

Application No: A.23-08-010
Exhibit No: GSW-EG-028
Date: May 22, 2024
Witness: Ernest Gisler et al.

BEFORE THE
PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

GOLDEN STATE WATER COMPANY

PREPARED TESTIMONY

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Attachment F – 7
Bell-Bell Gardens Master Plan

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August 2023

Bell-Bell Gardens System Water Master Plan

Golden State Water Company

December 2022

Executive Summary

Purpose

The purpose of this Master Plan is to assess the ability of Golden State Water Company's (GSWC) Bell-Bell Gardens System to meet current and future water needs, and to identify upgrades needed if deficiencies exist. This assessment is developed by using hydraulic analysis criteria, future demands and available supply, water quality standards, and condition of facilities.

These updates provide GSWC with a basis to determine the impacts of new development on the existing system and to identify system deficiencies and improvements needed to correct them. These system improvement needs are used as the basis for developing the Capital Improvement Program (CIP) for the system. TABLE 9-1 summarizes the CIP projects identified in this master plan.

GSWC's goal is to meet the minimum requirements identified in the technical memorandum titled *Golden State Water Company Master Planning Criteria and Standards* (see Appendices).

Master Plan Process

This master plan document is organized as follows:

- Update existing system information
- Establish existing demands and forecast future demands
- Update system hydraulic model
- Evaluate supply and storage capacities
- Perform hydraulic analyses and evaluation
- Identify water quality issues
- Assess condition of facilities in the system
- Develop CIP

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Acronyms and Abbreviations

AACE International	Association for the Advancement of Cost Engineering International
ADD	average day demand
AFY	acre-feet per year
amsl	above mean sea level
CIP	capital improvement program
CPUC	California Public Utilities Commission
DDW	State Water Resources Control Board's Division of Drinking Water
EPA	U.S. Environmental Protection Agency
fps	foot or feet per second
gpm	gallons per minute
GSWC	Golden State Water Company
MCL	maximum contaminant level
MDD	maximum day demand
Metropolitan	Metropolitan Water District of Southern California
MG	million gallons
O&M	operations and maintenance
PHD	peak hour demand
PRV	pressure-regulating valve
psi	pounds per square inch
PSV	pressure-sustaining valve
SDWA	Safe Drinking Water Act
UWMP	Urban Water Management Plan
VFD	Variable Frequency Drive
WMP/MP	Water Master Plan

Introduction

1.1 Overview of Golden State Water Company

GSWC is a subsidiary of American States Water Company, an investor-owned utility dedicated to increasing value through the expert management of utility assets and services. As a public utility, GSWC is committed to the purchase, supply, distribution, and sale of water to over 262,000 customer connections.

GSWC is organized into three regions throughout the state of California. Region I is located in northern and central coast of California. Region II serves communities in Los Angeles County. Region III serves communities in Los Angeles, San Bernardino, Imperial, and Orange Counties.

FIGURE 1-1, provided at the end of this section, shows the locations of all GSWC water systems.

Region II operations are focused in 28 cities, one county, and several communities, serving more than 104,296 customer connections. The GSWC distribution network in Region II consists of eight separate water distribution systems with approximately 920 miles of pipelines and associated supply and storage facilities. The Bell-Bell Gardens System is one of the following eight systems in Region II:

- Artesia System
- Norwalk System
- Bell-Bell Gardens System
- Florence-Graham System
- Hollydale System
- Willowbrook System
- Culver City System
- Southwest System

1.2 Master Plan Update

The purpose of this master plan is to assess the Bell-Bell Gardens System's ability to meet current and future water needs and recommend system upgrades needed to meet current customer needs. This assessment is developed by using hydraulic design criteria, water quality standards, system demands and available supply, and facility condition assessments.

Specifically, this master plan supports GSWC's effort to update existing master plans and hydraulic models for water systems throughout the company. These updates provide GSWC with a baseline for determining the impacts of new development on existing systems as well as identifying short and long-term system needs. These system needs are used as the basis for developing the capital improvement program (CIP) for the system. The primary drivers of this master plan update are the following:

- Assess the distribution system's hydraulic performance
- Identify infrastructure that is in poor condition and needs to be replaced
- Identify supply and storage needs
- Identify water quality and treatment needs
- Provide documentation for the proposed CIP projects in support of the General Rate Case for the California Public Utilities Commission (CPUC)
- Reduce operations and maintenance (O&M) efforts and costs required to maintain service under current conditions
- Minimize service failures

1.3 Document Organization

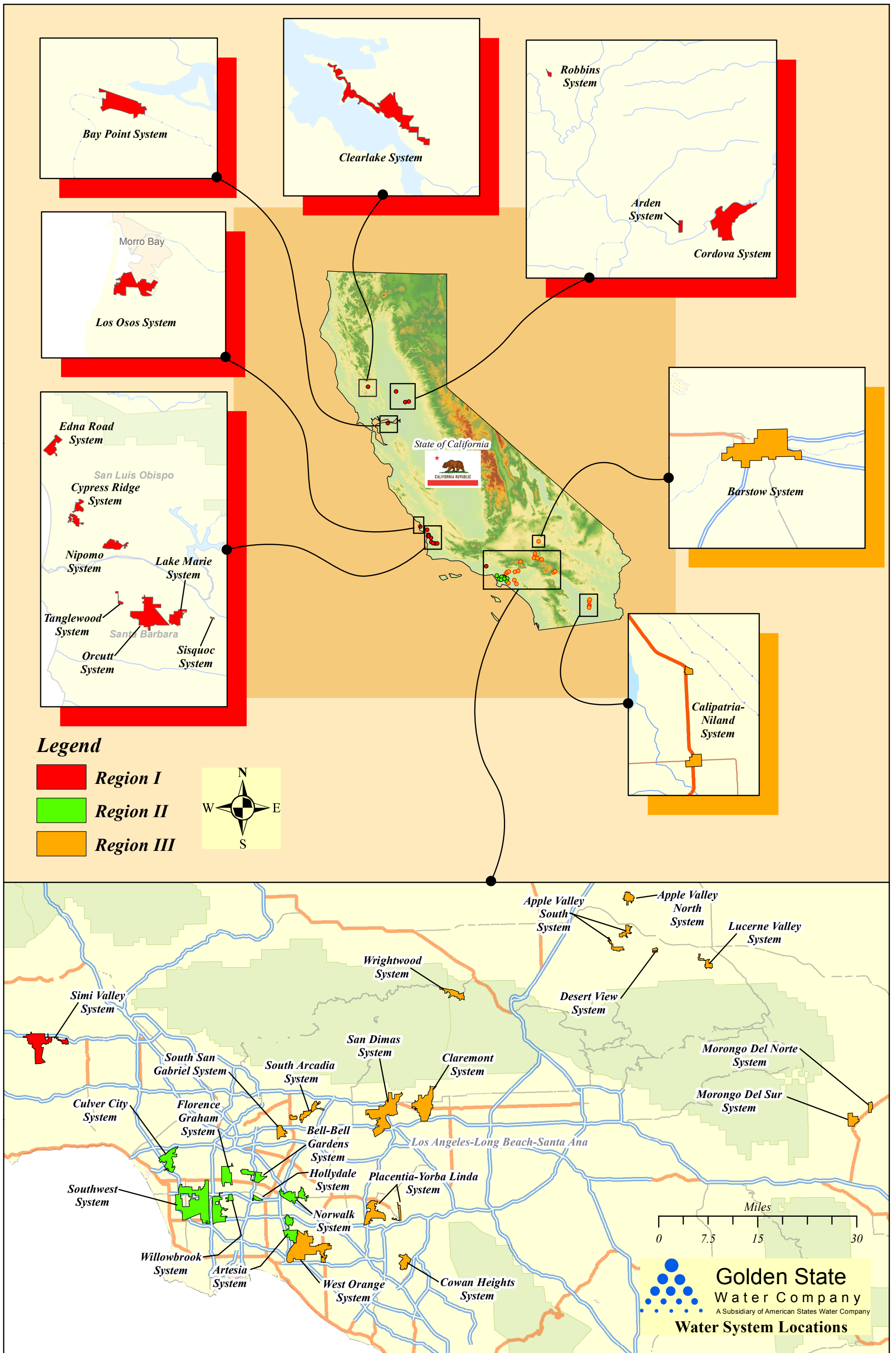
This master plan document is organized to provide information in a sequential manner that considers historical progression (past to present to future) and logical evaluation of the system from existing facilities and requirements through future needs. The title of each section and a brief summary are as follows:

1. **Introduction:** Provides background information on the company and its systems.
2. **Existing Water System Facilities:** Provides an overview of the system and its facilities. System facilities identified include the system service area boundary, pressure zones, distribution areas, supply sources, storage facilities, pump stations, pressure regulating and water control stations, and transmission and distribution pipelines.
3. **Existing and Future Demands:** Provides definition of demand types and periods, as well as existing and future demands. Explains the demand development approach and determination of peaking factors. Provides the current demands and projected demands developed for a future 2045 condition. Future demands are based on population growth rate and demand projections.
4. **Hydraulic Model Development and Calibration:** Provides an overview of the modeling process, including hydraulic model construction and calibration.

5. **Supply and Storage Capacity Evaluation:** Documents the evaluation of the system's water supply and storage capacity using the objectives identified in GSWC's *Master Planning Criteria and Standards*. The evaluation results establish supply and storage needs for each distribution area and the entire distribution system. Existing and future supply and storage deficiencies are also identified. Recommended improvements to mitigate deficiencies are also provided.
6. **Hydraulic Analysis and Evaluation:** Outlines the approach for the hydraulic analysis. Details how the updated hydraulic model was used to determine hydraulic deficiencies under simulated demand scenarios and was compared with the analysis and planning criteria for short and long-term planning periods. Provides recommendations to address deficiencies that were identified. Scenarios simulated by the hydraulic model include average day, maximum day, and peak hour conditions.
7. **Water Quality Analysis:** Provides GSWC's evaluation of water quality based on current and pending federal and state standards and rules.
8. **System Condition Assessment:** Provides GSWC's documentation of system condition assessment efforts including past efforts, recent field inspections, and recommendations for future improvements.
9. **Capital Improvement Program:** Describes the CIP plan resulting from all preceding tasks broken down into short and long-term planning periods. This includes prioritization and justification for the projects included in the CIP.
10. **References:** Lists the primary sources of information referred to throughout the master plan.

Appendices provide supporting information on various specifications and details referred to throughout the master plan.

Figures



SECTION 2

Existing Water System Facilities

This section documents existing water system facilities for the Bell-Bell Gardens System and provides detailed information about major facilities, such as water supply facilities, storage facilities, pipelines, pumping facilities, and regulating valves.

2.1 Overview

The Bell-Bell Gardens System, located in Los Angeles County, covers approximately 3 square miles and serves parts of the Cities of Bell, Bell Gardens, and Cudahy.

The Bell-Bell Gardens System is comprised of one pressure zone. Water supply to the Bell-Bell Gardens System includes local groundwater and purchased water from Metropolitan Water District of Southern California (Metropolitan or MWD). The Bell-Bell Gardens System also has emergency interconnections.

2.2 Facility Descriptions

The major system facilities are shown in FIGURE 2-1 at the end of this Section. These facilities are discussed in detail in the following subsections:

- Pressure zones
- Distribution Areas
- Supply sources
- Storage facilities
- Pumping stations
- Pressure regulating stations and flow control stations
- Transmission and distribution pipelines

2.2.1 Pressure Zones and Distribution Areas

The Bell-Bell Gardens System is comprised of one general pressure zone, the Main Zone, (HGL is the same for the entire system). FIGURE 2-1 at the end of Section 2 provides details of the pressure zones and distribution areas. FIGURE 2-2 at the end of Section 2 presents the system's hydraulic profile (schematic of the water system). TABLE 2-1 below provides details for this system and its pressure zones/distribution areas.

TABLE 2-1 Distribution Area Details

Pressure Zone	HGL (ft amsl)	Elevations Served (ft amsl)	Supply and Storage Facilities ^a			
			Storage Tanks	Wells	Purchased Water	PRVs
Main Zone	270	109-159	Bissell Tanks A & B Watson Tank	Clara Well 2 Gage Well 2 Bissell Well 2 Bissell Well 3 Otis Well 3 Watson Well 1	Metropolitan CB-3	None

^a Does not include hydropneumatic tanks or emergency interconnections.

2.2.2 Supply Sources

GSWC currently obtains its water supply for the Bell-Bell Gardens System from two primary sources – GSWC owned and operated groundwater wells and purchased water connections.

2.2.2.1 Groundwater

Active Wells

TABLE 2-2 presents the relevant data for the wells identified as active for this Master Plan. The elevation shown for each well is the elevation of the wellhead facilities. The pumping water level is the depth measured from the wellhead to the surface of the groundwater while the well pump is running. Pumping water levels were based on recent levels monitored and recorded by GSWC. The groundwater elevation was calculated by subtracting the pumping water level from the wellhead elevation. The discharge location describes where the well pump discharges.

TABLE 2-2 Active Wells

Well	Discharge Location	Wellhead Elevation (ft amsl)	Pumping Water Level (ft)	Pumping Groundwater Elevation (ft amsl)	Rated TDH ^a (ft)	Rated Capacity ^b (gpm)
Bissell Well 2	West Area	152	274	-126	330	500
Bissell Well 3	West Area	151	275	-124	320	2,000
Clara Well 2	East Area	121	129	-8	335	1,000
Gage Well 2	East Area	129	142	-13	282	1,000
Otis Well 3 ^c	West Area	149	191	-42	320	1,000
Watson Well 1	West Area	125	247	-122	337	660
Total Groundwater Supply Capacity						6,160

^a TDH is based on pump design point data.

^b Capacity is based on facility design capacity, under normal operating conditions, and may not reflect actual capacity at a given point in time.

^c Well pump is equipped with VFD.

Off-Line Wells

Off-line wells in the system are listed in TABLE 2-3.

TABLE 2-3 Off-Line Wells

Well	Discharge Location	Wellhead Elevation (ft amsl)	Previous Capacity (gpm)	Reason
None				

2.2.2.2 Purchased or Imported Water

Purchased water for the Bell-Bell Gardens System is provided by the Central Basin Municipal Water District (CBMWD) via connection(s) listed in TABLE 2-4.

TABLE 2-4 Purchased Water Supply Connections

Connection	Pressure Zone/ Distribution Area	Connection Elevation (ft amsl)	HGL (ft amsl)	Control Setting (psi)	Maximum Capacity (gpm)
Metropolitan CB-3	East Area	110	270	60	3,400
Total purchased water supply capacity					3,400

2.2.3 Storage Facilities

Water distribution systems rely on stored water to help stabilize fluctuations between supply and demand, to supply sufficient water for firefighting, and to meet demands during an emergency or an unplanned outage of a major supply source. This section describes the existing storage facilities in the system.

2.2.3.1 Storage Tanks

Details of the available storage in the Bell-Bell Gardens System are provided in TABLE 2-5.

TABLE 2-5 Storage Tanks

Tank	Type and Pressure Zone/ Distribution Area	Bottom of Tank (ft amsl)	High Water Elevation (ft amsl)	Tank Height (ft)	Diameter (ft)	Volume (MG)
Bissell Tank A	Ground level pumped to West Area	147	171	26	60	0.50
Bissell Tank B	Ground level pumped to West Area	147	171	26	88	1.00
Watson Tank	Ground level pumped to West Area	123	139.5	22	68	0.50
Total system wide storage capacity						2.00

2.2.4 Booster Pumping Stations

Booster pumping stations are sometimes required to convey water from tanks into the distribution system or from lower-pressure zones into higher-pressure zones. Booster pumping stations may consist of one or more individual pumps. Multiple pumps at each station, or multiple pumping stations that serve the same pressure zone, help to increase water system reliability by ensuring that water can still be delivered into that zone if one pump is out of service. Critical pumping stations may be equipped with variable frequency drives to stabilize the pressures in the system and emergency power supplies in case of failure of the primary power source.

TABLE 2-6 provides details of the booster pumps in the Bell-Bell Gardens System.

TABLE 2-6 *Booster Pumps*

Facility	Suction	Discharge	Backup Power Available	Elevation (ft amsl)	Rated TDH ^a (ft)	Rated Capacity ^b (gpm)
Bissell Booster A	Bissell Tanks	West Area	None	150	130	1,135
Bissell Booster B	Bissell Tanks	West Area	None	150	131	1,200
Bissell Booster C ^c	Bissell Tanks	West Area	None	150	133	1,000
Watson Booster A	Watson Tank	West Area	None	128	150	600
Watson Booster B ^c	Watson Tank	West Area	None	128	150	600

^a TDH is based on pump design point data.

^b Capacity is based on facility design capacity, under normal operating conditions, and may not reflect actual capacity at a given point in time.

^c Pump is equipped with VFD.

2.2.5 Pressure Regulating and Flow Control Stations

Pressure regulating and flow control stations allow distribution systems to transfer water from higher pressure zones to lower pressure zones without exceeding the allowable pressures in the lower zones or completely depressurizing the higher zone. Water is transferred through a valve that reduces the pressure or controls the flow rate to a specified setting. Regulating valves can operate based on one or more controlling parameters. The operational controls include pressure reducing, pressure sustaining, pressure relief, and flow rate:

- **Pressure Reducing Valve (PRV):** Modulates to maintain a preset minimum downstream pressure setting. If the downstream pressure drops, the valve will open until the downstream pressure matches the pressure setting of the valve.
- **Pressure Sustaining Valve (PSV):** Modulates to maintain a preset minimum upstream pressure setting. If the upstream pressure drops, the valve will close until the upstream pressure matches the pressure setting of the valve.
- **Pressure Relief Valve (Relief):** Opens when the upstream pressure exceeds a preset maximum pressure setting.
- **Flow Control Valve (FCV):** Modulates to maintain a preset flow rate through the valve regardless of pressure.

- **Normally Closed Gate Valve for zone break controls (NCGV)** - Closed for the sole purpose of providing a boundary between two pressure zones
- **Water Quality Bypass Valve (WQBV)** - Keeps some water moving between zones in order to prevent water quality issues or water age in the pipelines.

There are no zone-separation valves in the Bell-Bell Gardens System, since this system is comprised of one general pressure zone (HGL is the same for the entire system).

2.2.6 Emergency Interconnections

Water distribution systems are often connected to neighboring water systems to allow sharing of supplies during short term emergencies or during planned shutdowns of a primary supply source. GSWC is required to obtain permission from the water purveyor(s) prior to opening these manually controlled interconnections, and vice versa if GSWC provides emergency water to a neighboring system. These emergency interconnections are presented in TABLE 2-7 below.

TABLE 2-7 Emergency Interconnections

Interconnection Name/Location	Pressure Zone/Distribution Area	Maximum Capacity ^a (gpm)	Notes
City of Bell Gardens – El Selinda and Gage	East Area	3,591	Manually Closed
City of Huntington Park – Gage & Salt Lake	West Area	750-1,000	Manually Closed
Maywood Mutual Water Company – Florence and Atlantic	West Area	900	Manually Closed
Tract 180 Water Company/ Florence Ave and Woodward Ave ^b	West Area	1,565	Manually Closed

^a Capacity of emergency interconnections is approximate. These connections are not considered a reliable source of supply; therefore, they are not included in the Supply and Capacity Analysis.

^b The interconnection with Tract 180 Water Company (Tract 180) is an emergency export connection. In the event of an emergency within the Tract 180 service area, supply to Tract 180 is dependent upon GSWC's availability of excess capacity in the system at the time of the event.

2.2.7 Transmission and Distribution Pipelines

TABLE 2-8 lists the estimated length of pipelines by diameter and material.

TABLE 2-8 Pipes by Size and Material

Diameter (in)	Length of Pipe by Material (LF)						Total Length (ft)
	AC	CI	DI	PVC	CL-STL (RCP)	STL	
2	-	-	-	10	-	429	439
4	5,293	9,414	-	327	-	1,921	16,956
6	25,621	21,425	1,914	7,006	-	-	55,966
8	55,675	12,707	47,494	55,415	-	2,674	173,966
10	9,928	1,879	260	4,631	-	17	16,714
12	10,510	4,873	32,045	23,354	-	5	70,788
14	2,129	-	-	666	-	7,575	10,371
16	473	-	496	293	3,169	-	4,430
18	-	-	166	-	-	-	166
Totals (ft)	109,628	50,299	82,375	91,704	2,128	12,621	349,796
Totals (mi)	20.8	9.5	15.6	17.4	0.6	2.4	66.2
Percent (%)	31.3	14.4	23.5	26.2	0.9	3.6	100.0

AC: Asbestos Cement

DI: Ductile Iron

CL-STL (RCP): Cement Lined & Coated Steel

CI: Cast Iron

PVC: Polyvinyl Chloride

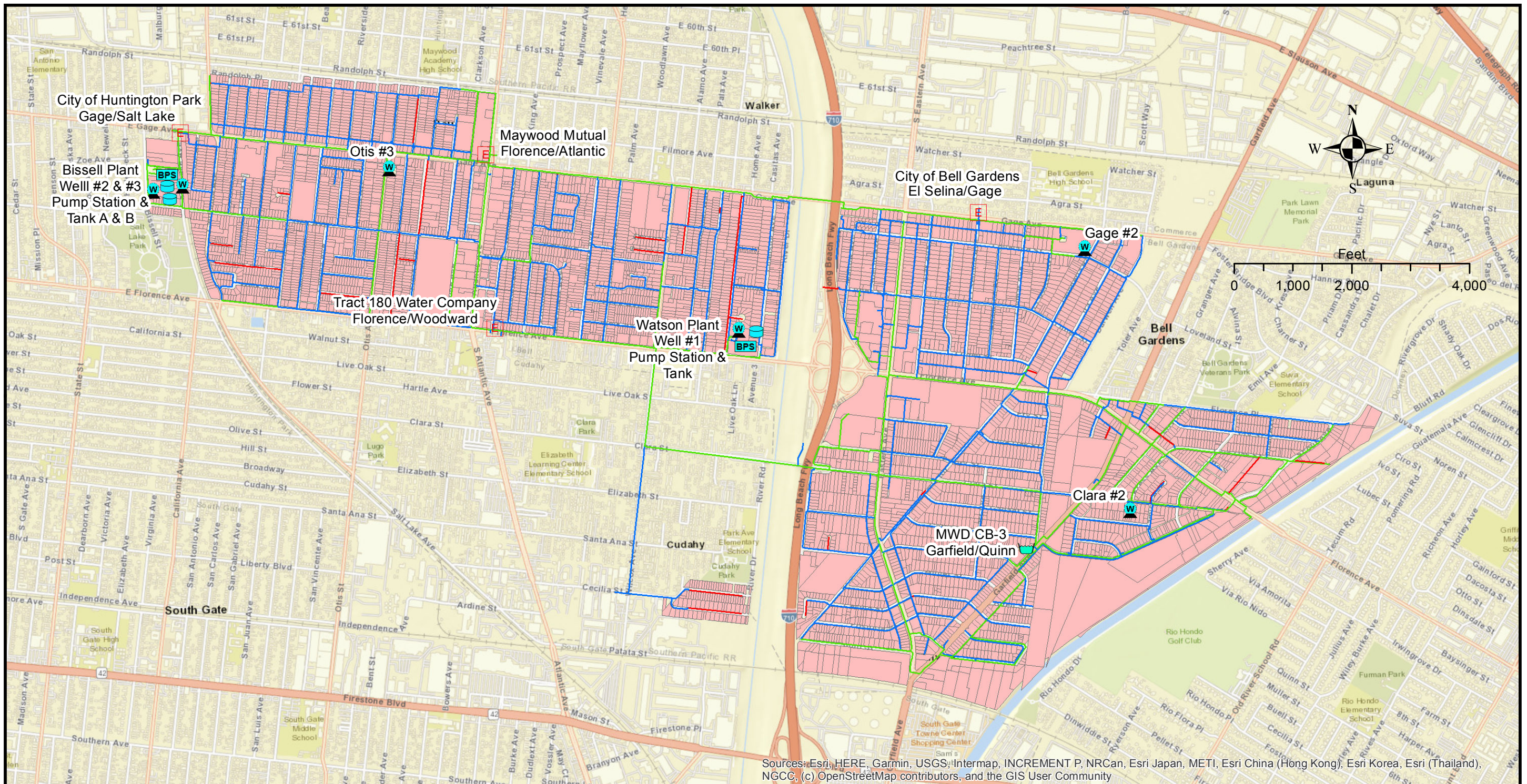
STL: Steel

TABLE 2-9 lists the estimated length of pipelines by diameter and year constructed.

TABLE 2-9 Pipes by Size and Year Built

Diameter (in)	Length of Pipe by Year Built (LF)					Total Length (ft)
	Pre 1960	1960-1979	1980-1999	2000-2019	2020-2021	
2	429	-	-	10	-	439
4	13,419	3,051	472	14	-	16,956
6	22,362	21,751	10,196	1,656	-	55,966
8	18,200	36,971	57,672	51,945	9,178	173,966
10	1,640	8,496	6,461	101	16	16,714
12	4,742	8,714	44,999	9,484	2,849	70,788
14	6,773	2,932	666	-	-	10,371
16	3,169	-	1,125	137	-	4,430
18	-	11	155	-	-	166
Totals (ft)	70,734	81,916	121,602	63,502	12,042	349,796
Totals(mi)	13.4	15.5	23.0	12.0	2.3	66.2
Percent	20.2	23.4	34.8	18.2	3.4	100.0

Figures



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

**FIGURE 2-1
BELL-BELL GARDENS SYSTEM
OVERVIEW MAP**

GSWC REGION II WATER MASTER PLAN
BELL-BELL GARDENS SYSTEM



Existing Facilities

- E Emergency Connection
- BPS Pump Station
- Supply Connection
- Tank
- Well

Pipelines

- Less than 6"
- 6" or 8"
- Greater than 8"

Distribution Zone

- Main Zone

Bell - Bell Gardens System Schematic

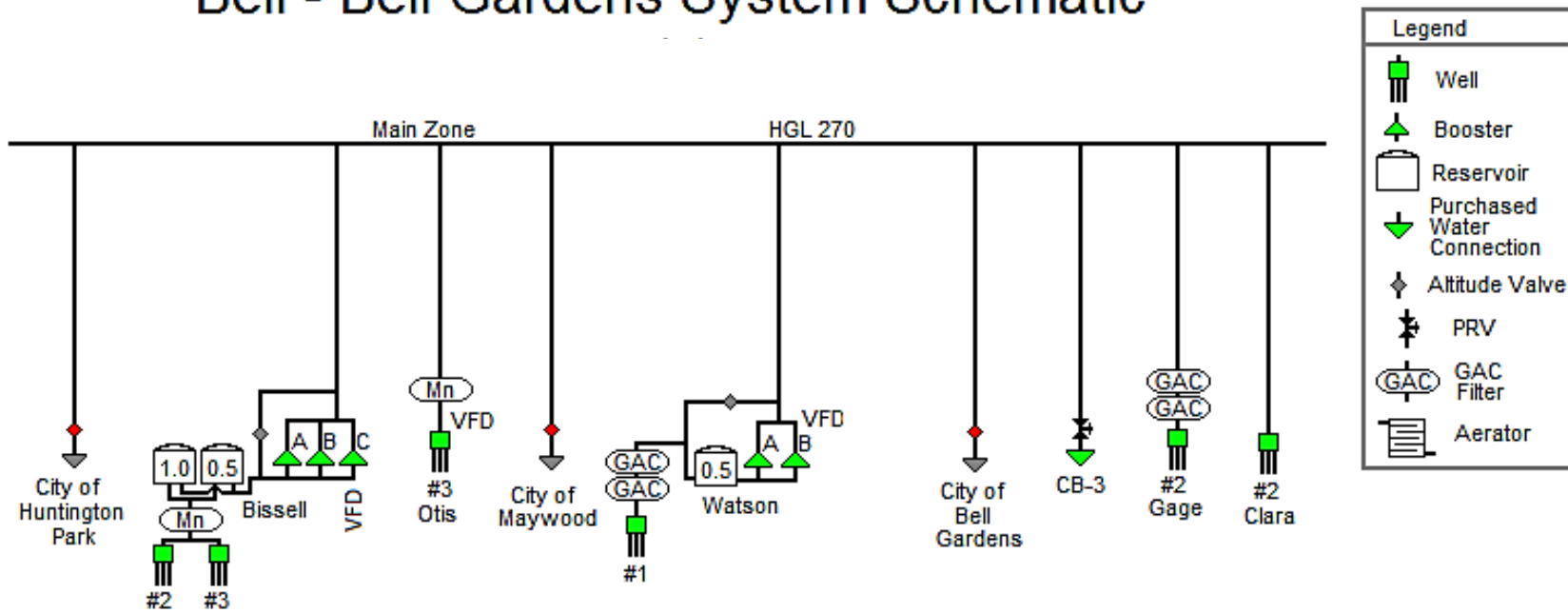


FIGURE 2-2

SYSTEM SCHEMATIC

GSWC REGION II MASTER PLAN
BELL-BELL GARDENS SYSTEM



Golden State
Water Company
A Subsidiary of American States Water Company

Existing and Future Water Demands

This section documents existing and future water demands for the system.

3.1 Demand Definitions and Periods

Demand is classified in two basic ways:

- **Demand:** The total quantity of water required for a given period of time to meet the water system's various uses. These uses may include residential, commercial, industrial, and other revenue and non-revenue demands.
- **Non-revenue Demand:** The difference between the total amount of water produced from water supply sources and the total amount of water delivered to customers. This includes water used for firefighting, flushing, and water lost due to system leaks and illegal connections. For systems without meters for all customers, this demand classification may not be quantifiable.

The water industry commonly uses several demand periods for developing water distribution system master plans. These demand periods are designated as average day demand (ADD), maximum day demand (MDD), peak hour demand (PHD), and maximum day demand plus fire flow (MDD+FF). These demand periods were applied to evaluate the Bell-Bell Gardens System. The American Water Works Association (AWWA, 2005) defines these common steady-state demand periods as follows:

- **ADD:** Total amount of water delivered to the system in 1 year divided by 365 days.
- **MDD:** Maximum amount of water delivered to the system in any single day of the year.
- **PHD:** Amount of water required to meet peak demands during MDD. GSWC applies PHD for four hours when analyzing system supply and storage.
- **MDD+FF:** Amount of water required to fight a fire in addition to MDD.

3.2 Existing Demands

The existing demands represent a baseline for evaluating the existing system and to project future demands. The data used to develop the existing demands was based on historical water supply.

3.2.1 Historical Demands

For this master plan, it was assumed that the historical water supply equaled the historical water demand (including non-revenue demand). TABLE 3-1 summarizes the historical annual water supply from 2012 through 2021.

TABLE 3-1 Historical Annual Water Supply

Year	Active Service Connections	Total Demand (AFY) ^a	Average Demand per Connection (AFY/conn.)
2012	7,435	5,314	0.715
2013	7,440	5,239	0.704
2014	7,442	4,981	0.669
2015	7,454	4,632	0.621
2016	7,422	4,569	0.616
2017	7,422	4,693	0.632
2018	7,435	4,703	0.633
2019	7,439	4,534	0.609
2020	7,440	4,520	0.607
2021	7,523	4,418	0.587
10-year average			0.639

^a Includes non-revenue demand

FIGURE 3-1 summarizes the historical annual water supply and number of active service connections. The figure demonstrates a correlation between the number of active service connections and the amount of water consumed.

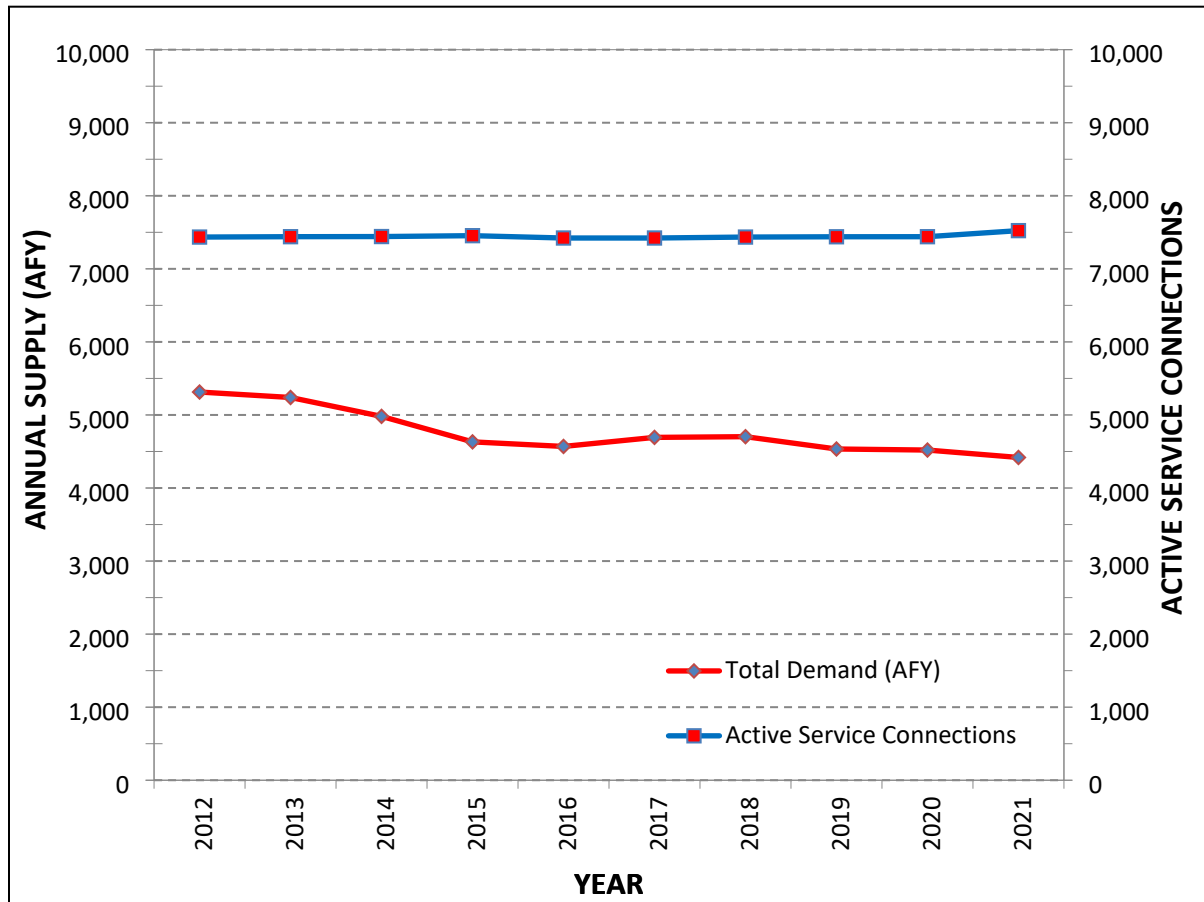


FIGURE 3-1 Historical Annual Supply Totals and Active Service Connections for the Last 10 Years

3.2.2 Establishing Demands

The total water demand for 2022 was estimated by multiplying the number of 2021 active service connections with the 10-year average of the average demand per service connection. This approach allows for the calculation of ADD for various planning years, and then allows for a direct calculation for other demand periods using the appropriate peaking factor.

In order to evaluate the system's performance during the MDD scenario, existing historical demand data was used in accordance with the Waterworks Standards set forth by the California Code of Regulations (2009). Section 64554.30 of the Waterworks Standards defines MDD as "the amount of water utilized by customers during the highest day of use (midnight to midnight), excluding fire flow, as determined pursuant to Section 64554." Section 64554(b)(1) of the Waterworks Standards says to "identify the day with the highest usage during the past ten years to obtain MDD." While GSWC is currently unable to track customer usage over an exact 24-hour period, GSWC does record daily water supply, and as stated in Section 3.2.1 above, it can be "assumed that the historical water supply equal[s] the historical water demand." However, because the daily supply readings are not collected at the same

time each day, the resulting data may be for time periods that can range anywhere from 16 to 32 hours. For example, the readings may be taken at 9 am one day and 4 pm the next. This introduces the chance of a fairly large error if single-day recordings are used, as it could include water supply over a period longer than 24 hours. To address the possible variations in the hours per day within a given supply reading, GSWC identifies and uses the average of the three consecutive days with the highest supply for each calendar year. By using the average of the highest three consecutive days of water supply, the effect of any imprecision due to the time of day when the data was collected is significantly reduced.

TABLE 3-2 presents the ADD, MDD, and peaking factor data over the last ten years.

TABLE 3-2 Historical Average and Maximum 3-day Demands

Year	ADD ^a		MDD ^b (gpm)	MDD Peaking Factor (MDD:ADD)
	AFY	gpm		
2012	5,314	3,294	4,580	1.39
2013	5,239	3,248	4,242	1.31
2014	4,981	3,088	3,870	1.25
2015	4,632	2,871	3,658	1.27
2016	4,569	2,832	3,520	1.24
2017	4,693	2,909	3,528	1.21
2018	4,703	2,915	3,802	1.30
2019	4,534	2,811	3,479	1.24
2020	4,520	2,802	3,385	1.21
2021	4,418	2,739	3,328	1.22

^a Includes non-revenue demand

^b Average of three consecutive highest days

Peaking factors are a ratio of MDD to ADD or PHD to MDD. For example, to determine the MDD peaking factor, the MDD would be divided by the ADD. It has been GSWC's experience that utilizing a PHD peaking factor of 1.5 has been sufficient to meet PHD. Peaking factors are used to estimate future water demands as presented and discussed in Section 3.3. To determine the existing MDD, Section 64554(b) of the Waterworks Standards states the following:

A system shall estimate MDD and PHD for the water system as a whole (total source capacity and number of service connections) and for each pressure zone within the system (total water supply available from the water sources and interzonal transfers directly supplying the zone and number of service connections within the zone), as follows:

- (1) *If daily water usage data are available, identify the day with the highest usage during the past ten years to obtain MDD; determine the average hourly flow during MDD and multiply by a peaking factor of at least 1.5 to obtain PHD.*

TABLE 3-3 summarizes the projected system demands for the ADD, MDD, and PHD scenarios for 2022.

TABLE 3-3 Projected System Demands for 2022 by Demand Period

Demand Period	Projected System Demands (gpm)
ADD	2,983
MDD	4,580
PHD	6,869

3.3 Future Demand Projections

Future demands were projected to estimate future ADD, and peaking factors were applied to estimate MDD and PHD. The following sources of data and approaches were used:

- Growth rate projections
- Water demand projections

3.3.1 Growth Rate Projections

Growth rate projections were obtained from the 2020 Urban Water Master Plan (UWMP) for the Bell-Bell Gardens System, and were based on estimates of the number of future service connections. The UWMP methodology used year 2020 U.S. census data to correlate population growth with the increase in service connections. This correlation was then used to determine future water demand.

3.3.2 Water Demand Projections

The projected annual water demands were obtained from the 2020 UWMP for the Bell-Bell Gardens System and are based on the projected number of service connections. A factor for average water demand per connection was then applied and state-mandated SBX7-7 reductions taken into account.

The State of California is in a long term drought and the Governor has issued Executive Orders that will likely result in significant reductions in future demands. This Master Plan utilizes the current requirements established by the State of California and California Public Utilities Commission in evaluating needed facilities but acknowledges that the requirements may change. Subsequent updates to this master plan will reflect future changes in requirements.

FIGURE 3-2 presents the historical and projected annual water demands, including the most recent 10-year period.

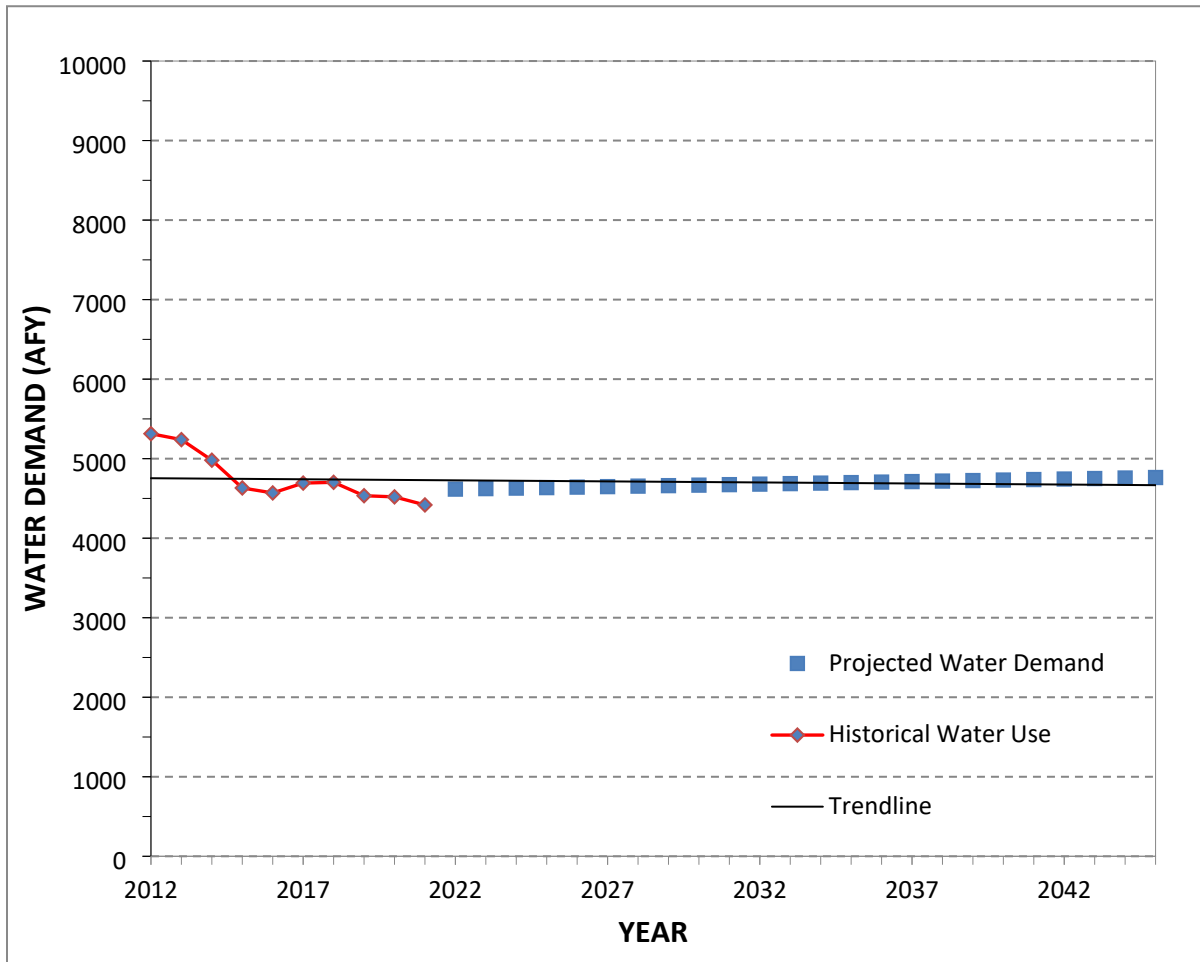


FIGURE 3-2 Historical Water Demands and Future Water Demand Projections

In order to determine the projected MDD for the year 2045, the peaking factor associated with the highest MDD from TABLE 3-2 was applied to the projected ADD. TABLE 3-4 summarizes the projected demands for ADD, MDD, and PHD periods.

TABLE 3-4 Water System Demands by Demand Period

Planning Year	Demand Period and Peaking Factor			
	Annual Average (AFY)	ADD (gpm)	MDD (gpm)	PHD (gpm)
2022	4,810	2,983	4,580	6,869
2045	4,763	2,954	4,107	6,160

Hydraulic Model Development and Calibration

4.1 Overview

A computerized hydraulic model of the water distribution system is an important tool used to conduct hydraulic analyses of water systems. The analyses are used to aid in the preparation of Water Master Plans for the systems.

The computer model is used to analyze the water system facilities, operational characteristics, and water supply and consumption data of the agency. The water distribution system hydraulic model includes pipes, junction nodes (connection points for pipes and location of demands), valves, wells, pumps, purchased water connections, tanks, and reservoirs. Operational characteristics include parameters that control the method in which the water is distributed through the system, such as on and off settings for pumps, pressure or flow controls for hydraulically actuated valves, or main line valve closures. Data for supply and consumption determine where the water supply and demands are applied within the distribution system.

Accurate computer model development begins with entering the correct information into the data file and calibrating the model to match existing conditions in the field. Once this foundation is complete, the resulting model becomes an invaluable tool. It can simulate the existing water systems and future water systems, identify system deficiencies, analyze impacts from increased demands, and determine the effectiveness of recommended improvements.

4.2 Construction of the Hydraulic Computer Model

The Bell-Bell Gardens System hydraulic computer model was revised as part of the 2019 Master Plan. For this Master Plan, the model was checked for accuracy and updated to include newly constructed facilities. Valve settings for pressure regulating valves were also verified, and the system demands were validated. Localized calibration was performed to refine the model in certain sections of the system.

4.3 Summary

This Master Plan update includes verification and updates of the physical components represented in the hydraulic model and validation of demands in the model.

It is important to note that model calibration for any water system is an ongoing effort. As changes in the system occur from changing demands, new infrastructure development, or changing operational settings, the model must be periodically updated and checked to ensure agreement with field measurements. This update serves as a baseline for future calibration efforts by GSWC.

Supply and Storage Capacity Evaluation

This section documents the evaluation of water supply and storage capacity for the Bell-Bell Gardens System. The following was accomplished as a result of this evaluation:

- Established supply and storage needs for each distribution area/pressure zone and the entire distribution system
- Identified supply and storage deficiencies in the existing system and future system
- Recommended improvements that mitigate the deficiencies identified

In each subsection, the supply and storage capacity of the existing system and future system were measured against the objectives identified in the technical memorandum titled *Master Planning Criteria and Standards* (see Appendices). When the analyses indicated that the system did not meet these criteria, deficiencies were identified and facilities were recommended to mitigate the deficiency.

5.1 Overview

To provide a reliable water supply, a water system must be able to meet the system demands under a variety of conditions. The water supplied may be provided by a combination of supply sources, or stored water, or both. The specific demand period being analyzed may limit the source of water for the scenario. For example, stored water should not be used to meet ADD or MDD but can be used for PHD or MDD+FF. Therefore, each demand period may require a different ratio of water supply and storage. This analysis is used to examine various demand periods to determine if the system has the ability to reliably meet the system demands under typical demand scenarios using a combination of water supply sources and storage.

5.2 Evaluation Approach

This supply and storage capacity analysis examined the Bell-Bell Gardens System under two planning periods:

- **Existing system.** The demands for the existing water system were determined by multiplying the 10 year historical average demand per connection and the most recent number of connections (year 2021) to obtain the total system demand. The analysis assumed all facilities that were operational in 2022.
- **2045 system.** The long term planning horizon (2045) water system analysis assumed demands projected for 2045 (assumed buildout). It was also assumed that the facilities included in the existing system analysis are active and the facilities proposed to correct the existing deficiencies have been constructed and are operational.

5.2.1 Analysis Criteria

It is GSWC's goal to ascertain that the system is capable of providing sufficient water supply and storage capacity to meet the minimum criteria summarized in TABLE 5-1. These criteria were extracted from the technical memorandum titled *Master Planning Criteria and Standards*. The criteria apply to the system as a whole and to each pressure zone or distribution area in the system. For planning purposes, this Master Plan uses the Planning Scenario MDD+FF to analyze the system performance under a worst-case planning scenario. The worst-case planning scenario is represented by applying the single most stringent fire flow requirement established (based on land use plans or as designated by the local fire jurisdiction) for a structure within a pressure zone or distribution area as the baseline fire flow requirement for the entire pressure zone or distribution area. For the purposes of the planning analysis, this is considered a goal rather than a requirement. If the result of the worst case planning scenario indicates a deficiency in MDD+FF, it should be noted that there may not be a deficiency in the actual fire flow requirement for a particular structure, but rather that GSWC is not meeting the planning goal for the overall pressure zone or distribution area.

TABLE 5-1 Supply Capacity Analysis Criteria

Planning Scenario	Demand and Duration	Evaluation Criteria	Storage Usage	Facilities Assumed to be Out of Service
Average day	ADD for 24 hours	Total capacity	No storage drawdown	None
Maximum day	MDD for 24 hours	Firm capacity	No storage drawdown	Largest pumping unit in system
Peak hour	PHD for 4 hours ^a	Firm capacity	Operational storage	Largest pumping unit in system
MDD + fire flow	MDD plus fire flow, duration varies ^b	Total capacity	Fire storage	None
Planned MWD outage	ADD for 7 days	Total capacity without most critical MWD connection or pipeline	Operational and emergency storage	Largest MWD connection or pipeline
Unplanned MWD outage	MDD for 1 day followed by ADD for 6 days	Total capacity without most critical MWD connection or pipeline	Operational and emergency storage	Largest MWD connection or pipeline

^a Operational storage recommended to meet peak demands during MDD was defined as the supply needed during 4 hours of PHD.

^b Fire flow scenarios are based on fire agency maximum flow requirements for a single structure within a distribution area and are applied throughout the distribution area as part of the planning analysis. Actual fire flows may be less than the maximum fire flow used for planning analysis.

The California Public Utilities Commission (CPUC) and Division of Drinking Water (DDW) currently provide no specific requirements for storage volume. Therefore, recommended standards published by the American Water Works Association (AWWA) were considered in the development of the storage criteria used in this master plan.

5.2.2 Storage

In addition to providing adequate water supplies for the water consumers, water distribution systems often rely on stored water within the distribution system to provide the following operational benefits:

- Help stabilize fluctuations between supply and demand.
- Supply sufficient water for firefighting.
- Meet demands during an emergency or unplanned outage of a major supply source.

AWWA identifies three types of storage for any given system – operational, fire, and emergency. The amount of storage recommended for each of these types varies by system. Nevertheless, all three types of storage must be considered. In some cases, water stored in the groundwater basin can provide some of this storage. However, when the stored water does not flow by gravity and requires pumping, sufficient pumping redundancy and stand-by power generators must be provided if the storage source is to be considered reliable.

In this section, the ability of the system’s storage facilities to meet the water system’s storage requirements is evaluated. The resulting volume is allocated to the pressure zones where demands exist.

TABLE 5-2 presents the recommended operational, fire, and emergency storage criteria as defined by GSWC for the Bell-Bell Gardens System.

TABLE 5-2 Criteria for Calculating Storage

Storage Category	GSWC Criteria
Operational	Storage recommended to meet PHD in addition to MDD supply
Fire	Maximum fire storage recommended in the system
Emergency	ADD for 12 hours

5.2.2.1 Operational Storage

The recommended volume of water for operational storage is determined by the volume needed for regulating the difference between the rate of supply and the daily variations (peaks) in water usage. This difference results in the lowest and highest operating levels in the reservoirs under normal conditions. The resulting volume must be allocated to either the pressure zones where the demands exist or to a higher-pressure zone for use by the lower-pressure zone.

5.2.2.2 Fire Storage

The volume of water recommended for firefighting is a function of the instantaneous flow rate required to fight a fire over the duration of the fire flow event as determined by the local fire jurisdiction. Consideration is also made to evaluate the number of fire flow events that may occur before the volume can be replenished. Further, the volume of water necessary to fight a fire can be provided from water supply, water storage, or a combination thereof. For planning purposes, it is desirable and conservative to design the water system to have capacity within water tanks for the volume of water needed for firefighting; however, the fire storage in the tanks plus available supply in excess of MDD can be used to meet firefighting

requirements. TABLE 5-3 lists the largest volume of water recommended for firefighting within each pressure zone based on the land use in that zone, the flow rates, and durations.

TABLE 5-3 Fire Storage Volumes

Land Use Category	Minimum Fire Flow Required (gpm)	Duration (hr)	Recommended Fire Storage Volume (MG)
Commercial, industrial and school	5,000	5	1.50
Multiunit residential	1,500	2	0.18
Open space and other	1,500	2	0.18
Single-family residential	1,250	2	0.15

MG: million gallons

For the Bell-Bell Gardens System, it was assumed that only one fire event within the system would occur before storage tanks were able to refill. The lowest fire-flow volume (0.15 MG) is the result of a 1,250-gpm fire for a duration of 2 hours (single-family residential land use). The largest fire-flow volume (1.5 MG) is the result of a 5,000-gpm fire for a duration of 5 hours (commercial, industrial, and school land use).

5.2.2.3 Emergency Storage

Emergency storage is a dedicated source of water that can be used as a backup supply in the event a major supply source is interrupted. This can be provided by water from a second independent source, by water stored in reservoirs, or a combination of both. Industry standards for emergency storage is between 12 and 24 hours of ADD volume. GSWC used 12 hours of ADD storage for systems with a variety of supply sources and 24 hours of ADD storage for systems with limited supply sources. Because the Bell-Bell Gardens System is supplied by a variety of sources, GSWC assumed that 12 hours of ADD volume for this system is appropriate.

5.3 Existing System Evaluation

Evaluation of the existing system's supply and storage capacity involved analysis of key system facilities to identify supply or storage capacity deficiencies. This approach involved analyzing multiple recommended improvement alternatives to address these deficiencies. These recommended improvements were then evaluated to determine the most cost-effective and constructible alternatives, which were then identified as the proposed improvements and were incorporated into the CIP. The following subsections describe the method used for evaluating the existing system:

- Water demands for each demand period
- Supply facilities
- Storage facilities
- Supply and capacity analysis
- Storage analysis
- Recommended improvements to address deficiencies in the existing system
- Recommended improvements to address deficiencies in the future system

5.3.1 Existing System Water Demands for Each Demand Period

TABLE 5-4 defines the existing demands by distribution area in the Main Zone for each demand period. The demand allocations to each distribution area are based on spatial demand allocation data.

TABLE 5-4 Existing System Water Demands

Pressure Zone/Distribution Area	ADD (gpm)	MDD (gpm)	PHD (gpm)
Main Zone	2,983	4,580	6,869
Total	2,983	4,580	6,869

5.3.2 Existing System Supply Facilities

The existing water supply facilities in the system are described in Section 2. TABLE 5-5 summarizes the total capacity of each supply source.

TABLE 5-5 Existing System Supply Facilities

Facility Name	Source	Pressure Zone/ Distribution Area Served	Total Capacity (gpm)
Clara Well 2	Groundwater	East Area	1,000
Gage Well 2	Groundwater	East Area	1,000
Metropolitan CB-3	Connection	East Area	3,400
Bissell Well 2	Groundwater	West Area	500
Bissell Well 3	Groundwater	West Area	2,000
Otis Well 3	Groundwater	West Area	1,000
Watson Well 1	Groundwater	West Area	660
Systemwide Total			9,560

5.3.3 Existing System Storage Facilities

The existing storage facilities in the system are described in Section 2. TABLE 5-6 summarizes the storage facilities and volume.

TABLE 5-6 Existing System Storage Facilities

Facility Name	Primary Pressure Zone/Distribution Area Served	Volume (MG)
Bissell Tank A	West Area	0.50
Bissell Tank B	West Area	1.00
Watson Tank	West Area	0.50
Storage capacity		2.00

5.3.4 Existing System Supply and Capacity Analysis

In order to verify that the capacity of supply facilities were adequate in the existing system, the East and West Areas were first evaluated separately and then together for a full system analysis. The following demand periods were reviewed as part of this analysis – ADD, MDD, PHD, MDD+FF, and planned and unplanned MWD outages. For ADD and MDD, a duration of 24 hours was used since these are full-day demands. For PHD, a duration of 4 hours was used to account for the typical duration of peak demands during the day. The duration of MDD+FF was established by the fire-flow criteria identified in TABLE 5-3.

In the following subsections, analysis is performed for each distribution area and for the overall system. The tables in these subsections present the demands for each demand period.

Available supplies are presented below the demand volume totals. Available supplies include water supply sources, booster pumps, pressure-regulating valves (PRV), check valves, and stored water. Stored water was not used as a water supply during ADD or MDD scenarios. All supplies were assumed to be available for ADD and MDD+FF. In order to ensure that reliable water service is provided to customers, the ability of each zone is analyzed to meet MDD and PHD with firm capacity. Firm capacity is defined as the available capacity with the largest pumping unit out of service.

Demands and available supply capacities are presented as flow rates and are converted into volumes using the duration of the demand period. For example, a demand of 100 gpm for ADD would be equal to a demand volume of 144,000 gallons, given that the duration of ADD is 24 hours.

The last two lines of the tables compare the system's available supply capacity to the demands for the same duration. Where supply capacity meets or exceeds demands, the row "Supply Minus Demand" will be zero or positive. This indicates an adequate combination of supply and storage. Where this occurs, the last row of the table, "Supply Meets Demand", will contain "Yes". However, if demands exceed supply, then the row "Supply Minus Demand" will have a negative value, and the row "Supply Meets Demand" will contain "No". In this latter case, improvements were evaluated to correct the deficiency.

5.3.4.1 Systemwide Supply and Capacity Analysis

All supply and storage facilities from the East and West Areas are included for the Systemwide analysis except for the 12-inch and 14-inch transmission mains, which are not relevant to this analysis. All supply sources and storage facilities for the system are listed in Sections 5.3.2 and 5.3.3 and demands are listed in Section 5.3.

Bissell Well 3 (2,000 gpm) is assumed to be out of service for firm capacity. The Metropolitan CB-3 Connection (3,400 gpm) is assumed to be out of service for the planned and unplanned connection outages.

TABLE 5-1 details the criteria used for this analysis. The total existing demands presented in TABLE 5-4 were used for their respective demand period. The fire flow used for MDD+FF was based on the largest expected fire in the system from Table 5-3 – 5,000 gpm for 5 hours. The results of the Systemwide supply and capacity analysis for the existing system are summarized in TABLE 5-7.

TABLE 5-7 Existing System Supply and Capacity Analysis—Systemwide

		Planning Scenario							
		ADD		MDD		PHD		MDD+FF	
Duration (Hours)		24		24		4		5	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Total Demand		2,983	4.296	4,580	6.595	6,869	1.649	9,580	2.874
Supply	Capacity								
Wells	3,000	0	0.000	3,000	4.320	3,000	0.720	3,000	0.900
Purchased Water	3,400	0	0.000	430	0.619	2,719	0.653	3,400	1.020
Boosters	4,535	2,983	4.296	1,150	1.656	1,150	0.276	3,180	0.954
Total Supply		2,983	4.296	4,580	6.595	6,869	1.649	9,580	2.874
Supply Minus Demand		0	0.000	0	0.000	0	0.000	0	0.000
Supply Meets Demand		YES		YES		NO		YES	

		Planning Scenario					
		Planned MWD Outage (ADD)		Unplanned MWD Outage - Day 1 (MDD)		Unplanned MWD Outage - Days 2-7 (ADD)	
Duration (Hours)		168		24		144	
Demand		GPM	MG	GPM	MG	GPM	MG
Total Demand		2,983	30.072	4,580	6.595	2,983	25.776
Supply	Capacity						
Wells	3,000	2,983	30.069	3,000	4.320	2,983	25.773
Purchased Water	3,400	0	0.000	0	0.000	0	0.000
Boosters	4,535	0	0.000	1,580	2.275	0	0.000
Total Supply		2,983	30.069	4,580	6.595	2,983	25.773
Supply Minus Demand		0	0.00	0	0.00	0	0.00
Supply Meets Demand		YES		YES		YES	

The results of this analysis indicate that facilities are adequate to meet the demands for all planning scenarios. No improvements to the existing system are necessary.

5.3.5 Existing System Storage Analysis

In order to determine storage deficiencies in the existing system, the recommended storage for each distribution area was evaluated and compared to the existing storage available for each distribution area. The benefits of storage and the types of storage (operational, fire, and emergency) are described in more detail in Section 5.2.2.

TABLE 5-8 below demonstrates the total recommended storage for each distribution area and the entire system. The operational storage is calculated by subtracting the MDD from the PHD to obtain the additional flowrate that is required during the PHD scenario. This additional flowrate is multiplied by the duration of PHD to obtain the volume recommended for operational storage. A duration of four hours was used to account for the typical duration of peak demands during the day. The fire storage for each distribution area is based on the criteria in Section 5.2.2. If two distribution areas of the system retained their fire storage in the same reservoir, that reservoir only needed to contain the fire storage for the distribution area with the largest recommended fire storage volume. This is because the criteria assumed that only one fire can occur in the system at any given time. To prevent excess fire storage, the distribution areas were given a fire storage volume of 0 MG when fire storage of larger or equal size was used in another distribution area that had its fire storage in the same tank. Emergency storage is the volumetric measurement of ADD over a 12-hour duration. Fire storage is calculated to supplement supply when the supply is less than the current demand plus fire flow.

Storage deficiencies are identified for each distribution area in TABLE 5-9. A dash in the table denotes storage from that tank is unavailable.

TABLE 5-8 Existing System Storage Analysis - Calculated Storage

		Systemwide
Operational	PHD	6869
	MDD	4580
	PHD minus MDD	2290
	Duration	4
	MG	0.550
Fire	GPM	5000
	Duration	5
	MG	1.500
Emergency	ADD	2983
	Duration	12
	MG	2.148

Total Recommended Storage	4.198
<p>* A fire storage total of zero indicates that fire storage of larger or equal size was used in another zone that receives its fire storage from the same tank.</p> <p>NOTE: All demand period scenarios (ADD, MDD, and PHD) are in gallons per minute (GPM). All durations are in hours. The rows titled "MG" and the total recommended storage are in million gallons (MG)</p>	

TABLE 5-9 Existing System Storage Analysis - Deficiencies Evaluation

	Systemwide
Bissell A Tank	0.50
Bissell B Tank	1.00
Watson Tank	0.50
Available Storage	2.00
Recommended Storage	4.20
Available minus Recommended	-2.20
Adequate Storage	NO
Amount from purchase water	1.07
(Available storage) + (purchased water amount) - (recommended storage)	-1.128
Adequate Storage (with purchased water)	NO
* Recommended Storage numbers are from Table 5-8.	
NOTE: All numbers in this table are in million gallons (MG)	

Purchased water connections can be utilized to offset up to 1/2 of the emergency storage requirements. The purchased water surplus is available after accounting for use of purchased water to meet supply needs in 'Existing System Supply and Capacity Analysis - Systemwide'. A duration of 6 hours which is half of the emergency storage duration is assumed in the calculation.

The existing system storage analysis results indicate a 1.128 MG storage deficiency. Improvements to correct these deficiencies are discussed under proposed improvements in Section 5.3.7.

5.3.6 Recommended Improvements to Address Deficiencies in the Existing System

Various alternatives were considered while investigating improvements to correct the deficiencies identified in the supply and storage evaluation. These alternatives are listed in TABLE 5-10. Deficiencies may be corrected by adding supply, storage, or a combination of both. In these cases, the deficiency is shown in both supply (gpm) and storage (MG). The descriptions of the deficiency alternatives are given after TABLE 5-10.

There were no supply deficiencies identified in this section.

The storage deficiencies identified in this section were:

- 1.128 MG Systemwide

The numbering system used in TABLE 5-10 is a series of three numbers. The first number indicates the planning period 1 for the existing system and 2 for the 2045 system. The second number indicates the deficiency number, which starts at 1 and increments by 1 for each deficiency identified. The third number identifies the improvement alternative, but zero is reserved for the deficiency. Therefore, the alternative number 1.2.3 would be used to identify the third recommended alternative for the second deficiency in the existing system.

TABLE 5-10 Existing System Recommended Supply and Storage Improvements

Deficiency/ Alternative Number	Deficiency/Alternative Description	Pressure Zone/ Distribution Area	Supply Capacity (gpm)	Storage Capacity (MG)
1.01.0	Inadequate storage	Systemwide	--	-1.128
1.01.1	Construct ground level storage and booster station	Systemwide	--	1.5

5.3.6.1 Descriptions of Deficiency Alternatives

Deficiency No. 1.01.0

Alternative No. 1.01.1

This alternative is to construct a tank with a usable volume of 1.5 MG Systemwide. This alternative would likely require land acquisition and installation of transmission main and a booster station, or the use of an existing plant site.

5.3.7 Proposed Improvements to Address Deficiencies in the Existing System

Proposed improvements to resolve the deficiencies in the existing system are given in TABLE 5-11. These proposed improvements were recommended for their ability to correct the deficiency and be cost effective and constructible compared to competing alternatives. Refer to the *Descriptions of Deficiency Alternatives* in Section 5.3.6.1 for more detailed descriptions of proposed improvements. In some cases, the capacity of the proposed improvement is larger than described in the *Descriptions of Deficiency Alternatives*. This was necessary in order to resolve multiple deficiencies.

TABLE 5-11 Existing System Proposed Supply and Storage Improvements

Alternative Number	Alternative Description	Deficiencies Resolved	Supply/Storage Capacity
1.01.1	Construct additional storage and booster station with transmission main in acquired land or existing plant site.	1.01.0	1.5 MG

5.4 2045 System Evaluation

Analysis of the water system for the year 2045 was performed to identify long term improvements needed for the water system. This analysis included the following assumptions:

- Existing supply sources are active or have been replaced in kind
- Planned improvements to address existing system deficiencies and the post-2018 improvements have been constructed and are operational
- The demands developed in Section 3, Existing and Future Water Demands, were assumed for the respective demand periods

5.4.1 2045 System Water Demands

TABLE 5-12 defines the 2045 demands for the Bell-Bell Gardens System. The demands are not broken down by distribution area because the individual increase in demands for each distribution area is difficult to determine.

TABLE 5-12 2045 System Water Demands

Pressure Zone/ Distribution Area	ADD (gpm)	MDD (gpm)	PHD (gpm)
Systemwide	2,954	4,107	6.160

5.4.2 2045 System Supply Facilities

The supply facilities for the 2045 system include all supply facilities in the existing system along with all proposed supply facilities to resolve the deficiencies in the existing system. TABLE 5-13 summarizes the supply for the 2045 System.

TABLE 5-13 2045 System Assumed Supply

Facility Name	Total Capacity (gpm)
Additional supply facilities in the 2045 System	None
Existing supply – Wells	6,160
Existing supply - MWD	3,400
Total supply capacity for 2045	9,560

5.4.3 2045 System Storage Facilities

The storage facilities for the 2045 system include all storage facilities in the existing system along with all proposed storage facilities to resolve the deficiencies in the existing system. TABLE 5-14 summarizes the storage for the 2045 System.

TABLE 5-14 2045 System Assumed Storage Facilities

Facility Name	Primary Pressure Zone/ Distribution Area Served	Total Capacity (MG)
New reservoir & boosters	Systemwide	1.50
Existing storage	Systemwide	2.00
Total storage capacity for 2045		3.50

5.4.4 2045 System Supply and Capacity Analysis

The supply analysis for the 2045 system uses the 2045 projected demands and includes the recommended 2045 supply and storage improvements to analyze system deficiencies. Each distribution area is not analyzed individually because it is unknown how much demands in each distribution area will increase by year 2045. All supply and storage facilities from the East and West Areas are included for the Systemwide analysis except for the 12-inch and 14-inch transmission mains, which is not relevant to this analysis. All supply and storage for the system are listed in Sections 5.4.2 and 5.4.3 and demands are listed in Section 5.4.1.

Bissell Well 3 (2,000 gpm) is assumed to be out of service for firm capacity. The Metropolitan CB-3 Connection (3,400 gpm) is assumed to be out of service for the planned and unplanned connection outages.

TABLE 5-1 details the criteria used for this analysis. The total demands presented in TABLE 5-12 were used for their respective demand period. The fire flow used for MDD+FF was based on the largest fire in the system – 5,000 gpm for 5 hours, as noted in TABLE 5-3. The results of the Systemwide supply and capacity analysis are summarized in TABLE 5-15.

TABLE 5-15 2045 System Supply and Capacity Analysis—Systemwide

		ADD		MDD		PHD		MDD+FF	
Duration (Hours)		24		24		4		5	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Total Demand		2,954	4.254	4,107	5.914	6,160	1.478	9,107	2.732
Supply	Capacity								
Wells	3,000	0	0.000	3,000	4.320	3,000	0.720	3,000	0.900
Purchased Water	3,400	0	0.000	0	0.000	2,010	0.482	2,957	0.887
Boosters	4,535	2,954	4.254	1,107	1.594	1,150	0.276	3,150	0.945
New									
Reservoir/Booster	1.5	0	0.000	0	0.000	0	0.000	0	0.000
Total Supply		2,954	4.254	4,107	5.914	6,160	1.478	9,107	2.732
Supply Minus Demand		0	0.000	0	0.000	0	0.000	0	0.000
Supply Meets Demand		YES		YES		YES		YES	

		Planning Scenario					
		Planned MWD Outage (ADD)		Unplanned MWD Outage - Day 1 (MDD)		Unplanned MWD Outage - Days 2-7 (ADD)	
Duration (Hours)		168		24		144	
Demand		GPM	MG	GPM	MG	GPM	MG
Total Demand		2,954	29.776	4,107	5.914	2,954	25.522
Supply	Capacity						
Wells	3,000	2,954	29.776	3,000	4.320	2,954	25.523
Purchased Water	3,400	0	0.000	0	0.000	0	0.000
Boosters	4,535	0	0.000	1,107	1.594	0	0.000
New							
Reservoir/Booster	1.5	0	0.000	0	0.000	0	0.000
Total Supply		2,954	29.776	4,107	5.914	2,954	25.523
Supply Minus Demand		0	0.00	0	0.00	0	0.00
Supply Meets Demand		YES		YES		YES	

The results of this analysis indicate that supply facilities are adequate to meet all demand periods for the 2045 System. No further improvements are recommended for the Bell-Bell Gardens System.

5.4.5 2045 System Storage Analysis

The storage analysis for the 2045 system uses the 2045 projected demands and includes the recommended 2045 supply and storage improvements to analyze system deficiencies. The storage analysis is given in TABLE 5-16.

TABLE 5-16 2045 System Storage Analysis

		Systemwide
Operational	PHD	6160
	MDD	4107
	PHD minus MDD	2053
	Duration	4
	MG	0.49
Fire	GPM	5000
	Duration	5
	MG	1.50
Emergency	ADD	2954
	Duration	12
	MG	2.13
Total Recommended Storage		4.12
Available Storage in 2045		3.50
Available minus Recommended		-0.62
Adequate Storage		NO
Amount from purchased water ^a		1.22
Available + Purchased - Recommended		0.60
Adequate Storage (with purchased)		YES

^a Purchased water connections are utilized to offset up to 6 hours of equivalent MDD demand. The purchased water surplus is available after accounting for use of purchased water to meet supply needs in '2045 System Supply and Capacity Analysis - Systemwide' (TABLE 5-15). A duration of 6 hours (half of the emergency storage duration from TABLE 5-2) is assumed in the calculation.

The results of this analysis indicate that storage facilities are adequate to meet the storage requirements for the 2045 System. No further improvements are recommended for additional storage for the Bell-Bell Gardens System.

5.4.6 Proposed Improvements to Address Deficiencies in the 2045 System

The results of the supply and storage analyses for the 2045 System indicate that supply and storage facilities will be adequate to meet the requirements for the 2045 System. No further improvements are proposed for additional supply or storage for the Bell-Bell Gardens System.

5.5 Summary of Proposed Supply and Storage Improvements through 2045

Based on the supply and capacity analysis in this section, the following additional supply is necessary to meet existing and future demands:

- Existing system: No additional supply required

- 2045 system: No additional supply required

Based on the storage analysis in this section, the following additional storage is necessary to meet existing and future demands:

- Existing system: Construct 1.5 MG total reservoir capacity and booster station
- 2045 system: No additional storage required.

SECTION 6

Hydraulic Analysis and Evaluation

This section documents the hydraulic analysis and evaluation results for the Bell-Bell Gardens System. An updated hydraulic computer model was used to accomplish the following:

- Identify the criteria for the hydraulic analysis
- Perform simulations for various demand conditions and demand periods
- Identify deficiencies
- Recommend improvements to mitigate these deficiencies in a cost-effective manner

In the following sections, the results of the hydraulic analysis are compared with the objectives identified in the technical memorandum titled *Master Planning Criteria and Standards* (see Appendices). If the analysis showed that the system did not meet these criteria, a deficiency was identified and improvements were proposed to mitigate the deficiency.

6.1 Overview

Hydraulic analyses of networked water distribution systems are most efficiently performed with the aid of hydraulic computer models that perform the numerical analysis. The hydraulic computer model assists with measuring system performance, analyzing operational improvements, and developing a systematic method of determining the size of new facilities. The model can be used to analyze existing water systems, future water systems, and the effect of specific improvements.

6.2 Analysis Approach

A hydraulic analysis was performed on the existing Bell-Bell Gardens System as follows:

- **Existing (2022) system.** The existing water system analyses assumed 2022 demands as described in Section 3 and facilities that were operational in 2022.

The demands used in this hydraulic analysis are the same as those used for the supply and storage capacity analysis in Section 5.

6.2.1 System Performance Criteria

The hydraulic analysis involved the use of a computer model that was developed specifically for the Bell-Bell Gardens System and updated based on current plant and pipeline facilities (see Section 4, Hydraulic Model Development and Calibration). This computer model was used to identify hydraulic deficiencies under existing conditions. Hydraulic model simulations were developed to analyze demand periods (ADD, MDD, and PHD) to determine whether the system could meet the performance objectives identified for this master plan. These criteria are summarized in TABLE 6-1.

TABLE 6-1 Hydraulic Analysis Criteria

Demand Period	Pipeline Criteria ^a	Pressure Criteria ^b
ADD	Velocity less than 5 fps and head loss less than 6 ft per 1,000 ft	Greater than 40 psi and less than 125 psi
MDD	Velocity less than 5 fps and head loss less than 6 ft per 1,000 ft	Greater than 40 psi and less than 125 psi
PHD	Velocity less than 10 fps	Greater than 30 psi and less than 125 psi
MDD + fire flow	Velocity less than 10 fps	Greater than 20 psi

6.2.2 Fire-flow Requirements

In addition to providing adequate water supply and pressure to serve residential, commercial, and industrial customers, the water system must also deliver an adequate supply for firefighting. Since fires can occur at any time, the water system must be ready to provide the required flows at all times with an adequate residual pressure. The water system should be capable of providing the fire flows during an MDD period (MDD+FF). The fire flow criteria were presented in Section 5.2.2, TABLE 5-3.

6.3 Existing System Hydraulic Analysis

Several hydraulic computer model simulations were conducted for the existing distribution system to identify deficiencies and to evaluate improvements to mitigate these deficiencies. If more than one alternative was possible to mitigate a deficiency, the most cost effective and constructible improvement was proposed.

6.3.1 Operational Assumptions

GSWC Operations staff provided information on how the Bell-Bell Gardens System would normally be operated under ADD, MDD, and PHD periods. Based on this information, the facilities available for the hydraulic analysis of the existing system are presented in TABLE 6-2. The status of wells, MWD connections, booster pumps, and storage tanks was not based on the model results, but on the amount of supply needed for each demand period. For ADD, there is flexibility to operate various combinations of wells, since not all of the wells need to be operational to achieve the desired pressures. For MDD and PHD scenarios, firm capacity must be used.

TABLE 6-2 Existing System Operating Facility Status

Facility Name	ADD	MDD	PHD
Wells—East Area			
Clara Well 2	Available	Available	Available
Gage Well 2	Available	Available	Available
Wells—West Area			
Bissell Well 2	Off	Off	Off
Bissell Well 3	Available	Off	Off
Otis Well 3	Available	Available	Available
Watson Well 1	Available	Available	Available
Booster Pumps—West Area			
Bissell Booster A	Available	Available	Available
Bissell Booster B	Available	Available	Available
Bissell Booster C	Available	Available	Available
Watson Booster A	Available	Available	Available
Watson Booster B	Available	Available	Available
Storage Tanks—West Area			
Bissell Tank A	75% full	75% full	75% full
Bissell Tank B	75% full	75% full	75% full
Watson Tank	75% full	75% full	75% full
Connections—East Area			
Metropolitan CB-3	Available	Available	Available
Connections—Emergency Only			
City of Bell Gardens	Closed	Closed	Closed
City of Huntington Park	Closed	Closed	Closed
Maywood Mutual Water Company	Closed	Closed	Closed
Tract 180 Water Company/Florence Ave & Woodward Ave	Closed	Closed	Closed

6.3.2 Average Day Scenario Analysis

The demands were distributed in the model per TABLE 5-4. Only the facilities listed as *Available* for ADD in TABLE 6-2 were used. Storage was not drawn down for this planning scenario. The modeling results were compared to the criteria identified in TABLE 6-1. These results are discussed in Section 6.3.6.

6.3.3 Maximum Day Scenario Analysis

The demands were distributed in the model per TABLE 5-4. Only the facilities listed as *Available* for MDD in TABLE 6-2 were used. Storage was not drawn down for this planning

scenario. The modeling results were compared to the criteria identified in TABLE 6-1. These results are discussed in Section 6.3.6.

6.3.4 Peak Hour Scenario Analysis

The demands were distributed in the model per TABLE 5-4. Only the facilities listed as *Available* for PHD in TABLE 6-2 were used. Storage can be drawn down for this planning scenario. The modeling results were compared to the criteria identified in TABLE 6-1. These results are discussed in Section 6.3.6.

6.3.5 Fire-flow Scenario Analysis

For this master plan revision, the fire flow scenario was not analyzed using the hydraulic computer model.

6.3.6 Analysis Results and Recommended Improvements for the Existing System

Various alternatives were considered to correct the hydraulic deficiencies identified in the hydraulic analysis. The recommended improvements were evaluated for their ability to correct the deficiency and for their cost effectiveness and constructability.

6.3.6.1 Steady-State Deficiencies

The distribution system was analyzed to identify areas of the system that experienced pressures below 40 psi or above 125 psi (criteria stated in TABLE 6-1). Various steady-state planning scenarios were used to analyze system pressures under different demand conditions to verify adequate system pressures. One or more approaches can be used to mitigate the low-pressure problems. Low pressure problems can be corrected by increasing the pressure setting of an upstream pressure regulating valve. However, sometimes substantial improvements may be required such as replacing older pipelines with larger diameter pipelines to reduce friction losses, constructing new pump stations or pressure regulating stations, or modifying the boundaries of existing distribution areas.

High velocities contribute to increased head loss, usually resulting in a less efficient water distribution system and can result in scoured pipe linings or valve failures. Higher velocities may be acceptable for short term operation, such as fireflow, but otherwise velocities should meet the criteria stated in TABLE 6-1 where practical. The planning scenarios used to analyze the Bell-Bell Gardens System for pressure deficiencies were also used to evaluate the velocities under the same demand periods (ADD, MDD, and PHD).

The hydraulic analysis showed that there were no pressure deficiencies, high velocities or headloss during any of the scenarios; therefore no capital projects were identified.

Water Quality Evaluation

The purpose of this section is to provide documentation of Golden State Water Company's water quality assessment effort for the Bell-Bell Gardens System. Water quality of local groundwater and purchased water were evaluated based on current federal and state standards and rules.

7.1 Current Status of Drinking Water Quality

The drinking water quality of the Bell-Bell Gardens System must comply with the Safe Drinking Water Act (SDWA), which is composed of primary and secondary drinking water standards. Compliance with primary drinking water standards is regulated by the U.S. Environmental Protection Agency (EPA). Compliance with both primary and secondary standards is required by the State Water Resources Control Board, Division of Drinking Water (DDW).

7.1.1 Source Summary

The Bell-Bell Gardens water system is supplied by six active chlorinated wells (one of which is non-operational) and one active purchased water connection with the Metropolitan Water District (MWD). The system also has four emergency interconnections: one with the City of Bell Gardens, one with the City of Huntington Park, one with Maywood Mutual, and one with Tract 180 Water Company.

7.1.2 Purchased Water Quality

The water received from the connection with MWD is treated surface water containing a chloramine residual and meets all state and federal drinking water regulations.

7.1.3 Groundwater Quality

The groundwater sources in the Bell-Bell Gardens System currently comply with all primary maximum contaminant levels (MCLs) and recommended limits for secondary MCLs. Some sources require treatment to meet these standards as described in Section 7.1.4.

7.1.3.1 VOCs

Clara Well 2 contains low level of tetrachlorethylene (PCE) and trichloroethylene (TCE), though currently the levels are well below the MCL. Clara Well 2, Otis Well 3 and Watson Well 1 contain 1,4-Dioxane that has exceeded the notification level at times. It is difficult to predict the fate and transport of organic chemicals in groundwater. There is a possibility that VOCs in excess of the MCLs could exist in one or more of the wells in the future and treatment would be required.

7.1.4 Treatment Summary

At each facility, 12.5 percent liquid sodium hypochlorite is injected to provide a disinfectant residual in the distribution system.

All groundwater sources are fluoridated with a concentration goal of 0.7 mg/L. The treated purchased water received from MWD is also fluoridated.

Gage Well 2 is currently treated for volatile organic compound (VOC) removal using granular activated carbon (GAC). Watson Well 1 is treated for VOC removal using GAC treatment. At each VOC removal plant, 12.5 percent liquid sodium hypochlorite is added to the treatment effluent to provide a disinfectant residual in the water entering the distribution system. Bissell Well 2, Bissell Well 3 and Otis Well 3 are treated for manganese removal by oxidation followed by filtration through pyrolusite media. Clara Well 2 has detections above the current response level for one of PFAS constituents and was removed from service in November of 2020. A GAC treatment for PFOA and PFOS removal is currently being constructed for this well.

7.1.5 Distribution System Water Quality

There are no substantial water quality challenges in the distribution system.

The Bell-Bell Gardens water system contains chlorinated groundwater and chloraminated treated surface water at times. Therefore, chloraminated and free chlorinated water may blend in certain areas of the distribution system resulting in lowered residual concentrations. This is currently addressed through operation of the sources and reservoirs.

7.1.6 Water Quality Monitoring

Water quality sampling is performed at the sources as well as within the distribution system to ensure compliance with regulatory standards.

Sources are sampled as prescribed in Title 22 of the California Code of Regulations. Monitored constituents include general mineral, general physical, inorganic, volatile organic, synthetic organic, and radiological chemicals. The frequency of monitoring is dependent upon the parameter tested and the concentration of the constituent in the source water. Monitoring frequencies range from weekly to once every 9 years. Sources equipped with treatment plants are monitored frequently to ensure that the treatment process is working effectively. The parameters monitored include the constituent being treated, coliform bacteria, heterotrophic plate counts (HPCs) if required, and chlorine residual.

The distribution system is tested regularly for coliform bacteria, chlorine residual, general physical parameters, and disinfection byproducts (trihalomethanes and haloacetic acids). The distribution system is tested weekly for the presence of coliform bacteria at representative locations throughout the system. Collection of disinfection byproduct samples is performed on a quarterly basis.

7.2 Water Quality Evaluation

The following discussion provides information on the relevant water quality evaluation rules for the Bell-Bell Gardens System including:

- 1,4-Dioxane
- Lead and Copper Rule Revisions (LCRR)
- Manganese
- Microplastics

- Per- and Polyfluoroalkyl Substances
- Assembly Bill 1668

7.2.1 1,4-Dioxane

1,4-dioxane is a synthetic chemical historically used as stabilizer for industrial chlorinated solvents, predominantly 1,1,1-trichloroethane (TCA) that was used for degreasing. Although not intentionally used in commercial application, it is found as a trace contaminant in some foods, pharmaceuticals, cosmetic products, and detergents. The current drinking water notification level for 1,4-dioxane is set at 1 µg/L in November 2010. The response level, the level at which removal of the source from service, is 35 µg/L.

As part of EPA's third unregulated contaminant monitoring rule (UCMR3) the entry points to the distribution system were monitored for 1,4-dioxane between 2013 and 2015. The concentration of 1,4-dioxane detected in the current active groundwater wells ranged from 0.14 to 2.4 µg/L in years 2013, 2014 and 2015.

The State Water Board (DDW) intends to begin a rulemaking process to set a drinking water standard, known as a maximum contaminant level (MCL), for 1,4-dioxane. In order to set an MCL, California's Office of Environmental Health Hazard Assessment (OEHHA) must first evaluate risk and develop a public health goal (PHG). In January 2019, DDW requested for the OEHHA to establish a PHG for 1,4-dioxane. OEHHA's PHG will be used by the DDW to set an MCL for 1,4-dioxane in drinking water. MCLs are required to be established at a level as close to its public health goal as is technologically and economically feasible, placing primary emphasis on the protection of public health. Depending upon the MCL set by the State, treatment for the removal of 1,4-dioxane might be necessary at one or more sites in this system.

Advanced oxidation processes using hydrogen peroxide with ultraviolet light (UV) or ozone, have been shown to effectively remove 1,4-dioxane. Pilot testing of different treatment solutions may be necessary to identify the most cost effective approach.

7.2.2 Lead and Copper Rule Revisions (LCRR)

The US EPA has developed revisions to the Lead and Copper Rule. The LCRR is effective as of December 16, 2021, with a compliance deadline of October 16, 2024. US EPA intends to further revise the LCRR by late 2024 in a Lead and Copper Rule Improvements (LCRI) rulemaking. The State Water Board may promulgate its own regulations for the LCRR and seek primacy for the rule. The federal LCRR focus on lead service line inventories and replacements. GSWC completed a utility-side service line inventory under State regulations, and has determined there are no existing lead service lines in its service areas. The federal LCRR also includes requirements to inventory the customer side of the meter as well. Developing a customer side inventory will require significant staff time and resources. The LCRR also includes new monitoring requirements for tap sampling, including new tier levels based on service line type, and new trigger levels in addition to the action level. The monitoring requirements are not expected to have a significant impact since there are no known lead service lines. The LCRR also has a new requirement for lead sampling in schools, including daycares. GSWC collected lead samples from elementary and secondary public schools in its service areas as part of a State regulation. The federal LCRR will likely

not allow grandfathering of previous data. All schools will need to be sampled again under the LCRR, along with all daycares, which will require staff time and sampling resources. The rule requires 20% of schools to be sampled each year for a five year period, with ongoing sampling if requested. GSWC water quality staff are closely following LCRR regulation developments.

7.2.3 Manganese

Manganese occurs naturally in the environment in rocks and soil and is widely used in industrial and manufacturing processes. Levels of manganese above the Secondary Maximum Contaminant Level (SMCL) of 0.05 mg/L may lead to discolored grey to blackish water and staining of household fixtures. Legacy or historical manganese oxide deposits can accumulate overtime as a scale in water mains. If this scale becomes unstable, manganese oxide minerals can cause grey to black discolored water in the distribution system and customer's water pipes.

It is recognized in professional literature that the SMCL of 0.05 mg/L is too high to prevent discolored water events from manganese. Discolored water events due to mobilized legacy manganese or dissolved manganese in bulk water can occur at concentrations generally above 0.02 mg/L (*Legacy of Manganese Accumulation in Water Systems*, Brandhuber et. al., Water Research Foundation Report #4314, pages 7 and 31, 2015). Therefore, Golden State Water is targeting a finished water manganese concentration of 0.02 mg/L instead of the SMCL of 0.05 mg/L as protective against aesthetic water quality issues associated with manganese. Single points above the target will trigger monitoring rather than proposed treatment.

In 2003, the California Department of Health Services' Drinking Water Program (DDW) established the 0.5 mg/L notification level (then called an "action level") for manganese. On March 11, 2022 DDW listed manganese as a priority for updating the notification and response levels due to recent studies indicating manganese is a developmental toxin. The notification and response levels proposed are 0.5 µg/l and 5 µg/l, respectively. This could impact the existing manganese treatment or how much flushing is necessary to meet these proposed standards. Currently, the Bell-Bell Gardens water system has two manganese treatments using oxidation/filtration technology permitted in place. One of the existing treatments have adsorptive media that is older than 10 years and intermittently has manganese breakthrough. The media will need to be replaced to ensure adequate manganese removal.

7.2.4 Microplastics

Microplastics are defined as "solid polymeric materials to which chemical additives or other substances may have been added, which are particles which have at least three dimensions that are greater than 1 nanometer and less than 5,000 micrometers. Polymers that are derived in nature that have not been chemically modified (other than by hydrolysis) are excluded." Microplastics are found in many sources of water including oceans, lakes, rivers, and potentially some wells. Groundwaters typically have lower detections and surface waters typically have high detection frequencies.

Since no government has required monitoring for microplastics there is a lack of testing methods, accredited laboratories, and health-based guidance levels. The California State Water Board has identified a couple testing methods and is working to accredit laboratories. Four years of testing is expected to begin 2022 through 2026 and will target larger surface water systems. Although there is not a standard health effects language for detected microplastics, water systems with detections are required to report in their annual consumer confidence reports.

7.2.5 Per- and Polyfluoroalkyl Substances

Per- and polyfluoroalkyl substances (PFAS) are a group of man-made chemicals that include Perfluorooctanoic Acid (PFOA), Perfluorooctane Sulfonate (PFOS) and Perfluorobutane Sulfonic Acid (PFBS). PFOA and PFOS can be found in a wide range of consumer products such as carpets, cookware and stain repellent, as they are resistant to water, grease and stains. PFOA and PFOS have also been used for suppressing certain types of fires, primarily at airfields and military bases. PFBS was developed and manufactured to replace the eight-carbon chain PFOS.

While consumer products and food are a large source of exposure to these chemicals for most people, drinking water can be an additional source in the communities where these chemicals have infiltrated water supplies. Such contamination is typically localized and associated with a specific facility, such as an industrial facility where these chemicals were produced or used to manufacture other products; or an airfield at which they were used for firefighting; or wastewater treatment plants or landfills where products containing the chemicals were disposed of.

To date, there are no established national or state maximum contaminant levels (MCLs) for PFAS. In May 2016, USEPA released a health advisory for PFOA and PFOS at 70 nanograms per liter (ng/L). The following table outlines California regulatory development for PFAS since 2019:

TABLE 7-1 California Regulatory Action Levels & Goals

California Actions	PFOA (ng/L)	PFOS (ng/L)	PFBS (ng/L)	PFHxS (ng/L) ^a
Notification Levels	5.1	6.5	500	3
Response Levels	10	40	5,000	20
Public Health Goals ^b	0.007	1	None	None

^a DDW issued notification and response levels in October 2022.

^b Proposed public health goals for PFOA and PFOS took place in 2021.

TABLE 7-2 California Health Advisories

Federal Actions	PFOA (ng/L)	PFOS (ng/L)	PFBS (ng/L)	GenX Chemicals (ng/L)
Health Advisory*	0.004	0.02	10	2000

*EPA issued health advisories in June 2022.

The following table outlines Bell-Bell Gardens water system's mandated PFAS testing program:

TABLE 7-3 Bell-Bell Gardens PFAS Testing Program

Date	Testing Program
2013-2015	During EPA's third unregulated contaminant monitoring rule (UCMR3) the entry points to the distribution system were monitored for six PFAS including PFOA and PFOS. No PFAS was detected above the method reporting limits.
April 2019	DDW issued the first phase of mandatory PFAS testing orders for public water systems based on proximity to: airports with fire training/response sites and previous PFOA/PFOS detections. The Bell-Bell Gardens water system did not receive a mandatory testing order in the first phase.
August 2020	DDW issued a second phase of mandatory PFAS testing orders for public water systems based on the 2019 results. The Bell-Bell Gardens water system received a mandatory testing order in the second phase.
February 2021	DDW issued a third phase of the mandatory PFAS testing orders for public water systems based on proximity with other water sources known to have confirmed PFAS detections. The Bell-Bell Gardens water system did not receive a mandatory testing order in the third phase.
October 2022	DDW issued a fourth phase of the mandatory PFAS testing orders for public water systems based on proximity with other water sources known to have confirmed PFAS detections. The Bell-Bell Gardens water system received a mandatory testing order in the fourth phase.
2023-2025	EPA's UCMR5 sampling will require sample collection for 29 PFAS compounds for the Bell-Bell Gardens water system.

The regulatory requirements for PFAS are expected to continue to develop over the next three years. In the current absence of a state or federal maximum contaminant level, Golden State Water has proceeded with designing and installing PFAS treatment for its affected wells with PFAS detections above the current California response levels.

To date one of six sources has been impacted above the response level for at least one of the PFAS constituents. One PFOA and PFOS removal treatment system is currently being constructed.

7.2.6 Assembly Bill 1668

This State Assembly Bill sets an indoor water usage limit of 55 gallons per day per person until January 2025; the standard will become more stringent over time, decreasing to 50 GPD

in January 2030. The Bill also requires the State Water Resources Control Board (SWRCB), in coordination with the Department of Water Resources (DWR), to establish long-term standards for the efficient use of water and performance measures for commercial, industrial, and institutional water use on or before June 30, 2022. In March 2020, DWR released the draft public report “Small Water Suppliers and Rural Communities at Risk of Drought and Water Shortage Vulnerability and Recommendations and Guidance to Address the Planning Needs of these Communities” and the Drought and Water Shortage Risk Scoring Tool for small water suppliers and rural communities. If the implementation of this legislation results in significant reduction of water usage, it may result in increased water age in the distribution system. This may cause corresponding water quality challenges such as low chlorine residual. Future water quality studies may be needed as implementation of this law unfolds over the next two to five years.

7.3 Recommended Water Quality Improvement Projects

The water quality improvements necessary for this system are summarized in TABLE 7-1.

TABLE 7-1 Water Quality Improvement Projects

Deficiency/ Alternative Number	Deficiency/Alternative Description
1.02.0	Breakthrough Mn due to aging media
1.02.1	Replace media at Bissell Plant

SECTION 8

System Condition Assessment

This section documents the condition assessment efforts for the Bell-Bell Gardens System.

8.1 Condition Assessments

GSWC Operations and Planning personnel reviewed the condition of plant facilities and pipeline data within the Bell-Bell Gardens System in order to identify the facilities requiring upgrade or replacement. GSWC staff conducted facility condition assessments as necessary, in order to inspect and evaluate existing facilities. For the pipeline condition assessments, recommendations were made based on age and material along with pipeline leaks/breaks and input from Operations staff. In some cases, pipelines were recommended due to water quality issues in the area or for improved access and safety of GSWC staff.

8.1.1 Facility Condition Review

The purpose of this review was to identify plant improvement projects based on the following:

- General condition
- Operational needs
- Groundwater treatment needs
- Reliability
- Safety and security
- Well replacement needs due to age, low yield, water quality, and other issues
- Operation and maintenance costs of wells versus purchasing water
- Structural, mechanical, and electrical deficiencies
- Recommendations from previous condition assessments that were not installed

TABLE 8-1 summarizes the recommendations for plant improvements that were developed as a result of the system condition assessment.

TABLE 8-1 Condition Assessment – Plant Projects

Alternative Number	Facility	Project Description	Reason	Priority Category
1.03.0	Systemwide	Land acquisition	Purchase land to construct additional storage and booster (See supply and Storage project 1.01.1 Table 5-12)	Short-term
1.04.0	Systemwide	Drought tolerant landscaping	Replace turf with drought tolerant landscaping at Bissell, Clara, and Otis Plant; reduce overall water usage	Short-term
1.05.0	Bissell Plant	Install back-up generator	Install diesel-powered generators; needed during MWD water and electrical power outage	Short-term

1.06.0	Bissell Plant	Bissell backwash recoating and upgrades	Recoat interior of bolted steel tank and perform safety/health/code modifications; prolong service life	Short-term
1.07.0	Watson Plant	Watson backwash recoating and upgrades	Recoat interior and exterior of welded steel tank and make necessary structural modifications; Overall coating system is approximately 20 years old and paint adhesion in poor condition	Short-term
1.08.0	Systemwide	2025 Urban Water Management Plan (UWMP)	Per the Urban Water Management Planning Act, this system is required to complete a 2025 UWMP. The UWMP improves local, regional, and statewide water planning and water resilience.	Short-term

8.1.2 Pipeline Condition Review

GSWC monitors distribution system condition through the tracking of pipeline leaks/breaks on an annual basis. FIGURE 8-1 is a map of the leaks in the Bell-Bell Gardens System from 2017 to 2021. This information was used, along with additional risk assessment analysis and input from Operations staff, to make recommendations regarding potential CIP projects. See GSWC's *Pipeline Management Program Report* and *Risk Based Asset Management Program Report* for further information.

GSWC also replaces old deteriorated backyard mains since they pose several problems for operations personnel, including difficult access to inline gate valves, repair of main breaks, installation of water meters, and meter reading. The installation of new mains within the public streets enables operators to more readily perform monthly meter reading and access gate valves for main flushing, general maintenance, and emergency main repairs. In addition, GSWC abandons old parallel mains and connects dead end mains that increase water age in pipelines and can lead to water quality issues.

TABLE 8-2 summarizes the recommendations for pipeline projects that were developed as a result of the system condition assessment.



TABLE 8-2 Condition Assessment – Pipeline Projects

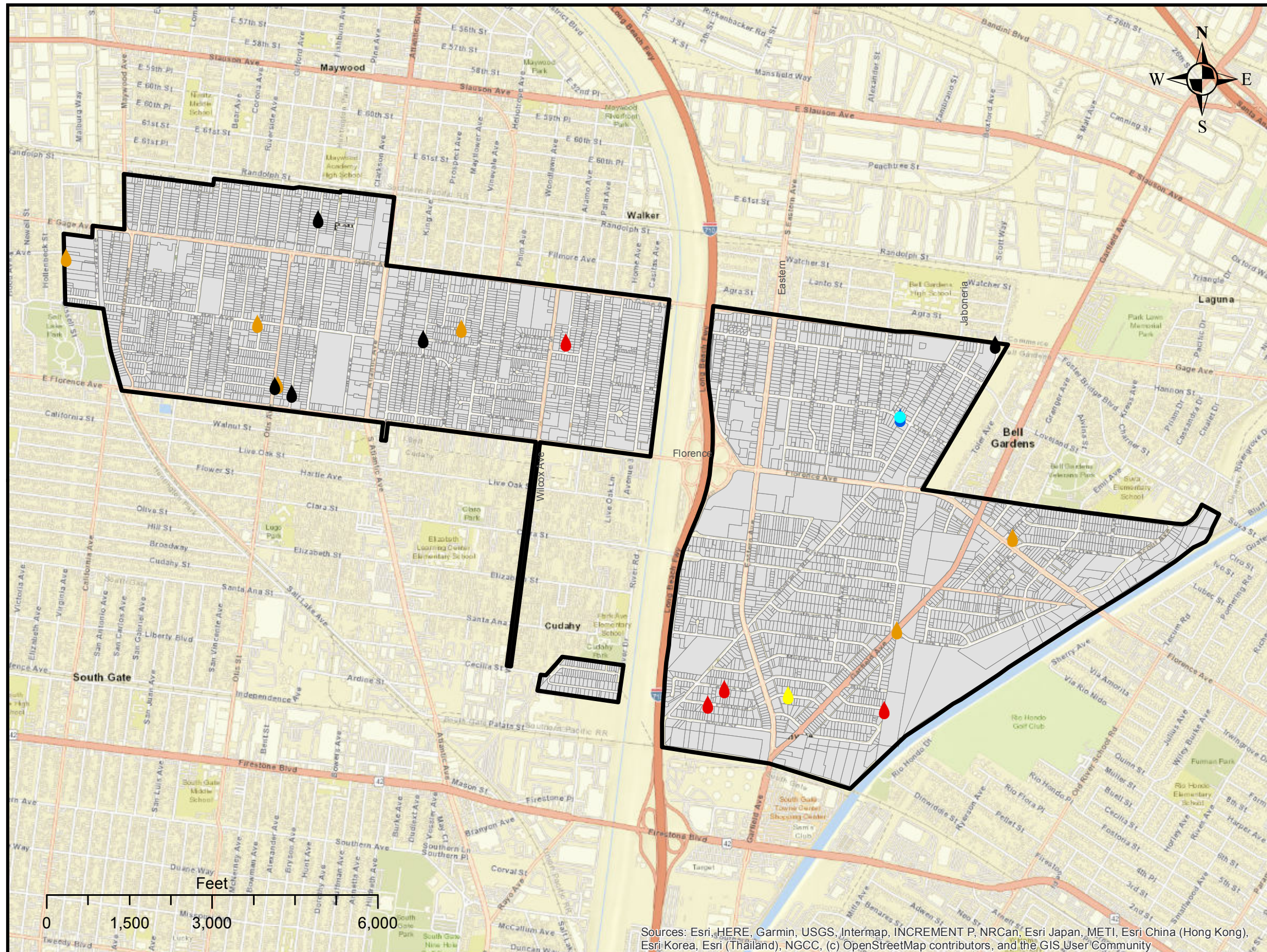
Alternative Number	Recommended Improvement	Reason	Priority Category
1.09.0	Alley north of Florence Ave, from Granger Ave to Live Oak St Main Replacement; Approximately 650 LF with 8" PVC	Address leaks, age, and condition of the existing 4" STL pipeline	Short-term
1.10.0	Bell Ave Main Replacement, install approximately 3,050 LF with 8" PVC	Address leaks, age, and condition of the existing 4" & 8" CL pipeline	Short-term
1.11.0	Flora Ave Main Replacement, install approximately 9,050 LF with 8" & 12" PVC	Address leaks, age, and condition of the existing 4", 6", & 8" AC pipeline	Short-term
1.12.0	River Dr from Cecilia St to Fostoria St Main Installation; Approximately 500 LF with 8" PVC	Address water quality issues and improve hydraulic	Short-term

Figures

**BELL-BELL GARDENS
SYSTEM
LEAK MAP
2017 - 2021
FIGURE 8-1**

Year & Number of Leaks

-  2017: 4 leaks
-  2018: 6 leaks
-  2019: 5 leaks
-  2020: 1 leak
-  2021: 2 leaks



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community



SECTION 9

Capital Improvement Program

The capital improvement program (CIP) is an essential component of this water master plan. The CIP summarizes the proposed improvements that were analyzed and evaluated in the previous sections of this master plan, along with priority and timing of these improvements.

The recommended improvements were prioritized into two categories – short term (existing system) or long term (2045 system). Various items were considered during the project selection and prioritization process, including hydraulic deficiencies, projected demands and available supply, water quality, regulatory compliance, reliability, and facility condition.

9.1 Project Prioritization

The following descriptions define how projects were prioritized:

- **Short-term** improvement projects are based on deficiencies identified in the existing system that will provide a significant short-term benefit. Deficiencies included supply and storage, hydraulic, condition assessment, and water quality.
- **Long-term** improvement projects are based on deficiencies identified beyond the Mid Term planning years through the year 2045. The long-term improvements are typically improvements needed to keep up with future demands and aging infrastructure.

9.2 CIP Projects

TABLE 9-1 lists the recommended improvements for the Bell-Bell Gardens System. Each project is assigned a unique identification number and a priority: short-term, or long-term. FIGURE 9-1 is a map showing all the proposed pipeline projects in the system. FIGURE 9-2 is a map showing all the proposed plant projects in the system.

TABLE 9-1 Summary of Recommend CIP Projects

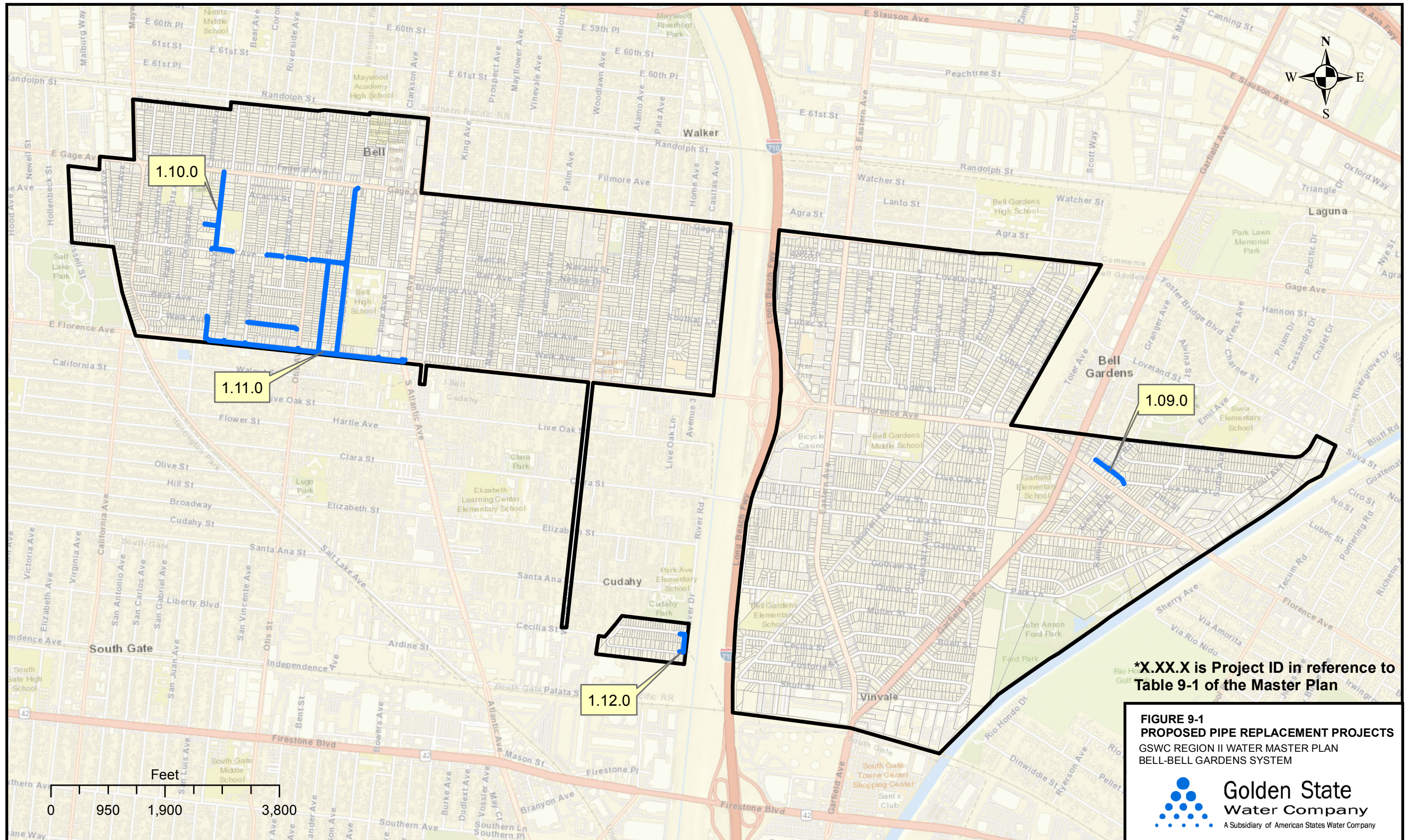
Project ID	Recommended Improvement	Improvement Type	Priority Category
1.01.1	Construct additional storage	Supply/Storage	Short-term
1.02.1	Replace filter media at Bissell Plant	Water Quality	Short-term
1.03.0	Systemwide land acquisition	Condition Assessment	Short-term
1.04.0	Systemwide drought tolerant landscaping	Condition Assessment	Short-term
1.05.0	Install back-up generator at Bissell Plant	Condition Assessment	Short-term
1.06.0	Backwash recoating and upgrades at Bissell Plant	Condition Assessment	Short-term
1.07.0	Backwash recoating and upgrades at Watson Plant	Condition Assessment	Short-term
1.08.0	Per the Urban Water Management Planning Act, this system is required to complete a 2025 UWMP. The UWMP improves local, regional, and statewide water planning and water resilience.	Condition Assessment	Short-term

Project ID	Recommended Improvement	Improvement Type	Priority Category
1.09.0	Alley north of Florence Ave Main Replacement	Condition Assessment	Short-term
1.10.0	Bell Ave Main Replacement	Condition Assessment	Short-term
1.11.0	Flora Ave Main Replacement	Condition Assessment	Short-term
1.12.0	River Dr Area Main Installation	Condition Assessment	Short-term

9.3 Additional Considerations

As part of the overall main replacement program for the Bell-Bell Gardens System, GSWC is also striving to install new water lines in the public roadways to replace old and deteriorating water lines located in the backyards of customers. Installation of new mains within the public streets will continue as part of the long-term pipeline replacement/management program in conformance with KANEW replacement recommendations.

Figures



*X.XX.X is Project ID in reference to Table 9-1 of the Master Plan

FIGURE 9-1
PROPOSED PIPE REPLACEMENT PROJECTS
 GSWC REGION II WATER MASTER PLAN
 BELL-BELL GARDENS SYSTEM



Golden State Water Company
 A Subsidiary of American States Water Company

SECTION 10

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