,300
18 -inch		8,227	LF	$ 257	$ 2,114,458
20 -inch		1,664	LF	$ 264	$ 439,300
24 -inch		67,876	LF	$ 293	$ 19,887,607
30 -inch		5,305	LF	$ 370	$ 1,962,800
36 -inch		29,502	LF	$ 438	$ 12,921,900
42 -inch		3,371	LF	$ 510	$ 1,719,300
54 -inch		40,704	LF	$ 767	$ 31,220,000
Installation in Major Arterials			EA	10.00%	$ -
Butterfly Valves					
16 -inch		149	EA	$ 6,866	$ 1,023,100
18 -inch		9	EA	$ 7,896	$ 71,064
20 -inch		2	EA	$ 10,871	$ 21,742
24 -inch		68	EA	$ 20,711	$ 1,408,348
30 -inch		6	EA	$ 25,061	$ 150,366
36 -inch		30	EA	$ 34,444	$ 1,033,400
42 -inch		4	EA	$ 52,409	$ 209,700
54 -inch		41	LF	$ 81,362	$ 3,335,900
Horizontal Drilling					
30 -inch Casing		0	LF	$ 1,361	$ -
36 -inch Casing		0	LF	$ 1,361	$ -
42 -inch Casing		0	LF	$ 1,902	$ -
Trench Restoration					
Paved		859,509	SF	$ 2	$ 1,719,019
Blow-Off Assembly		0	EA		$ -
Fire Hydrants		0	EA		$ -
Connection to (E) System		0	EA	$ 10,000	$ -
Abandonment Exist Pipe		0	EA		$ -
Property Acquisition		0	ACRE		$ -
Railroad Crossing Permitting		0	EA	10%	$ -
Highway Crossing Permitting		0	EA	10%	$ -
HighwayCrossing Permitting		0	EA	10%	$ -
SUBTOTAL					$ 112,980,304
Contingencies		1	LS	25%	$ 28,245,076
Engineering, Admin, and Legal		1	LS	25%	$ 35,306,345
Environmental & Permitting		1	LS	10%	$ 14,122,538
TOTAL					**$ 190,654,300**

Sacramento County Water Agency — Phases 2 and 3 Pipelines, Cumulative

Project Element	Quantity	Unit	Unit Cost	Total
Pipelines				
16 -inch	165,716	LF	$ 227	$ 37,617,700
18 -inch	14,351	LF	$ 257	$ 3,688,326
20 -inch	-	LF	$ 264	$ -
24 -inch	67,876	LF	$ 293	$ 19,887,607
30 -inch	5,305	LF	$ 370	$ 1,962,800
36 -inch	29,502	LF	$ 438	$ 12,921,900
42 -inch	3,371	LF	$ 510	$ 1,719,300
54 -inch	40,704	LF	$ 767	$ 31,220,000
Installation in Major Arterials		EA	10.00%	$ -
Butterfly Valves				
16 -inch	166	EA	$ 6,866	$ 1,139,800
18 -inch	15	EA	$ 7,896	$ 118,440
20 -inch	0	EA	$ 10,871	$ -
24 -inch	68	EA	$ 20,711	$ 1,408,348
30 -inch	6	EA	$ 25,061	$ 150,366
36 -inch	30	EA	$ 34,444	$ 1,033,400
42 -inch	4	EA	$ 52,409	$ 209,700
54 -inch	41	LF	$ 81,362	$ 3,335,900
Horizontal Drilling				
30 -inch Casing	0	LF	$ 1,361	$ -
36 -inch Casing	0	LF	$ 1,361	$ -
42 -inch Casing	0	LF	$ 1,902	$ -
Trench Restoration				
Paved	920,983	SF	$ 2	$ 1,841,966
Blow-Off Assembly	0	EA		$ -
Fire Hydrants	0	EA		$ -
Connection to (E) System	0	EA	$ 10,000	$ -
Abandonment Exist Pipe	0	EA		$ -
Property Acquisition	0	ACRE		$ -
Railroad Crossing Permitting	0	EA	10%	$ -
Highway Crossing Permitting	0	EA	10%	$ -
Highway Crossing Permitting	0	EA	10%	$ -
SUBTOTAL				$ 118,255,553
Contingencies	1	LS	25%	$ 29,563,888
Engineering, Admin, and Legal	1	LS	25%	$ 36,954,860
Environmental & Permitting	1	LS	10%	$ 14,781,944
TOTAL				**$ 199,556,300**

This page intentionally left blank.

Elk Grove Multi-Sport Complex & Grant Line Industrial Annexation Area

FINAL Water Study

October 1, 2020

Prepared for:

CITY OF ELK GROVE
PROUD HERITAGE. BRIGHT FUTURE.

and

Sacramento County Water Agency

SACRAMENTO COUNTY

Prepared by:

WOOD RODGERS
DEVELOPING INNOVATIVE DESIGN SOLUTIONS
3301 C Street, Bldg. 100-B Tel: 916.341.7760
Sacramento, CA 95816 Fax: 916.341.7767

Kevin J. Gustorf, PE
CA PE No. 64755

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1.0 Introduction

The City of Elk Grove (City) has acquired two parcels totaling approximately 104-acres of property to develop a Multi-Sport Complex (MSC). The property is located just outside of the southern City limit and requires annexation into the City. The City has initiated the annexation process with the Local Agency Formation Commission (LAFCo). One of the LAFCo conditions to annex the 104-acre City-owned parcels is that adjacent properties also be annexed into the City's Sphere of Influence (SOI). The adjacent properties are located to the west and east of the City-owned parcels, with a total combined area of approximately 572-acres in size (Plan Area or Project). The 572-acre Plan Area, also known as the "Elk Grove Multi-Sport Complex and Grant Line Industrial Annexation Area" includes the 104-acre City-owned property.

The purpose of this water study (study) is to identify the on-site backbone domestic water system required to serve the Plan Area. The study is part of an overall high-level infrastructure analysis for the Plan Area. This study will demonstrate it is possible to construct an on-site domestic water distribution system to meet the proposed Project's ultimate water demand and fire flow requirements within the water purveyor's requirements for water conveyance and operating pressure. The Project falls within the jurisdiction of Zone 40 of the Sacramento County Water Agency (SCWA). An amendment to the SCWA Zone 40 Water Supply Master Plan (Zone 40 WSMP Amendment) is required to incorporate the Plan Area. At the time of preparation of this study, a separate, but concurrent, effort is underway to analyze the existing off-site SCWA system and prepare the Zone 40 WSMP Amendment to determine the water system boundary conditions adjacent to the project site and determine if off-site improvements are required to serve the Plan Area. This study and analysis have been prepared based upon boundary conditions provided from the system analysis performed for the Zone 40 WSMP Amendment.

Existing and planned domestic water facilities border the project area to the north, and west. It is anticipated that these existing facilities will be utilized to provide domestic water service to the Plan Area. This study has been prepared to identify the ultimate build-out on-site backbone domestic water distribution facilities required to serve the Plan Area and meet SCWA's service criteria. This study includes a discussion on proposed land use, water demands, point of connections, hydraulic modeling results, phasing and planning-level cost estimates.

1.1 Multi-Sport Complex and Grant Line Industrial Annexation Area

Location

The Plan Area spans approximately 572-acres of land located just outside the current City of Elk Grove city limits. The Plan Area is immediately adjacent to the southeast portion of the City, located east of Interstate 99 and the railroad tracks and south of Grant Line Road. See **Figure 1-1: Vicinity Map** for a vicinity map of the Project location.

Topography

The majority of the existing site is currently being used for agriculture purposes. The existing topography of the Plan Area is flat with elevations varying from 55 feet to 48 feet, and generally sloping east to west.

Proposed Land Use

The proposed zoning for the City's 104-acre property is "Industrial" and allows a range of land use activities, including warehousing and manufacturing, as well as the proposed sports complex. Historically, a sports complex has been considered the most likely use for the City parcels, although the City is considering the potential sale of a portion of the property to facilitate development of the balance as a sports complex. Parks, or a sports complex, is the most intensive water user of those permitted uses within the industrial land use designation. Therefore, in order to analyze the most conservative Project, this study

has assumed the development of a sports complex as the primary project for consideration for the entirety of the City's 104-acre property.

The proposed land uses within the Plan Area will consist of mixed use, parks and open space, regional commercial, light industrial, and heavy industrial as provided in **Table 1-1: Proposed Project Land Use** and illustrated in **Figure 1-2: Land Use Plan**. The analysis conducted for this study evaluates the on-site water system required to serve the ultimate buildout of the Plan Area, referred to as the "Ultimate Phase." This study will also discuss an "Initial Phase" of development, which includes only the 104-acre City-owned parcel.

Table 1-1: Proposed Project Land Use – Ultimate Buildout of Plan Area

Land Use Category		**Area[1] (acres)**
P/OS	Parks and Open Space	169.0
MU	Mixed Mosher Use	118.9
LI	Light Industrial	112.2
HI	Heavy Industrial	143.2
RC	Regional Commercial	20.0
ROW	Right-of-Way	8.2
Total		**571.5**

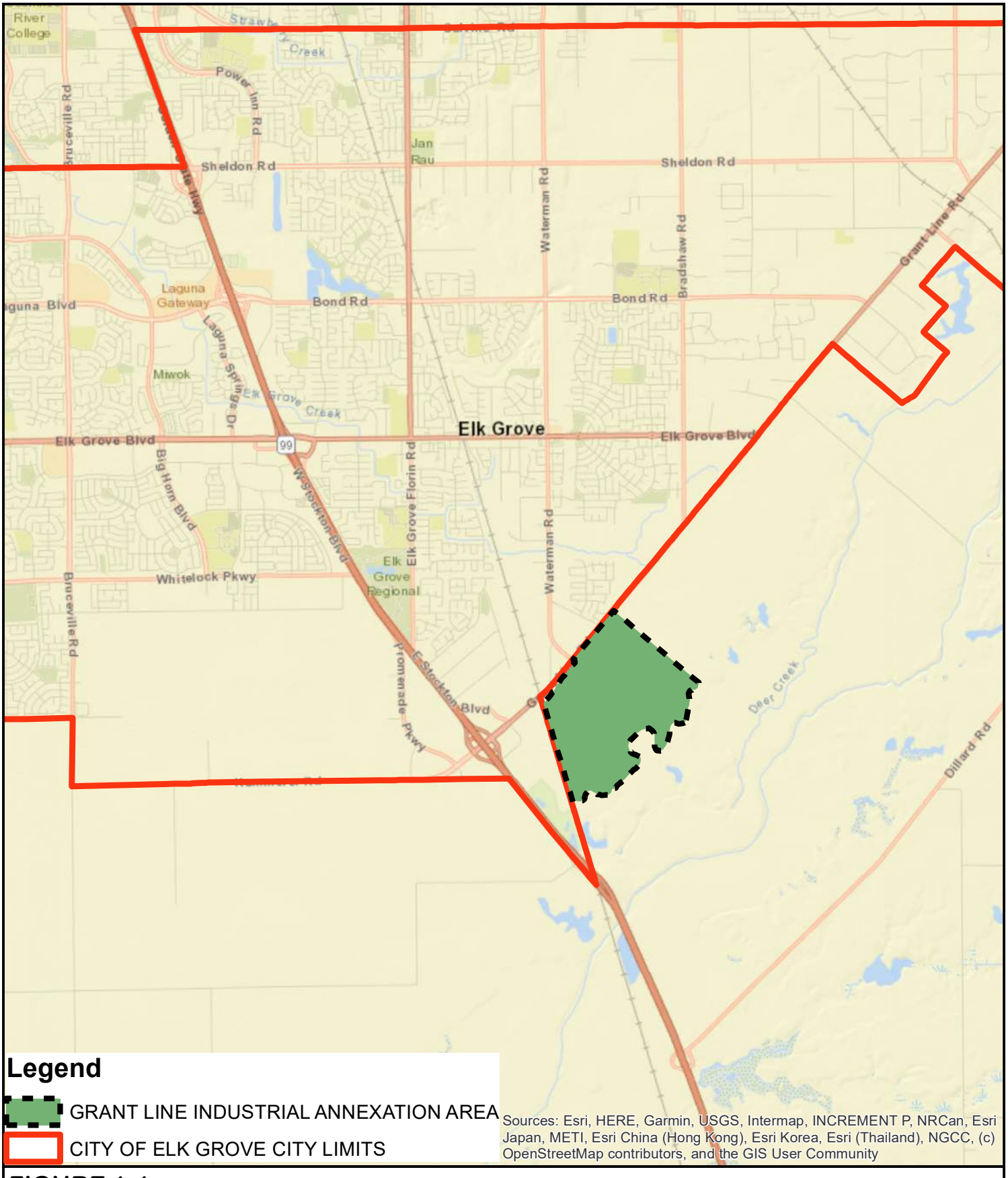
Source: Land use spreadsheet provided by City of Elk Grove, June 10, 2020

1.2 Existing & Future Water Studies

The Plan Area falls within the jurisdiction of the Sacramento County Water Agency (SCWA), and is located within SCWA's Central Service Area. The SCWA Zone 40 Water System Infrastructure Plan (WSIP), dated September, 2016 was utilized as the basis for the design criteria discussed in this study. The WSIP, and subsequent Record Drawings, identify existing transmission facilities that run in Waterman Road and Grant Line Road adjacent to the Plan Area. There is an existing 24-inch transmission main in Grant Line Road that extends easterly to the intersection with Waterman Road, at which point it becomes a 16-inch waterline and continues to the east. A 24-inch transmission main located in Waterman Road conveys water supply from the East Elk Grove Groundwater Water Treatment Plant to the 24-inch transmission main in Grant Line Road.

Concurrent to the preparation of this study, an Amendment to the SCWA Zone 40 Water Supply Master Plan (Zone 40 WSMP Amendment) is being prepared to evaluate the capabilities of the existing water supply and transmission system to accommodate the ultimate demands of the proposed Project. Results from the Zone 40 WSMP Amendment, dated June 5, 2020, have been incorporated into the analysis for the on-site backbone water system to serve the Plan Area. The Zone 40 WSMP Amendment will determine if off-site water system improvements are required to serve the Plan Area and meet SCWA's minimum service criteria.

[1] Acreage values are approximate and reflect high-level master planning. Acreages are subject to change through subsequent development processing in keeping with the policies and procedures provided in the City's Special Planning Area document.



Legend

GRANT LINE INDUSTRIAL ANNEXATION AREA

CITY OF ELK GROVE CITY LIMITS

FIGURE 1-1

Elk Grove Multi-Sport Complex
and Grant Line Industrial Annexation Area

VICINITY MAP

ELK GROVE, CALIFORNIA
JULY, 2020

0 2,500 5,000 10,000
Feet

NORTH

WOOD RODGERS

J:\3000-s\3770_City of Elk Grove\001_Multi-Sport Complex Master Plans\GIS\Data\Task_Specific_Folder\Vicinity Map.mxd 7/27/2020 7:45:07 AM dvalencia

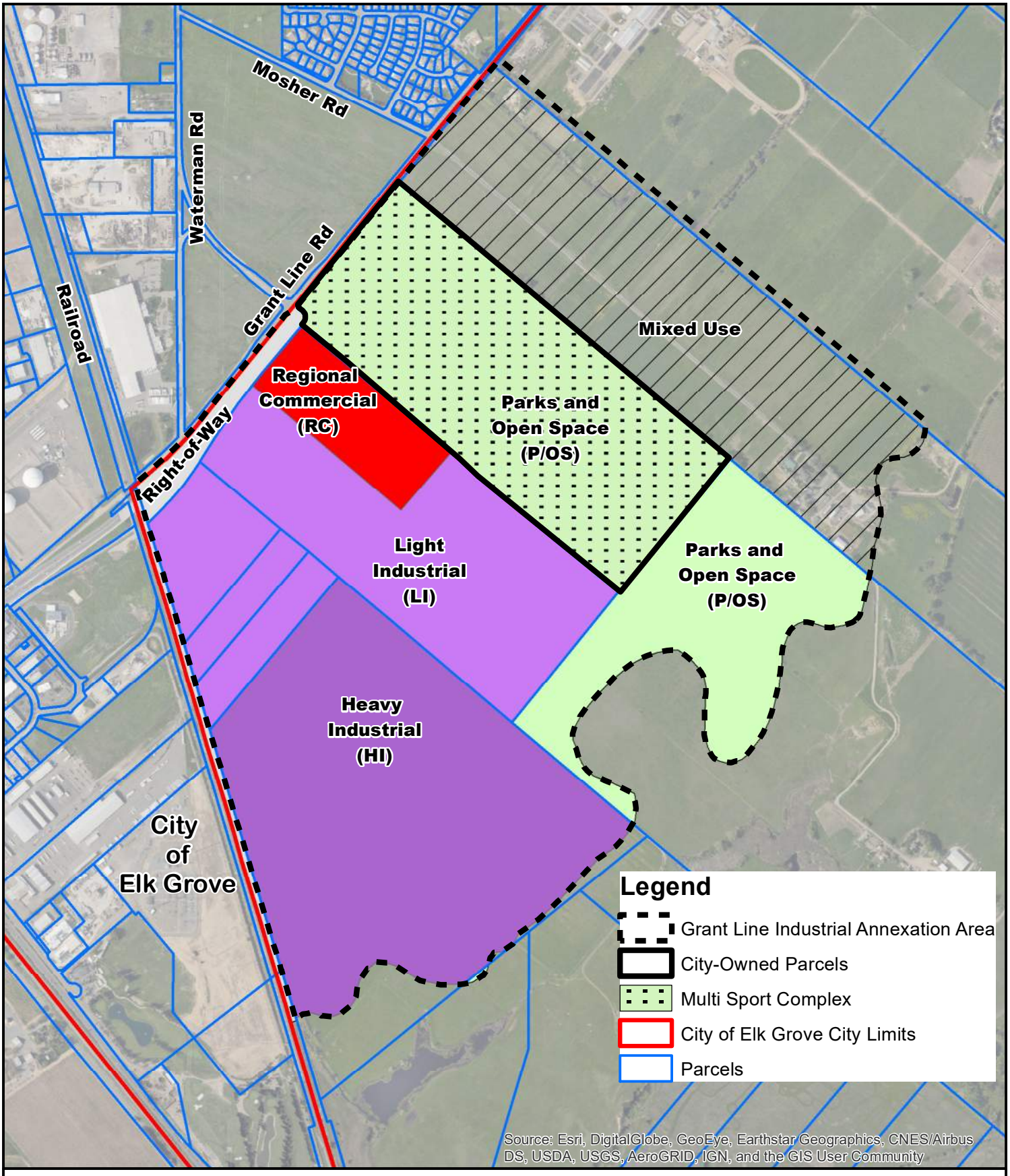


FIGURE 1-2
Elk Grove Multi-Sport Complex
and Grant Line Industrial Annexation Area

LAND USE PLAN
ELK GROVE, CALIFORNIA
JULY, 2020

0 500 1,000 2,000
Feet

NORTH

WOOD RODGERS

J:\3000-s\3770_City of Elk Grove\001_Multi-Sport Complex Master Plans\GIS\Data\Task_Specific_Folder\Land use ALT_A_WATER.mxd 7/27/2020 7:50:55 AM dvalencia

2.0 Project Water Demands

The proposed project water demands were determined based on the land use area and the corresponding SCWA demand factors. The Project water demands were determined by multiplying the annual demand factor by the land use area to determine the average annual demand. Annual demand factors utilized in this study are shown in **Table 2-1: Water Demand Factors and Average Annual Water Demand**. Some of the proposed land uses are not explicitly referenced in the WSIP, therefore assumptions were made to align the proposed land use with a corresponding demand factor consistent with the WSIP.

Table 2-1: Water Demand Factors and Average Annual Water Demand

Land Use Category		Annual Demand Factor per WSIP (AFY/acre)	Annual Demand Factor[2] (AFY/acre)	Annual Demand[2] (AFY)
P//OS	Parks and Open Space	2.80	3.01	509
MU	Mixed Mosher Use	2.15	2.31	275
LI	Light Industrial	2.02[3]	2.17	244
HI	Heavy Industrial	2.02[3]	2.17	311
RC	Regional Commercial	2.02[4]	2.17	43
ROW	Right-of-Way	0.18	0.19	2
Total				**1,383**

In determining the demand assumptions to use for the Project a number of factors have been considered, including the proposed zoning and the range of land activities (e.g., warehousing and distribution, manufacturing, retail, office) that are permitted or conditionally permitted within the zoning, as well as the proposed sports complex use for the City's 104-acre property. Generally, the most common use within the proposed zoning have been selected (e.g., warehousing and manufacturing in industrial, retail in commercial).

The proposed zoning for the City's 104-acre property is "Industrial" and allows a range of land activities including warehousing and manufacturing, as well as the proposed sports complex. Historically, a sports complex has been considered the most likely use for the City parcels, although the City is considering the potential sale of a portion of the property to facilitate development of the balance as a sports complex. Parks, or a sports complex, is the most intensive water user of those permitted uses within the industrial land use designation, as shown in Table 2-1. Therefore, in order to analyze the most conservative Project, this study has assumed the development of a sports complex as the primary project for consideration for the entirety of the City's 104-acre property.

As depicted in **Table 2-2: Proposed Water Demand – Ultimate Buildout**, the water demand assumptions for a 104-acre sports complex are more intensive than for development of either a portion of the site or the full site with an industrial use (inclusive of both daily water demand and fire flow).

[2] Includes 7.5% system losses.

[3] WSIP does not contain specific or separate unit demand factors for "light and heavy industrial." This study assumes the same demand factor as industrial land use.

[4] WSIP does not contain a unit demand factor for "regional commercial." This study assumes the same demand factor as commercial land use.

Furthermore, this report does not assume or analyze the potential impacts associated with a significant water user (e.g., beverage producer). Additional analysis would be necessary should a project that includes a significant water user be proposed for the City's 104-acre parcel, or any other property within the Project area.

The average day, maximum day and peak hour water demands utilized for the hydraulic modeling analysis are shown in **Table 2-2: Proposed Water Demand – Ultimate Buildout**. The average day demand is calculated by taking the average annual demand (AFY) from Table 2-1 and converting it into gallons per minute (gpm).

Per the WSIP, the maximum day demand is the highest demand expected on any given day throughout the year. Typically, this demand occurs in the summer when temperatures are excessively warm. The maximum day demand is assumed to be twice the average day demand. The maximum day demand is also utilized for fire flow scenarios in the model analysis.

The peak hour demand is the highest expected demand for any given hour throughout the year. The peak hour demand is two times the maximum day demand. A detailed breakdown of the water demand calculations per parcel is included in **Appendix A.**

Table 2-2: Proposed Water Demand – Ultimate Buildout

Land Use Category		Area (acres)	Average Annual Demand (AFY)	Average Day Demand (gpm)	Maximum Day Demand (gpm)	Peak Hour Demand (gpm)
P/OS	Parks and Open Space	169.0	509	315.5	631.0	1262.0
MU	Mixed Mosher Use	118.9	275	170.4	340.8	681.6
LI	Light Industrial	112.2	244	151.3	302.7	605.3
HI	Heavy Industrial	143.2	311	192.9	385.7	771.4
RC	Regional Commercial	20.0	43	26.9	53.9	107.7
ROW	Right-of-Way	8.2	1.6	1.0	2.0	3.9
Total		**571.5**	**1,383**	**858.0**	**1,716.0**	**3,432.0**

The "Initial Phase" of the development will be the 104-acre city-owned parcels. The water demands associated with the city-owned parcels are summarized in **Table 2-3: Proposed Water Demand – Initial Phase.**

Table 2-3: Proposed Water Demand – Initial Phase

Land Use Category		Area (acres)	Average Annual Demand (AFY)	Average Day Demand (gpm)	Maximum Day Demand (gpm)	Peak Hour Demand (gpm)
P/OS	Parks and Open Space	103.9	313	193.9	387.8	775.7
Total		**103.9**	**313**	**193.9**	**387.8**	**775.7**

3.0 Service Description and System Criteria

The proposed water mains are to be designed to provide the required flow deliveries while maintaining acceptable service pressures to all customers within the Plan Area. A description of the proposed water system, operating goals, and facility sizing requirements are discussed in this section.

3.1 Service Description

The proposed water system piping layout is represented by distribution main sizes of 8-inch and 12-inch and a transmission main size of 16-inch, that will comprise the Plan Area's backbone system. The basis of the proposed domestic water backbone infrastructure layout within the Plan Area is in conformance with the criteria identified in SCWA's 2016 WSIP. The backbone water system follows the proposed roadway layout identified in the Elk Grove Multi-Sport Complex Transportation Master Plan, dated September 29, 2020. A layout of the proposed water system to serve the Ultimate Phase of the Plan Area is shown on **Figure 3-1: On-Site Water System Layout – Ultimate Phase**.

Further discussion regarding the design criteria, connection to the existing SCWA system and the on-site facilities to serve the Plan Area are included below.

3.2 System Criteria

The WSIP outlines system criteria for both distribution and transmission main design. Included in **Table 3-1: Design Criteria** are the design criteria and operating goals utilized in this study to determine the sizing of the domestic water system for the Plan Area.

Water Main Design System Criteria

The responsibility for operation and maintenance of the water facilities within the Plan Area is SCWA Zone 40, the retail zone of SCWA. SCWA has developed minimum operating goals to be used in the planning of new water distribution and transmission systems. The operating goals help ensure adequate pressure and flow are available to serve existing and future customers on a daily basis and also during emergency fire flow conditions. The operating goals used in this study to size the on-site water pipelines are identified in **Table 3-1: Design Criteria**.

Table 3-1: Design Criteria

Criteria	Operating Goal
Maximum System Pressure in Distribution Main	65 psi
Minimum Pressure in Distribution Main at PHD	35 psi
Minimum Pressure in Distribution Main at MDD +FF	20 psi
Maximum System Pressure in Transmission Main	75 psi
Minimum Pressure in Transmission Main at PHD	40 psi
Minimum Pressure in Transmission Main at MDD +FF	25 psi
Maximum Pipe Velocity at ADD	5 fps
Maximum Pipe Velocity at PHD	7 fps
Maximum Pipe Velocity at MDD + FF	10 fps
Unit Headloss	3 to 5 ft/1,000 ft

Source: Sacramento County Water Agency, Zone 40 WSIP, September 2016

Fire Flow Criteria

For the purposes of system analysis, the required fire flow is assumed to occur during a maximum day demand condition. In the WSIP, the fire flow requirements are identified by land use types, and are summarized in **Table 3-2: Fire Flow Criteria**. Due to differences in the land use descriptions between the Multi-Sport Complex and Grant Line Industrial Annexation Area and the given SCWA designations, assumptions were made in assigning fire flows for corresponding land uses. The Mixed Mosher Use, Regional Commercial, and Light Industrial were assigned to "Commercial/Industrial" with a corresponding fire flow requirement of 3,000 gpm. Parks and Open Space was assigned to "Single Family Residential (<3,600 sq ft)" with a corresponding fire flow requirement of 1,500 gpm. The Heavy Industrial land use was assigned to "Industrial/Institution" with a corresponding fire flow requirement of 4,000 gpm.

Table 3-2: Fire Flow Criteria

SCWA Land Use Type (building size)	Fire Flow Requirement	Corresponding Project Land Use
Single family residential (<3,600 sq ft)	1,500 gpm	Parks and Open Space
Single family residential (≥3,600 sq ft)	2,000 gpm	-
Commercial/Industrial	3,000 gpm	Mixed Mosher Use / Regional Commercial / Light Industrial
Industrial/Institution	4,000 gpm	Heavy Industrial

Source: Sacramento County Water Agency, Zone 40 WSIP, September 2016

System Assumptions

A hydraulic model was developed to analyze and size the proposed on-site water system. The hydraulic model, model analysis and results are further discussed in Section 4.0. The following assumptions and criteria were utilized in the development of the on-site hydraulic model:

- Model demands do not take into account water demand outside the boundary of the Plan Area.
- Node elevations were assigned based upon the existing topography. It is assumed that the precise grading will closely follow the existing contours.
- A Hazen-Williams "C" value of 125 was used to represent the friction factor for all pipe material, included ductile iron, welded steel, concrete cylinder, and polyvinyl chloride mains.
- Preliminary model analysis of the existing off-site SCWA system has been performed as a part of the Zone 40 WSMP Amendment. Results from the off-site model analysis were used to simulate the system boundary conditions at the proposed points of connection to the existing transmission system in Grant Line Road.
- The preliminary model results utilized from the Zone 40 WSMP Amendment analysis were based on the existing system conditions only, and did not account for future system improvements.
- Based on discussions with SCWA staff, 14-inch diameter distribution mains are not allowed.

FIGURE 3-1

ON-SITE WATER SYSTEM LAYOUT
ULTIMATE PHASE

ELK GROVE MULTI-SPORT COMPLEX
AND GRANT LINE INDUSTRIAL ANNEXATION AREA
ELK GROVE, CA
OCTOBER 2020

EXISTING 24" SCWA TRANSMISSION MAIN

EXISTING 16" SCWA TRANSMISSION MAIN

EXISTING 24" SCWA TRANSMISSION MAIN

WATERMAN RD.

GRANT LINE RD.

RAILROAD

CITY OF ELK GROVE

J100 J102 J104 J106 J108 J110 J112 J114 J116 J118 J120 J122 J124 J126 J128 J130 J132

55 54 55 56 57 57 53 52 50 51 50 51 49 50

Legend

CITY OF ELK GROVE CITY LIMITS

Model Elements

Junctions

'XX' Node ID Number

Proposed Water Main

8-Inch Diameter
12-Inch Diameter
16-Inch Diameter

Existing Conditions

Existing Water Main
Existing Contours
'XX' Existing Contour Lables
Parcel Lines
City Owned Parcel

0 450 900 1,800
Feet

NORTH

WOOD RODGERS

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

J:\3000-s\3770_City of Elk Grove\001_Multi-Sport Complex Master Plans\Civil\Studies\Water\WaterModel\Report Attachement\Water_Layout_Alt_A.mxd 10/8/2020 2:14:38 PM dvalencia

4.0 Hydraulic Model Analysis and Results

Wood Rodgers developed a hydraulic model of the on-site backbone water system to serve the Plan Area to determine the required size of the proposed facilities to meet the SCWA operating criteria. The model was developed utilizing the hydraulic model program InfoWater developed by Innovyze. The model was developed to analyze the varying demand conditions and fire flow requirements for the ultimate buildout of the Plan Area. Upon request, an electronic copy of the water model is available.

Point of Connection and Boundary Conditions

To serve the Plan Area, domestic water will be conveyed to the Project site from SCWA's supply sources through existing transmission mains as identified in the Zone 40 WSMP Amendment. Per the Zone 40 WSMP Amendment, water for the Plan Area will primarily be supplied from the East Elk Grove Groundwater Treatment Plant, located on Waterman Road about one mile north of the Plan Area. Water will be conveyed to the Plan Area through an existing 24-inch transmission main in Waterman Road. Water will also be delivered to the Project site through an existing 24-inch and 16-inch transmission located in Grant Line Road. The 24-inch transmission main originates west of the project site, and extends easterly in Grant Line Road to the intersection of Waterman Road. From Waterman Road, the transmission main continues easterly as a 16-inch diameter transmission main.

There are two proposed points of connection to the existing transmission main in Grant Line Road, one at the intersection of Waterman Road, and one at the intersection of Mosher Road.

The boundary conditions utilized for the on-site hydraulic model were based upon the hydraulic modeling results performed for the Zone 40 WSMP Amendment. The boundary conditions were simulated by using a single fixed-head reservoir with an HGL of 177 feet at the location of the East Elk Grove Groundwater Treatment Plant as the water supply source, and routing flows only through the 24-inch transmission main in Waterman Road to Grant Line Road. The HGL of the fixed head reservoir was set to simulate a system pressure of approximately 49 psi in the transmission main in Grant Line Road at the point of connection to the Plan Area at the intersection of Waterman Road, based upon the model results for a maximum day plus 4,000 gpm fire flow demand condition. This was determined to be a conservative assumption. SCWA guarantees that a minimum pressure of 40 psi is available in the system transmission mains.

Allocated Water Demands

Water demands, as previously discussed in this study, were distributed to the model nodes (or junctions) throughout the Plan Area based upon adjacent land use areas. See **Appendix B** for the detailed allocation of water demands to the model nodes for the proposed land use.

Model Results

The model was set-up with three demand scenarios: average day, maximum day, and peak hour. Under the maximum day scenario, a system-wide fire flow analysis was conducted to determine the critical fire flow location. The critical fire flow location was determined to be node J128. An additional scenario was set-up that included the maximum day demand plus a 4,000 gpm fire flow at J128.

Utilizing the boundary conditions described in this study, along with SCWA's criteria for transmission and distribution main systems, pipe sizes were determined and optimized for the proposed build-out of the on-site backbone domestic water system. It is noted that the "Heavy Industrial" land use requires a 4,000-gpm fire flow, which is the driver for the pipe diameters. There is a total of five (5) pipe segments within the Plan Area that require a 16-inch diameter transmission main. Two of those segments are the main fee off of Grant Line Road on the extension of Waterman Road. The other three segments are dead-end lines in cul-de-sacs within the Heavy Industrial land use area. Model results for the project area are summarized in **Table 4-1: Hydraulic Model Results**. Detailed model results for each scenario are included in **Appendix B**. The results indicate that the on-site proposed system, as presented in Figure 3-1, is adequate to meet SCWA's operating goals.

Table 4-1: Hydraulic Model Results

Demand Scenario	Minimum Pressure	Maximum Pressure	Maximum Velocity	Maximum Headloss
Average Day Demand [1]	52.5 psi	55.5 psi	1.0 fps	0.3 ft/kft
Peak Hour Demand	48.2 psi	51.9 psi	4.0 fps	3.7 ft/kft
MDD + 4,000gpm Fire Flow @ J128	22.2 psi	49.0 psi	7.0 fps	15.1 ft/kft

[1] It is noted that the maximum pressure under the average day demand condition will likely be higher than shown. The assumed HGL at the point of connection is based upon a maximum day plus fire flow condition.

5.0 Phasing

It is anticipated that the 104-acre city-owned parcels will be developed first. The remainder of the Plan Area will be developed at a later date, but a detailed development plan has yet to be established. For the purpose of this study, it is assumed that there are two phases: the "Initial Phase," which includes the development of the 104-acre city-owned parcels, and the "Ultimate Phase," which includes development of the entire Plan Area. It is assumed that the water infrastructure required to serve the Initial Phase will be built at the diameters required to serve the Ultimate Phase.

The pipe segments required to be constructed to serve the city-owned parcels in the Initial Phase include the 16-inch transmission main (approximately 3,000 LF) in the extension of Waterman Road which runs along the west side of the city-owned parcels, as shown on **Figure 5-1: On-Site Water System Layout – Initial Phase**.

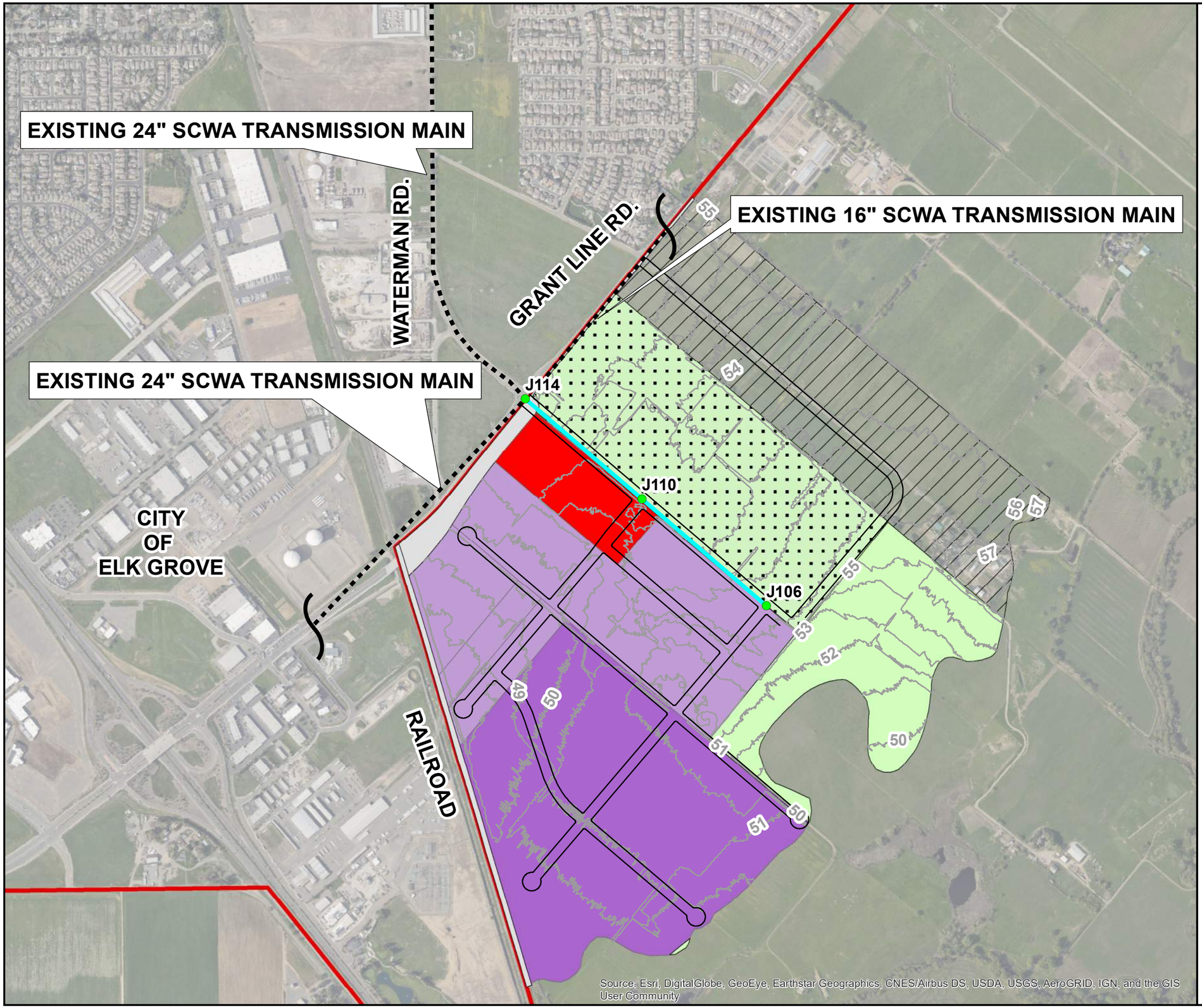


FIGURE 5-1
ON-SITE WATER SYSTEM LAYOUT
INITIAL PHASE
ELK GROVE MULTI-SPORT COMPLEX
AND GRANT LINE INDUSTRIAL ANNEXATION AREA
ELK GROVE, CA
JULY 2020

Legend

CITY OF ELK GROVE CITY LIMITS

Model Elements

- Junctions
- 'XX' Node ID Number

Proposed Water Main

- 8-Inch Diameter
- 12-Inch Diameter
- 16-Inch Diameter

Existing Conditions

- Existing Water Main
- Existing Contours
- 'XX' Existing Contour Lables

Landuse Alternative A

- Existing Right-of-Way (ROW), no APN
- Heavy Industrial (HI)
- Light Industrial (LI)
- Mixed Mosher Use
- Parks and Open Space (P/OS)
- Regional Commercial (RC)
- Multi Sport Complex

0 450 900 1,800
Feet

NORTH

WOOD RODGERS

J:\3000-s\3770_City of Elk Grove\001_Multi-Sport Complex Master Plans\Civil\Studies\Water\WaterModel\Report Attachement\FIGURE_5_1_ONLY.mxd 7/27/2020 8:23:25 AM dvalencia

6.0 Cost Estimate

Table 6-1: Planning Level Cost Estimate contains a conceptual opinion of probable construction costs to construct the on-site backbone water infrastructure. The costs are broken down for the Initial Phase of development, the 104-acre city-owned parcel, and to construct the remainder of the system to serve the Ultimate Phase.

These cost opinions account for the on-site infrastructure required to meet the on-site water demand and fire flow requirements. It does not account for any off-site improvements, if required. The per foot cost to install the pipe is assumed to include all appurtenances, including isolation valves, fire hydrants, service connections, blow-offs, air-vac valves, etc. and assumes pipes will be installed at normal depth (approximately 4-feet of cover).

Table 6-1: Planning Level Cost Estimate

Initial Phase

Description	Quantity	Unit	Unit Cost	Total Cost
16-inch	2,980	LF	$ 340	$ 1,013,207
Subtotal				*$ 1,013,207*
Contingency			30%	$ 303,962
Total Initial Phase				**$ 1,317,000**

Ultimate Phase

Description	Quantity	Unit	Unit Cost	Total Cost
8-inch	3,079	LF	$ 180	$ 554,296
12-inch	13,092	LF	$ 260	$ 3,404,016
16-inch	3,665	LF	$ 340	$ 1,246,253
Subtotal				*$ 5,204,565*
Contingency			30%	$ 1,561,369
Total Ultimate Phase				**$ 6,766,000**

7.0 Conclusion

This study has been prepared in accordance with SCWA design guidelines and criteria to identify on-site backbone water facilities to serve the City of Elk Grove Multi-Sport Complex and Grant Line Industrial Annexation Area. The 572-acre Plan Area will require an average annual water demand of approximately 1,383 AFY under the Ultimate Phase. The average annual water demand translates into an average daily demand (ADD) of 858 gpm, maximum day demand (MDD) of 1,716 gpm and a peak hour demand (PHD) of 3,432 gpm. The maximum required fire flow is 4,000 gpm. Projected water demands under the Initial Phase are projected to be 194 gpm (ADD), 388 gpm (MDD) and 776 gpm (PHD).

A 16-inch / 24-inch SCWA transmission main exists within Waterman Road and Grant Line Road adjacent to the Project site that will deliver water to the site. There are two proposed points of connection to the Grant Line Road transmission main, one at the intersection with Waterman Road and one at the intersection with Mosher Road. The Waterman Road point of connection is proposed as a 16-inch diameter connection, and the Mosher Road point of connection is proposed as a 12-inch diameter connection.

The on-site backbone domestic water system was laid out to follow the proposed roadway alignment. The water system was analyzed, optimized and sized to meet SCWA's minimum and maximum service criteria and operating goals. The boundary conditions utilized for the on-site hydraulic model were based upon information provided in the Zone 40 WSMP Amendment, and based upon SCWA providing minimum service pressures. The boundary conditions were simulated by using a single fixed-head reservoir with an HGL of 177.0 feet as the water supply source at the East Elk Grove Groundwater Treatment Plant, which represented a 49-psi service pressure in the transmission main at the intersection of Grant Line Road and Waterman Road. All water supply was routed through the existing 24-inch transmission main on Waterman Road to Grant Line Road. This was determined to be a conservative assumption.

The recommended on-site water system identified in this study will provide the ultimate water demand and meet the fire flow requirements, while in compliance with SCWA's criteria. Initial results provided by others from the analysis conducted for the Zone 40 WSMP Amendment indicate that no additional off-site improvements are required to serve the Plan Area from those that have already been identified in SCWA's Phase 3 CIP.

Appendix A
Water Demand Calculations

City of Elk Grove
Multi-Sport Complex and Grant Line Industrial Annexation Area
Water Demand Projections

Parcel No.	Acreage	Proposed Land Use	Water Demand Factor [1] (ac-ft/acre/yr)	7.5% Water Loss Factor (ac-ft/acre/yr)	Demand Projections (Average Day)			Demand Projections (Maximum Day) [2]		Demand Projections (Peak Hour)		Fire Flow Allocations (gallon/minute)[3]
					(ac-ft/yr)	(gallon/day)	(gallon/minute)	(gallon/day)	(gallon/minute)	(gallon/day)	(gallon/minute)	
13401900020000	118.9	Mixed Mosher Use	2.15	2.31	274.7	245,388	170.4	490,775	340.8	981,550	681.6	3,000
13401900030000	65.0	Parks and Open Space (P/OS)	2.80	3.01	195.5	174,653	121.3	349,306	242.6	698,611	485.1	1,500
13401900090000	103.9	Parks and Open Space (P/OS)	2.80	3.01	312.6	279,235	193.9	558,470	387.8	1,116,940	775.7	1,500
13401900100000	77.5	Light Industrial (LI)	2.02	2.17	168.3	150,309	104.4	300,619	208.8	601,238	417.5	3,000
	20.0	Regional Commercial (RC)	2.02	2.17	43.4	38,790	26.9	77,579	53.9	155,158	107.7	3,000
13401900130000	143.2	Heavy Industrial (HI)	2.02	2.17	310.9	277,710	192.9	555,420	385.7	1,110,839	771.4	4,000
13401900260000	0.2	Parks and Open Space (P/OS)	2.80	3.01	0.5	432	0.3	864	0.6	1,728	1.2	1,500
13401900290000	8.5	Light Industrial (LI)	2.02	2.17	18.4	16,396	11.4	32,792	22.8	65,583	45.5	3,000
13401900300000	9.7	Light Industrial (LI)	2.02	2.17	21.1	18,886	13.1	37,772	26.2	75,544	52.5	3,000
13401900320000	16.7	Light Industrial (LI)	2.02	2.17	36.2	32,321	22.4	64,642	44.9	129,283	89.8	3,000
ROW	8.2	Existing Right-of-Way (ROW), no APN	0.18	0.19	1.6	1,411	1.0	2,822	2.0	5,644	3.9	N/A
Grand Total	**571.5**				**1,383**	**1,235,530**	**858**	**2,471,059**	**1,716**	**4,942,118**	**3,432**	

[1] SCWA Zone 40/41 (Central Service Area) Factors - 2016 WSIP
[2] Maximum Day Peaking Factor = 2.0 x Average Day
[3] Fire Flow allocations from WSIP Zone 40 Master Plan
City-owned parcels highlighted in green.

Appendix B
Hydraulic Model Data and Results

ELK GROVE MULTI-SPORT COMPLEX AND GRANT LINE INDUSTRIAL ANNEXATION AREA
ULTIMATE PHASE - AVERAGE DAY WATER DEMAND ALLOCATION

	Land Use Designation						Total Demand		
Model Node ID	Mixed Mosher Use (gpm)	Parks and Open Space (gpm)	Regional Commercial (gpm)	Light Industrial (gpm)	Heavy Industrial (gpm)	ROW (gpm)	ADD (gpm)	MDD (gpm)	PHD (gpm)
J100							0	0	0
J102	85						85	170	341
J104	85	79					164	328	656
J106		79	5				84	168	337
J108			5	22			27	54	108
J110		79	5				84	168	337
J112			5	22			27	54	108
J114						1	1	2	4
J116			5	22			27	54	108
J118				22			22	43	86
J120				22	39		60	120	241
J122		79			39		117	235	469
J124					39		39	77	154
J126				22			22	43	86
J128		0			39		39	78	155
J130					39		39	77	154
J132				22			22	43	86
Total	**170**	**315**	**27**	**151**	**193**	**1**	**858**	**1,716**	**3,432**

ELK GROVE MULTI-SPORT COMPLEX AND GRANT LINE INDUSTRIAL ANNEXATION AREA

AVERAGE DAY DEMAND MODEL OUTPUT

JUNCTION REPORT				
JUNCTION NODE ID	DEMAND (gpm)	ELEVATION (feet)	HEAD (feet)	PRESSURE (psi)
J100	0	54	176.6	53.1
J102	85	54	176.2	53.0
J104	164	55	176.2	52.5
J106	95	54	176.2	52.9
J108	30	53	176.1	53.3
J110	95	51	176.3	54.3
J112	30	52	176.2	53.8
J114	1	53	176.7	53.6
J116	30	50	176.1	54.6
J118	14	51	176.1	54.2
J120	53	50	176.0	54.6
J122	118	51	176.0	54.2
J124	39	51	176.0	54.2
J126	14	48	176.0	55.5
J128	39	48	176.0	55.5
J130	39	50	176.0	54.6
J132	14	48	176.0	55.5

ELK GROVE MULTI-SPORT COMPLEX AND GRANT LINE INDUSTRIAL ANNEXATION AREA
AVERAGE DAY DEMAND MODEL OUTPUT

PIPE REPORT									
PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	DIAMETER (in)	ROUGHNESS (C-value)	FLOW (gpm)	VELOCITY (ft/s)	HEADLOSS (ft)	HL/1000 (ft/kft)
P102	*J100*	*J114*	*1699*	*16*	*125*	*-236*	*0.4*	*0.1*	*0.1*
P104	J100	J102	1889	12	125	236	0.7	0.4	0.2
P106	J102	J104	920	12	125	151	0.4	0.1	0.1
P110	J106	J110	1540	16	125	-287	0.5	0.1	0.1
P112	J110	J114	1440	16	125	-624	1.0	0.4	0.3
P114	J110	J112	568	12	125	242	0.7	0.1	0.2
P116	J106	J108	564	12	125	178	0.5	0.1	0.1
P118	J112	J108	1540	8	125	33	0.2	0.1	0.0
P120	J108	J120	760	12	125	181	0.5	0.1	0.1
P122	J112	J118	760	12	125	179	0.5	0.1	0.1
P124	J116	J118	1021	12	125	-30	0.1	0.0	0.0
P126	J118	J120	1539	8	125	34	0.2	0.1	0.0
P128	J120	J122	1538	16	125	118	0.2	0.0	0.0
P130	J120	J124	1330	12	125	44	0.1	0.0	0.0
P132	J124	J128	1384	16	125	39	0.1	0.0	0.0
P134	J124	J130	743	16	125	39	0.1	0.0	0.0
P136	J126	J124	1660	12	125	73	0.2	0.0	0.0
P138	J118	J126	813	12	125	101	0.3	0.0	0.0
P140	J126	J132	444	12	125	14	0.0	0.0	0.0
P142	J104	J106	2364	12	125	-14	0.0	0.0	0.0
P69	*RES10*	*J114*	*4632*	*24*	*125*	*860*	*0.6*	*0.3*	*0.1*

Notes:

Pipes P69 and P102 are a part of the existing off-site system, therefore not a part of proposed system.

Pipes required to serve the city-owned parcels in the Initial Phase

ELK GROVE MULTI-SPORT COMPLEX AND GRANT LINE INDUSTRIAL ANNEXATION AREA
MAXIMUM DAY DEMAND + FIRE FLOW MODEL OUTPUT

JUNCTION ID	STATIC DEMAND (gpm)	STATIC PRESSURE (psi)	STATIC HEAD (feet)	FIRE FLOW DEMAND (gpm)	RESIDUAL PRESSURE (psi)	AVAILABLE FLOW AT HYDRANT (gpm)	AVAILABLE FLOW PRESSURE (psi)
J102	170	52.1	174.3	3,000	39.6	5,540	20
J104	328	51.6	174.0	3,000	38.2	5,469	20
J106	190	52.0	174.0	3,000	43.7	7,453	20
J108	60	52.3	173.8	3,000	41.6	6,214	20
J110	190	53.5	174.4	3,000	46.6	8,736	20
J112	60	52.9	174.0	3,000	42.8	6,513	20
J116	60	53.6	173.6	3,000	31.0	3,876	20
J118	28	53.2	173.7	4,000	33.0	5,484	20
J120	106	53.5	173.5	4,000	32.5	5,484	20
J122	236	53.0	173.4	4,000	25.6	4,725	20
J124	78	53.0	173.4	4,000	26.3	4,643	20
J126	28	54.4	173.5	4,000	29.6	4,925	20
J128	78	54.3	173.4	4,000	**22.2**	4,242	20
J130	78	53.5	173.4	4,000	23.8	4,389	20
J132	28	54.4	173.5	4,000	22.7	4,228	20

Notes:
Critical Fire Flow Node

ELK GROVE MULTI-SPORT COMPLEX AND GRANT LINE INDUSTRIAL ANNEXATION AREA

MAXIMUM DAY DEMAND + FIRE FLOW AT NODE J128 MODEL OUTPUT

JUNCTION REPORT				
JUNCTION NODE ID	DEMAND (gpm)	ELEVATION (feet)	HEAD (feet)	PRESSURE (psi)
J100	0	54	164.2	47.8
J102	170	54	155.8	44.1
J104	328	55	152.6	42.3
J106	190	54	148.2	40.8
J108	60	53	140.9	38.1
J110	190	51	151.0	43.3
J112	60	52	142.4	39.2
J114	2	53	166.1	49.0
J116	60	50	133.0	36.0
J118	28	51	133.0	35.5
J120	106	50	130.0	34.7
J122	236	51	130.0	34.2
J124	78	51	111.8	26.3
J126	28	48	125.7	33.7
J128	4078	48	99.2	**22.2**
J130	78	50	111.8	26.8
J132	28	48	125.7	33.7

Notes:

Critical Fire Flow Node

ELK GROVE MULTI-SPORT COMPLEX AND GRANT LINE INDUSTRIAL ANNEXATION AREA

MAXIMUM DAY DEMAND + FIRE FLOW AT NODE J128 MODEL OUTPUT

PIPE REPORT									
PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	DIAMETER (in)	ROUGHNESS (C-value)	FLOW (gpm)	VELOCITY (ft/s)	HEADLOSS (ft)	HL/1000 (ft/kft)
P102	*J100*	*J114*	*1699*	*16*	*125*	*-1307*	*2.1*	*1.9*	*1.1*
P104	J100	J102	1889	12	125	1307	3.7	8.5	4.5
P106	J102	J104	920	12	125	1137	3.2	3.2	3.5
P110	J106	J110	1540	16	125	-1699	2.7	2.8	1.8
P112	J110	J114	1440	16	125	-4411	7.0	15.1	10.5
P114	J110	J112	568	12	125	2522	7.2	8.6	15.1
P116	J106	J108	564	12	125	2318	6.6	7.3	12.9
P118	J112	J108	1540	8	125	195	1.2	1.5	1.0
P120	J108	J120	760	12	125	2453	7.0	10.9	14.4
P122	J112	J118	760	12	125	2267	6.4	9.4	12.4
P124	J116	J118	1021	12	125	-60	0.2	0.0	0.0
P126	J118	J120	1539	8	125	284	1.8	2.9	1.9
P128	J120	J122	1538	16	125	236	0.4	0.1	0.1
P130	J120	J124	1330	12	125	2395	6.8	18.3	13.7
P132	J124	J128	1384	16	125	4078	6.5	12.6	9.1
P134	J124	J130	743	16	125	78	0.1	0.0	0.0
P136	J126	J124	1660	12	125	1839	5.2	14.0	8.4
P138	J118	J126	813	12	125	1895	5.4	7.2	8.9
P140	J126	J132	444	12	125	28	0.1	0.0	0.0
P142	J104	J106	2364	12	125	809	2.3	4.4	1.8
P69	*RES10*	*J114*	*4632*	*24*	*125*	*5721*	*4.1*	*10.9*	*2.4*

Notes:

Pipes P69 and P102 are a part of the existing off-site system, therefore not a part of proposed system.

Pipes required to serve the city-owned parcels in the Initial Phase

ELK GROVE MULTI-SPORT COMPLEX AND GRANT LINE INDUSTRIAL ANNEXATION AREA

PEAK HOUR DEMAND MODEL OUTPUT

JUNCTION REPORT				
JUNCTION NODE ID	DEMAND (gpm)	ELEVATION (feet)	HEAD (feet)	PRESSURE (psi)
J100	0	54	171.7	51.0
J102	341	54	167.1	49.0
J104	657	55	166.1	48.2
J106	380	54	166.2	48.6
J108	120	53	165.3	48.7
J110	380	51	167.5	50.5
J112	120	52	166.0	49.4
J114	4	53	172.7	51.9
J116	120	50	164.9	49.8
J118	56	51	164.9	49.4
J120	212	50	164.2	49.5
J122	472	51	163.9	48.9
J124	156	51	164.1	49.0
J126	56	48	164.5	50.5
J128	156	48	164.0	50.3
J130	156	50	164.0	49.4
J132	56	48	164.5	50.5

ELK GROVE MULTI-SPORT COMPLEX AND GRANT LINE INDUSTRIAL ANNEXATION AREA
PEAK HOUR DEMAND MODEL OUTPUT

PIPE REPORT									
PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	DIAMETER (in)	ROUGHNESS (C-value)	FLOW (gpm)	VELOCITY (ft/s)	HEADLOSS (ft)	HL/1000 (ft/kft)
P102	*J100*	*J114*	*1699*	*16*	*125*	*-943*	*1.5*	*1.0*	*0.6*
P104	J100	J102	1889	12	125	943	2.7	4.6	2.4
P106	J102	J104	920	12	125	602	1.7	1.0	1.1
P110	J106	J110	1540	16	125	-1148	1.8	1.3	0.9
P112	J110	J114	1440	16	125	-2495	4.0	5.3	3.7
P114	J110	J112	568	12	125	966	2.7	1.5	2.6
P116	J106	J108	564	12	125	714	2.0	0.8	1.5
P118	J112	J108	1540	8	125	131	0.8	0.7	0.5
P120	J108	J120	760	12	125	725	2.1	1.1	1.5
P122	J112	J118	760	12	125	715	2.0	1.1	1.5
P124	J116	J118	1021	12	125	-120	0.3	0.1	0.1
P126	J118	J120	1539	8	125	134	0.9	0.7	0.5
P128	J120	J122	1538	16	125	472	0.8	0.3	0.2
P130	J120	J124	1330	12	125	175	0.5	0.1	0.1
P132	J124	J128	1384	16	125	156	0.3	0.0	0.0
P134	J124	J130	743	16	125	156	0.3	0.0	0.0
P136	J126	J124	1660	12	125	293	0.8	0.5	0.3
P138	J118	J126	813	12	125	405	1.2	0.4	0.5
P140	J126	J132	444	12	125	56	0.2	0.0	0.0
P142	J104	J106	2364	12	125	-55	0.2	0.0	0.0
P69	*RES10*	*J114*	*4632*	*24*	*125*	*3442*	*2.4*	*4.3*	*0.9*

Notes:

Pipes P69 and P102 are a part of the existing off-site system, therefore not a part of proposed system.

Pipes required to serve the city-owned parcels in the Initial Phase