2020 Urban Water Management Plan

CARMICHAEL WATER DISTRICT

Final – Adopted June 24, 2021

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This 2020 Urban Water Management Plan was prepared under the direction of a California licensed civil engineer.

Executive Summary

After the devastating drought in the late 1970s, the California Legislature declared California's water supplies a limited resource, subject to ever-increasing demands and that the long-term, reliable supply of water is essential to protect California's businesses, communities, agricultural production, and environmental interests. The Legislature also recognized a need to strengthen local and regional drought planning and increase statewide resilience to drought and climate change. Thus, in 1983, the California Legislature created the Urban Water Management Planning Act (UWMPA).[1] The UWMPA requires urban water suppliers serving over 3,000 customers or supplying at least 3,000 acre-feet of water annually to prepare and adopt an urban water management plan every five years,[2] and demonstrate water supply reliability in a normal year, single dry year, and droughts lasting at least five years over a twenty-year planning horizon.[3] The UWMPA also requires each urban water supplier to prepare a drought risk assessment and water shortage contingency plan.[4] And last, beginning in July 2022, each urban water supplier must prepare an annual water supply and demand assessment.[5] The California Legislature asserts that aggregating all of these legal requirements at the urban water supplier level will improve local, regional, and statewide water planning and water resilience.

At a practical level, the Urban Water Management Plan (UWMP) is the legal and technical water management foundation for urban water suppliers throughout California. A well-constructed UWMP will provide the supplier's elected officials, management, staff, and customers with an understanding of past, current, and future water conditions and management. The UWMP integrates local and regional land use planning, regional water supply, infrastructure, and demand management projects as well as providing for statewide challenges that may manifest through climate change and evolving regulations. Thoughtful urban water management planning provides an opportunity for the supplier to integrate supplies and demands in a balanced and methodical planning platform that addresses short-term and long-term planning conditions. In brief, the UWMP gathers, characterizes, and synthesizes water-related information from numerous sources into a plan with local, regional, and statewide practical utility.

[1] California Water Code Section 10610 *et seq*. (Chapter 1 added by Stats. 1983, Ch. 1009, Sec. 1).
[2] California Water Code Section 10610 *et seq*.
[3] California Water Code Sections 10631-10635
[4] California Water Code Sections 10632
[5] California Water Code Sections 10632.1

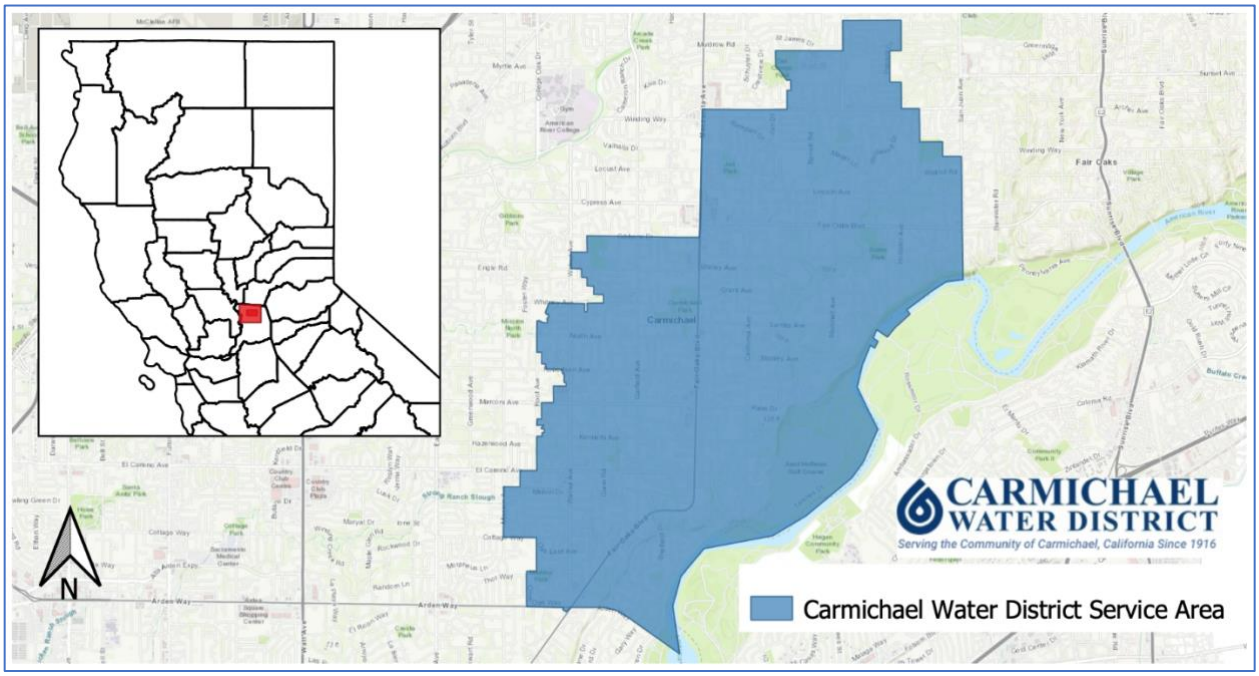
ES-1 Carmichael Water District

Carmichael Water District, formerly Carmichael Irrigation District, was formed in 1916 to serve water for irrigation and to a small but growing township called "Carmichael Colonies." The District was formed under the California Irrigation District laws but has changed its name to "Water District" in order to reflect its metamorphosis from a primarily irrigation supplier to an urban water supplier. Today, CWD serves approximately 11,700 connections and serves multiple beneficial uses in its service area and in the American River.

CWD has numerous sources of water in its water supply portfolio. The District has surface water rights to divert the natural flows of the American River, groundwater supplies derived from its well system, alternative water supplies related to its contractual relationship with Aerojet Corporation, and stored water supplies derived from its long-term conjunctive use activities. All of these water supplies are collectively managed to meet the District's demands.

CWD has a sophisticated water diversion, treatment, and conveyance systems. The District's surface water rights are diverted through Ranney collectors in the American River and treated at the Bajamont Water Treatment Plant. The District also diverts and treats water supplies for neighboring water agencies at these same facilities. CWD also derives groundwater supplies from its four primary wells and is developing additional well capacity to meet dry year demands. The diverted and treated water supplies are then blended with the groundwater supplies and delivered to customers throughout the District's service area. Figure ES-1 shows the District's service area and main water system features.

Figure ES-1: Carmichael Water District Water Service Area



ES-2 CWD's Water Service Reliability

Carmichael Water District's water supply portfolio has provided over 100 years of water supply reliability to the District's customers. The District's transition from exclusive surface water diversions from the American River to groundwater and then into a sophisticated conjunctive use program, that includes a state-of-the-art water treatment facility, epitomizes the flexibility and adaptability the District has displayed throughout its history. Renewed flexibility and adaptability will be required by the District in handling climate change, regulatory change, and legislated conservation and water quality protection.

The District's water supply portfolio consists of three surface water rights, groundwater rights, contract supplies and stored water. The total annual water supplies available from this water asset portfolio exceed 40,000 acre-feet per year in a normal hydrological year. And even in dry years, CWD's portfolio provides in excess of 20,000 acre-feet of water to served demands of about 10,000 acre-feet – nearly double the required volume to satiate demands.

But in 2015, the driest year in California's history, CWD's surface water rights were curtailed by the State Water Resources Control Board for five months – requiring the District to implement its water shortage plan and acquire additional supplies to meet customer demands. This first-ever water rights curtailment exposed a monthly supply vulnerability in CWD's water supply portfolio that had not been observed before. Fortunately, at that time, the District's Board and Management had the foresight to anticipate the problematic condition and take pre-emptive actions to address the supply shortage. Similarly, today, the Board and Management have prepared contingency plans to address another short-term water shortage and are developing long-term plans to mitigate the shortage issue. Nevertheless, in critically dry years, CWD relies upon its Water Shortage Contingency Plan and access to additional regional water sources to create a reliable water supply to meet its customer's demands.

Table ES-1 depicts the monthly water supplies as compared to the unconstrained water demands in a critically dry year. The portions highlighted in yellow depict the monthly water supply deficits that CWD experiences in critically dry conditions. Table ES-2 shows the short-term actions that CWD takes in order to mitigate the water shortage and meet customer demands through demand management actions in its WSCP as well as supply augmentation actions.

Table ES-1: Critically Dry Year Monthly Water Shortage with Unconstrained Demand (values in acre-feet)

Single Dry Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Supply	3,098	3,032	3,098	3,076	685	663	685	685	663	685	3,076	3,098	22,546
Demand	458	319	424	457	670	909	1,176	1,204	1,218	1,018	816	516	9,186
Difference	2,640	2,713	2,675	2,620	15	-246	-491	-519	-555	-333	2,260	2,583	13,360

Table ES-2: Critically Dry Year Monthly Supply and Demand with WSCP and Supply Augmentation (values in acre-feet)

Single Dry Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Supply	3,098	3,032	3,098	3,076	685	663	685	685	663	685	3,076	3,098	22,546
Demand	481	319	424	457	670	909	1,176	1,204	1,218	1,018	816	516	9,209
20% Demand Reduction						728	941	963	975	814			
Alt Supply						65	256	278	312	129			
Difference	2,617	2,713	2,675	2,620	15	0	0	0	0	0	2,260	2,583	13,337

The District has developed the combination solution depicted in Table ES-2 in order to address the water shortage issue from multiple angles. The District has flexibility to increase its supply augmentation actions through a number of coordinated activities with neighboring agencies including increasing groundwater supply deliveries, receiving surface water from the American River, and opening interties to receive additional water assets. Moreover, the District may also implement other aspects of its WSCP in order to increase demand reduction beyond 20% depending upon the severity of the water shortage and the shortage duration. These combined actions demonstrate the CWD's flexibility and adaptability to its water management efforts.

The District's water supply is reliable in all year types except the critically dry years. And although this condition is extremely rare, changing climatological and regulatory conditions necessitate developing a long-term solution. CWD is deeply committed to solving the critically dry year issue by expanding its access to surface water supplies and improving its conjunctive use activities. Together, these long-term planning actions will address CWD's water reliability vulnerability.

Chapter 1
Introduction

The Carmichael Water District (CWD or District) was the first irrigation district established in Sacramento County. The District was formed in 1916 to address the growing needs of the Carmichael Colony. It is governed by a five member, publicly elected Board of Directors, each one representing a division of approximately equal population within the service area.

CWD's service area encompasses about eight square miles and serves primarily residential and commercial customers in the community of Carmichael. The District originally served 10 acre plots for farming purposes, but as the community became more populated it became primarily an urban water supplier with mostly residential connections.

The District's water supply comes from direct surface water diversions from the American River which are conveyed to the Bajamont Water Treatment Plant, as well as several groundwater wells operated as part of its conjunctive use strategy. These supplies represent a viable and substantial water supply that is available to meet CWD's customers' uses in all year types. CWD's mission statement is: "Committed to providing the highest quality water for the lowest feasible cost and to serving our customers with diligence, efficiency, and integrity[6]."

Ensuring an adequate supply of water is available to serve the existing and future needs for the District's customers is a critical component of successful planning for CWD. This Urban Water Management Plan (UWMP) draws on local, regional and statewide inputs to synthesize information from numerous sources into a reliable water management action plan designed to be referred to as management and Board level decisions arise and conditions change.

1.1 Background and Purpose

The District has prepared this 2020 UWMP to comply with the Urban Water Management Planning Act (UWMPA) requirements for urban water suppliers.[7] This 2020 UWMP addresses the District's water management planning efforts to assure adequate water supplies to meet forecast demands over the next 25 years. As required by the UWMPA, the District's 2020 UWMP specifically assesses the availability of its supplies to meet forecast water uses during average, single-dry and five consecutive drought years through 2045. Verification that future demands will not exceed supplies and assuring the availability of supplies in dry-year conditions are critical outcomes of this 2020 UWMP.

[6] Carmichael Water District website

[7] California Water Code sections 10610 through 10657.

The 2020 UWMP is an update to the District's 2015 UWMP and presents new data and analysis as required by the California Department of Water Resources (DWR) and the California Water Code (CWC) since 2015. The 2020 UWMP is also a comprehensive water planning document that describes existing and future supply reliability, forecasts future water uses, presents demand management progress, and identifies local and regional cooperative efforts to meet projected water use.

The UWMP is designed to be a valuable water management and planning tool to guide and inform the District's managers, its customers, and the State of California about its water management practices. It conveys the District's planning assumptions and goals and should be used in combination with other planning resources and documents over the UWMP planning horizon.

The State of California's drought vulnerability and the additional pressures of climate change and population growth have emphasized the importance of planning ahead to meet water demands with potentially at-risk water supplies. Such forward planning is an important outcome of the 2020 UWMP.

1.2 Basis for Plan Preparation

The District operates a Public Water System as described in California Health and Safety Code 116275. The District qualifies as a Retail Urban Water Supplier as described in Water Code Section 10617, providing water for municipal purposes to more than 3,000 customers or 3,000 acre/feet of water per year. This qualification require the preparation of an Urban Water Management plan every five years. The District's Public Water System detail is listed in Table 1-1.

Table 1-1: Public Water System Information

Public Water System Number	Public Water System Name	Number of Municipal Connections 2020
CA3410004	Carmichael Water District	~11,700

The State Legislature passed numerous new requirements since the 2015 UMWP which are detailed throughout this 2020 UWMP.[8] Major updates to the requirements are listed below along with a reference to the corresponding section in which they are addressed in this document.

- **Five Consecutive Dry-Year Water Reliability Assessment:** The Legislature modified the dry-year water reliability planning from a "multiyear" time period to a "drought lasting five consecutive water years" designation. This statutory change requires a supplier to analyze the reliability of its water supplies to meet its water use over an extended drought period. This new requirement is addressed in Chapter 3—Water Supply, Chapter 4–Water Use, and Chapter 5— Water Service Reliability.
- **Drought Risk Assessment (DRA):** Due to the extensiveness of recent California droughts and the variability associated with climate change predictions, the California Legislature created a DRA requirement for UWMPs. The DRA requires assessment over a five-year period from 2021 to 2025

[8] California Water Code Section 10608 to 10608.44; Section 10609 to 10609.38; Section 10610 to 10657

that examines water supplies, water uses, and the resulting water supply reliability for five consecutive dry years. The DRA is addressed in Chapter 5— Water Service Reliability Assessment and Chapter 6—Water Shortage Contingency Plans.

- **Seismic Risk:** Evaluating seismic risk to water system infrastructure and facilities and having a mitigation plan is now required by the Water Code. Incorporating the water system into regional or county hazard mitigation planning is an important aspect of this new statue. Seismic risk is addressed in Chapter 6.
- **Water Shortage Contingency Plan:** In 2018, the Legislature modified the UWMPA to require a Water Shortage Contingency Plan (WSCP) with specific elements. The WSCP is a document that provides a Supplier with an action plan for a drought or catastrophic water supply shortage. The WSCP is in Chapter 6 of this UWMP.
- **Groundwater Supplies Coordination:** 2020 UWMPs are required to be consistent with Groundwater Sustainability Plans following the 2014 Legislature enactment of the 2014 Sustainable Groundwater Management Act (SGMA). The reliance on groundwater is described in Chapter 3—Water Supply.
- **Lay Description:** A synopsis of the fundamental determinations of the UWMP is a new statutory requirement in 2020. This section of the is intended for new staff, new governing members, customers, and the media, and it can ensure a consistent representation of the UWMP's detailed analysis. This requirement is captured in the Executive Summary.

1.3 Coordination and Outreach

As required by the UWMPA, CWD has coordinated with nearby agencies while developing this UWMP in order to ensure consistency with other related planning efforts such as the Sacramento County 2030 General Plan, Special Planning Areas, Neighborhood Preservation Areas, Specific Plans, Water Master Plan (WMP), and Groundwater Sustainability Plan (GSP). This requirement includes coordination with (a) water suppliers that share a common water source, (b) relevant water management agencies that affect the District's water assets, and relevant public agencies that may have land use or other regulatory relationships with the District. The District has prepared this 2020 UWMP in coordination with regional water purveyors and has appropriately notified and coordinated with other appropriate local government agencies, including the Regional Water Authority, as listed in Table 1-2.

As stipulated in Water Code Section 10621(b), every urban water supplier shall seek active involvement from diverse elements of the community. The District sought public participation with hearings and notices to members of the community. These coordination efforts and statutory requirements for notice are also included in Table 1-2.

The District participates in region-wide planning efforts as a member of the Regional Water Authority (RWA), a joint powers authority, created by water purveyors in the Sacramento region to have a unified approach to regional water issues. The RWA provides members and associates significant regional coordination to enhance water management practices. The District is also a member of Sacramento Groundwater Authority (SGA). SGA is a joint powers authority created to collectively manage the Sacramento region's North Area Groundwater Basin, which includes all of Sacramento County north of the American River.

The District has shared groundwater interests with numerous neighboring water suppliers and private interests. The District has ongoing relationships with Aerojet, Golden State Water Company (GSWC), Sacramento Suburban Water District (SSWD), and Fair Oaks Water District (FOWD), because of the groundwater contamination plume in the District's service area that was discovered in 2004. The District remains in close coordination with Aerojet and GSWC regarding groundwater resources extraction and treatment. Additional coordination efforts were made with respect to the two groundwater extraction treatment (GET) facilities operated by Aerojet – known as GET L-A and GET L-B. These resources are described in Chapter 3 of the 2020 UWMP.

Table 1-2: Public and Agency Coordination

Coordinating Agencies	Coordinate Regarding Demands	Sent Copy of Draft UWMP	Sent 60-Day Notice	Notice of Public Hearing
Cities, Counties, Customers and Interested Parties				
Aerojet Rocketdyne	Mailed Notice on April 14, 2021	E-mailed Notice on June 4, 2021	Posted the 2020 Urban Water Management Plan Notice to the Carmichael Water District Website on April 14, 2021	June 7, 2021
Ancil Hoffman Golf Course				
Carmichael-Old Foothill Farms Community Planning Advisory Committee				
Citrus Heights Water District				
Fair Oaks Water District				
San Juan Water District				
General Public				
Golden State Water Company				
Regional Water Authority				
Sacramento County				
Sacramento County Planning Department				
Sacramento County Water Agency				
Sacramento Groundwater Authority				
Sacramento Suburban Water District				

1.4 UWMP Adoption

The District held a public hearing regarding its 2020 UWMP on June 24, 2021. Before the hearing, a draft was made available for public inspection at the District's office and posted on the District's website. Pursuant to CWC Section 10642, general notice of the public hearing was provided through publication of the hearing date and time and posting of the hearing at CWD's office.

The District adopted this 2020 UWMP on June 24, 2021. A copy of the adopted 2020 UWMP will be submitted to DWR, provided to the County and the California State Library, and posted onto the District's website.

The District plans to submit all required documentation related to the UWMPA through the DWR submittal website soon after adoption. These include online tables for the following DWR Excel workbooks:

- "FINAL Submittal 2020 UWMP Tables 05.10.2021.xls"
- "FINAL SBX7-7 Verification Form 04.02.2021.xls"
- "FINAL Energy Use Tables 04.01.21.xls"

1.5 Document Organization

This UWMP is organized as follows:

- Executive Summary provides an overview of the purpose and findings of this 2020 UWMP.
- Chapter 1 establishes the basis for the UWMP, describes outreach activities and introduces the document organization.
- Chapter 2 provides a description of the District's service area, demographic characteristics and climate, and describes the future population the District anticipates needing to serve.
- Chapter 3 describes the current and future water supplies and the availability of the supplies through 2045.
- Chapter 4 details the customer uses, including the past and future estimated uses, and describes District's past and on-going demand management measures.
- Chapter 5 presents the District's water system service reliability into the future, including an assessment of reliability if a drought occurred over the next five consecutive years.
- Chapter 6 is the District's stand-alone water shortage contingency plan, incorporated as a chapter in this UWMP, but also available to be shared and utilized separate from the UWMP.

NOTE TO DWR:

Carmichael Water District has written this Urban Water Management Plan (UWMP) primarily as a water resources planning tool to effectively manage water supply, reliability and demand. This UWMP also satisfies all the requirements of the Urban Water Management Planning Act (UWMPA).

The body of the document provides narratives, analysis and data that DWR requests in its 2020 UWMP Guidebook, including changes to the California Water Code since 2015. Efforts have also been made to include enhancements to this document wherever possible as recommended in the 2020 UWMP Guidebook.

To facilitate review by DWR for compliance with the UWMPA, data from the body of the document has been transferred into required DWR submittal tables consistent with the organization of the tables in Appendix E of the 2020 UWMP Guidebook. These tables are separately uploaded to DWR's web portal. This UWMP has been reviewed for adequacy according to the UWMP Checklist as contained in Appendix F in the 2020 UWMP Guidebook.

Chapter 2
Water Service and System Description

Carmichael Water District (District) serves the unincorporated community of Carmichael and is located in the northern part of Sacramento County (County) along the north bank of the American River. The District is about ten miles east of downtown Sacramento and provides water for irrigation, municipal and commercial customers. The District was formed in 1916 to supply irrigation water for farming, but as the community of Carmichael developed and became more residential, it became predominantly an urban water supplier.[9] The District serves approximately 11,700 connections as shown in Table 2-1.

The District is located in the American River watershed and the majority of the water supply comes from direct diversions from the river. The District also operates four groundwater wells, and has recently met some local water needs with non-potable remediated water from a well within Ancil Hoffman Golf Course owned and operated by Aerojet/Rocketdyne. System supply is discussed in detail in Chapter 3.

The southern boundary of the District has about 4.25 miles of frontage on the American River. The District is otherwise bordered entirely by other Sacramento County water purveyors, including Citrus Heights Water District, Fair Oaks Water District, Sacramento Suburban Water District (Northridge Area), California-American Water Company, and Golden State Water Company.

Land use in the District is mostly classified as low density residential, and the service area is near full buildout with limited infill opportunities.[10] The community of Carmichael also has significant commercial districts that are located along key transportation corridors which link some of the County's neighborhoods, business areas and employment districts. Other notable land uses are natural preserves along the river and ample parkland and recreation space. The water service area covers about eight square miles as shown in Figure 2-1.

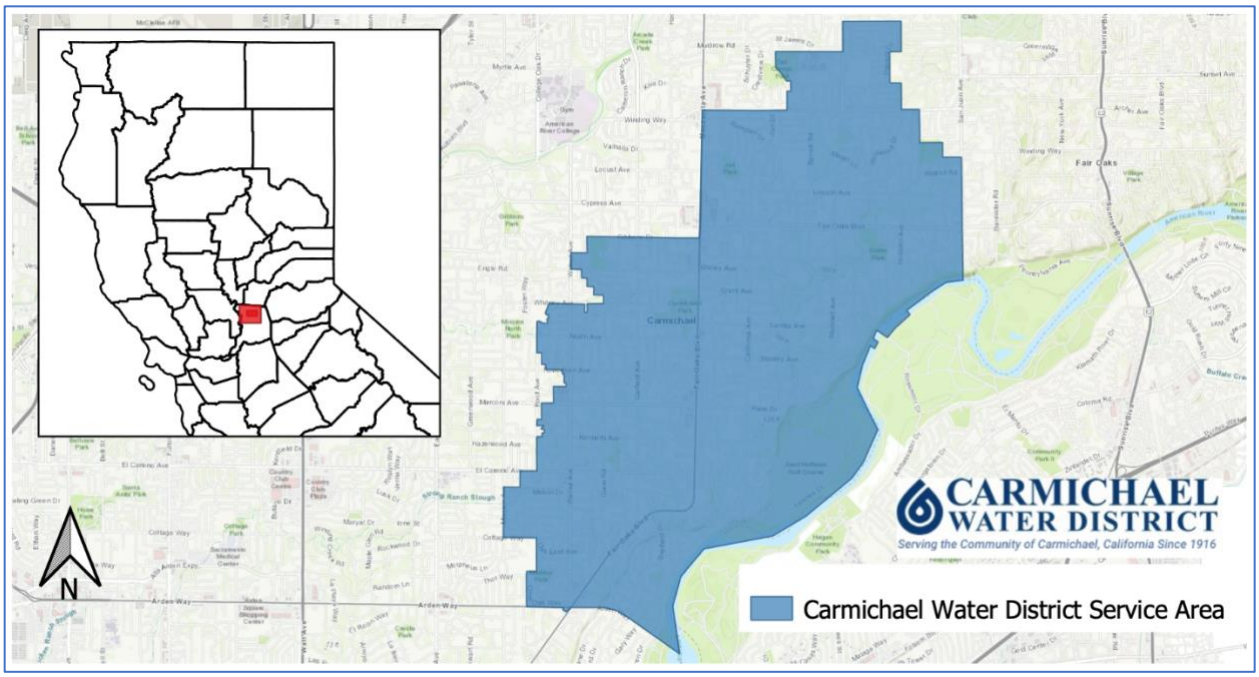
Table 2-1: Customer Water Service Connections

Customer Class	2015	2016	2017	2018	2019	2020
Single Family Residential	9,770	9,778	9,773	9,776	9,782	9,790
Multi-Family Residential	1,397	1,399	1,398	1,224	1,396	1,397
Commercial/Institutional	441	440	446	446	446	437
Landscape Irrigation	73	76	72	70	70	79
Total	11,681	11,693	11,685	11,521	11,694	11,703

[9] The community of Carmichael is slightly larger than the service area of Carmichael Water District.
[10] County of Sacramento General Plan, Land Use Element, Amended October 6, 2020.

Wastewater services are managed by the Sacramento Area Sewer District which collects and conveys wastewater to the Sacramento Regional County Sanitation District (Regional San) generated within Sacramento County and the CWD service area. The regional wastewater treatment plant located 15 miles south of the District in the City of Elk Grove.

Figure 2-1: Water Service Area

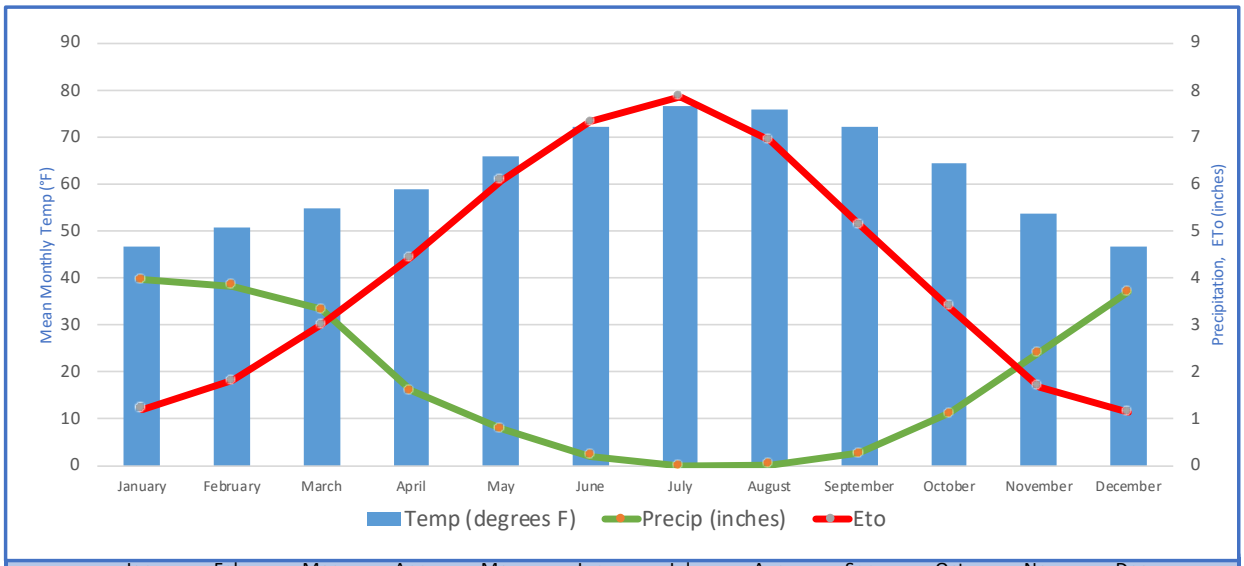


2.1 Service Area Climate

Typical of the California Central Valley, the District service area has a Mediterranean climate with hot, dry summers and cool, wet winters. Historical averages show January as the coolest and wettest month, and July as the hottest and driest. The wet season is from October to April with a 30-year annual average rainfall of 21.27 inches. The annual mean temperature is 62 degrees, but the summer months can regularly see average highs in the mid-high 90s, and average winter lows hover down in the 40s, occasionally reaching the 30s. Other climate characteristics include occasional Tule Fog coinciding with the rainy season, which brings dense fog caused by high relative humidity (after rain) and rapid cooling during the night. The fog can get trapped, due to temperature inversions common in the Sacramento valley, for days or even weeks. Snow is rare but cold fronts can bring freezing temperatures with trace amounts of snow and ice. Autumn starts warm and dry and becomes cooler, wetter and foggier later into the season. The last rains in spring are generally in late April or early May.

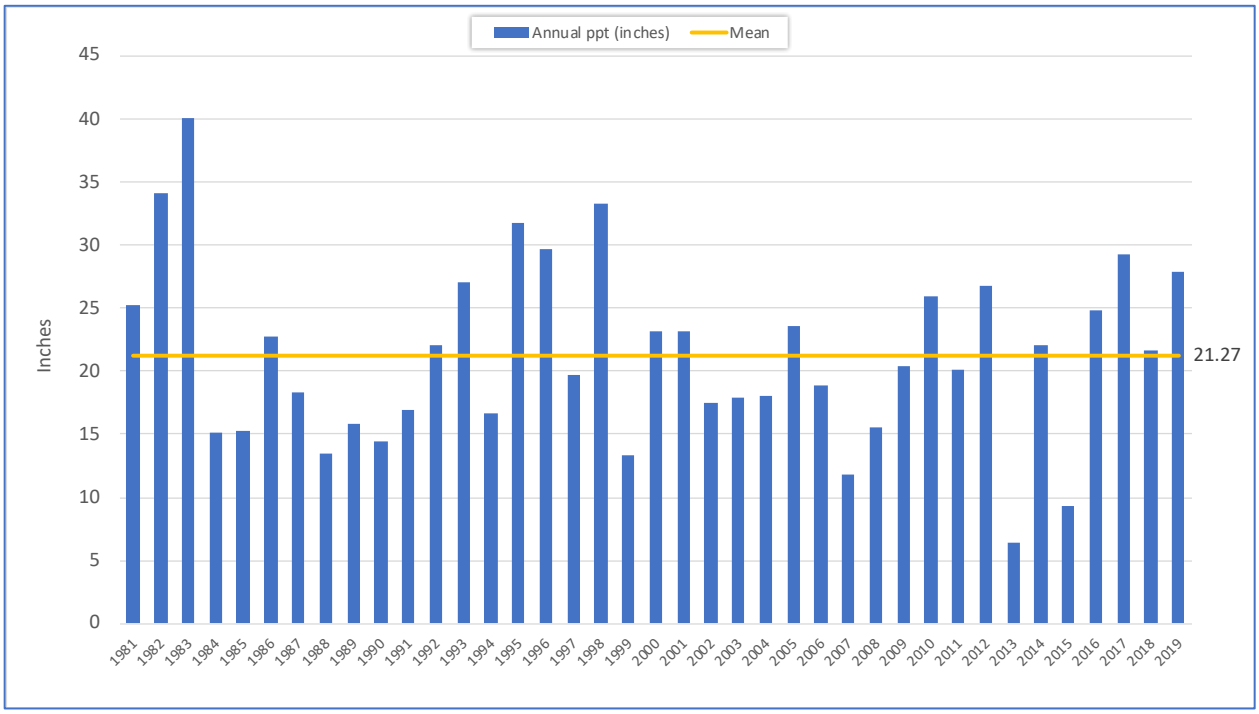
Figure 2-2 shows the average monthly temperature, rainfall, and evapotranspiration (ETo) for the service area. Actual annual rainfall totals deviate quite significantly from the 30-year average as illustrated in Figure 2-3; in most years, precipitation totals fall below the mean.

Figure 2-2: Average Climate Conditions[11]



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temp	46.9	50.9	55.0	59.1	65.8	72.3	76.9	75.9	72.4	64.4	53.9	46.9
Precip	3.97	3.83	3.33	1.60	0.79	0.21	0.00	0.03	0.27	1.12	2.42	3.70
ETo	1.21	1.82	3.01	4.45	6.09	7.32	7.87	6.95	5.14	3.38	1.69	1.15

Figure 2-3: Annual Precipitation Variability (1981-2019)



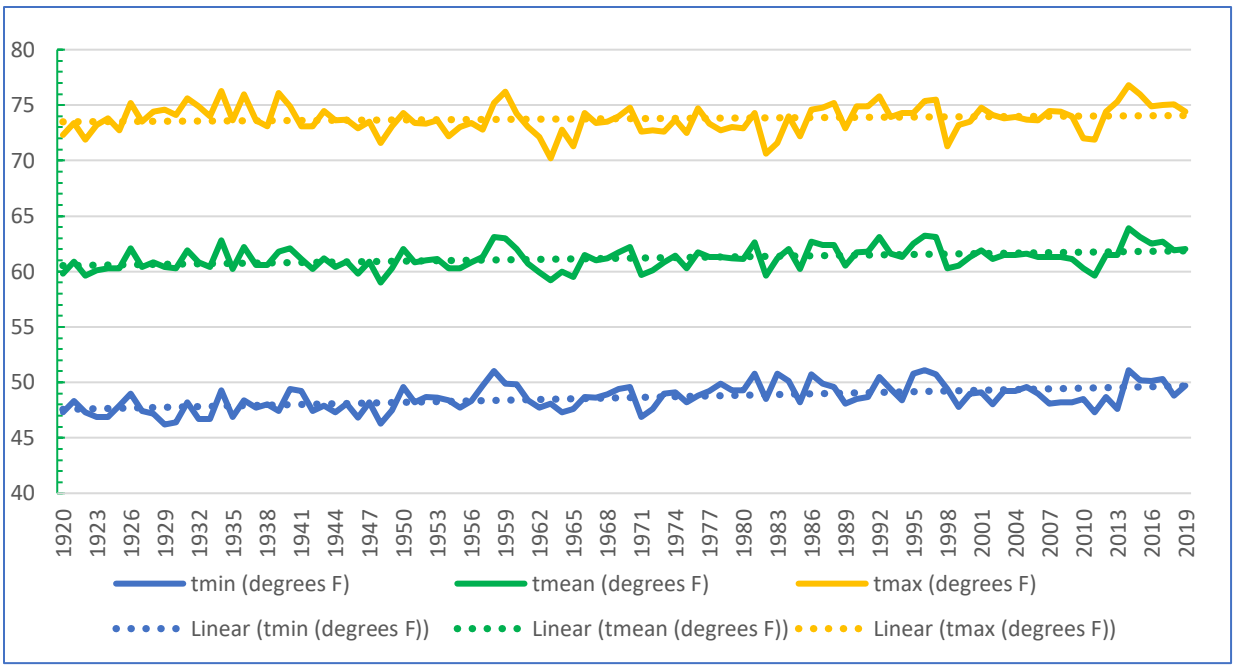
[11] Temperature and rainfall data represents annual averages from 1981-2019 from the PRISM Climate Group https://prism.oregonstate.edu/ Location: Location: Lat: 38.6257 Lon: -121.3323 Elev: 108ft ; ETo data is from Fair Oaks - Sacramento Valley - Station 131, Jan 2010 - Dec 2019.

2.1.1 Climate Change

While the California Water Code does not prescribe specific climate change planning and management measures for water suppliers, it does emphasize that climate change is appropriate to consider when assessing drought risk assessment, water conservation and use efficiency, and demand management and supply—both in a historical and projected context. Given the State's reliance on imported water from other watersheds, including from the Sacramento Valley, any effect from climate change on Sierra Nevada snowpack and flows into Northern California reservoirs and the Delta region will have a serious impact on water availability, both locally and statewide. Risks to the District's specific water supplies are further discussed in Chapter 3.

As shown by the trendlines in Figure 2-4, there has been a gradual warming in average temperatures over the past 100 years. Increasing temperatures regionally can result in increased demands, especially from outdoor water uses, and place further stress on supply reliability if current surface water sources are not sufficient to meet increasing need. The District has experienced a general warming trend over the last 100 years, as shown by the trendlines in Figure 2-4. Additional discussion regarding the potential effects of climate change are included in Chapter 3, Chapter 4, and Chapter 5.

Figure 2-4: Historical Annual Temperature (1920-2019)[12]



[12] Temperature data is from the PRISM Climate Group https://prism.oregonstate.edu/ Location: Lat: 38.6257 Lon: -121.3323 Elev: 108ft

2.2 Current and Projected Population, Land Use, Economy, and Demographics

Service area population and land use projections are critical to developing a useful planning framework as population dynamics and growth are a primary influence on water use. These projections directly influence planning measures for system supply, delivery, infrastructure, and demand management. Similarly, understanding the District's economic, social, and demographic trends give valuable insight to water management and planning. This section of the UWMP addresses these factors to provide a supportable basis for forecasting future water use.

2.2.1 Current Population and Historic Trends

The population served by the District includes a mix of users and user classes, and follows similar demographic and population trends as the community of Carmichael. The District's customer base is predominantly residential customers, comprised of single-family residential (85%) and multi-family (12%), with non-residential customers reflecting only 3% of the connections.

Table 2-2 presents the recent and estimated current population for the District's service area. Because the service area does not easily correlate to existing boundaries represented by the California Department of Finance in their historic and recent population analyses, the estimates in the table are derived using an occupancy rate and the residential connection data provided in Table 2-1.

The service area's currently averages about 2.43 persons per connection.[13] Also, because the existing multi-family connection information in Table 2-1 represents multiple residences for each connection, an estimate needs to be made of the number of units per connection in order to estimate population. For the purposes of this UWMP, each multi-family connection reflects an average of 4 units.

Table 2-2: Estimated Population – Historical and Current

2015	2016	2017	2018	2019	2020
37,830	37,870	37,850	36,100	37,850	37,900

2.2.2 Current and Projected Land Use

As described previously, the District is nearly built-out, with mostly infill projects remaining. As still recognized by Sacramento County Planning Department's General Plan, "[c]ommunities such as Arden Arcade and Carmichael are almost at full buildout with limited infill opportunities…"

Therefore, for purposes of this 2020 UWMP, the anticipated nominal growth described in the 2015 UWMP will be maintained. Specifically, the Sacramento Area Council of Government's (SACOG) Blueprint anticipated build-out to occur around 2050. The SACOG Blueprint anticipates around 60 acres of

[13] https://www.census.gov/quickfacts/carmichaelcdpcalifornia This persons-per-household value represents an average for single-family and multi-family residences, with single-family often having higher occupancy, and multi-family lower.

commercial space to be converted to mixed use, which will include additional residential dwelling units – primarily multi-family units. Around 1,800 new multi-family residences are expected without reducing the amount of commercial space. These additional dwelling units result in around a 10% population increase by build-out. The District anticipates there will also be additional single-family residential units added, likely occurring through splitting larger lots and a small amount of infill on currently vacant parcels. For purposes of the growth analysis, a small number of single-family homes are also included.

To estimate non-residential growth, the existing mix of residential to non-residential connections can be a proxy for estimating the future mix for the incremental new connections. As noted previously, residential connections represent about 96% of the District's customers, with non-residential uses representing 4%. With the addition of approximately 1,825 residential units by 2045, the existing ratio would result in 70 new non-residential connections by 2045. Table 2-3 presents the expected new connections by customer classification over the UWMP's planning horizon.

Table 2-3: Cumulative New Connections

Classification	2025	2030	2035	2040	2045
Single-family Residential	5	10	15	20	25
Multi-family Residential	100	450	900	1,350	1,800
Commercial/Institutional	5	20	40	50	70

Table 2-4 presents the expected total connections by classification, combining the new residential and non-residential connections with the existing connections. This connection forecast will be used to estimate future water use, as detailed in Chapter 4.

Table 2-4: Expected Total Connections

Customer Class		2025	2030	2035	2040	2045
Existing	Single Family Residential	9,790				
	Multi-Family Residential	1,397				
	Commercial/Institutional	437				
	Landscape Irrigation	79				
New	Single Family Residential	5	10	15	20	25
	Multi-Family Residential	100	450	900	1,350	1,800
	Commercial/Institutional	5	20	40	50	70
Total	Single Family Residential	9,795	9,800	9,805	9,810	9,815
	Multi-Family Residential	1,497	1,847	2,297	2,747	3,197
	Non-residential	521	536	556	566	586
	Total Connections	11,813	12,183	12,658	13,123	13,598

2.2.3 Projected Population

To forecast projected service area population, the forecast new connections and the existing occupancy rate are used, adding the new residents to the existing population.

The resulting projected population through the planning horizon of 2045 is presented in Table 2-5. Values are rounded to represent the estimated nature of this forecast.

Table 2-5: Population Forecast

2020	2025	2030	2035	2040	2045
37,900	38,200	39,000	40,100	41,200	42,300

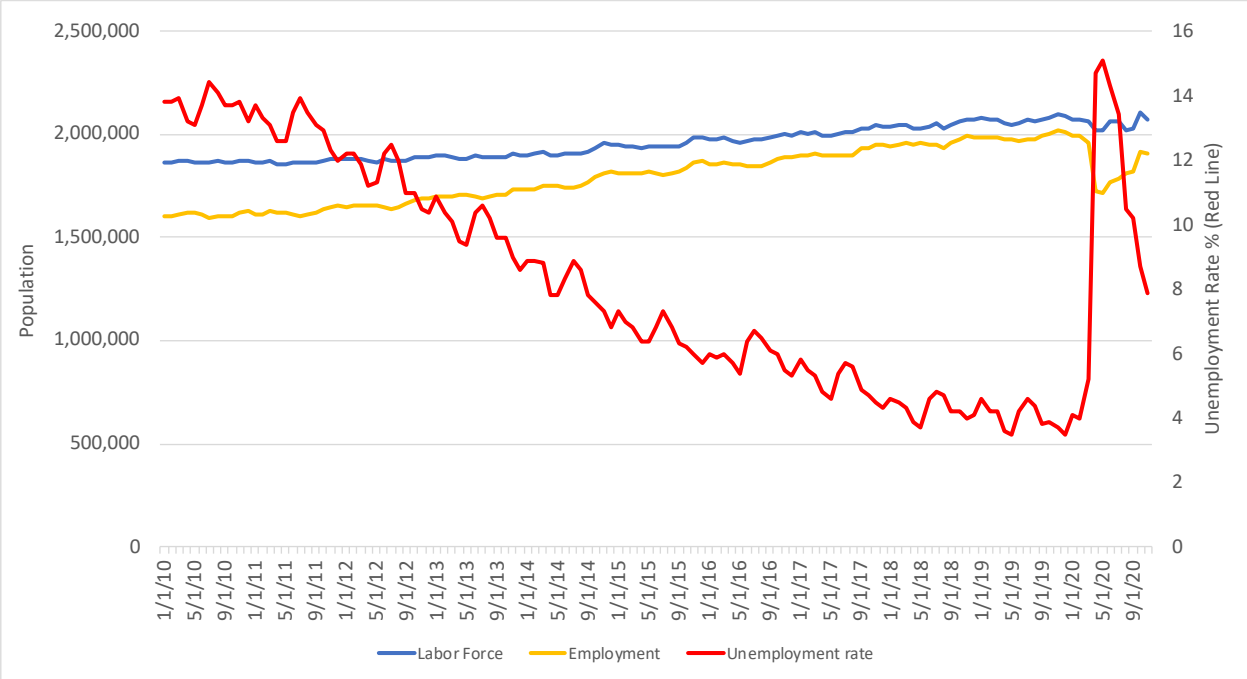
2.2.4 Economic Trends & Other Social and Demographic Factors

The community of Carmichael's local economy is centered around its retail and commercial activity, and its largest employment sectors are construction, healthcare, and public administration. San Juan Unified School District is a large employer in Carmichael. Land use is mostly residential low-density single-family housing and many of the residents commute to other locations in Sacramento County and surrounding areas for work.

Since 2010 the Sacramento--Roseville--Arden-Arcade, CA Metropolitan Area has seen impressive growth adding jobs and decreasing the unemployment rate from as high as 13% in January 2011 to just over 3% as recently as December 2019. However, the coronavirus pandemic crippled the national (and global) economy in 2020 and the County is no exception. The unemployment rate in the area spiked to almost 14% in May 2020. Since then, the area has regained some of the jobs, but the labor force has dropped about 5% year over year and there remains a high level of uncertainty with the pace of economic recovery due to the pandemic. These data are shown in Figure 2-5.[14]

[14] U.S. Bureau of Labor Statistics: Sacramento--Roseville--Arden-Arcade, CA Metropolitan Statistical Area

Figure 2-5: Sacramento County Employment Data, January 2010 – November 2020



2.3 Delivery System Details

This subsection focuses specifically on the District's potable and raw water delivery systems. The water supplies are described in Chapter 3, with water uses described in Chapter 4.

The District's water supply system draws surface water from the American River and groundwater from the North American Basin beneath the District's service area. These supply sources are treated, stored, and distributed to District customers via a complex array of water facilities including over 160 miles of pipelines, a large clearwell, two ground level water storage tanks, several groundwater wells, and the Bajamont Water Treatment Plant (WTP).

2.3.1 Potable Water System

The District operates a potable water system to provide water service to its customers. Figure 2-6 represents the major features of CWD's water system.

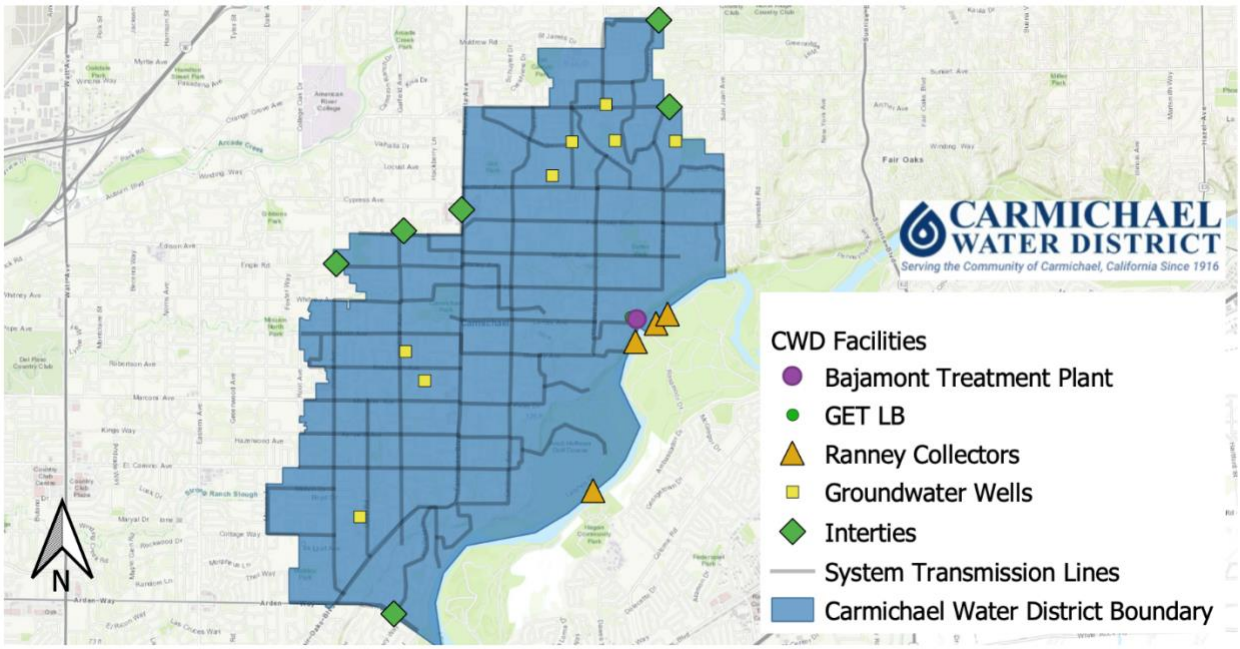
The main raw water source is surface water from the American River. Three Ranney collectors use a series of laterals to collect water and utilize the natural sand and gravel riverbank filtration system. Water flows from the three collectors by gravity to a central collector and is then conveyed by gravity to the WTP through a 48" pipeline. The WTP has a nominal capacity of about 22 million gallons per day (MGD).[15] Once at the WTP the raw water is pressurized and sent to a series of Continuous Microfiltration (CMF) units. Two trains of eight CMF skids per train filter water through a total of 1,440 individual membrane

[15] Actual capacity is estimated at 20.7 MGD due to filter backwash requirements.

filters. The filtered water then receives chlorine for disinfection and caustic soda for corrosion control to finish the treatment process. The treated water is temporarily stored in a 2 million gallon clearwell located beneath the WTP. The treated water is then pumped to customers through the District's distribution system at about 70psi. The WTP has a diesel generator used for stand-by power in the event of a power outage.

Used conjunctively with surface water, groundwater is becoming increasingly important due to surface supply limitations and consecutive dry years. The District has eight groundwater production wells, four of which are active, two that are set for decommissioning, and two that are inactive. The supply capacity is aided by two ground level water storage tanks, the La Vista Tank and the Dewey Tank, with a combined available storage capacity of 4 million gallons.

Figure 2-6: CWD Major Facilities Map



The District water delivery system consists of both a distributed and centralized supply. Storage reservoirs and groundwater production wells are located throughout the District, providing a distributed supply that does not require transmission mains to connect supply in the vicinity of these sources. The WTP is the centralized supply delivering water through 20 to 30-inch steel transmission pipelines and 20 to 24-inch ductile iron pipelines. The majority of the buried distribution infrastructure consists of water supply mains ranging in size from 4-inch to 18-inch pipe. The existing District piped water system consists of several types of pipe materials ranging from steel pipe installed in the pre-1950s to the ductile iron pipe installed as a District standard today.

2.3.2 Non-Potable Water System

The District's only significant non-potable water delivery system is located in the Sacramento County-maintained Ancil Hoffman Golf Course. In 2010 the golf course started receiving water from Aerojet's Groundwater Extraction Treatment (GET) facility in Ancil Hoffman Park. This facility is owned, monitored, and operated by Aerojet and the remediated water is used to offset golf course water irrigation demand. The Ancil Hoffman booster pump station supplies the irrigation water directly from the GET facility to the golf course. The remediated water from the GET facility supplies about half of the golf course's non-potable irrigation water needs from May through September, and all of the non-potable irrigation water needs from October through April. This approach has reduced the District's largest water user's consumption by about 50 percent. The District is in the process of acquiring these discharged water assets from Aerojet. However, Aerojet has begun ceasing operations of the GET facility as the groundwater contamination concerns have been addressed. In 2020 and moving forward, the District anticipates the golf course will again be served from the District's potable water system and potable water supplies.

2.4 Energy Intensity

Among the statutory changes enacted with new requirements for 2020 UMWPs, an urban supplier shall include information it can readily obtain related to the energy use to produce, treat and deliver water.[16]

Referred to as "Energy Intensity Reporting" for urban water suppliers, this is defined as the total amount of energy expended in kilowatt-hours (kWh) on a per acre-foot basis to take water from the location where the urban water supplier acquires the water to its point of customer delivery.

For purposes of this 2020 UWMP, District is reporting its energy intensity using the Total Utility Approach. This method sums the annual net energy consumed for all water management processes, divided by total volume of water produced in acre feet. These processes include diversion, conveyance, placement into storage, treatment, and distribution. The total energy intensity is reported in Table 2-6.

Table 2-6: Energy Intensity – Total Utility Approach[17]

Sum of All Water Management Processes	
Volume of Water Entering Process (acre-feet)	13,568
Energy Consumed (kWh)	8,916,018
Energy Intensity (kWh/acre-foot)	657

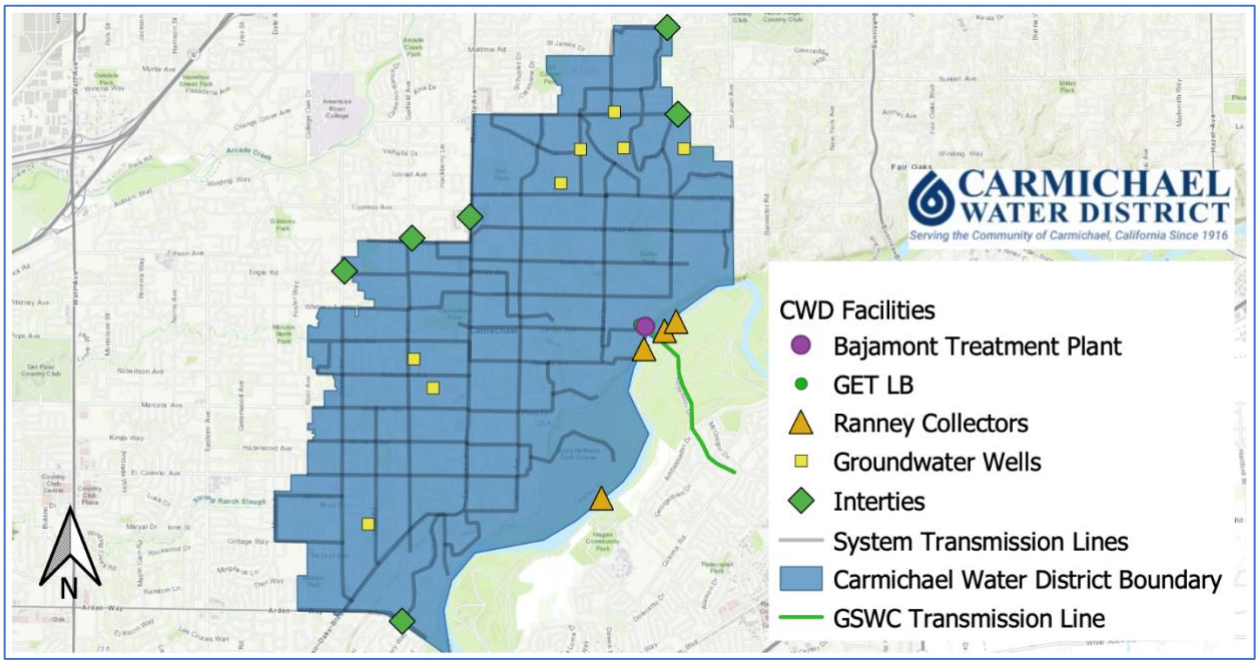
[16] California Water Code Section 10631.2(a).

[17] Energy consumption numbers cover water treatment plant, wells, and booster pumps for the 2020 calendar year. The total production includes 5,055 acre-feet treated at the WTP on behalf of Golden State Water Company (GSWC) and delivered to GSWC's system.

Chapter 3 Water Supply

This Chapter describes the District's water supplies and characterizes the supply availability under changed hydrological and regulatory conditions. The District conjunctively manages surface water, groundwater, and reclaimed water assets. The District primarily relies on its American River surface water supplies in order to preserve its groundwater assets for dry conditions. The groundwater supplies are used to supplement surface water supplies and address system operational issues, like peak demands, emergencies, and drought periods. The District also used reclaimed water developed from Aerojet's GET facilities and is investigating additional surface and groundwater resources for use in its service area. The District's service area boundary and its major water facilities are shown in Figure 3-1. Collectively, all of these water assets constitute the District's water supply portfolio and all of them are described in the following analysis below.

Figure 3-1: Carmichael Water District's Service Area



3.1 Surface Water Supplies

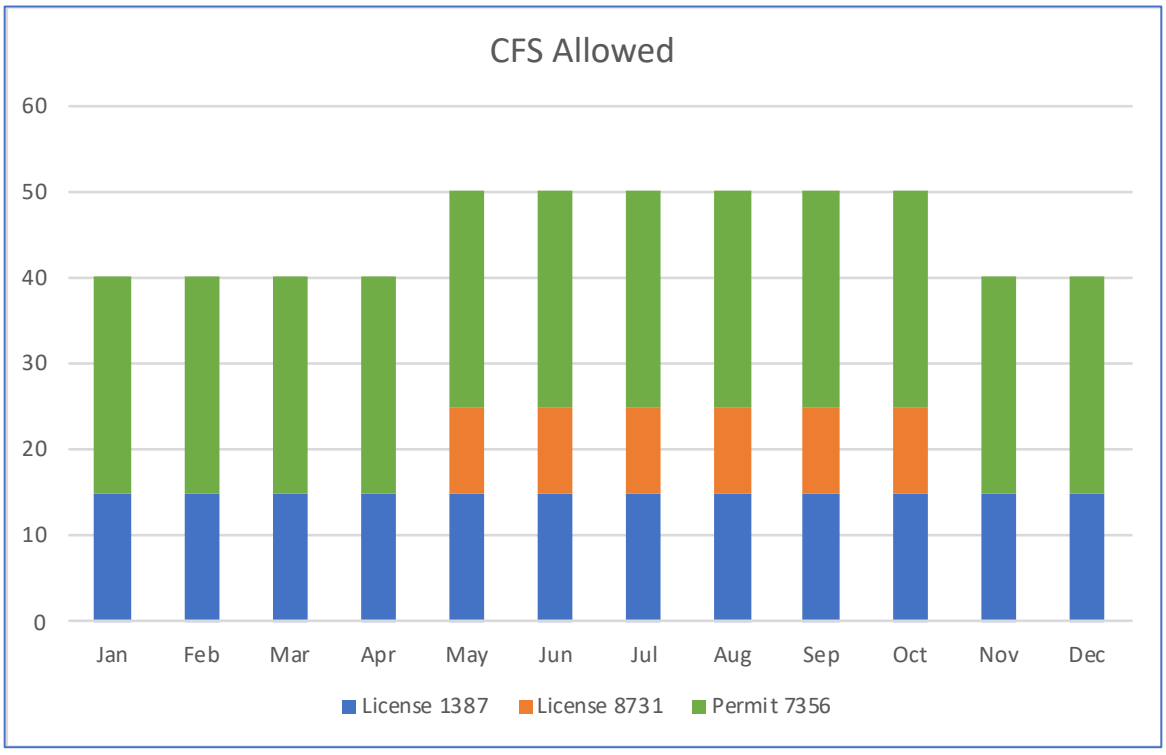
The District's surface water supplies are secured through two licensed water rights and one permitted water right. The District utilizes these three post-1914 appropriative rights to the natural flow of the American River to divert up to 50 cubic feet per second, depending on the season of use and the correlating hydrological conditions. In addition, the District also has rights to GET water supplies derived from GET LA and GET LB under a contract with Aerojet. The District's three main water rights are summarized below in Table 3-1.

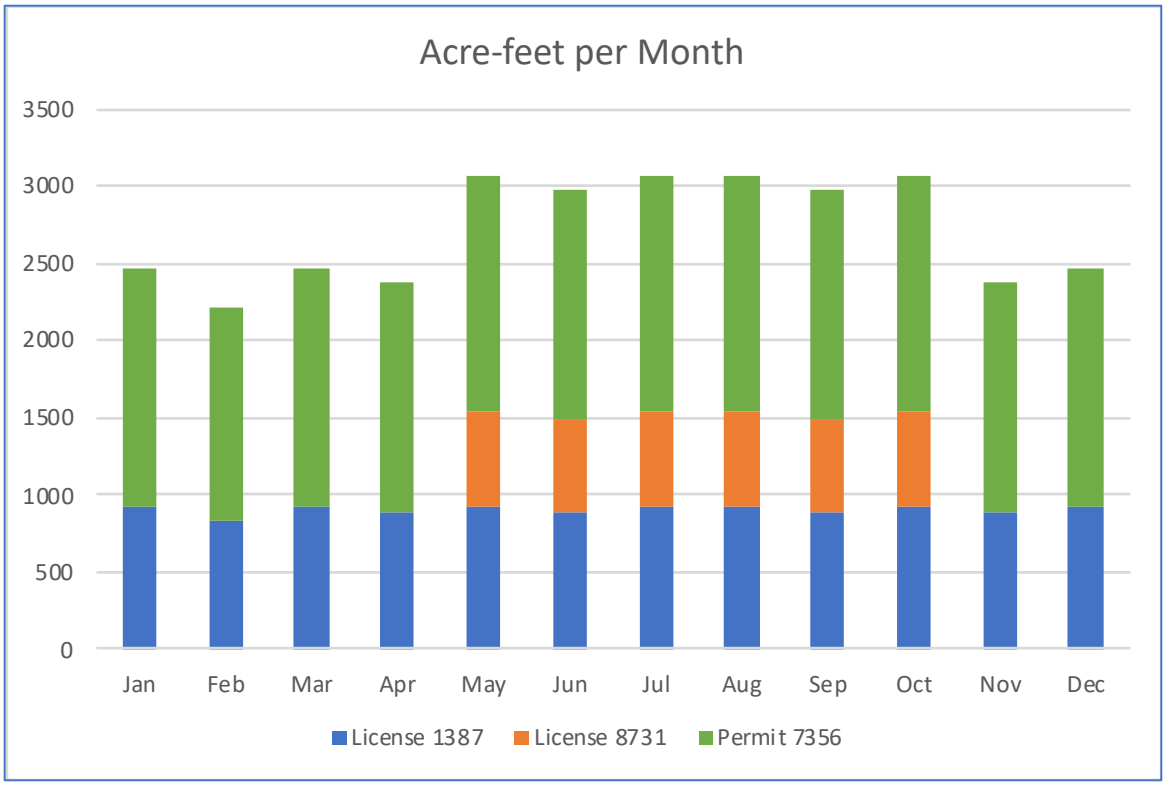
Table 3-1: CWD's Water Rights

Water Right	Diversion Rate	Volume (AFY)	Diversion Period	Purposes of Use
License 1387	15 cfs	10,859	Jan – Dec	Irrigation and Domestic
License 8731	10 cfs	3,669	May – Oct	Irrigation, Domestic, and Municipal
Permit 7356	25 cfs	18,099	Jan – Dec	Domestic and Municipal

Figure 3-2 shows CWD's water rights in a stacked bar graph form showing the monthly diversion rate availability as well as the monthly volumes available.

Figure 3-2: Monthly Diversions and Volumes under CWD's Water Rights





The District also has access to GET LA and GET LB water supplies for use in its service area and may also have access to the City of Sacramento's Area D water rights and entitlements as well as San Juan Water District water supplies. The District maintains connections with neighboring water agencies, like Fair Oaks Water District and Sacramento Suburban Water District, and has received water supplies from those systems to support the District's water portfolio management actions. And last, the District diverts, treats, and delivers water supplies to Golden State Water Company under a contract. Although this supply is not currently available in the District's water supply portfolio, it does present options to work with GSWC on future water management activities. All of these additional water assets are described later in this Chapter.

3.1.1 License 1387

The District diverts water under License 1387 to meet demands in its service area. This water right license has a 1915 priority date for a water diversion of 15 cubic feet per second (cfs) from January 1 to December 31 of each year from the natural flow of the American River for domestic and irrigation uses within the boundaries of the Carmichael Irrigation District (now Carmichael Water District). The total diversion right equals approximately 905 acre-feet per month for an annual total of 10,860 af/yr. Each of the water right characteristics is important to understanding the disposition of the water asset in the District's water supply portfolio.

The 1915 priority date is relatively senior in the overall picture of water rights in California. Post-1914 water rights, like this license, were the first water rights that were subjected to the ongoing regulatory jurisdiction of the State Water Resources Control Board (formerly State Water Commission). This

jurisdiction has recently become more paramount as demand for water grows throughout California. In 2014 and again on May 1, 2015, during the driest year in California's history – SWRCB declared the District's License 1387 unavailable for diversion. The 2015 Curtailment Order was lifted on October 27, 2015 allowing the District to resume diversions under this senior water right. But this six month curtailment impacted CWD's water supply reliability and required the District to access alternative water supplies. Pre-1914 water rights were also curtailed during this extreme drought event with priority dates as early as 1903.[18] License 1387 had not been curtailed in the 100-year history of the District until the emergency conditions of 2014 and 2015. In short, the 2014 and 2015 hydrological droughts indicate that the District's surface water diversions are not reliable during the driest months (May through October) in critically dry years. Accordingly, the continuing regulatory actions of the SWRCB related to water rights under its jurisdiction coupled with changes in natural hydrological patterns must be carefully monitored and considered in assessing each assets supply reliability.

License 1387's domestic and irrigation "purposes of use" have specific meanings in California law and limit the applications to which the water under this license can be applied. Section 660 of the California Code of Regulations defines "domestic uses" as:

> "…the use of water in homes, resorts, motels, organization camps, campgrounds, etc., including the incidental watering of domestic stock for family sustenance or enjoyment and the irrigation of not to exceed one- half acre in lawn, ornamental shrubbery, or gardens at any single establishments. The use of water at a campground or resort for human consumption, cooking or sanitary purposes is a domestic use."

Section 661 of the California Code of Regulations defines "irrigation uses" to include:

> "any application of water to the production of irrigated crops or the maintenance of large areas of lawns, shrubbery, or gardens."

Any uses of the water under License 1387 for items other than those expressly recognized in these regulatory definitions is prohibited.

Last, the name and boundary of the District has changed over time. The District was formed under California irrigation district law and was called "Carmichael Irrigation District" until its name changed to "Carmichael Water District" in the 1980s. The District is still subject to the rules and laws governing irrigation districts even though the District has changed its name to "Water" district – which are governed by an entirely separate set of laws in the California Water Code. The boundary of the District has also changed over time – expanding to incorporate new areas in need of water service that were not present during the District's formation. The water rights place of use designation is generally described as able to serve those areas within the "District's boundaries."

The District continues to rely on Water Right License 1387 as its primary source of surface water supply in its water supply portfolio. Table 3-2 below depicts the water diversions under License 1387 from 2010 through 2020.

[18] https://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/docs/pre14curtailmentjun2015.pdf

Table 3-2: License 1387 Water Diversion from 2010 through 2020 (acre-feet)

Year	License 1387	Used
2010	10,860	7,789
2011	10,860	7,698
2012	10,860	7,298
2013	10,860	7,582
2014	10,860	2,345
2015	10,860	2,336
2016	10,860	4,545
2017	10,860	5,612
2018	10,860	5,460
2019	10,860	5,840
2020	10,860	5,534

Table 3-3 depicts the projected annual water deliveries under License 1387 in a normal, single dry, and five consecutive dry years.

Table 3-3: License 1387 Projected Water Deliveries from 2021 through 2025 (acre-feet)

License 1387	Year Type	Amount
Normal		10,860
Single Dry Year		5,430
Multi-Year Drought	2021	10,860
	2022	5,430
	2023	5,430
	2024	10,860
	2025	10,860

Table 3-4 depicts the project water deliveries under License 1387 from 2025 through 2045 in normal, single dry, and five consecutive dry years.

Table 3-4: License 1387 Projected Water Deliveries 2025-2045 (acre-feet)

License 1387	Year Type	2025	2030	2035	2040	2045
Normal		10,860	10,860	10,860	10,860	10,860
Single Dry Year		5,430	5,430	5,430	5,430	5,430
Multi-Year Drought	Year 1	10,860	10,860	10,860	10,860	10,860
	Year 2	5,430	5,430	5,430	5,430	5,430
	Year 3	5,430	5,430	5,430	5,430	5,430
	Year 4	10,860	10,860	10,860	10,860	10,860
	Year 5	10,860	10,860	10,860	10,860	10,860

The District has also conserved a significant portion of water under License 1387 that is protected under Water Code section 1011. Moreover, the District has conjunctively used groundwater in lieu of its surface water supplies available under License 1387 under certain conditions in accordance with Water Code

section 1011.5. And last, the District has used reclaimed water in lieu of water under License 1387 in accordance with Water Code section 1010. Together, all of these management actions have preserved the District's surface water supplies under License 1387.

3.1.2 License 8731

Since 1925, the District has also diverted water under License 8731 to meet other demands in its service area. The licensed water right provides for a diversion of 10 cfs from May 1 to November 1 of each year for application to "irrigation, domestic, and municipal uses." The monthly diversion volume under this right is about 612 acre-feet per month and, assuming a continuous diversion for this time period, the total divertible quantity of water is about 3,669 af/yr. Water supplies diverted from the American River under License 8731 may be used anywhere in the District's boundary like License 1387.

Many of the issues described in the previous section about License 1387 apply to the substantive components of this water right. The addition of "municipal use" to this water right is important. Specifically, Section 663 of the California Code of Regulations defines municipal use as:

> *"the use of water for the municipal water supply of a city, town, or other similar population group, and use incidental thereto for any beneficial purpose."*

Comparatively, municipal use as defined in the California Code of Regulations has much broader application within the District as compared to the uses confined by the definitions of domestic use and irrigation use. In short, municipal uses can essentially be applied to anything "municipally oriented" – which could include both irrigation and domestic uses (among others). Accordingly, this water right is needed to satisfy particular types of municipal uses throughout the water year within District's boundary that cannot be met with water from License 1387 that is confined to domestic and irrigation uses.

License 8731 has a junior priority of 1925 as compared to other senior pre-1914 water rights and pre-1914 appropriative water rights. This priority date may make it more susceptible to dry period curtailment. Moreover, its utility during a limited time period in a year – May through October – may render it less reliable to meet municipal demands. In 2014 and 2015, the SWRCB also curtailed this water right license. The curtailment order was issued on May 1, 2015 and lifted on October 27, 2015 – giving this water right merely 4 days of utility for the District during the critically dry year. Nevertheless, those years were the first time that License 8731 had been curtailed since the District acquired it. Accordingly, although the water right is generally reliable (curtailed twice in 95 years), this water right has almost no reliable supply in critically dry years as captured in this 2020 UWMP.

The District continues to rely on Water Right License 8731 as another reliable source of surface water supply in its water supply portfolio. Table 3-5 below depicts the water diversions under License 8731 from 2010 through 2020.

Table 3-5: License 8731 Water Diversion from 2010 through 2020 (acre-feet)

Year	License 8731	Used
2010	3,670	3,649
2011	3,670	3,648
2012	3,670	731
2013	3,670	507
2014	3,670	4
2015	3,670	0
2016	3,670	99
2017	3,670	56
2018	3,670	20
2019	3,670	44
2020	3,670	245

Table 3-6 depicts the projected water deliveries under License 8731 in a normal, single dry, and five consecutive dry years. In critically dry years, there is no supply available under this water right.

Table 3-6: License 8731 Projected Water Deliveries from 2021 through 2025 (acre-feet)

License 8731	Year Type	Amount
Normal		3,670
Single Dry Year		0
Multi-Year Drought	2021	3,669
	2022	0
	2023	0
	2024	3,669
	2025	3,669

Table 3-7 depicts the project water deliveries under License 8731 from 2025 through 2045 in normal, single dry, and five consecutive dry years.

Table 3-7: License 8731 Projected Water Deliveries 2025-2045 (acre-feet)

License 8731	Year Type		2025	2030	2035	2040	2045
Normal			3,669	3,669	3,669	3,669	3,669
Single Dry Year			0	0	0	0	0
Multi-Year Drought	Year 1		3,669	3,669	3,669	3,669	3,669
	Year 2		0	0	0	0	0
	Year 3		0	0	0	0	0
	Year 4		3,669	3,669	3,669	3,669	3,669
	Year 5		3,669	3,669	3,669	3,669	3,669

The District has also conserved a significant portion of water under License 8731 that is protected under Water Code section 1011 and the District has conjunctively used groundwater in lieu of its surface water supplies available under License 8731 under certain conditions in accordance with Water Code section 1011.5. And last, the District has used reclaimed water in lieu of water under License 8731 in accordance with Water Code section 1010. Together, all of these management actions have preserved the District's surface water supplies under License 8731.

3.1.3 Permit 7356

The District holds a third post-1914 appropriative water right from the American River – Water Right Permit 7356 (Permit 7356). Permit 7356 allows for diversion of 25 cfs from the American River with a priority date of March 1, 1948. This water right is also paramount to the District's water supply portfolio. The District's water right Permit 7356 allows for diversion of the natural flow of the American River for domestic, irrigation and municipal uses from January 1 to December 31 of each year. The addition of municipal uses for every month of the year fills a beneficial use gap left open in License 1387 and License 8731.

Unlike Licenses 1387 and 8731, Permit 7356 has not been "legally perfected" and remains in the water permit stage. A water right permit is issued by the SWRCB after a request is made through a water right application to divert water from an identified surface water source and a hydrological and engineering report justifies the availability of water under the defined parameters. The Permit issued to the District by SWRCB contains specific terms and conditions that must be met before the water right can be legally perfected and a water right license issued. Generally, such terms include construction of all necessary diversion and conveyance facilities as well as application of all of the water identified in the Permit to the identified beneficial uses.

The terms of the Permit must be legally perfected by the date identified in the text of the Permit. In Permit 7356 the original completion date was identified as 1951. But completion date extensions were regularly granted to the District because the District could demonstrate that it was planning to use the entire supply identified in the Permit at some point in the future.

The District had historically been successful in receiving extensions of time from SWRCB to perfect its water use under the Permit. For example, in 1996, the SWRCB issued an order extending the time in which District could show application of water to beneficial use under Permit 7356 to December 31, 2005. In 2005, however, the SWRCB denied the District's request to receive another time extension to perfect water use under the water right Permit. Specifically, the SWRCB ruled that the District did not adequately demonstrate that it could apply all of the water under the Permit to beneficial uses by 2025 and denied the District's request for a permit extension based upon the District's inability to expand its demands within its service area and the reliability of its other available water assets.

After the SWRCB denied the District's permit renewal request, the District was subject to a significant water quality problem in its service area that limited its ability to use groundwater supplies. Specifically, an Aerojet groundwater contamination plume unexpectedly migrated northward from the Aerojet properties on the south side of the American River and into the District's service area on the north side of

the American River. This problematic issue further demonstrated the need and utility of the District's continued use of Permit 7356.

In 2013, District staff met with the SWRCB and requested that the District perfect the water right as much as possible based upon the conditions prevailing in the District in 2005. Although the SWRCB indicated that it was willing to accept the District's pursuit of a license for Permit 7356, it indicated that such an action was not urgent and could be organized at an appropriate future time. The District's counsel agreed with this assessment but the District has recently reinvigorated its efforts to convert its Permit 7356 into a water right license.

It is unclear to what extent the SWRCB will approve use of water under this water right. The denied Permit extension request lacked evidence that the District was utilizing this water resource at all. But subsequent investigations definitively demonstrate that the District was and is using the water asset based on the "municipal use" beneficial use designation, the expanded contamination of groundwater in the District's service area, the District's ongoing water conservation under Water Code section 1011, its conjunctive use activities under Water Code section 1011.5, its remediated water use under Water Code section 1010, and the District's peak needs during the high demand months of June through September. Moreover, given the documented groundwater contamination underlying District (described herein), surface supplies from the American River remain critical to the District's longevity to (1) to make up for supplies limited by the contamination; and (2) reduce hydrogeological gradients that affect contaminant movement that an over-reliance on groundwater pumping might create. Importantly, it is possible that any license issued by SWRCB will be conditioned with new terms that will limit the availability of this water asset under certain hydrological and regulatory conditions affecting San Francisco Bay – San Joaquin Delta (Delta) water quality and aquatic species. All of these considerations are under investigation and the District is pursuing actions to legally perfect this water asset.

Water diversions from the American River under Permit 7356 were also eliminated from May 1 through October 27 in 2015 under the SWRCB's water rights Curtailment Orders. The water under this Permit was diverted, however, from January 1 through April 30 as well as October 27 through December 31 in 2015. As such, the water supply under this water asset is available for use in limited months during critically dry years.

The District continues to rely on Water Right Permit 7356 as another source of surface water supply in its water supply portfolio. Table 3-8 below depicts the water diversions under Permit 7356 from 2010 through 2020.

Table 3-8: Permit 7356 Water Diversion from 2010 through 2020 (acre-feet)

Year	Permit	Used
2010	18,100	8,213
2011	18,100	7,849
2012	18,100	285
2013	18,100	277
2014	18,100	91
2015	18,100	93
2016	18,100	315
2017	18,100	228
2018	18,100	153
2019	18,100	167
2020	18,100	262

Table 3-9 depicts the projected water deliveries under Permit 7356 in a normal, single dry, and five consecutive dry years.

Table 3-9: Permit 7356 Potential Water Deliveries from 2021 through 2025 (acre-feet)

Permit	Year Type	Amount
Normal		18,100
Single Dry Year		12,067
Multi-Year Drought	2021	18,100
	2022	9,050
	2023	9,050
	2024	18,100
	2025	18,100

Table 3-10 depicts the project water deliveries under Permit 7356 from 2025 through 2045 in normal, single dry, and five consecutive dry years.

Table 3-10: Permit 7356 Potential Water Deliveries 2025-2045 (acre-feet)

Permit	Year Type	2025	2030	2035	2040	2045
Normal		18,100	18,100	18,100	18,100	18,100
Single Dry Year		12,067	12,067	12,067	12,067	12,067
Multi-Year Drought	Year 1	18,100	18,100	18,100	18,100	18,100
	Year 2	9,050	9,050	9,050	9,050	9,050
	Year 3	9,050	9,050	9,050	9,050	9,050
	Year 4	18,100	18,100	18,100	18,100	18,100
	Year 5	18,100	18,100	18,100	18,100	18,100

The District has also conserved a significant portion of water under Permit 7356 that is protected under Water Code section 1011. Moreover, the District has conjunctively used groundwater in lieu of its surface

water supplies available under Permit 7356 under certain conditions in accordance with Water Code section 1011.5. And last, the District has used reclaimed water in lieu of water under Permit 7356 in accordance with Water Code section 1010. Together, all of these management actions have preserved the District's surface water supplies under Permit 7356.

3.1.4 Aerojet GET Water Conveyance for GSWC

The District signed a water supply agreement with Aerojet in 2017 that supplies Groundwater Extraction and Treatment (GET) water to the District. Aerojet has agreed to provide 5,000 af/yr of water to Golden State Water Company as part of a broader agreement to utilize the District's facilities to deliver remediated water to Golden State Water Company (GSWC) and manage groundwater contamination from the Aerojet plume that has migrated into the District's service area. In addition, Aerojet has agreed to pay the District to use its Bajamont WTP to treat GET water discharged to the American River and available for diversion at the District's facilities for use in GSWC's service area. More specifically, Aerojet paid for a pipeline to deliver water across the American River in order to meet its replacement water obligations under a contract with GSWC. This pipeline has the ability to move water in both directions to and from GSWC. CWD may work with GSWC to access this water supply under shortage conditions.

3.1.5 Additional Water Supplies in the District's Service Area

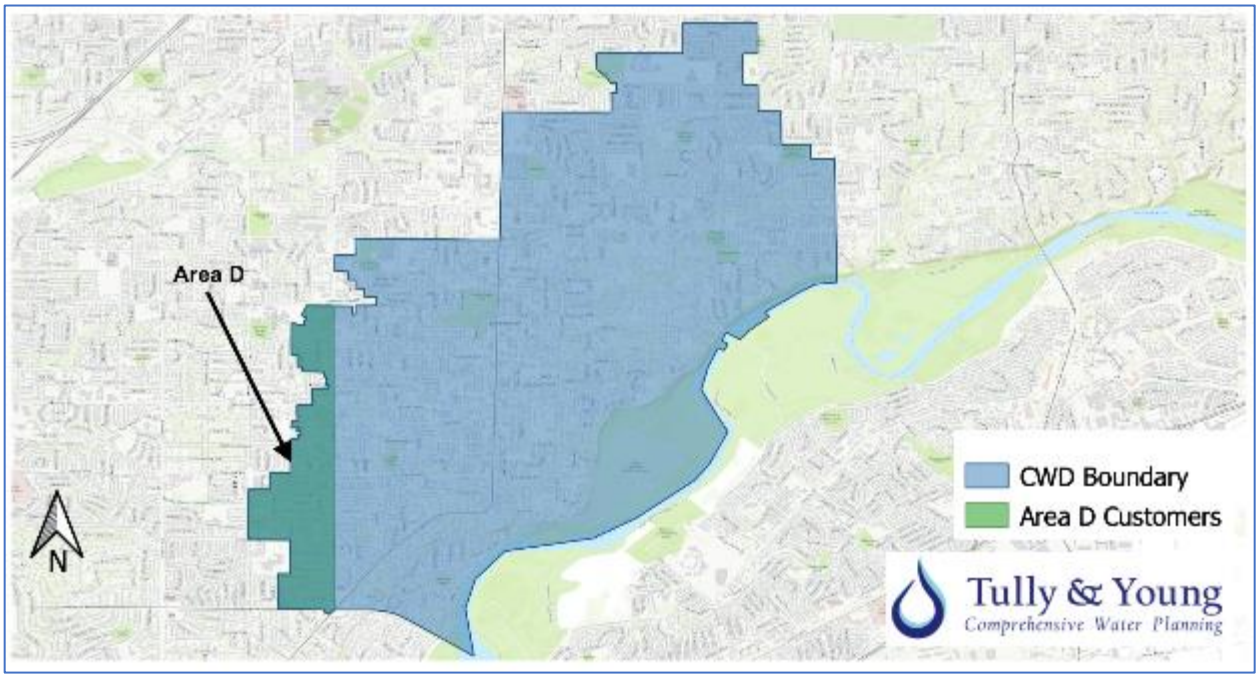
The District is investigating other regional water supplies that may be available for use in the District's service area as well as wheeling agreements with neighboring agencies to enhance dry year reliability and emergency conditions. This section describes these additional water supply opportunities.

Sacramento Area D Water Entitlements

The City of Sacramento has several water assets that can be used within a broad area called Area D. These water assets include the City's water rights as well as water rights linked to the Sacramento Municipal Utility District. Area D overlaps part of the District along Walnut Avenue. Thus, this portion of the District may be capable of applying Area D water supply for uses in the defined area with the State Water Resources Control Board. There are approximately 390 acres of the District within Area D. Water assets could be available to the District in Area D subject to the District reaching an agreement with the City for sharing of those resources. Figure 3-3 depicts Area D location in the District's service area.

Wheeling water into the portion of Area D that lies within the District's service area boundary would require coordinating wheeling activities with SSWD. And although the District and SSWD have a close working relationship, the District and SSWD have not coordinated a wheeling arrangement at this time due to the cost of permitting. As such, although this water supply remains a viable future water supply option, it is not included in the District's 2020 UWMP.

Figure 3-3: Map Showing Area D in District's Service Area



Fair Oaks Water District Imported Supply

In 2020, the District imported groundwater supplies from FOWD into the District's service area as part of a regional groundwater substitution transfer. The importation of this supply connected the District with FOWD's water system which provides access to alternative supplies under critically dry conditions. In addition, the District is engaging in discussions with FOWD about developing a joint water production facility that may be used to meet future District demands.

Sacramento Suburban Water District Water Supply

The District has opportunities to collaboratively work with Sacramento Suburban Water District (SSWD) to provide alternative supplies into the District's service area. SSWD has access to both surface water through its contractual arrangements with the City of Sacramento as well as groundwater supplies through its extensive network of groundwater wells in its service area. CWD could use its current connections with SSWD to obtain portions of these supplies as they are made available through SSWD's water system. The City's surface water supplies place of use would be limited to the Area D boundaries noted in the previous section but SSWD's groundwater supplies could be used throughout the District's service area boundary. As such, the District is engaging SSWD to augment its dry year water supply portfolio. And last, the District has engaged with a large group of regional purveyors as part of a collaboration assessment that may present opportunities to deliver additional water assets into the District's service area. In short, the District continues to diversify its water asset portfolio and create opportunities to improve normal, single dry, and five consecutive dry year conditions well into the future.

Aerojet GET Water Supplies

In 2015, the District engaged Aerojet to obtain GET supplies discharged to the American River that were surplus to the needs of its primary contract obligations with GSWC and Sacramento County Water Agency (SCWA). Since the District is currently unable to capture the GET supplies in GET LA and GET LB for diversion and use from its existing Ranney Collectors and Bajamont Water Treatment Plant (Bajamont), the District could exchange those supplies in order to acquire other supplies in the GET system. These sorts of dry-year arrangements could be activated in the event the District has a water supply shortage in a dry year.

GSWC GET Water

The District has engaged GSWC to utilize a portion of its GET water that is diverted and treated at Bajamont in exchange for GSWC accessing additional groundwater supplies from its groundwater system. This potential water supply would not change the current regimen for diverting and treating water supplies at the Bajamont facility. It would essentially redirect the treated supplies to CWD's service area and replace the deficit in the GSWC service area with additional pumped groundwater. However, this water supply exchange with GSWC's additional groundwater supply would require Aerojet's approval based on contractual obligation for groundwater contamination concerns.

San Juan Water District Water Supplies

In 2021, the District acquired San Juan Water District (SJWD) water supplies for use in its service area. These supplies are derived from SJWD's pre-1914 appropriative water right that incorporated a portion of CWD's service area into the original place of use of the water right. SJWD is foregoing the diversion of this water supply at its Folsom Lake diversion facilities and allowing this supply to be diverted at the District's American River facilities. As such, the District is acquiring some water supplies to supplement its potential 2021 water deficit. The defining event to execute this option arrangement is for the District's water rights to be curtailed.

3.2 Groundwater Supplies

Groundwater supplies constitute a major component of the District's water supply portfolio. The District conjunctively manages its surface water and groundwater supplies to optimize the utility of its water system. This section will address the fundamentals of the groundwater basin, the key activities related to the Sustainable Groundwater Management Act, the issues associated with Aerojet contaminated groundwater supplies in the District's service area, and the short-term and long-term utility of groundwater managed by the District.

3.2.1 Groundwater Basin Description

The North American Subbasin covers an area of approximately 548 square miles and is located under lands contained in Placer, Sutter, and Sacramento counties. The North American Subbasin is bound on the south by the American River, on the north and west by the Sacramento, Feather, and Bear Rivers, and on the east by the bedrock of the Sierra Nevada foothills. In January 2016, DWR released an updated list of

critically-overdrafted basins, which did not include the North American Subbasin. The North American Subbasin, however, is categorized as a "high priority basin" because there is a large population overlying the basin that relies upon its supplies to meet its potable and raw water needs. The North American Subbasin is not in an overdraft condition and has no adjudicated areas.

The North American Subbasin is stratified into different hydrogeological layers with regional differences in groundwater quality and transmissivity. The stratigraphic succession of geologic formations in the subbasin include, from oldest to youngest: crystalline basement rock, Miocene/Pliocene Volcanics, Older Alluvium of Pliocene and Pleistocene, and Younger Alluvium. Those formations which consist of the main freshwater-bearing aquifer system underlying the CWD service areas include (from oldest to youngest):

- Miocene/Pliocene Volcanics
- Older Alluvium of Pliocene and Pleistocene
- Younger Alluvium

The deepest deposits consist of Miocene and Pliocene Volcanic of the Mehrten Formation. It is composed of black sands, gravels, silts, and clays interbedded with tiff breccia. The thickness ranges from between 200 and 1,200 feet thick. The sand and gravel intervals are found to be highly permeable.

The older alluvium of Pliocene and Pleistocene age is the primary freshwater bearing formation within the North American Subbasin. The older alluvium consists of loosely compacted sands, silts, and gravels. This alluvial unit is exposed between the Sierra Nevada Foothills and the younger alluvium. Thicknesses range from 100 to 650 feet thick and is moderately permeable.

The younger alluvium is a formation of silts and clays that overlies the older alluvium. This alluvium consists of flood basin deposits and stream channel deposits from the nearby Sacramento River. The estimated thickness ranges from zero to 100 feet and may be locally interbedded with stream channel deposits. Due to the small grain sizes of the clays and silts, this layer generally has lower permeability and low well yield. However, sand and gravel zones interbedded in the younger alluvium are highly permeable and commonly have high well yields.

The 2000 Water Forum Agreement help characterize a smaller sub-component of the North American Subbasin as the "North Basin." The North Basin is shown in Figure 3-4 below. The North Basin contains all of the District's service areas discussed in this section.

The District overlies the North Basin. Figure 3-5 shows a close-up view of the location of the District's service areas in Sacramento County in the North Basin.

Figure 3-4: North Basin within the Sacramento Valley – North American Subbasin

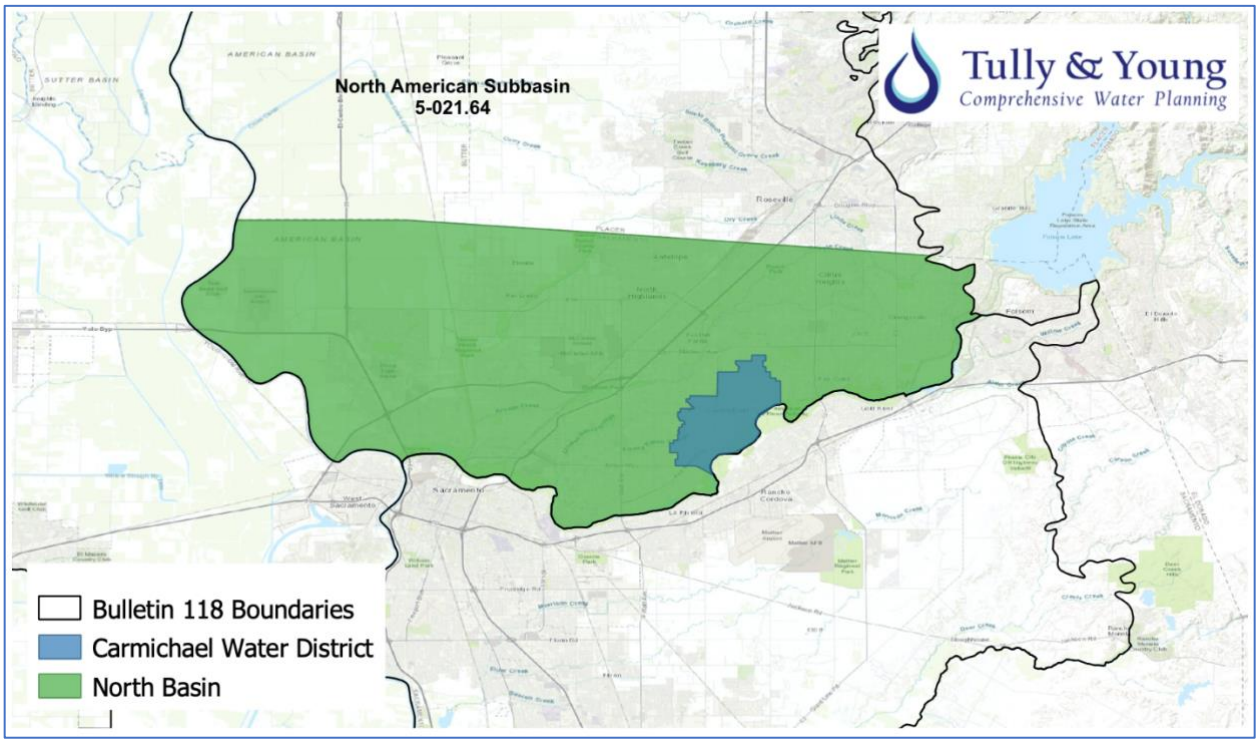
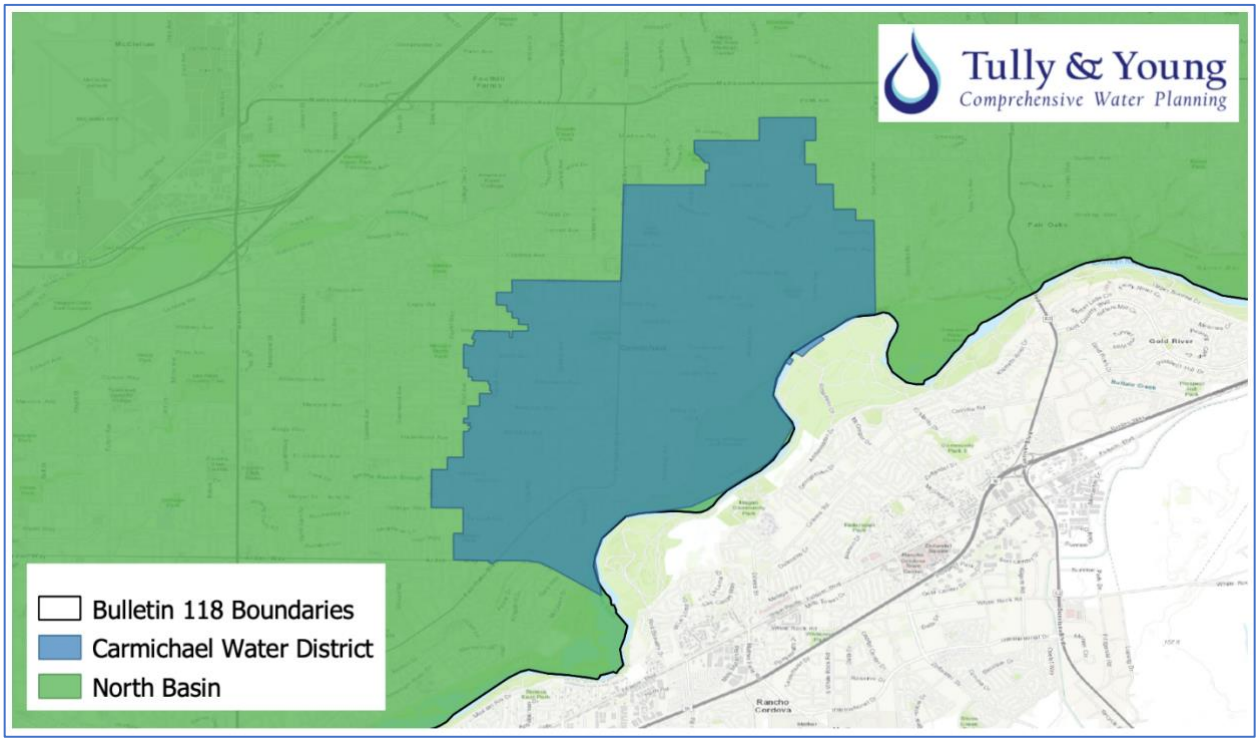


Figure 3-5: Location of District Service Area in North Basin



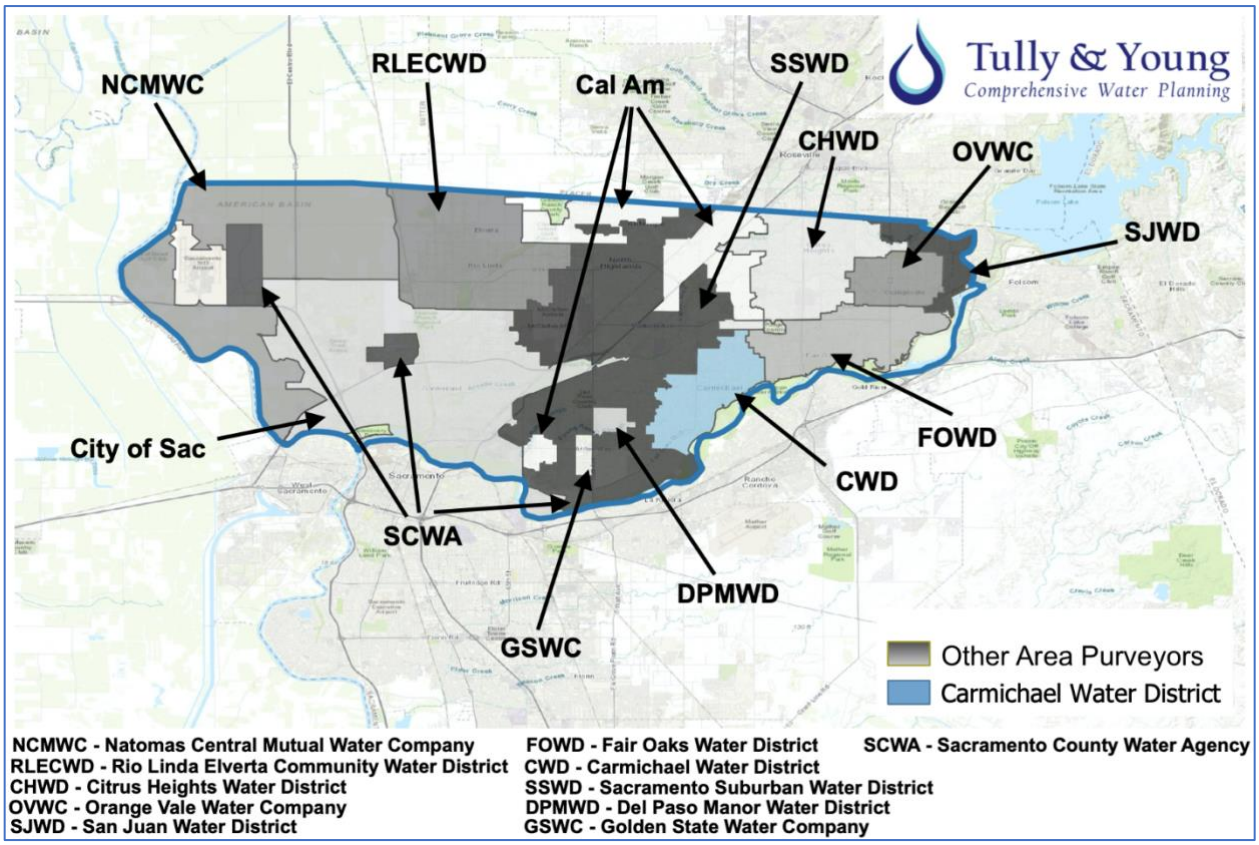
3.2.2 CWD's Groundwater Management

Groundwater is an existing and planned water supply for the District. In average years, the District relies on groundwater to meet about 15 to 30 percent of its total supply. However, in 2014 and 2015, the District relied upon groundwater and groundwater related assets to meet a large portion of its total supply in some months as its surface water sources were entirely curtailed. As such, groundwater is a critical component of the District's overall water supply portfolio. The District uses surface water supplies in lieu of groundwater where possible in order to protect its groundwater supplies for future use and prevent contaminant plume migration associated with the Aerojet facilities in Sacramento County. The District will continue to use groundwater to meet existing and future needs and to handle dry and critically dry conditions as they arise in the future.

3.2.3 Sacramento Groundwater Authority

The SGA, formerly the Sacramento North Area Groundwater Management Authority, was formed as a joint powers authority and charged with the management of the Sacramento region's North Basin. SGA incorporates the service areas of a number of water purveyors, including the District. Figure 3-6 shows the SGA agencies.

Figure 3-6: Sacramento Groundwater Authority Participating Agencies



In 2014, SGA developed a Groundwater Management Plan (GMP) under Assembly Bill 3030 (called an AB 3030 GMP). The 2014 GMP established parameters to maintain the long-term sustainable yield target of 131,000 acre-feet, detailed activities SGA will take to sustainably manage the North Basin, and evaluated groundwater management activities and their effectiveness.

The Sustainable Groundwater Management Act (SGMA) was signed into law in September 2014. SGMA requires development of Groundwater Sustainability Agencies (GSA) and Groundwater Sustainability Plans (GSP) to achieve sustainability in the state's groundwater basins. In 2016, SGA became the exclusive GSA for the North Basin. By January 2022, SGA and the other GSAs in the North American Subbasin must prepare a GSP in compliance with SGMA. However, at the time of preparation for the 2020 UWMP, the primary planning document guiding sustainability in the North Basin subcomponent of the North American Subbasin is SGA's 2014 GMP. As such, the guiding principles in that document govern the District's groundwater planning in the North Basin.

The SGA GMP assessed the groundwater levels in the North Basin. For about 40-50 years up through the mid-1990s, groundwater production in the North Basin resulted in a general lowering of the groundwater levels near its center. The cone of depression coalesced around an area to the west of the District's service area and the elevation settled at a low of about 40 feet below mean sea level. Since the mid-1990s, groundwater elevations have stabilized throughout the area overlying the regional cone of depression and, in some cases, groundwater elevations are continuing to rise. Recent regional conjunctive use activities, like those undertaken by the District, have resulted in providing new surface water supplies to water purveyors historically producing groundwater in the central portion of the North Basin. Although water purveyors in the region will rely more heavily on groundwater during dry periods, the net increase in available surface water have resulted in a maintained or improved amount of groundwater in storage in the basin over the long term. The average safe yield of the groundwater basin is estimated by SGA to be 131,000 af/yr.

Percolating Groundwater

The District has the right to pump naturally occurring percolating groundwater from the water-bearing formations in the North Basin. That right is only limited by the general terms identified in the SGA GMP. Specifically, the District is utilizing a groundwater appropriation right to extract groundwater and deliver it to water users within its service area. An appropriative groundwater right, however, is generally junior in priority to an overlying groundwater right unless the appropriator has established a prescriptive right against the overlying user. An overlying groundwater right allows for the extraction and use of groundwater from the underground formations only for uses upon lands overlying the groundwater basin that the extractor actually owns. Generally, in times of shortage, an overlying groundwater user can theoretically use California judicial law to stop a groundwater appropriator from pumping and delivering any water whatsoever to non- overlying end users. Because the majority of groundwater users in the North Basin are municipal users and the groundwater basin is generally stabilized, considerations about the priority of groundwater pumping are not impactful to the 2020 UWMP.

Banked Groundwater

The SGA also developed rules and regulations for banking groundwater within the North Basin. These rules and regulations are collectively called the Groundwater Accounting Framework (Framework). The Framework recognizes investments by the SGA member agencies in the development of conjunctive use programs and supports groundwater banking programs that enhance the long-term sustainability of the groundwater basin.

According to the parameters of the Framework, the District has been pumping less naturally occurring percolating groundwater each year since 1998. The District has a targeted groundwater pumping allocation of 12,000 af/yr in accordance with the Water Forum Agreement. The District has pumped a portion of this annual allocation but has reduced its overall pumping by nearly 5,000 acre-feet per year. SGA has also assigned a "basin sustainability goal" to each purveyor which is an annual production quantity that represents the difference between the quantity each Central Unit purveyor was producing prior to SGA's formation (1993-1997), and that purveyor's sustainable pumping estimate. The District's basin sustainability goal is 870 af/yr. This reduction in groundwater use was largely made possible through the completion of the Bajamont WTP in 2001. As a result of the District's implementation of proactive conjunctive use, the District has banked over 50,000 acre-feet of groundwater in the basin since 1998. This water may now be available as a District resource and buffer for dry year access, or for selling credits to other interested parties in the basin that could benefit from the stored supply.

Banked groundwater has a special meaning in the context of California law. Water that could have otherwise been taken but was not taken and instead preserved for future use is treated as a beneficial use of water. As such, the banked water gains a more senior water right priority even above those of overlying groundwater users. The reason for this designation is that the forbearance actions of the potential user makes the water available in the basin. Therefore, the water – or at least a portion of it – is banked and protected for that user for future use. The SGA Framework further solidifies this principle by applying an agreement among participating agencies about the disposition of banked water in the basin.

3.2.3 Groundwater Production

The District operates five groundwater production wells, with four of these wells providing the primary groundwater supply for daily peak demand management, and one well serving as backup that is activated when necessary to maintain adequate system pressure. All 4 active wells were activated during the curtailment conditions in 2014 and 2015. The reasonable groundwater production capacity and last ten years of production are provided in Table 3-11.

Table 3-11: District Groundwater Well Production 2010-2020 (acre-feet)

Year	Groundwater	Used
2010	6,646	1,518
2011	6,646	1,469
2012	6,646	1,580
2013	6,646	2,031
2014	6,646	3,417
2015	6,646	4,712
2016	6,646	1,189
2017	6,646	2,384
2018	6,646	2,718
2019	6,646	2,165
2020	6,646	3,496

The District produces groundwater conjunctively with surface water to meet customer demands. As shown in Table 3-11, for the past ten years, the District has produced between about 1,200 and 4,700 af/yr. While recent normal year values show a declining trend in groundwater production as part of planned in lieu surface water use, the District will continue to rely on its available groundwater resources. For purposes of the 2020 UWMP, the planned groundwater supply available to the District will be 6,646 af/yr. The District will continue, however, to produce groundwater in a conjunctive use with its surface water supplies. In the near future, the District anticipates expanding its groundwater extraction capability in the event of any limitation on its ability to use its surface water supplies.

Table 3-12 depicts the District's projected groundwater supplies in a normal, single dry, and five consecutive dry years.

Table 3-12: Projected Groundwater Supplies from 2021 through 2025 (acre-feet)

Groundwater	Year Type	Amount
Normal		8,066
Single Dry Year		8,066
Multi-Year Drought	2021	8,066
	2022	8,066
	2023	11,291
	2024	11,291
	2025	11,291

Table 3-13 depicts the District's projected groundwater supplies from 2025 through 2045 in normal, single dry, and five consecutive dry years.

Table 3-13: Projected Groundwater Supplies 2025-2045 (acre-feet)

Groundwater	Year Type	2025	2030	2035	2040	2045
	Normal	11,291	11,291	11,291	11,291	11,291
	Single Dry Year	11,291	11,291	11,291	11,291	11,291
Multi-Year Drought	Year 1	11,291	11,291	11,291	11,291	11,291
	Year 2	11,291	11,291	11,291	11,291	11,291
	Year 3	11,291	11,291	11,291	11,291	11,291
	Year 4	11,291	11,291	11,291	11,291	11,291
	Year 5	11,291	11,291	11,291	11,291	11,291

3.2.4 Groundwater Extraction and Treatment

Aerojet groundwater contamination has had an important impact on the District's overall water management strategy. The purposes of this section are to elaborate on that history and to describe the current activities between the District and Aerojet that impact the District's water management strategies.

In February 2004, Aerojet detected N-Nitrosodimethylamine (NDMA) in a monitoring well located near Grant and Hollister avenues in Carmichael, California. NDMA is a byproduct of combustion from solid rocket fuel and is believed to be a possible carcinogen. Since 2004, Aerojet has installed seven monitoring wells to identify the extent of the contaminant plume that is migrating north from its rocket and chemical manufacturing facility located about eight miles east of the District service area. Several of the monitoring wells have detected NDMA in concentrations ranging from 2 parts per trillion (ppt) to a high of 93 ppt.

In July 2005, the District signed a Memorandum of Understanding (MOU) to support Aerojet for its groundwater remediation project. The goal of the MOU is to prevent groundwater contaminant plumes from reaching the District's groundwater supplies at no cost to the District's customers. The District supports Aerojet's effort to capture and remediate groundwater.

Since 2007 Aerojet has been treating and discharging remediated water within the District's water service area for contaminant plume containment. In this 2020 UWMP reporting period, approximately 2.3 cfs (approximately 1,680 af/yr) of remediated water was continuously treated within District's service area at the GET L-A (Ancil Hoffman) and GET L-B (Bajamont) facilities. Since 2020, Aerojet reached its groundwater clean-up goals for GET L-A and is not actively operating GET L-A. A portion of the GET L-A supply has been utilized for irrigation of Ancil Hoffman Golf Course and the remaining supply is discharged to the American River during irrigation periods. The entire flow is being discharged to the American River during the year when irrigation is not necessary. More recently, the District has opted to close the GET LA facility rather than pay for the operation of that system. The District retains the option to reactivate that supply facility at any time.

The District accounts for the use of this water asset within its service area in reporting water use under its water right licenses and permit, as the wells will be transferred to the District once the remediation efforts are completed. Specifically, under Water Code Section 1010, use of remediated, recycled and reclaimed water supplies within a water purveyor's service area counts towards the beneficial use

calculation of the foregone water sources that would have been used instead. In other words, since the District has used the remediated water at Ancil Hoffman in lieu of its otherwise available treated water sources, Water Code Section 1010 protects the District's other surface water and groundwater supplies for other beneficial uses desired by the District. Continually accounting for remediated, recycled, or reclaimed water uses within the District's service area is a critical step in protecting and preserving the District's water assets for future needs.

3.3 Desalination

The District does not have or plan to develop desalinated water as a water supply source.

3.4 Transfer and Exchange Opportunities

The purpose of this section is to describe the opportunities for exchanges or transfers of water on a short-term or long-term basis. Water exchanges and transfers are an integral part of the District's comprehensive water management strategy. This section will break down the water exchange and transfer discussion into three sections: (1) Existing transactions; (2) Transfer and Exchange Objectives; and (3) Mechanisms to meet the Objectives. The District anticipates engaging in a robust transfer effort over the next several years.

3.4.1 Existing Water Transactions

Aerojet Transaction

The District purchased groundwater from Aerojet in 2014 and 2015 to ameliorate its supply deficit caused by the severe droughts. In 2014, the District purchased 2,501 acre- feet, and in 2015, purchased 2,169 acre-feet. The District used these water supplies to offset the curtailment order applicable to its three appropriative surface water rights on the American River. A portion of this water is now under contract with GSWC and SCWA.

Under its existing water remediation program, Aerojet discharged remediated water from its GET facilities into the American River. Per a statement from the SWRCB, this groundwater is hydrologically disconnected from the American River when it is extracted and treated. As such, the water is deemed "foreign" to the watershed. The discharge of this foreign source of water then allows that water to be made available for other users. The District diverted the foreign groundwater that was discharged to the American River into its Bajamont WTP and delivered that water to its customers.

Groundwater Substitution Transfers

The District engaged in groundwater substitution transfers in 2018 and 2020. The District released available surface water supplies available under its three surface water rights and used groundwater in lieu of the supplies in its service area. In 2020, the District also imported groundwater supplies from Fair Oaks Water District to augment the transferable supplies available. These groundwater substitution transfers provide opportunities for the District to benefit from its conjunctive use actions and provide supplies to areas within California that are experiencing extreme water shortages.

3.4.2 Water Exchange and Transfer Objectives

The District has three primary objectives in assessing water exchange and transfer opportunities: (1) improved dry year reliability; (2) managing assets for local, regional, and statewide benefits; and (3) a viable supply option for growth. The District considers these objectives as both a water provider that could make water available for other users as well as a water receiver in obtaining water supplies for certain beneficial purposes.

The District would consider water transfer opportunities in the context of improved dry year reliability. There are many unknowns related to dry year reliability that may affect the District in the future including: (1) Hydrological changes related to climate change, (2) The WFA implementation, (3) Groundwater contamination, (4) Regulatory-induced shortage issues associated with existing water supplies, and (5) Future Delta water quality standards. The District may pursue water transfers and exchanges to address these potential issues should they arise.

The District may also pursue water transfers and exchanges in the interest of managing its water assets in order to provide local, regional and statewide benefits. Delta water supply issues, climate change, fisheries issues, and aging infrastructure may all impact numerous purveyors' water management planning activities throughout the American River Watershed region. The District continues to pursue opportunities to improve statewide, regional and local water planning objectives through water transfers and exchanges and has developed these opportunities through regional collaboration efforts.

The District could provide significant surface water supplies through a conservation-based transfer, reclaimed water substitution transfer, and groundwater substitution transfer. The District has significant groundwater pumping capabilities and access to additional groundwater and foreign water supplies in other areas. In 2018 and again in 2020, the District worked with its regional partners to develop a groundwater substitution transfer. The District transferred its licensed water right and substituted groundwater assets for the transferred volume.

The District may consider water transfers and exchanges as a viable water supply option for potential new growth within or outside of its existing boundaries that has not been contemplated in the planning horizon presented in this UWMP. Although the District does not intend to expand its service area or provide any permanent supplies outside its service area, in the event such a potential action were to happen or unforeseen significant increased industrial development occurs with the service area (due to high water using industries) the District may consider entering alternative water exchange or transfer arrangements.

3.4.3 Mechanisms to Meet Objectives

There are numerous mechanisms that may be used to meet the District's water transfer objectives, as described previously. This section discusses some of the mechanisms that may be available to meet the District's exchange and transfer objectives.

The District is undertaking aggressive activities to meet water conservation objectives. These conservation activities assessing infrastructure, and end-user water conveyance and use. All water supplies conserved through the District's efforts will be retained by the District and potentially made available for alternative

uses as provided under California Water Code section 1011. The conservation actions demonstrate that the District can make water available for this type of transaction.

The District is actively engaged in conjunctive use activities that protect its water assets under Water Code section 1011.5. These conjunctive use activities allow the District to manage its surface water groundwater supplies to make water supplies available for alternative uses. The District is pursuing groundwater banking and storage arrangements in the context of regional cooperation and SGA's water management activities. These banking and storage opportunities have been developed in order to flexibly and reliably manage the District's entire water supply portfolio for beneficial purposes within and outside of its service area. The District has demonstrated its ability to substitute groundwater assets for surface water assets and will have the opportunity to engage in this sort of transaction with willing buyers in the future.

The District may manage water to meet the Water Forum objectives. Such management may include engaging in exchange arrangements in order to meet Lower American River flow objectives for other water purveyors, provide water to those purveyors who are obligated to meet those objectives, or preserve storage at Folsom Dam. Such short-term arrangements may also include controlling water below the confluence of the American River and the Sacramento River and applying that water to other beneficial uses. In addition, the District may also decide to leave its water assets instream and not deliver them for other consumptive uses so that the water supplies benefit environmental purposes. Such purposes may include fishery propagation, fish flows, and pulse flows to meet fish life- stage needs.

The District has and will continue to work with regional purveyors and others to assess conveyance and wheeling arrangements that may impact water transfer and exchange opportunities. Such wheeling and conveyance arrangements may include delivering water to regional purveyors who may then use or exchange water assets for later use in the District boundaries. Such conveyance and wheeling arrangements may improve water supply reliability and have economic advantages.

3.5 Recycled Water Opportunities

The County, through Sacramento Regional County Sanitation District (SRCSD), treats the wastewater generated within the County at a regional wastewater treatment plant located 15 miles south of the District in the City of Elk Grove. SRCSD currently has the capacity to process 3 mgd (future expansion is permitted up to 10 mgd) of recycled water. The current water recycling program is a partnership between SRCSD and the Sacramento County Water Agency (SCWA).

SRCSD is investigating new water recycling opportunities and coordinates with water purveyors within the County. Part of this effort includes identifying the most cost- effective locations to treat wastewater and supply recycled water. Treatment could be at the existing water recycling plant, a new facility (satellite facility) closer to the user, or possibly both. In its effort to support the use of recycled water, the District will consider participating in the SRCSD's future program should a facility or distribution system become available near the District's customers.

The District will also continue to work with SRCSD to define potential intra-regional or extra-regional uses for the treated wastewater that SRCSD produces. SRCSD is actively investigating such opportunities, which

may include delivery of treated wastewater to a variety of destinations. These future destinations may also be considered part of the District's efforts to recycle water even though the recycled water deliveries may be made to areas outside the District's service area.

3.6 Water Quality

The District continually monitors the water quality within its system. The District treats the water derived from the American River and groundwater systems with appropriate treatment actions that meet all state and federal guidelines. Table 3-14 below shows the 2020 water quality data to be published in the consumer confidence report.

Table 3-14: Water Quality

Water Quality Standards	Public Health Goal	Maximum Contamination Level	Surface Water Average	Groundwater Range	Groundwater Average
Primary Standards					
Turbidity (NTU)	n/a	TT	0.02	N/D-1.4	0.42
Gross Alpha (pCi/L)	0	15	ND	N/D-2.21	0.94
Uranium (pCi/L)	0.43	20	ND	N/D-3.9	0.1
Barium (ppm)	2	1	ND	N/D-.12	0.07
Nitrate (ppm)	10	10	ND	.56-3.6	1.6
Tetrachloroethylene (PCE) (ppb)	0.06	5	ND	N/D-3.3	1.5
Secondary Standards					
Total Dissolved Solids (ppm)	n/a	1000	47	140-310	205
Specific Conductance (micromhos)	n/a	1600	73	150-420	263
Chloride (ppm)	n/a	500	2.6	4.1-33	12
Manganese (ppb)	n/a	50	ND	ND-11	3
Sulfate (ppm)	n/a	500	2.1	4.4-17	9.0
Other Constituents					
Sodium (ppm)	n/a	n/a	2.4	6.8-21	12
Calcium (ppm)	n/a	n/a	5.7	12-36	22
Hardness (ppm)	n/a	n/a	21	63-170	109
Magnesium (ppm)	n/a	n/a	1.9	7.8-19	13
Chlorine Residual (ppm)	n/a	n/a	.30-1.17		0.86
TTHM (ppb)	n/a	80	ND-27		12
HAA5 (ppb)	n/a	60	ND-12		6
Total Organic Carbon (ppm)	n/a	TT	n/a		1

Legend:

N/D = Analyzed; Non Detected
NTU = Nephelometric Turbidity Unit
PCi/l = Picocuries per Liter
N/A = Not Applicable
PPM = Parts Per Million
MRDL = Maximum Residual Disinfection Level
N/S = No Standard
TT = Treatment Technique

3.6 Current and Projected Water Supplies

The current and projected water supplies available to the District are shown in the integrated water supply assessment in Table 3-15 shows the total water supplies available to the District on a Monthly timestep and Table 3-16 breaks down each supply on a monthly timestep.

Table 3-15: CWD's Monthly Water Supply Summary (acre-feet)

		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Normal Year		3,098	3,032	3,098	3,076	3,710	3,688	3,710	3,710	3,688	3,710	3,076	3,098	40,695
Single Dry Year		3,098	3,032	3,098	3,076	685	663	685	685	663	685	3,076	3,098	22,546
Multi-Year Drought	2021	3,098	3,032	3,098	3,076	3,710	3,688	3,710	3,710	3,688	3,710	3,076	3,098	40,695
	2022	3,098	3,032	3,098	3,076	685	663	685	685	663	685	3,076	3,098	22,546
	2023	3,372	3,279	3,372	3,341	959	928	959	959	928	959	3,341	3,372	25,771
	2024	3,372	3,279	3,372	3,341	3,984	3,953	3,984	3,984	3,953	3,984	3,341	3,372	43,920
	2025	3,372	3,279	3,372	3,341	3,984	3,953	3,984	3,984	3,953	3,984	3,341	3,372	43,920

Table 3-16: CWD's Monthly Water Supplies For Each Water Asset (values in acre-feet)

		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Source 1:		License 1387 (15 cfs diversion) monthly max is 905 AF)												
Normal Year		905	905	905	905	905	905	905	905	905	905	905	905	10,860
Single Dry Year		905	905	905	905							905	905	5,430
Multi-Year Drought	2021	905	905	905	905	905	905	905	905	905	905	905	905	10,860
	2022	905	905	905	905							905	905	5,430
	2023	905	905	905	905							905	905	5,430
	2024	905	905	905	905	905	905	905	905	905	905	905	905	10,860
	2025	905	905	905	905	905	905	905	905	905	905	905	905	10,860
Source 2:		License 8731 (10 cfs from May 1 to Nov 1												
Normal Year						612	612	612	612	612	612			3,669
Single Dry Year														0
Multi-Year Drought	2021					612	612	612	612	612	612			3,669
	2022													0
	2023													0
	2024					612	612	612	612	612	612			3,669
	2025					612	612	612	612	612	612			3,669
Source 3:		Permit 7356 (25 cfs from Jan-Dec)												
Normal Year		1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	18,100
Single Dry Year		1,508	1,508	1,508	1,508							1,508	1,508	9,050
Multi-Year Drought	2021	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	18,100
	2022	1,508	1,508	1,508	1,508							1,508	1,508	9,050
	2023	1,508	1,508	1,508	1,508							1,508	1,508	9,050
	2024	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	18,100
	2025	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	18,100
Source 4:		Groundwater Supplies												
Normal Year		685	619	685	663	685	663	685	685	663	685	663	685	8,066
Single Dry Year		685	619	685	663	685	663	685	685	663	685	663	685	8,066
Multi-Year Drought	2021	685	619	685	663	685	663	685	685	663	685	663	685	8,066
	2022	685	619	685	663	685	663	685	685	663	685	663	685	8,066
	2023	959	866	959	928	959	928	959	959	928	959	928	959	11,291
	2024	959	866	959	928	959	928	959	959	928	959	928	959	11,291
	2025	959	866	959	928	959	928	959	959	928	959	928	959	11,291

Carmichael Water District has a significant long-term volume of water to meet its long-term water supply needs. Although the monthly vulnerability exists in the short-term water supply assessment, this 2020 UWMP assumes that the District will have resolved this issue by 2025 with additional groundwater capacities. The District plans to drill new wells and/or rehabilitate its backup supply well(s) as part of its regular water sources. As such, Table 3-17 depicts the District's long-term water supply reliability.

Table 3-17: CWD Water Supply Available 2025-2045 (acre-feet)

Total Supply		2025	2030	2035	2040	2045 (opt)
Normal		43,920	43,920	43,920	43,920	43,920
Single Dry Year		28,788	28,788	28,788	28,788	28,788
Multi-Year Drought	Year 1	43,920	43,920	43,920	43,920	43,920
	Year 2	25,771	25,771	25,771	25,771	25,771
	Year 3	25,771	25,771	25,771	25,771	25,771
	Year 4	43,920	43,920	43,920	43,920	43,920
	Year 5	43,920	43,920	43,920	43,920	43,920

Chapter 4
Water Use

Understanding water use characteristics is essential to enable the District to reliably and cost-effectively manage its water supplies to continue to meet customer needs. This chapter characterizes the District's retail customer water needs – current and forecast over the next few decades. Characteristics such as how water uses vary among different land use classifications, throughout the year, and under differing hydrologic conditions, all help with that understanding.

A thorough characterization and analysis provides a realistic prediction of future water use based upon the District's past and current water use, in addition to considerations of anticipated growth, new regulations, changing climate conditions and trends in customer water use behaviors. A thorough analysis examines each water use sector for a variety of factors, then aggregates the information into a comprehensive projection of customer water use that becomes the foundation for integration with the District's water supplies (see Chapter 3) to assess long-term water system reliability (see Chapter 5).

Several legislative changes were enacted since the District completed its 2015 UWMP. The new requirements must be addressed in the 2020 UWMP in addition to completing requirements from the prior statutory language. While there have been many changes, the critically important items the District must address are highlighted below:

- Provide quantified distribution system losses for each of the 5 preceding years. [CWC 10631(d)(3)(A) and (C)]
- Include a drought risk assessment (DRA) for a drought period that lasts five consecutive water years, starting from the year following the assessment, which would be 2021 for this round of UWMPs. The DRA requires a comparison of water supplies with total projected water use. Therefore, the District must produce a projected water use for the years 2021 through 2025 as part of the water use projections up to 2045. [CWC 10635(b)]
- Conduct an annual water supply and demand assessment on or before July 1 of each year (following adoption of its 2020 UWMP) where the annual assessment includes current year unconstrained demand. The District will consider "unconstrained demand" as the expected water use in the upcoming year, based on recent water use, before any projected response actions it may trigger under its Water Shortage Contingency Plan (see Chapter 6). [CWC 10632.1]

This section is organized as follows:

- Current Customer Water Use – This subsection presents data reflecting the District's residential and non-residential customers for 2016 through 2019 as well as the actual 2020 water use, and presents the District's distribution system losses.
- Compliance with 2020 Urban Water Use Target – This subsection documents the derivation of the 2020 GPCD value and comparison to the 2020 GPCD target.
- Demand Management Measures – This subsection provides a narrative description of water demand management measures implemented by the District over the past five years, and describes the District's planned measures for the foreseeable future.
- Forecasting Customer Use – This subsection presents the derivation and results of future water use forecasts for potable and non-potable water within the District's service area, including land-use classifications, unit demand factors, and estimation of distribution system losses. This subsection also estimates the variations in customer water use the District should expect during years with low rainfall as well as discusses longer-term climate change considerations.
- Forecasting Water Use for DRA and Annual Assessment – This subsection focuses on the subset of the customer water use forecast that is necessary for completing the 5-year Drought Risk Assessment (DRA) and defining the "unconstrained demand" for purposes of the District's annual water supply and demand assessment.
- Projecting Disadvantaged Community Water Use – This subsection presents the estimated water use necessary to meet lower income households, pursuant to California Water Code 10631.1.

4.1 Current Customer Water Use

As described in Chapter 2, the District has been serving potable water to about 11,700 customer connections for the past several years. Under normal operations, the majority of the water supplied to its customers is drawn from the American River, treated at the water treatment plant and delivered through an array of pipelines and turnouts (see Figure 2-6). The current customers, their recent and expected water use trends, and the District's on-going demand management efforts targeting these customers provide a foundational basis for this UWMP's water use forecast to 2045.

Furthermore, the actual water use in 2020 is the basis for determining the District's compliance with its 2020 gallons per capita per day (GPCD) target established in its 2015 UWMP. This subsection presents this relevant information.

4.1.1 Customer Water Use: 2016 to 2019

Recent customer water use can help the District understand water use trends, effects of temporary use restrictions imposed during the most recent prolonged drought and recovery from such temporary restrictions, effects of long-term demand management measures, and other pertinent water use factors relevant to its forecast of future water use. Water Code Section 10631(d)(1) also requires the District to quantify past customer water use.[19]

[19] California Water Code Section 10631(d)(1)

Table 4-1 presents the District's past potable water use by customer classification for 2016 through 2019. While the District tracks connections and use under four primary categories (see Table 2-1), it records water use by only two categories:

- Single-Family Residential
- Multi-Family Residential
- Commercial/Institutional (CII)
- Landscape Irrigation

Table 4-1: Customer Water Use: 2016 to 2019 (acre-feet)

	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Single-Family Residential	2016	170	155	157	223	282	469	645	732	735	513	317	202	4,600
	2017	179	167	167	176	287	530	720	786	783	613	466	252	5,125
	2018	207	192	190	199	353	490	662	752	712	578	520	303	5,159
	2019	190	184	148	186	309	450	631	750	747	613	489	339	5,038
Multi-Family Residential	2016	102	63	98	69	106	85	156	115	170	94	114	72	1,244
	2017	99	68	96	62	112	102	172	129	177	103	136	68	1,326
	2018	112	66	105	71	121	91	165	123	177	108	159	74	1,371
	2019	111	66	101	64	121	84	167	119	177	108	145	76	1,338
Commercial Institutional	2016	33	29	34	32	41	75	62	113	82	87	49	37	673
	2017	36	32	35	33	51	104	96	152	93	177	64	53	927
	2018	39	39	38	40	48	118	89	199	90	135	73	68	976
	2019	40	34	34	31	49	81	81	182	96	147	68	64	906
Landscape Irrigation	2016	1	1	1	3	6	25	24	51	30	24	9	2	176
	2017	0	0	0	0	4	6	14	15	17	10	9	1	76
	2018	1	1	1	1	4	8	13	13	14	10	11	3	80
	2019	1	0	0	1	4	7	13	11	17	9	11	4	79
Total Metered Deliveries	2016	305	247	291	327	436	653	886	1,011	1,016	718	489	313	6,694
	2017	315	268	299	272	454	741	1,002	1,082	1,070	902	675	375	7,454
	2018	359	298	334	311	526	707	929	1,086	993	831	763	448	7,586
	2019	341	285	284	281	483	623	892	1,062	1,037	877	713	483	7,361

This historic data also provides insight into the relative ratio of differing customer classifications to each other as well as seasonal variations. For instance, use across nearly all classifications was relatively consistent for 2017 through 2019. Yet, all classifications were higher than 2016, showing a likely continued recovery after conservation mandates imposed in 2014 and 2015 began to be eased in 2016. Additionally, the Landscape Irrigation classification had a significant drop from 2016 to the 2017 through 2019 period as a result of irrigation at the Ancil Hoffman Golf Course being met with remediated groundwater produced on site by Aerojet. As discussed later, the golf course was again irrigated with the District's potable supplies in 2020 and will continue so into the future.

Looking closer at the single-family residential classification illustrates two important characteristics: (1) it represents about 70% of the annual water use, and (2) it has summer demands that are nearly four times the monthly volume needed in winter months. When combined with multi-family use, the residential classification represents over 85% of the District's annual water use, a value that generally trends from month-to-month, also.

4.1.2 Customer Use in 2020

Customers served by the District are metered at their connection to the District's potable water distribution system. These metered values are collected periodically for each customer account and summarized into annual reports prepared by the District and for reporting to the SWRCB Division of Drinking Water and to DWR.[20] The 2020 actual customer use presented in Table 4-2 represents the summarized delivery to all the District's customers. It does not, however, include the distribution system losses inherent in a pressurized water delivery system that occur during the District's efforts to treat, store and route the water throughout the extensive distribution system to each customer's connection.

Table 4-2: Total District Customer Use: 2020 (acre-feet)

Use Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Single-family Residential	241	185	233	285	399	588	756	764	785	662	508	323	5,727
Multi-family Residential	119	66	103	80	144	103	185	117	192	111	149	76	1,444
Commercial/ Institutional	46	33	39	37	47	82	77	122	79	95	56	49	761
Landscape Irrigation	3	1	3	6	9	39	32	73	32	42	16	13	269
Customer Total	409	285	378	408	599	812	1,050	1,075	1,088	909	729	460	8,202

Further, comparing to the total values in Table 4-1, the 2020 annual customer use is about 12% higher than the 2017 through 2019 average use, which was fairly consistent over those years. Comparing the specific customer classifications, the 2020 data displays three unique circumstances: (1) the increase was primarily in the residential sector, (2) residential use in March through May was 30% to 45% higher than during prior years, and (3) commercial use decreased by nearly 20%.

While new customers in 2020 could account for some of the increase, the District only added 9 additional accounts between 2019 and 2020.[21] Rather, the higher-than-average use, especially starting in March, is likely due to the pandemic that dominated 2020 and the multiple advisories and even government-imposed restrictions that resulted in many people working from, learning from, or simply staying at

[20] The annual SWRCB report is referred to as the 'electronic Annual Report' or eAR, and the annual DWR report is known as the Public Water System Statistics report.

[21] As shown in Table 2-1, the District added 8 residential customers in 2020.

home.[22] With the corresponding closing of many businesses and schools during this time, the significant drop in Commercial use could also be explained by pandemic advisories and effects.

4.1.3 Existing Distribution System Losses

Distribution system water losses (also known as "real losses") are the physical water losses from the District's water distribution system up to the point of delivery to the customer's system (e.g., up to the residential water meter).

Since 2016, the District has been required to quantify its distribution system losses using the American Water Works Association Method (Title 23 California Code of Regulations Section 638.1 et seq.). An electronic copy of the audit in Excel format is to be submitted to the Department by October 1 of each year for the prior year's estimated system losses, using DWR's online submittal tool pursuant to Code of Regulations Section 638.5. The District's submittals for the last 5 years are shown in Table 4-3. The 2020 estimate has not been officially submitted to DWR as of the drafting of this UWMP but is estimated to be approximately 990 acre-feet over the year, or about 10.7% of the water entering the distribution system.

As can be anticipated given the dynamic functions of a pressurized potable water distribution system, the estimated annual distribution system loss as a percentage of water entering the system will vary year-to-year and month to month. On average, however, the District's distribution system loss represents about 9.2% of the water entering the District's distribution system. This average is conservatively used for purposes of forecasting water use to 2045.

Table 4-3: Distribution System Loss: 2016 through 2020

2016	2017	2018	2019	2020
11.3%	10.5%	7.0%	8.1%	10.7%
			Average =	9.2%

4.2 Compliance with 2020 Urban Water Use Target

Pursuant to California Water Code Section 10608.24(b),[23] the District must demonstrate its 2020 water use met the GPCD target adopted in its 2015 UWMP. As set forth in the 2015 UWMP, the District's 2020 GPCD target was established as 237 GPCD, derived as the "gross water use" divided by the population during a defined baseline period, and reduced pursuant to one of four methods defined under California Water Code Section 10608.20(b). The District's 2020 actual GPCD must use the same methodology to derive "gross water use" for 2020, then divide by the estimated 2020 population presented in Chapter 2.

As presented in the District's 2015 UWMP, gross water was determined to be the total water produced by the District's water treatment plant and wells. This value was 2,994.502 million gallons – or 9,190 acre-feet. This value represents both the customer deliveries shown in Table 4-2 and the distribution system

[22] Monthly weather conditions in 2020, including precipitation and temperature, were within historic ranges shown in Figure 2-2, Figure 2-3, and Figure 2-4, so were unlikely to have a significant influence on single-family water use.

[23] 10608.24. (b) Each urban retail water supplier shall meet its urban water use target by December 31, 2020.

losses recorded in Table 4-3. As shown in Table 2-5, the District's population in 2020 was estimated to be 37,900. This results in a calculated 2020 compliance value of 216 GPCD, which is less than the District's established target. Thus, the District is in compliance with CWC Section 10608.24(b). The compliance calculation parameters are summarized in Table 4-4.

Table 4-4: Demonstration of Compliance with 2020 GPCD Target

2020 Volume into Distribution System =	9,190	acre-feet
Allowable Adjustments	0	acre-feet
2020 Gross Water Use =	9,190	acre-feet
2020 Population =	37,900	people
2020 Actual GPCD =	216	
2020 Target GPCD =	237	
Compliance Achieved?	Yes	

4.3 Demand Management Measures

Pursuant to California Water Code Section 10631(e), the District needs to provide a narrative discussion of the water demand management measures it has implemented, is currently implementing, and plans to implement. The historic and on-going measures can help the District understand the effectiveness on managing existing customer uses so as to help guide refinements, emphasis or augmentation that will help position the District to best meet its undefined, to-be-established water use objective.[24]

To date, the District's overall water management efforts have resulted in significant and long-term water conservation savings. During the 2013 to 2015 drought, the District's residents showed great ability to temporarily reduce water usage and many of the efforts have had long-term viability, providing on-going savings well into the future.

The District's demand management measures are highlighted in this subsection.

4.3.1 Foundational Demand Management Measures

This subsection describes the foundational demand management measures (DMMs) that underpin the District's operations and customer deliveries. These particular DMMs represent adopted ordinances, policies, and long-standing budgeted conservation programs.

Water Waste Prevention Ordinances

Wasteful water is prohibited in the District's service area as recognized in Resolution 06202016-2 as part of its Water Shortage Contingency Plan (WSCP). These fundamental prohibitions align with state-mandated requirements. The WSCP prohibits all users from unreasonable waste and includes graduated

[24] Beginning in 2023, all urban water suppliers will be required to begin reporting their use compared to a "Water Use Objective" that is being established pursuant to the recently enacted California Water Code Section 10609.20.

penalties for waste and/or unreasonable use during all stage declarations. For all conditions, including Normal Water Supply, restrictions on water waste include:

- Unnecessary and wasteful uses of water are prohibited.
- No water runoff from property allowed.
- All water plumbing, fixtures, or heating or cooling devices must not be allowed to leak or discharge. All known leaks must be repaired within seven (7) days or less depending on the severity of the leak.
- Free flowing hoses are prohibited for any use, all hoses must have an automatic shut-off control nozzle capable of completely shutting off the flow of water.
- Car washing must use a bucket and hose with an automatic shut-off control nozzle.
- All pools, spas, decorative or ornamental fountains, ponds and water features must be equipped with a recirculation pump and maintained leak free. Internal and external water leaks must be repaired within seven (7) days or less depending on the severity of the leak.
- All landscapes must be watered during cooler morning or evening hours to reduce evaporation and minimize landscape runoff. No watering allowed between the hours of 10 a.m. and 7 p.m.
- No irrigating turf or ornamental landscapes during and 48 hours following measurable precipitation.

In addition, the District's website also allows for reporting of waste with the "Report Water Waste" link[25], allowing for proactive response and improved management.

The District has implemented this DMM over the planning period (through multiple versions of the WSCP) and will continue to actively manage water waste through 2045.

Metering

All water service connections in the District's service area are metered utilizing an automatic meter reading (AMR) platform. Following the completion of its meter installation program, the District experienced a reduction in demand.[26] The District anticipates transitioning to automated metering infrastructure (AMI) within the next 10-15 years to provide more timely information to customers and for the District's management needs.

Conservation Pricing

The District's water rate structure is set to generate the necessary funds to efficiently operate the District's water system and maintain reliable water supplies. The District uses a single-tier pricing structure for monthly volumes, in addition to a bi-monthly fixed-fee portion. Under normal water supply conditions, this rate structure has effectively reduced customer water use. As of July 1, 2021, the District will be transitioning to monthly billing including a monthly fixed-fee. The District also has a water shortage rate

[25] https://carmichaelwd.org/for-customers/report-water-waste/

[26] Carmichael Water District – Water Shortage Contingency Plan, 2016.

surcharge schedule based on reduction goals for when a water shortage is declared by the District's Board of Directors.[27]

Public Education and Outreach

The District regularly engages its customer base with a number of conservation and demand management outreach programs. Promoting water-wise activities, watering schedules, and educational programs are part of the District's regular outreach efforts. This includes regularly engaging the community through public outreach events and maintaining a water efficiency web page which provides valuable water use reduction resources to the community.

In addition to local public education and outreach programs, the District also participates in a regional public education and outreach program through the Regional Water Authority (RWA). The RWA is a joint powers authority formed in 2001 to promote collaboration on water management and water supply reliability programs in the greater Sacramento, Placer, El Dorado, Yolo and Sutter counties. In collaboration with 19 water provider members and other wastewater, stormwater and energy partners, RWA formed the Water Efficiency Program (WEP) in 2001 to bring cost effectiveness through economies of scale to public education and outreach activities.

The WEP operates on an average annual budget of $530,000 and is supplemented by grant funding. Grants are an important funding resource for the Program. Since 2003, the Program has been awarded $13.2 million in grant funding for public outreach and education as well as a variety of rebate programs, fixture direct install programs, system water loss, individualized customer usage reports, large landscape budgets and more. Of those funds, $3.8 million was awarded between 2016 and 2020.

The main function of the WEP is to develop and distribute public outreach messages to customers in the region by collaborating with its water provider members. The Program distributes these messages on a regional scale through regional media and advertising buys and was honored with the United States Environmental Protection Agency WaterSense Excellence in Education and Outreach Award in 2016. From 2016-2020, the WEP created a series of public outreach campaigns. Below is a summary of each campaign and highlighted achievements.

Following the historic 2015 California drought, the WEP launched the "Rethink Your Yard" Campaign in 2016 with a focus on prioritizing landscape watering, putting trees first and transitioning thirsty lawn and landscaping to beautiful, low water use, River-Friendly landscapes. The Program advertised the campaign through online ads, social media, commercial radio, Raley Field (local baseball stadium) and local billboards. The campaign featured local homeowners with their newly redesigned yards on billboards throughout the region.

The campaign launched in 2017 focused on encouraging customers to understand and deliver the amount of water their landscape really needs and to make permanent equipment changes to improve efficiency such as installing weather-based irrigation controllers, more efficient sprinklers and drip irrigation. The

[27] Rate schedule is available for viewing here: https://carmichaelwd.org/wp-content/uploads/2021/01/2021-2025-Water-Rate-Schedule.pdf

Program partnered on this messaging with local nurseries through a "Get Growing this Fall" initiative to encourage residents to plant in the fall when days are cooler and plants don't need as much water to establish roots.

From 2018 through 2020, the regional campaign focused on tackling the landscape overwatering problem with a "Check and Save" message encouraging residents to check the soil moisture with a moisture meter before turning on sprinklers. To support this message, the Program provided free moisture meters via an online request form and at events. In 2019, WEP distributed 3,000 moisture meters to customers throughout the region.

These campaigns are implemented through both paid advertising buys and earned media from public service announcements (PSAs). Every year the campaigns can be heard on local radio stations such as Capital Public Radio and online through Google, Facebook and YouTube advertisements. From 2016-2020, the WEP public outreach campaigns produced:

- Radio Advertising (2016-2020)
- - 3,443 radio advertisements ran
- - 17.2 million impressions
- Digital Advertising (Facebook, Google Display Network and Spotify) (2016-2020)
- - 24.3 million impressions
- - 262,900 clicks
- Additional advertising (billboards in 2016)
- - 1.8 million digital advertisements ran
- - 51.6 million impressions
- Public Service Announcements (Television and Radio) (2016-2020)
- - 20 million impressions
- - $570,000 in value had they been purchased as advertising

The Program also continues messaging through its own Facebook page. From 2016-2020, the Program created about 60 Facebook posts a year featuring water saving tips and other relevant information. The WEP hosted several Facebook sweepstake contests including: Tree Hugger in 2016, where participants submitted pictures hugging a tree to raise awareness about the importance of healthy trees and the Under/Over Debate in 2020, where participates were asked to weigh in what is the proper way to hang toilet paper to raise awareness of toilet leaks. The winner of the Under/Over Debate sweepstakes received a case of toilet paper delivered via mail and gift card to a local hardware store.

The Program continues to utilize the public outreach website bewatersmart.info to reach customers throughout the region. The website contains regional and local water provider information on rebates and services, top ways to save, an interactive watering and water waste information map, a water-wise gardening database, recent press releases, the Sacramento Smart Irrigation Scheduler tool, and more.

Educational information and customer services were modified to address the COVID pandemic in 2020 including online water efficiency lessons for kids, a list of nurseries that offered curbside pick-up, virtual water wise house calls, and numerous virtual educational customer workshops. Between 2016 and 2020, the website averaged 96,000 unique visitors per year.

For more targeted outreach, the Program distributed quarterly e-newsletters to participating residents. The e-newsletters are filled with water savings tips, upcoming events and other interesting articles. They are usually timed around changes in the weather to help signal the need for residents to adjust their irrigation systems, such as day light savings coupled with a message to dial back sprinkler systems. The e-newsletter reaches 6,300 households.

Every year the WEP selects 3 public events to attend for the public to interact with local water efficiency staff. This provides an opportunity for the region to communicate its messages in person. Events have included the Sacramento Home & Landscape Show at Cal Expo, Creek Week, Harvest Day, Farm-to-Fork Festival and several Earth Day events. Additionally, RWA, in coordination with participating local water providers, hosts an annual Mulch Mayhem event in which customers can pick up a truck load of free mulch from selected locations throughout the region. All in-person regional events were canceled in 2020 due to the COVID pandemic.

The Program is also very active in communicating to local media outlets such as the Sacramento Bee. Between 2016 and 2020, RWA issued 50 press releases on WEP activities and regionally significant news and participated in nearly 30 radio public affairs interviews. The RWA and the WEP were mentioned in dozens of news articles published by local and regional media outlets both within and outside of the Sacramento region during the same time frame.

To support public outreach messaging and water savings tips, the Program also coordinated several regional rebate programs, which were partially funded by state and federal grants. A variety of rebate options were provided including toilets, clothes washers and irrigation. Collectively these rebates and installations will produce an estimated lifetime (10 years) savings of 6 billion gallons of water and 6.4 million kilowatt hours (kWhs) of energy.

In addition to public outreach, the Program also coordinates school education activities. Since 2012, the Program has hosted the Water Spots Video Contest for high school and middle school students. The WEP provides a new contest theme each year and provides the region's teacher and students with relevant facts and images to help develop 30 second video PSAs. Students submit their videos to RWA who hosts a panel of local celebrities including Monica Woods from ABC 10 to decide on a first, second and third place winner. The top 10 scoring videos are then posted online for public voting to select a "people's choice" winner as well. Both teachers and student receive cash prizes and the winning videos are played at Raley Field during River Cats games and in select movie theaters throughout the region. The winning PSAs are incorporated into the WEP's media activities as well. Past themes include WATER MYTHS BUSTED!, H2o Hero, and Show Off Your Water Smarts. Between 2016 and 2019, 450 videos were submitted (average of 90 videos a year). The 2020 Water Spots Video Contest was canceled due to the COVID pandemic.

Implementation of this DMM is active and ongoing.

Programs to Assess and Manage Distribution System Real Loss

The District's water loss assessment and management program includes annual water audits and an ongoing leak detection and repair. This includes a routine meter calibration and replacement program for all production and distribution meters. The District's activities include:

- Annual water audit and water balance
- Proactive leak identification and repair in the District's distribution system
- Annual leak detection and repair program
- A long term Capital Improvement Program (CIP) that involves annual main line replacement projects

Water Conservation Program Coordination and Staffing Support

The District funds one full time equivalent (FTE) staff to oversee and implement the District's water conservation programs with an annual budget of approximately $80,000. The District also has one additional supporting staff. The conservation budget is used to fund various incentive, conservation, and education programs. The District works with customers, neighboring water suppliers and RWA to promote conservation through public education, water audits, landscape studies to affect water conservation, and monitoring conservation efforts.

4.3.2 Recent DMM Activities

The District has continued to aggressively promote and implement water conservation actions with great success. Since prior to the 2013 to 2016 drought, the District reached remarkable on-going conservation levels through the attentive actions of its citizens. Highlights of the District's recent actions and conservation measures include:

- Operating a booth at several community events, such as the annual Carmichael Founder's Day, providing giveaways and promoting water efficiency.
- Facilitating children's education activities through student programs like the annual Water Efficiency Calendar Art Contest.
- Providing flyers and brochures, updated throughout the year.
- Producing in house videos instructing customers on subjects such as:
  - Locating plumbing leaks
  - How to read water meters
  - How to adjust an irrigation timer
  - How to replace broken sprinkler heads
- Offering incentive programs for residential and CII customers, which include:
  - Home and Landscape water efficiency surveys
  - Smart Irrigation Timer rebate in partnership with RWA
  - Free high efficiency sprinkler head replacements
  - Plumbing Retro Kits

4.3.3 Planned DMM Activities

In addition to ongoing water conservation commitments, the District will continue to evaluate the need for additional programs and actions necessary to achieve water use objectives in compliance with California Water Code Section 10609.20. Resources will be dedicated in the District's budget for demand management activities which will help comply with these future water use objectives. Special consideration will be taken regarding changing urban water use patterns in the service area as well as the configuration of anticipated new residential customers to assure use remains efficient.

4.4 Forecasting Customer Use

Forecasting future water demands begins with an understanding existing customer demands and trends, recognizing the additional customers expected through growth, and considering the factors that will influence the water use of both existing and new customer well into the future – especially factors that directly affect the efficiency of water use.

Pursuant to California Water Code 10610.4(c), an urban water supplier "*shall be required to develop water management plans to actively pursue the efficient use of available supplies*." One challenge from this directive is reflecting how the pursuit of efficient use is best represented in the forecast water uses that are the cornerstone of good planning. As required by the Act, the future water uses of both existing customers and those added over the 25-year planning horizon should reflect the "efficient use" of water.

4.4.1 Representing Current Customer Water Use

Table 4-1 and Table 4-2 provided the actual customer water use for 2016 through 2020 by classification. From this information, an estimate of the representative "current" water use by existing customers has been developed. Knowing that actual use by existing customers varies slightly year-to-year based on a variety of factors (e.g. total rainfall and the timing of spring rain events impacting when landscape irrigation may begin), the recent data provides a basis for estimating current water use. Applying a slight downward adjustment to the 2020 residential customer use data while returning to the 2017 to 2019 average for the commercial customers provides a basis for a proxy that represents "current" water use. This creates a baseline from which to estimate the future use of these existing customers.

Importantly, the 2020 actual use was adjusted in estimating representative "current" water use, since it appears to have been skewed by pandemic conditions during 2020 (see subsection 4.1.2). For purposes of the proxy estimate, the 2020 annual residential actual use was decreased by 5%, and commercial accounts returned to the 2017 to 2019 average. These adjustments to 2020 conditions may be conservatively high for existing customers, but the District also has a desire to conservatively assure long-term water system reliability (see Chapter 5). Monthly patterns

This target total 'current water demand' was then estimated using customer-type demand factors and 2020 connection by classification (see Table 2-1) to generate a comparable estimate. This representative water use for current conditions provides the foundation for estimating the future needs of these existing customers. Table 4-5 provides the representative monthly and annual current water use, including

distribution system losses. Values are rounded to the nearest 10 acre-feet to reflect these are proxy values to assist with forecasting future water use.

Table 4-5: Representative Current Customer Water Use (acre-feet)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Single-family Residential	200	190	180	200	330	520	710	810	790	640	520	320	5,400
Multi-family Residential	110	70	100	70	120	100	170	130	180	110	150	80	1,400
Commercial/ Institutional	40	40	40	40	50	100	90	180	90	160	70	60	950
Landscape Irrigation	0	0	0	10	10	40	30	70	30	40	20	10	275
Customer Total	350	300	320	320	510	760	1,000	1,190	1,090	950	760	470	8,020
System Loss	40	30	30	30	50	80	100	120	110	100	80	50	820
Total Use	390	330	350	350	560	840	1,100	1,310	1,200	1,050	840	520	8,840

4.4.2 Factors Affecting Future Customer Use

There are several factors that affect the forecast of future customer use, ranging from State and local landscape regulations, building code requirements, and other water-use mandates, to changes in the types of housing products being offered. These factors are incorporated into determining appropriate per-dwelling unit or per customer connection water demand values for use in forecasting future water needs. Relevant characteristics of the factors are described here.

Water Conservation Objectives

In 2009, Governor Arnold Schwarzenegger signed Senate Bill No. 7 (SBX7-7), which established a statewide goal of achieving a 20 percent reduction in urban per capita water use by 2020 for urban retail water suppliers.[28] As presented previously, the District has met this mandated target.

Furthermore, the efforts undertaken by the District and its customers to meet these targets, as well as efforts throughout the State by other urban retail suppliers, have changed the availability and use of appliances, fixtures, landscapes and other water using features, through changes or additions to ordinances and/or through a continuing "conservation ethic."

In response to the recent multi-year drought conditions, Governor Brown issued Executive Order B-37-16 in May 2016 entitled "*Making Water Conservation a California Way of Life*." In May 2018, Governor Brown signed into law SB 606 and AB 1668, which imposed additional statutory requirements above and beyond the 20 percent by 2020 target reflected in the 2009 legislation. This is expected to result in continued efforts to increase water use efficiency and ultimately to reduce water demands of existing water users and continue to influence the expected demands of future water users.

[28] California Water Code § 10608.20.

Requirements in California Code

Beginning in January 2010, the California Building Standards Commission adopted the statewide mandatory Green Building Standards Code (hereafter the "CAL Green Code") requiring the installation of water-efficient indoor and outdoor infrastructure for all new projects after January 1, 2011. The CAL Green Code was incorporated as Part 11 into Title 24 of the California Code of Regulations, and was revised in 2013 and in 2016 to address changes to the State's Model Water Efficient Landscape Ordinance ("MWELO") adopted during the drought.[29] Revisions to the CAL Green Code in 2019 modified sections to direct users to MWELO regulations contained in other regulatory sections.[30]

The CAL Green Code applies to the planning, design, operation, construction, use and occupancy of every newly constructed or remodeled building or structure. All new residential and non-residential customers must meet the water use requirements of the CAL Green Code as well as the outdoor requirements described by MWELO. The CAL Green Code's requirements generally manifest through: (1) installation of plumbing fixtures and fittings that meet the 20 percent reduced flow rate specified in the CAL Green Code, or (2) by demonstrating a 20 percent reduction in water use from the building "water use baseline."[31] Future customers are expected to satisfy one of these two requirements through the use of appliances and fixtures such as high-efficiency toilets, faucet aerators, on-demand water heaters, or other fixtures as well as Energy Star and California Energy Commission-approved appliances.

California Model Water Efficient Landscape Ordinance and County Ordinance

The Water Conservation in Landscaping Act was enacted in 2006, and has since been revised and expanded multiple times by DWR resulting in today's MWELO.[32] In response to Governor Brown's executive order dated April 1, 2015, (EO B-29-15), DWR updated the MWELO and the California Water Commission approved the adoption and incorporation of the updated State standards for MWELO on July 15, 2015. MWELO requires a retail water supplier or a county to adopt the provisions of the MWELO or to enact its own provisions equal to or more restrictive than the MWELO provisions. The District uses the State's standard.

The changes included a reduction to 55 percent of reference evapotranspiration rates for the maximum amount of water that may be applied to residential landscapes, and non-residential projects to 45 percent,

[29] The 2016 Triennial Code Adoption Cycle consisted primarily of the MWELO updates adopted in response to the drought. Indoor infrastructure changes were limited to some minor non-residential fixture changes and changes to the voluntary Tier 1 and Tier 2 requirements. Additionally, the Code was updated to match the new Title 20 Appliance Efficiency Regulations.

[30] The 2019 updated sections to direct CAL Green code users to Title 23 of the California Code of Regulations to allow Title 23 to be the sole location of MWELO requirements.

[31] See CAL Green Code. For Residential construction, Section 4.303.1 provides the residential water conservation standard and Table 4.303.2 identifies the infrastructure requirements to meet this standard. Table 4.303.1 and Worksheets WS-1 and WS-2 are to be used in calculating the baseline and the reduced water use if Option 2 is selected. For non-residential construction, Section 5.303.2.3 provides the water conservation standard as well as the baseline and reduced flow rate infrastructure standards. Note that Worksheets WS-1 and WS-2 incorporate both residential and non-residential fixtures, yet the water use is still to be analyzed by "building or structure" as specified in Chapter 1, Section 101.3.

[32] Gov. Code §§ 65591-65599

which effectively reduces the landscape area that can be planted with high water use plants, such a turf. For residential projects, the allowable maximum coverage of high-water use plants is reduced to 25% of the landscaped area (down from 33%). The newly updated MWELO also now applies to new construction with a landscape area greater than 500 square feet (the prior MWELO only applied to landscapes greater than 2,500 square feet).[33] The District reviews all relevant new development for conformance with these standards.

Metering, Volumetric Pricing, and Water Budgets

California Water Code section 525 requires water purveyors to install meters on all new service connections after January 1, 1992. California Water Code Section 527 requires water purveyors to charge for water based upon the actual volume of water delivered if a meter has been installed. This action alone is not expected to substantially reduce water use. However, it is anticipated that the retail billing system will encourage and help maintain reasonable use (e.g. through implementation of a tiered rate structure and/or water budgets), so that individual customer water demands are reasonably not expected to increase over time.

4.4.3 Customer Water Use Forecast

The following subsections detail the assumptions used to forecast customer water use and gross water needs for the District's water service area, separated into the needs of (a) existing water use customers, and (b) new water use customers.

Existing Customer Future Use

To be conservative and assure the analysis of water system reliability is adequate (see Chapter 5), the District is maintaining the annual "current" retail customer potable water use as shown in Table 4-5, a total delivered quantity of about 8,000 acre-feet, with a total production need of about 8,800 acre-feet when considering system losses. Additionally, as recognized with the analysis of 2020 gpcd use, the existing customers have undertaken significant reductions to date even with the elevated use in 2020 resulting from pandemic circumstances.

While these existing customers may undertake a variety of conservation measures – actively through decisions to modify a behavior or a water use, or passively through the purchase of appliances and fixtures that simply use less water – they may also maintain their use as-is. Holding the current use as a constant for all existing customers into the future will provide a conservative number that can be re-evaluated prior to the 2025 UWMP and the compliance with forthcoming water use objectives.[34]

[33] CCR Title 23, Div. 2, Ch. 27, Sec. 490.1.

[34] Per California Water Code Section 10609.20, urban water suppliers shall calculate a water use objective composed of, among other factors, aggregated efficient indoor water use based upon standards of no more than 55 gpcd.

New Customer Future Use

Chapter 2 detailed the District's anticipated new residential and non-residential growth over the UWMP planning horizon. This growth provides the basis for the estimated future customer water needs. The District anticipates these new customer connections will be built in accordance with all applicable building codes including the Cal Green Code discussed previously, and relevant District regulations.

For this UWMP, two distinct customer classifications are anticipated: (1) residential, and (2) non-residential. Residential customers will include a nominal number of single-family dwelling units built under a variety of densities, and a more significant number of multi-family residential dwelling units accompanying mixed-use developments in the Fair Oaks Corridor (see Chapter 2). Non-residential uses are expected to include mostly commercial customers as part of the anticipated mixed-use developments. No additional landscapes, such as parks, are expected as the growth is expected as minor infill along with the mixed-use projects.

Values developed for each distinct land use are based on several sources of information, details of which are provided in the following subsections.

New Residential Customer Water Use

Table 2-6 summarized the District's anticipated new residential growth over the UWMP planning horizon. Table 4-6 presents the relevant growth information.

The District anticipates these new residential elements will be built in accordance with all applicable building codes including the Cal Green Code discussed previously, and relevant District ordinances.

Table 4-6: Anticipated New Residential Units and Commercial Connections[35]

Classification	2025	2030	2035	2040	2045
Single-family Residential	5	10	15	20	25
Multi-family Residential	100	450	900	1,350	1,800
Commercial/Institutional	5	20	40	50	70

For purposes of this UWMP, residential unit water demand factors are described as "the acre-feet of water use annually per dwelling unit" – or acre-feet/dwelling unit ("af/du"). Distinct demand factors are provided for the following residential uses:

- Indoor Residential Use – this category identifies the generally anticipated water use for single-family and multi-family dwelling units.
- Outdoor Residential Use – this category addresses the landscape water demands commonly anticipated for the two primary dwelling unit types.

Residential indoor water demands are estimated using an assumed value of 55 gallons-per person per day, multiplied by the assumed occupancy rates for anticipated residential densities for single-family or

[35] From Table 2-6

multi-family classifications. The assumed per-person rate of 55 gallons per day is derived from California Water Code Section 10609.4(a)(3), which states a value of 55 gallons per capita (i.e., per person) per day ("gpcd") be used for estimating indoor residential use targets, though the value is stated to drop to 50 gpcd by 2030.[36]

Based on this per-capita assumption, the following indoor per-dwelling unit value is assumed for each new residential unit:

- Single-family residential indoor use: 0.21 acre-feet per year based upon an assumed occupancy of 3.39 people per unit (see Chapter 2).
- Multi-family residential indoor use: 0.12 acre-feet per year based upon an assumed occupancy of 2 people per unit (see Chapter 2)

Outdoor single-family residential water use is primarily a factor of lot size and the type and extent of landscaped area. The District's anticipated growth will likely include a range of residential densities (e.g., houses per acre) and therefore an estimated "typical" lot is assumed for purposes of forecasting.

For purposes of this UWMP, the new single-family residential units are anticipated to have a total gross area of 7,000 square-feet, with 3,500 square-feet anticipated to be irrigable (after accounting for the home footprint, driveways, walkways, other hardscapes, and non-irrigated areas). Multi-family units, which typically have shared common landscape areas, are assumed to have 400 square-feet of irrigable area per unit.

Outdoor demands for new residential dwelling units are calculated based on regulations defined under the MWELO. The MWELO provides for determining the Maximum Applied Water Allowance (MAWA) where the maximum is calculated as 55 percent of the reference evapotranspiration for the area for every square foot of landscaped area, resulting in the following equation:

> *MAWA = (ETo)(0.62)(0.55 x LA), where ETo is the reference evapotranspiration in inches per year, and LA is the landscape area in square-feet. 0.62 is a conversion factor to gallons. The resulting value is in "gallons per year."*

A primary factor in this calculation is evapotranspiration ("ET"). The methodology directs the use of ET from a reference crop, such as maintained grass – a value referred to as ETo. For this UWMP, the ETo is 52.6 inches per year (4.4 feet per year).[37]

Using the MAWA equation, outdoor demand factors for each residential lot category are calculated:

- Single-Family Residential – Anticipated single-family dwellings are conservatively assumed to be constructed on lots averaging 7,000 sf, with an average landscape area of 3,500 sf. The resulting outdoor demand factor is forecast to be 0.20 acre-feet per dwelling unit per year.

[36] Water Code Section 10609.4(a) also establishes the indoor residential water use 'standard' to be 52.5 gpcd beginning in 2025 and as low as 50 gpcd by 2030, though the Water Code also provides provisions for the water use target to revert above 50 gpcd. For purposes of this UWMP, the higher value of 55 gpcd is assumed.

[37] ETo is from the CIMIS Station 235 (Verona) available at: https://cimis.water.ca.gov/Default.aspx

- Multi-Family Residential – Anticipated multi-family dwellings will have larger common areas, assumed to equate to 400 sf of landscape area per unit. The resulting outdoor demand factor is forecast to be 0.02 acre-feet per dwelling unit per year.

Combining the assumed indoor and outdoor residential demand factors results in the following estimated use for each new connection:

- Single-Family Residential – 0.21 af/du for indoor plus 0.20 af/du for outdoor combines for an annual demand factor of 0.41 af/du.
- Multi-Family Residential – 0.12 af/du for indoor plus 0.02 af/dur for outdoor combines for an annual demand factor of 0.14 af/du.

New Commercial Customer Water Use Factors

Per-connection demand factors were also estimated for purposes of forecasting the water needs of anticipated new commercial customers. This customer classification represents a wide array of different uses from neighborhood retail centers, to large retail centers, to office and government buildings with a range of actual use per type of commercial service. To reflect this variety, the existing use per-connection is used as a proxy for the expected growth. Based on use data shown in Table 4-1 and connection data shown in Table 2-1, an estimated per-connection value of 2 acre-feet is used for future commercial customers.

4.4.4 Summary of Forecast Water Use

Based upon the estimated water use of the existing and new customers, the District anticipates a minor continued increase in water use over the planning horizon. Table 4-7 presents the resulting customer water use forecast. Notably, this forecast is less than the unusual water use experienced in 2020, which, as explained earlier, appears to be a result of unique circumstances in 2020. Values in the table have been rounded to the nearest 10 acre-feet to recognize the approximate nature of this forecast. This information will be used to evaluate the District's water system reliability in Chapter 5.

Table 4-7: Forecast Future Water Use (acre-feet per year)

Classification		2025	2030	2035	2040	2045
Existing	Single-family Residential	5,400	5,400	5,400	5,400	5,400
	Multi-family Residential	1,400	1,400	1,400	1,400	1,400
	Commercial/Institutional	950	950	950	950	950
	Landscape and Other	275	275	275	275	275
New	Single-family Residential	2	4	6	8	10
	Multi-family Residential	10	60	130	190	250
	Commercial/Institutional	10	40	80	100	140
Customer Water Use Subtotal		8,050	8,130	8,240	8,320	8,430
Distribution System Water Loss		810	820	830	840	850
Total Water Use		8,860	8,950	9,070	9,160	9,280

4.4.5 Adjusting Water Use Forecasts for Single-Dry and Multiple Dry Conditions

The demand forecasts presented in the prior subsection represent expected water needs under normal hydrologic conditions. To credibly forecast potential maximum future water use, the forecasted normal-year water uses must be modified to reflect anticipated increases in demand during drier conditions.

Conservative modifications to the forecasted normal year water use to more likely reflect use conditions during drier and dry years are warranted to help adequately address water service reliability in Chapter 5. For purposes of this UWMP, the following adjustments are made:

- Single dry year: Landscape irrigation needs would increase to reflect the generalized earlier start of the landscape irrigation season due to limited rainfall in the single driest year. Since this increase only applies to the outdoor portion of a customer's forecast use, an adjustment factor of 5% is applied to the total normal-year forecasts to conservatively reflect the expected increase in demand for water for landscaping.
- Multiple dry years: During multiple dry years, demands are also expected to increase similar to the single dry year. For multiple dry year conditions, the single dry year increase of 5% is held in each of the subsequent years. This is representative of an "unconstrained demand" as should be represented when evaluating whether Water Shortage Contingency Plan actions may be warranted.[38]

These values are reflected in tables provided for the Drought Risk Assessment and Annual Reliability Assessment presented in later subsections.

4.4.6 Climate Change Considerations

Including climate change analysis into a water use analysis will assist the District in understanding the potential effects on long-term reliability, which in turn, allows the District to proactively begin planning appropriate responses. For example, hotter and drier weather may lead to an increased demand in landscape irrigation, especially during spring and fall months, increasing the pressure on water supplies that may have availability restrictions during these periods. Chapter 2 provides a more detailed discussion of potential effects of climate change on the District's supplies and customer water needs.

The potential for water needs to be higher is reflected in the consideration of the single dry year increase of 5% that is used for the water service reliability analysis, as discussed previously. Whether the elevated single dry year water forecast becomes more akin to the "normal" demand will become more apparent as the District continues to assess monthly water use trends throughout its service area.

[38] California Water Code Section 10632(a)(2) states water suppliers should use "unconstrained demand" when performing their annual water supply and demand assessment.

4.5 Forecasting Water Use for the DRA and Annual Assessment

The California Legislature created two new UWMP requirements to help suppliers assess and prepare for drought conditions: The Drought Risk Assessment,[39] and the Annual Water Supply and Demand Assessment.[40] These new planning requirements were established in part because of the significant duration of recent California droughts and the predictions about hydrological variability attributable to climate change.

The Drought Risk Assessment (DRA) requires assessing water supply reliability over a five-year period from 2021 to 2025 that examines water supplies, water uses, and the resulting water supply reliability under a reasonable prediction for five consecutive dry years.

As a slight variant, the Annual Water Supply and Demand Assessment (Annual Assessment) undertakes a similar analytical exercise as the DRA but is to focus on actual, and not hypothetical, conditions anticipated for the upcoming water year in which the Annual Assessment is being performed. The previously presented water use forecasts facilitate both of these planning exercises as described in the following subsections.

4.5.1 Projecting Water Use for 5-year Drought Risk Assessment

A critical component of new statutory language for the 2020 UWMP cycle is the requirement to prepare a five-year DRA using a supplier-defined hypothetical drought conditions expected to occur from 2021 through 2025. This drought condition is meant to allow suppliers to test the resiliency of their water supply portfolio and their Water Shortage Contingency Plan actions to meet severe conditions.

DWR recommends that supplier's first estimate expected water use for the next five years without drought conditions (also known as unconstrained demand). In other words, unconstrained demand is water demand absent any water supply restrictions and prior to implementing any short-term WSCP demand reduction actions. If normal water use includes water conservation programs, either currently implemented or planned for implementation, estimated water use values would incorporate the effect of those conservation programs when reporting projected water use during this period.

Total water use for 2021, for example, is developed by modifying the water use representation for "current" conditions (see Table 4-5) taking into consideration the anticipated factors affecting water use, with each subsequent year further adjusted, as appropriate. Adjustments year-to-year reflect several factors the District anticipates may occur, including minor increases from growth. To make these adjustments, the difference in annual water use between the "current" condition and the forecast potable use in 2025 is prorated equally across each of the years 2021 through 2025, so that the same 2025 forecast water use is matched.

With an initial annual estimate, each year is further adjusted to reflect anticipated increases in the "unconstrained demand" during a single dry year. As noted previously, this is reflected by applying a 5%

[39] California Water Code Section 10635(b)
[40] California Water Code Section 10632.1

increase to the total potable water use forecast. The resulting unconstrained demand during a dry year for 2021 through 2025 are shown in Table 4-8.

Table 4-8: Forecast DRA Water Use for 2021 through 2025 (acre-feet)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2021	410	347	368	368	588	882	1,156	1,376	1,261	1,103	882	546	9,286
2022	410	347	368	368	589	883	1,156	1,377	1,261	1,103	883	546	9,290
2023	410	347	368	368	589	883	1,157	1,377	1,262	1,104	883	547	9,295
2024	410	347	368	368	589	884	1,157	1,378	1,262	1,104	883	547	9,299
2025	411	347	368	369	590	884	1,158	1,378	1,263	1,105	884	547	9,303

4.5.2 Projecting Water Use for Annual Assessments

The District will need to perform an Annual Assessment and submit the findings to DWR beginning in 2022. To evaluate the plausible water service reliability conditions for 2021 or 2022, described in Chapter 5, requires two separate representative "current" water use conditions to be developed. The first condition uses the "current" water use characterization included in Table 4-5. These demands represent the water use under a normal condition. Alternatively, a "single-dry year current" forecast is also calculated to provide the District with representative current unconstrained demands. This second characterization of current water use applies the same single-dry year adjustment described previously, represented by a 5% increase in the current water use values. Table 4-9 provides the Normal Year and Single Dry Year current water use for the District's water service area. These are used in Chapter 5.

Table 4-9: Normal and Single Dry Year "Current" Water Use (acre-feet)

Year Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Normal	390	330	350	350	560	840	1100	1310	1200	1050	840	520	8,840
Single Dry	410	350	370	370	590	880	1160	1380	1260	1100	880	550	9,300

4.6 Projecting Disadvantaged Community Water Use

Pursuant to CWC Section 10631.1, retail suppliers are required to include the projected water use for lower income households in 2020 UWMPs. Per California Health and Safety Code Section 50079.5, a lower income household has an income below 80 percent of area median income, adjusted for family size. For purposes of this UWMP, annual median income was derived from 2019 U.S. Census Bureau and determined to be about $68,000 for the District.[41] Therefore, 80% of this is estimated to be about $55,000 per year. According to the detailed data, approximately 37% of the households earn at or below this 80-percentile income.

[41] This data is from the Household Income in the Past 12 Months (In 2019 Inflation-adjusted Dollars) American Community Survey 1-year estimates; https://censusreporter.org/profiles/16000US0611390-carmichael-ca/

For purposes of estimating the future water needs, 37% of the total single-family and multi-family connections are presumed to represent disadvantaged households. Applying this condition to the forecast water use for the entire District results in the estimate provided in Table 4-10.

Table 4-10: Estimated Low-Income Water Use Forecast (acre-feet)

AF/Yr	2025	2030	2035	2040	2045
Total Retail Treated	8,860	8,950	9,070	9,160	9,280
Low Income	2,520	2,540	2,566	2,589	2,612
% of treated	28.4%	28.4%	28.3%	28.3%	28.1%

Chapter 5
Water System Reliability

This chapter provides the Carmichael Water District's (CWD) water system reliability findings as required under Water Code Section 10635 and provides reliability information that CWD may use in completing an annual supply and demand assessment pursuant to Water Code Section 10632.1.

Assessing water service reliability is the fundamental purpose for CWD in preparing its 2020 UWMP. Water service reliability reflects CWD's ability to meet the water needs of its customers, including end-use customers and retail urban suppliers, with water supplies under varying conditions. CWD's UWMP considers the reliability of meeting customer water use by analyzing plausible hydrological variability, regulatory variability, climate conditions, and other factors that impact CWD's water supply and its customers' water uses. The reliability assessment looks beyond CWD's past experience and considers what could be reasonably foreseen in the future. Moreover, the analysis posits that active supply management will be integral to CWD's long-term water reliability as well as accessing supplemental water supplies in dry conditions. This chapter synthesizes the details imbedded in the Chapters 3 and 4 and provides a rational basis for future decision-making related to supply management, demand management, and project development. This chapter presents three system reliability findings:

- Five Year Drought Risk Assessment: The 2021 through 2025 Drought Risk Assessment (DRA) for CWD's service area.
- Long-Term Service Reliability: The reliability findings for a Normal Year, Single Dry Year, and Five Consecutive Drought Years in five-year increments through 2045.
- Annual Reliability Assessment: The reliability findings for an existing condition for both a Normal Year and Single Dry Year that can inform an annual supply and demand assessment for 2021 or 2022.

In short, CWD has reliable water supplies available for its service area through 2045.

5.1 Five Year Drought Risk Assessment

The Drought Risk Assessment is a new requirement for the 2020 UWMP cycle. The DRA requires a methodical assessment of water supplies and water uses under an assumed drought period that lasts five consecutive years. CWD has prepared an independent monthly assessment of the water supplies and demands for its system because of the monthly variability associated with the surface water supplies that are used to serve that system. Moreover, CWD has incorporated other constraints in its system, like groundwater pumping constraints, which may also influence the near-term management of CWD's water asset portfolio.

CWD has a unique water supply portfolio and system operations. CWD currently has access to four water supply sources, each of which has unique attributes that affect reliability under various hydrological and regulatory conditions. This water supply portfolio creates a water management structure that requires careful consideration of hydrological, regulatory, and institutional variability. Specifically, some water assets are particularly susceptible to critical droughts while other water assets have varying degrees of reliability based upon water rights constraints and historical water use. Nevertheless, CWD has organized and coordinated its water portfolio management to ensure water supply reliability in the event of a severe drought by linking its portfolio management with implementation of its Water Shortage Contingency Plan. The CWD DRA represents a consolidation of its surface water supplies into an organized monthly management structure and then shows the implementation of its WSCP to address potential water supply deficits.

Table 5-1(a) below shows CWD's DRA that integrates all of its supply portfolio from 2021 through 2025 as described in Chapter 3 and reflects the dry year unconstrained water uses described in Chapter 4. As the table shows, CWD has insufficient water assets available in June through October in critically dry years.

Table 5-1(a): CWD Five Year Drought Risk Assessment (acre-feet)

2021	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Supply	3,098	3,032	3,098	3,076	3,710	3,688	3,710	3,710	3,688	3,710	3,076	3,098	40,695
Demand	410	347	368	368	588	882	1,156	1,376	1,261	1,103	882	546	9,286
Difference	2,689	2,686	2,731	2,709	3,122	2,805	2,554	2,334	2,427	2,607	2,194	2,552	31,409

2022	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Supply	3,098	3,032	3,098	3,076	685	663	850	685	663	685	3,076	3,098	22,711
Demand	410	347	368	368	589	883	1,156	1,377	1,261	1,103	883	546	9,290
Difference	2,688	2,686	2,730	2,708	96	-220	-306	-692	-598	-418	2,194	2,552	13,421

2023	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Supply	3,372	3,279	3,372	3,341	959	928	959	959	928	959	3,341	3,372	25,771
Demand	410	347	368	368	589	883	1,157	1,377	1,262	1,104	883	547	9,295
Difference	2,962	2,932	3,004	2,973	370	45	-198	-418	-334	-145	2,458	2,826	16,476

2024	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Supply	3,372	3,279	3,372	3,341	3,984	3,953	3,984	3,984	3,953	3,984	3,341	3,372	43,920
Demand	410	347	368	368	589	884	1,157	1,378	1,262	1,104	883	547	9,299
Difference	2,962	2,932	3,004	2,973	3,395	3,069	2,827	2,606	2,691	2,879	2,458	2,825	34,621

2025	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Supply	3,372	3,279	3,372	3,341	3,984	3,953	3,984	3,984	3,953	3,984	3,341	3,372	43,920
Demand	411	347	368	369	590	884	1,158	1,378	1,263	1,105	884	547	9,303
Difference	2,962	2,932	3,004	2,973	3,394	3,069	2,826	2,606	2,690	2,879	2,457	2,825	34,617

Table 5-1(b) shows the change in the supplies and demands when CWD activates its Water Shortage Contingency Plan. The WSCP has both supply augmentation actions and demand reduction actions of 20% conservation savings under Stage 2 that allow CWD to address the water shortage deficit.

Table 5-1(b): CWD Five Year Drought Risk Assessment with WSCP Activation (acre-feet)

2021	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Supply	3,098	3,032	3,098	3,076	3,710	3,688	3,710	3,710	3,688	3,710	3,076	3,098	40,695
Demand	410	347	368	368	588	882	1,156	1,376	1,261	1,103	882	546	9,286
Difference	2,689	2,686	2,731	2,709	3,122	2,805	2,554	2,334	2,427	2,607	2,194	2,552	31,409

2022	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Supply	3,098	3,032	3,098	3,076	685	663	850	685	663	685	3,076	3,098	22,711
Demand	410	347	368	368	589	883	1,156	1,377	1,261	1,103	883	546	9,290
20% Demand						706	925	1,101	1,009	883			
Alt Supply						43	75	416	346	198			
WSCP Difference	2,688	2,686	2,730	2,708	96	0	0	0	0	0	2,194	2,552	15,655

2023	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Supply	3,372	3,279	3,372	3,341	959	928	959	959	928	959	3,341	3,372	25,771
Demand	410	347	368	368	589	883	1,157	1,377	1,262	1,104	883	547	9,295
20% Demand							925	1,102	1,009	883			
Alt Supply								143	81				
WSCP Difference	2,962	2,932	3,004	2,973	370	45	34	0	0	76	2,458	2,826	17,680

2024	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Supply	3,372	3,279	3,372	3,341	3,984	3,953	3,984	3,984	3,953	3,984	3,341	3,372	43,920
Demand	410	347	368	368	589	884	1,157	1,378	1,262	1,104	883	547	9,299
Difference	2,962	2,932	3,004	2,973	3,395	3,069	2,827	2,606	2,691	2,879	2,458	2,825	34,621

2025	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Supply	3,372	3,279	3,372	3,341	3,984	3,953	3,984	3,984	3,953	3,984	3,341	3,372	43,920
Demand	411	347	368	369	590	884	1,158	1,378	1,263	1,105	884	547	9,303
Difference	2,962	2,932	3,004	2,973	3,394	3,069	2,826	2,606	2,690	2,879	2,457	2,825	34,617

5.2 Long Term Service Reliability

The Urban Water Management Planning Act directs urban water purveyors to analyze water supply reliability in a normal, single dry, and five consecutive dry years over a 20-year planning horizon. The 2020 UWMP Guidebook recommends extending that period to twenty-five (25) years to provide a guiding document for future land use and water supply planning through the next UWMP cycle. The following subsections describe the long-term water service reliability for CWD through a 25 year planning horizon.

5.2.1 CWD Long Term Service Reliability

CWD's long term service reliability reflects the recommended 25-year planning horizon anticipating a normal, single dry, and five consecutive dry years from 2020 through 2045.

Normal and Single Dry Conditions 2025-2045

CWD's future water supplies in normal and single dry conditions reflect the same hydrological, regulatory, and institutional criteria described in previous sections. In normal years, supplies are generally constrained only by their express limiting features. In dry years, additional hydrological, regulatory, and institutional issues will constrain the availability of water. However, future water supplies remain relatively constant as average demands grow over time. All of this information is described in detail in Chapters 3 and 4 and is reflected in the tables below.

CWD's future water demands in normal and single dry conditions through 2045 reflect the same considerations described in previous sections of this chapter. In normal conditions, demands tend to reflect anticipated uses based upon normal hydrological conditions. But in dry conditions, demands increase to reflect dry conditions and additional application of water for outdoor irrigation. Future water demands are generally predicted to increase. All of this information is detailed in Chapter 4 and reflected in the numbers shown in the tables below.

Table 5-2 shows the normal year supplies and demands on an annual timestep from 2025 through 2045. It is important to note that CWD anticipates eliminating the monthly supply deficits depicted in the DRA by the 2025 timeframe by addressing more permanent actions than those identified in the current WSCP. As such, these annual surplus conditions include the elimination of the critically dry year monthly supply deficits.

Table 5-2: Normal and Single Dry Year Water Supply and Demand in CWD through 2045 (acre-feet)

Normal Year	2025	2030	2035	2040	2045
Supply	43,920	43,920	43,920	43,920	43,920
Demand	8,860	8,950	9,070	9,160	9,280
Surplus Supply	35,060	34,970	34,850	34,760	34,640

Single Dry Year	2025	2030	2035	2040	2045
Supply	43,920	43,920	43,920	43,920	43,920
Demand	9,303	9,398	9,524	9,618	9,744
Surplus Supply	34,617	34,522	34,396	34,302	34,176

CWD Five Consecutive Dry Years 2025 – 2045

CWD defines drought condition lasting five consecutive years as one that constrains CWD from obtaining some of its water supplies in its water supply portfolio due to hydrological, regulatory, and institutional constraints. These conditions include more restrictive regulatory constraints on its water rights and constrained conditions for its water supply contracts. The restrictive conditions manifest in changes to the availability of CWD's water assets during different periods in a given year but keep the annual volumes

above the annual need. Moreover, these restrictive conditions may also impact the increased uses of available supplies in the future that are associated with land use and population growth. These conditions are described in significant detail in Chapter 3 and reflected in the tables below.

Five consecutive dry year demands include the anticipated demands based upon historical trends in water usage in drought conditions by CWD's customers. Demands in extended dry conditions may increase as hydrological conditions generate additional customer uses for outdoor irrigation. As droughts persist, however, demands may decline as the realistic constraints on supply availability are realized at the customer level. Out of an abundance of caution to ensure supplies are available to meet projected demands, the fluctuating demand pattern is not reflected in this future reliability assessment. The gradual increase in demands also account for reasonable water conservation measures derived from improved efficiencies in indoor fixtures, improved management of outdoor landscape irrigation, and a general awareness of the value of long-term water conservation at the consumer level. In addition, the future dry conditions reflect increased land use and populations that would rely upon available supplies. These variable conditions are described in significant detail in Chapter 4 and reflected in the tables below.

Table 5-3 below shows the annual water supply and demand conditions for CWD's service area in five consecutive dry years from 2025 through 2045.

Table 5-3: Five Consecutive Dry Years Reliability Through 2045 (acre-feet)

		2025	2030	2035	2040	2045
Year 1	Supply	43,920	43,920	43,920	43,920	43,920
	Demand	9,300	9,400	9,520	9,620	9,740
	Surplus Supply	34,620	34,520	34,400	34,300	34,180
Year 2	Supply	25,771	25,771	25,771	25,771	25,771
	Demand	9,320	9,424	9,540	9,640	9,760
	Surplus Supply	16,451	16,347	16,231	16,131	16,011
Year 3	Supply	25,771	25,771	25,771	25,771	25,771
	Demand	9,340	9,448	9,560	9,660	9,780
	Surplus Supply	16,431	16,323	16,211	16,111	15,991
Year 4	Supply	43,920	43,920	43,920	43,920	43,920
	Demand	9,360	9,472	9,580	9,680	9,800
	Surplus Supply	34,560	34,448	34,340	34,240	34,120
Year 5	Supply	43,920	43,920	43,920	43,920	43,920
	Demand	9,380	9,496	9,600	9,700	9,820
	Surplus Supply	34,540	34,424	34,320	34,220	34,100

5.3 Annual Reliability Assessment

The CWD may consider current supply and demand conditions and perform an annual water supply and demand assessment (Annual Assessment) pursuant to Water Code Section 10632.1 to evaluate real-time or near-term circumstances that are different than the DRA scenario. This assessment would evaluate actual current water supply and use conditions. For purposes of this UWMP, the "current" water use conditions as described in Chapter 4 are compared to the availability of CWD's existing water supplies as described in Chapter 3. Two scenarios are illustrated for CWD's service area:

- Normal Year condition: reflecting the availability of supplies under normal conditions and the "current" water uses
- Single-Dry Year condition: reflecting the availability of supplies under a severe, single-dry year and elevated "current" water uses reflecting increased demands expected in a single dry year.

5.3.1 CWD Normal Year Supply and Current Water Use

CWD defines a normal year condition as one that allows the agency to obtain water supplies from all sources under its CWD water supply portfolio under normalized conditions. These conditions include normally anticipated regulatory constraints on its water rights and limited constrained conditions for its water supply contracts. These conditions are described in significant detail in Chapter 3 and reflected in the monthly supply determinations shown below.

Normal year demands include the anticipated demands based upon historical trends in water usage in non-drought conditions by CWD's customers. Demands in normal conditions generally are lower in the wetter months and higher in the drier months. These demands may fluctuate over time as land uses and populations change within CWD's service area. The monthly demands also account for reasonable water conservation measures derived from improved efficiencies in indoor fixtures, improved management of outdoor landscape irrigation, and a general awareness of the value of long-term water conservation at the consumer level. These demand conditions are described in significant detail in Chapter 4 and reflected in the monthly demand assessments shown below.

Table 5-4 below shows the normal year water supply and demand conditions for CWD's service area on a monthly timestep.

Table 5-4: Normal Year Water Supply and Demand in CWD (acre-feet)

Normal Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Supply	3,098	3,032	3,098	3,076	3,710	3,688	3,710	3,710	3,688	3,710	3,076	3,098	40,695
Demand	458	319	424	457	670	909	1,176	1,204	1,218	1,018	816	516	9,186
Difference	2,640	2,713	2,675	2,620	3,039	2,778	2,534	2,506	2,470	2,692	2,260	2,583	31,509

5.3.2 CWD Single Dry Year Supply and Dry-Year Current Demand

CWD defines a single dry year condition as one that constrains CWD from obtaining some of its water supplies in its water supply portfolio due to hydrological, regulatory, and institutional constraints. These conditions include more restrictive regulatory constraints on its water rights and significantly constrained conditions for its numerous water supply contracts. The restrictive conditions manifest in changed availability of some CWD water assets in various months depicted in the tables below. These changed monthly water supply conditions are described in significant detail in Chapter 3.

Single dry year demands include the anticipated demands based upon historical trends in water usage in drought conditions by CWD's customers. Demands in dry conditions may increase in the normally wetter months as denuded hydrological conditions generate additional customer uses for outdoor irrigation.

These conditions are described in significant detail in Chapter 4 and reflected in the monthly demand tables below. The analysis uses the "current" water use, adjusted as described in Chapter 4.

Table 5-5 below shows the single dry year water supply and demand conditions for CWD's service area.

Table 5-5(a): Single Dry Year Water Supply and Demand in CWD (acre-feet)

Single Dry Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Supply	3,098	3,032	3,098	3,076	685	663	685	685	663	685	3,076	3,098	22,546
Demand	481	319	424	457	670	909	1,176	1,204	1,218	1,018	816	516	9,209
Difference	2,617	2,713	2,675	2,620	15	-246	-491	-519	-555	-333	2,260	2,583	13,337

In a single dry year, CWD will initiate its Water Shortage Contingency Plan as described in Chapter 6. Demand management actions and supply augmentation actions will be simultaneously initiated in order to meet the projected dry year supply reliability conditions. Table 5-5(b) shows the Single Dry Year Water supply and Demand in CWD with WSCP Implementation.

Table 5-5(b): Single Dry Year Water Supply and Demand in CWD with WSCP (acre-feet)

Single Dry Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Supply	3,098	3,032	3,098	3,076	685	663	685	685	663	685	3,076	3,098	22,546
Demand	481	319	424	457	670	909	1,176	1,204	1,218	1,018	816	516	9,209
20% Demand						728	941	963	975	814			
Alt Supply						65	256	278	312	129			
Difference	2,617	2,713	2,675	2,620	15	0	0	0	0	0	2,260	2,583	13,337

5.4 Water Supply Reliability Summary

The Carmichael Water District has a diverse and robust water supply portfolio capable of meeting the water demands in its service area in normal, single dry, and five consecutive dry years from 2020 through 2045 so long as active management of its supply portfolio occurs and CWD strategically implements its WSCP.

Chapter 6
Water Shortage Contingency Plan

This Water Shortage Contingency Plan (WSCP) addresses the requirements in Water Code Section 10632 of the Urban Water Management Planning Act (The Act). The WSCP is incorporated into the 2020 Urban Water Management Plan (UWMP) and is used by the Carmichael Water District (District) to respond to water shortage contingencies as they may arise. The WSCP addresses possible conditions in which the water supply available to customers of the District is insufficient to meet the normally expected customer water use at a given point in time due to drought, regulatory action constraints, and natural and man-made disasters. This WSCP describes the District's strategy for allocating water during such water supply shortages, while assuring customers that at all times it will meet the minimum health and safety requirements of a drinking water purveyor.

This WSCP consists of the following required elements:

1. An analysis of water supply reliability.
2. Procedures for conducting an annual water supply and demand assessment.
3. Six standard water shortage levels corresponding to progressive ranges of up to 10, 20, 30, 40, and 50 percent shortages and greater than 50 percent shortage.
4. Shortage response actions that align with the defined shortage levels.
5. Communication protocols and procedures.
6. Customer compliance, enforcement, appeal, and exemption procedures.
7. A description of legal authorities.
8. A description of financial consequences.
9. Monitoring and reporting requirements.
10. Reevaluation and improvement procedures.
11. Special Water Feature Distinction.
12. Plan Adoption, Submittal, and Availability.

The Act contains specific requirements for each of these elements.[42] As required by Water Code Section 10632 this WSCP is incorporated into the UWMP, yet it is also a stand-alone plan that is adopted independently from the UWMP and may be amended or refined and readopted over coming months and years as needed (see subsection 6.12 Plan Adoption, Submittal, and Availability, below).

6.1 Water Supply Reliability Analysis

The Carmichael Water District is located in Sacramento County and serves primarily residential and commercial customers in the unincorporated community of Carmichael. The District is located about ten miles east of downtown Sacramento along the north side of the American River and has a long history of providing water for irrigation, municipal, and commercial purposes. It was formed in 1916 to supply irrigation water for farming, but as the community of Carmichael became more urbanized, the District became predominantly an urban water supplier. The District covers an area of approximately eight square miles and serves approximately 11,700 municipal connections.

The District's water supply and reliability are analyzed fully in Chapter 5 of the UWMP. In summary, the District's water supply comes predominately from direct water diversions off of the American River. Water diversions are conveyed to the Bajamont Water Treatment Plant (WTP) for treatment and delivery throughout the District's potable water system. The District also maintains four active groundwater wells as part of its balanced supply strategy. Groundwater is mostly used to manage surface supply shortfalls and handle system peaking needs. The District relies on surface water to meet about 70 to 85 percent of its total annual supply and groundwater provides about 15 to 30 percent of total annual supply. These values will vary depending on time of year, American River flow conditions, maintenance requirements, water shortage conditions, or other factors.

The District has six interconnections with the four adjacent water agencies. There are four interties with Sacramento Suburban Water District, one with Citrus Heights Water District, one with Fair Oaks Water District, and one with Golden State Water Company – Cordova System. These interconnections can be used by either agency to provide emergency supplies in the event of short-term outages.

The District's service area is mostly built out with only infill development projects expected in the coming years. The District has experienced less than 0.2 percent annual growth over the last 10 years, and 10 percent total growth projected by 2045. The 2045 demand projection for the District is estimated at 9,280 acre-feet per year.

Carmichael Water District works closely with neighboring water suppliers and other stakeholders as part of three regional planning efforts to cooperatively manage surface and groundwater resources in the Sacramento area. These efforts include the Water Forum Agreement (WFA), The Regional Water Authority (RWA), and the Sacramento Groundwater Authority (SGA). Despite certain water supply

[42] California Water Code Section 10632, available at: (https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=10632)

constraints posed by legal agreements, the District retains secure rights to water supplies sufficient to meet projected annual water demands through the planning horizon.

Carmichael Water District may face potential water supply challenges in some months of critically dry years, but the UWMP uses the measures identified in this Water Shortage Contingency Plan to demonstrate that the District has reliable water supplies to meet demands in normal, single dry and five consecutive dry years through 2045 as noted in Chapter 5. Despite this relative water supply security, this WSCP serves as a roadmap to help the District meet the challenges that may arise from unexpected future water supply shortages, regulatory actions, and unforeseen man-made and natural disasters.

6.2 Annual Water Supply and Demand Assessment Procedures

The WSCP describes the District's procedural methodology for managing shortages and conducting its required Annual Water Supply and Demand Assessment (Annual Assessment). The Annual Assessment is to be submitted to California Department of Water Resources (DWR) by July 1 each year with the first Annual Assessment due July 1, 2022. The Annual Assessment examines the District's anticipated water reliability for the current year and one additional dry year. The Annual Assessment will be prepared at the beginning of each calendar year to evaluate near-term water supply reliability and determine what, if any, water shortages stages may be triggered during the required period. The Annual Assessment will be used by District decision-makers to prepare for and initiate implementation of any needed response actions, as well as to inform customers, the general public, interested parties, and local, regional, and state governmental entities to prepare for such required actions.

6.2.1 Analytical and Decision-making Processes

The District plans to conduct its Annual Assessment according to the following timeline and process:

February	Initial data collection and analysis
March	Preliminary Draft Annual Assessment internal review and revisions
April	Draft Annual Assessment and results briefing for District decision-makers
May	Public Notification and Release of Draft Annual Assessment
June	Approval of Annual Assessment by District Decision-makers
June	Submit Annual Assessment to DWR in advance of July 1 deadline

The District will prepare its Annual Assessment using the following key data and analytical procedures (which may be modified as needed):

- Prepare supply estimates for each water source on a monthly basis for the analysis period.
- Update unconstrained customer demand and estimate anticipated actual water use on a monthly basis for the analysis period.

- Update infrastructure assessment, including estimated water supply production capability on a monthly basis for the analysis period.
- Identify and quantify any locally applicable factors that may influence or disrupt supplies during the analysis period.
- Refine the definition of "dry year" as relevant to dry conditions like water year 2015 and 2021.
- Identify any shortfall between projected supply and anticipated demand.
- Identify and incorporate any applicable constraints (infrastructure, regulatory, etc.).
- Develop, analyze, and propose water resource management strategies to address any shortfall between projected supply and anticipated demand with reference to the water shortage stages identified in this WSCP.
- Present the Annual Assessment (and resulting water shortage stage declaration, if applicable) to District decision-makers.

If the results of the Annual Assessment indicate the need for any alternative water shortage response actions which may be addition to those specified in Subsection 6.4, below, the alternative response actions will be described and submitted in the Annual Assessment, as specified in CWC 10632.2.

6.2.2 Submittal Procedure

The District will submit its Annual Assessment to the DWR via email by the end of June each year, but in no case later than July 1 each year. Prior to, but no later than, the time of DWR submittal, the District will also notify Sacramento County, the adjacent water suppliers, the public, and other stakeholders concerning the results of the Annual Assessment and where it is available for review.

6.3 Six Standard Water Shortage Stages and Triggers

New state requirements for the WSCP require water suppliers to adopt six water shortage stages, which correspond to progressively severe water shortage conditions (up to 10%, 20%, 30%, 40%, 50%, and greater than 50% percent shortage), as compared to the normal service reliability condition. The District has adopted the six standard water shortage stages. Each stage corresponds to a range of reduction in anticipated water supply availability (or reduction in treated water production capacity) in relationship to "normal" demand. Because average water use varies on a monthly, seasonal, and sometimes annual basis, the District will determine the actual water shortage stage based on the expected water production "gap" between actual available water supply and anticipated water use (water demand) at any given time. Reduction of available water supply by the indicated percentages will trigger an appropriate water shortage stage and the District will implement some or all of the response actions listed for each stage.

The District will consider water supply availability factors together in determining the trigger for the appropriate water shortage stage. These factors include:

Bajamont WTP Capacity - Available production capacity is monitored to indicate any potential decreases. Production capacity could be decreased by scheduled maintenance within the plant, mechanical failure of equipment, or if river flow is less than 500 cubic feet per second (cfs). The

Ranney collectors have also been susceptible to flood events. At high flows in the river, the collectors can either be ineffective or unusable, creating a supply shortage.

Water Forum - Folsom Reservoir Inflow - Inflow values are used by the WFA to determine hydrologic year type and subsequent supply availability. The District's surface water supply is currently not impacted by this trigger except during extreme drought. In extreme drought there may be insufficient flows in the Lower American River to meet the District's surface supply diversions.

Groundwater Well Capacity - Groundwater production capacity could be decreased by scheduled maintenance for a well, mechanical failure of equipment, power outage, or other natural disaster events. Wells can also be impacted by water quality. All wells are monitored on a regular basis for water quality standards. If water quality is decreased to below acceptable standards, a well may be placed out of service until the situation is remedied. In the case of contaminated groundwater, the well may have to be placed out-of-service indefinitely. The impact to overall supply reliability will then be reevaluated by the District.

Aerojet Plume - The contaminated groundwater plume from the Aerojet site in Rancho Cordova has been detected on the north side of the American River, in and around Ancil Hoffman Regional Park. Monitoring wells have been installed to monitor the progress of the plume. Should the plume approach current production wells, the District will determine the impact to supplies and update the supply reliability analysis and strategy.

Neighboring Water Supplier Intertie Activity - A neighboring supplier may request emergency supply through one of the existing interconnections. The District will work with the requesting agency to determine the volume and duration requested and impacts to District supplies. Based on the situation, the District may decide to implement demand reduction measures.

Regional Supply Situation - Other agencies in the region may experience supply shortages that require water shortage declarations. The District will monitor these declarations and corresponding demand reduction requirements. It is the discretion of the District's Board of Directors to determine if other agency's stage declarations are significant enough to cause a water shortage stage triggering event.

State Supply Situation - Similar to the Regional Supply Situation, other regions in the state may suffer supply shortage and need to declare water shortage stages. Depending on the extent and impact of statewide issues, the State may issue emergency production reduction goals or water rationing requirements for all water users. Additionally the State may curtail surface water rights (as was the case in 2014 and 2015). The District will monitor statewide issues and actions to determine impacts to District supplies.

At the time of a water shortage emergency, the Board of Directors will consider adopting a Water Shortage Emergency Resolution. When the Board of Directors cannot assemble to adopt the Water Shortage Emergency Resolution, the General Manager, or his/her designee in case of absence, is authorized to implement the appropriate stage of the WSCP based on the reduction in water supply. The General

Manager's determination to implement the WSCP shall remain effective until the Board of Directors meeting immediately following such determination, at which time the Board of Directors will consider adopting an Emergency Water Shortage Resolution. The Board of Directors may elect to authorize the General Manager to declare further stage reductions if conditions merit.

6.4 Shortage Response Actions

The WSCP is required to identify locally appropriate shortage response actions that align with the defined shortage stages and include demand reduction actions, supply augmentation actions, system operational changes, and mandatory prohibitions against specific water use practices that are in addition to state-mandated prohibitions and appropriate to the local conditions. For each response action the WSCP is to provide an estimate of the extent to which the gap between supplies and demand will be reduced by implementation of the action.

Shortage response actions identified in the WSCP are intended to effectively meet the challenge, yet limit the impact to customers from reduced supply situations. Customer compliance with early water shortage stages should minimize the requirements for the severe cutbacks listed in later stages. The District created the requirements for each stage based on the following principles.

- Maintain water quality, safe operating conditions, and fire flow capability at all times;
- Provide flexibility to residential customers while also promoting the efficient use of water during decreased demand requirements;
- Preserve landscaping as much as possible, with permanent plantings such as trees and shrubs receiving more importance than replaceable plantings such as turf and annuals;
- Maintain public fields as long as possible;
- Minimize economic impact to District customers and;
- Enhance public outreach and messaging simplicity.

6.4.1 Stages of Shortage Response Actions

The District has identified shortage response actions to be implemented during each of the six sequential stages and corresponding water shortage conditions. These actions are based on specific hydrological and regulatory conditions and the fundamental need to meet water service requirements within the District's service area. Moreover, the shortage response actions provide the District with some flexibility to address dynamic water shortage conditions while protecting the District against extreme conditions where supplies are drastically reduced beyond 50%. The following is an overview of the staged response actions the District could follow during a given water shortage condition based on shortage severity, relative supply conditions for each stage, and percent shortage reduction levels.

The region's water agencies coordinate closely with water supply planning issues, implementing conjunctive use strategies, and potential supply shortages. The stages described below are used by all water agencies, but each agency will declare its own drought stage based on its specific supply and demand scenario.

The shortage response actions that may be implemented in each stage include, but are not limited to, the following:

Stage 1 (up to 10 percent shortage) "Water Alert" – If water supplies are threatened with constraint, the Plan calls for an introductory Stage 1 drought response, during which customers are informed of possible shortages and asked to voluntarily conserve 10 percent, or directed to mandatorily conserve 10 percent. In addition, customers are prohibited from wasting water or unreasonably using water for beneficial purposes. For example, prohibited water uses under this stage include allowing water to run off unused into a gutter, ditch, or drain; failing to repair a controllable leak; washing sidewalks, driveways, parking areas, tennis courts, patios, or other paved or areas; utilizing a hand-held hose without an automatic shut-off nozzle; and irrigating during a precipitation event. Additional prohibitions will apply to new developments such as prohibiting single pass-through cooling water systems; commercial car washes and laundries without recirculating water systems; and decorative fountains without recirculating water systems.

This stage includes performing public outreach and education about the shortage and methods individuals can implement to reduce their water use. The District will inform the public and neighboring governmental bodies of the potential shortage condition and will coordinate with customers to implement the actions consistent with this Stage.

Stage 2 (11 - 20 percent shortage) "Water Warning" – In the event Stage 2 is implemented the District will continue to encourage community-oriented voluntary conservation measures, enforce conservation measures, and implement mandatory water use reduction measures to decrease demand by up to 20 percent. Stage 2 activities include a continuation of activities described under Stage 1, as well as greater conservation and water use restrictions. These additional restrictions include beyond those identified in Stage 1, limiting outdoor irrigation to 3 days per week. High water user customer accounts will be monitored to identify high water users such that high water users and suspect water wasters will be investigated to determine possible high water use and verify WSCP compliance measures are followed. After water a use investigation, the identified accounts demonstrating excess use above the shortage percentage are subject to financial penalties as described in Subsection 6.8, below.

The District will also continue to engage in public outreach and education as it applies to the water shortage conditions and the actions necessary to achieve up to 20% reduction in use.

Stage 3 (21 - 30 percent shortage) "Severe Shortage" – Stage 3 includes all response actions taken in Stages 1 and 2 and is focused on continuing to encourage customers to voluntarily reduce water use regarding turf watering, fillings pools, etc., mandatory-watering restrictions will be implemented following additional shortage actions described in Stage 2. Increased monitoring related to prescribed water conservation actions will occur under this stage. High water use customers will be monitored and addressed with excess use above the shortage percentage subject to financial penalties as descried in Subsection 6.8, below.

The District will also continue to engage in public outreach and education as it applies to the water shortage conditions and the actions necessary to achieve up to 30% reduction in use.

Stage 4 (31 - 40 percent shortage) "Critical Shortage" – Stage 4 includes all response actions taken in prior stages regarding mandatory conservation and intensifies their implementation and enforcement. Stage 4 restrictions will be implemented if the Stage 3 demand reduction and other response actions are

deemed insufficient to achieve reductions due to water supply shortages. All Stage 3 response actions will be intensified, and water production will be monitored daily by the District for compliance with necessary reductions. Customer baseline water use will be monitored and addressed with excess use above the shortage percentage subject to financial penalties as descried in Subsection 6.8, below.

The District will also continue to engage in public outreach and education as it applies to the water shortage conditions and the actions necessary to achieve up to 40% reduction in use.

Stage 5 (41 - 50 percent shortage) "Water Crisis" – Stage 5 includes all response actions taken in prior stages regarding mandatory conservation. The primary focus of Stage 5 is to ensure the protection of the water supply for all public health and safety purposes. This Stage will require reductions in water demand by up to 50 percent and will follow all voluntary and mandatory actions described in Stages 1-4. Customer baseline water use will be monitored and addressed with excess use above the shortage percentage subject to financial penalties as descried in Subsection 6.8, below.

The District will also continue to engage in public outreach and education as it applies to the water shortage conditions and the actions necessary to achieve up to 50% reduction in use.

Stage 6 (greater than 50 percent shortage) "Water Emergency" – Stage 6 includes all response actions taken in prior stages focused on reducing water demands by more than a fifty percent in response to greater than 50 percent water shortages. This stage requires only use of water for human health and safety purposes. No additional water uses are permitted, including any outdoor irrigation. Waivers will be considered on a case by case basis. Customer baseline water use will be monitored and addressed with excess use above the shortage percentage subject to financial penalties as descried in Subsection 6.8, below.

The District will also continue to engage in public outreach and education as it applies to the water shortage conditions and the actions necessary to achieve greater than 50% reduction in use.

Tables 6-1 through 6-6 summarize staged response actions to reduce customer use and identify their estimated effectiveness (in parenthesis).

Table 6-1: WSCP Actions to Reduce Customer Use - Stage 1[43]

Stage 1 Water Alert: Savings up to 10%
1. Waste and Unreasonable Use of Water Prohibited and Voluntary conservation encouraged (up to 10%) 2. Situation and possible subsequent water shortage stages explained to the public and governmental bodies (up to 10%) 3. Focus on customers with high per capita water usage to achieve proportionally greater reduction than those with low use 4. Actions include, but not limited to: Public information campaign consisting of distribution of literature, speaking engagements, website updates, bill inserts, and conservation messages printed in local newspapers Educational programs in area schools Water Conservation Kits; Conservation Hotline (combined up to 10%) 5. Consumption Reduction Methods, including: • Encourage customers to fix leaks or faulty sprinklers promptly (*0-1%*). • Decorative water features (water fountains, etc.) to recirculate water and be leak proof (*0-1%*) • All landscapes shall be watered during cooler morning and evening hours to reduce evaporation and minimize landscape runoff. No watering allowed between the hours of 10 a.m. and 7 p.m. (*0-5%*). • Landscape watering shall be confined to a user's property and shall not runoff onto adjacent properties, roadsides or gutters (*0-5%*). • No irrigating turf or ornamental landscapes during and 48 hours following measurable precipitation (*0-5%*). • Free flowing hoses are prohibited for any use, all hoses must have an automatic shut-off control nozzle capable of completely shutting off the flow of water (*0-1%*). • Washing down impervious surfaces such as driveways and sidewalks is prohibited unless for public health and safety purposes (*0-1%*). • Unauthorized use of hydrants is prohibited. Authorization for use must be obtained from the District (*0-1%*). • Commercial, industrial, institutional equipment must be properly maintained and in full working order (*0-1%*). • Encourage customers to wash only full loads when washing dishes or clothes (*0-1%*). • Encourage customers to use pool covers to minimize evaporation (*0-1%*). • Encourage restaurants to only serve water to customers on request (*0-1%*).

[43] Potential reduction estimates were based on best professional judgement. Estimates in *italic* provided by the Regional Water Authority in the WSCP Template 2020 UWMP Water Savings spreadsheet.

Table 6-2: WSCP Actions to Reduce Customer Use - Stage 2

Stage 2 Moderate Shortage: Savings up to 20%
1. All measures implemented in Stage 1 2. Voluntary conservation usage reductions (up to 20%) 3. Mandatory Conservation Rules and Restrictions and Prohibitions on End Uses (10-20%) 4. All Consumption Reduction Methods from Stage I and intensified as needed; additionally: o Use prohibitions o Outdoor irrigation restrictions including limiting number of watering to 3 days per week, and time when irrigation can occur (e.g., between 7:00 pm and 10:00 am). Plant containers, trees, shrubs and vegetable gardens may be watered additional days using only drip irrigation or hand watering. Watering schedule to be developed specifying days and times allowed (5-10%). o Fix leaks or faulty sprinklers within 7 days (0-1%). 5. Encourage new landscape installations be limited to drought-tolerant plants and natives. 6. 5% water shortage surcharge may be implemented.

Table 6-3: WSCP Actions to Reduce Customer Use - Stage 3

Stage 3 Severe Shortage: Savings up to 30%
1. All measures implemented in Stages 1 and 2 2. Some or all of the following: o Adherence to customer actual water use reductions against 3-year average use baseline, water allocations and mandatory conservation rules o Water usage goals established by the Board or designated CWD employee. o High use customers water usage to be monitored and recorded, and accounts exhibiting potential excessive use will be reviewed o Water use prohibitions will continue to include restrictions of days and daytime hours for watering, excessive watering resulting in gutter flooding, using a hose without an automatic shut-off control nozzle, use of decorative fountains with non-recirculating pumps, washing down sidewalks or patios, not repairing leaks in a timely manner, etc. (up to 30%) 3. All activities are intensified and production is monitored daily for compliance with necessary reductions. (up to 30%) 4. All Consumption Reduction Methods from Stage 2 and intensified as needed; additionally: o Fix leaks or faulty sprinklers within 3 days (*0-1%*). o Decorative water features that use potable water must be drained and kept dry (*0-1%*). o Car washing is only permitted using a commercial carwash that recirculates water or by high pressure/low volume wash systems (*0-1%*). o Require a construction water use plan be submitted to the District that addresses how impacts to existing water users will be mitigated (such as dust control) (*0-1%*). o Limit the installation of new landscaping to drought tolerant trees, shrubs and groundcover. Prohibit installation of new turf or hydroseed. Customers may apply for a waiver to irrigate during an establishment period for the installation of new turf or hydroseed. (*0-1%*) o Outdoor watering restricted to two (2) days per week according to odd/even schedule. Plant containers, trees, shrubs and vegetable gardens may be watered additional days using only drip irrigation or hand watering (10-30%).. a. Watering schedule to be developed specifying days and times allowed. b. Restrictions may be reevaluated during cool/wet season. (*1-5%*). o Mandatory rationing (up to 30%) 5. 15% water shortage surcharge may be implemented

Table 6-4: WSCP Actions to Reduce Customer Use - Stage 4

Stage 4 Critical Shortage: Savings up to 40%
1. All measures implemented in Stages 1-3 2. All activities are intensified and production is monitored daily for compliance with necessary reductions. (up to 40%) 3. All Consumption Reduction Methods from Stage 3 and intensified as needed; additionally: o Fix leaks or faulty sprinklers within 1 day (*0-1%*). o Existing pools shall not be emptied and refilled using potable water unless required for public health and safety purposes and in such cases will require a pre-approved permit issued by the District(*0-1%*). o Water use for new landscape installations or renovations is not authorized (*0-1%*). o Outdoor irrigation. Outdoor irrigation only allowed one (1) day per week according to odd/even schedule. Plant containers, trees, shrubs and vegetable gardens may be watered additional days using only drip irrigation or hand watering. (*10-30%*). a. Watering schedule to be developed specifying days and times allowed. b. Restrictions may be reevaluated during cool/wet season. (1-5%). 4. 20% water shortage surcharge may be implemented 5. Catastrophic Event (Supply reduction up to 40%): Implement Applicable Actions for Catastrophic Events

Table 6-5: WSCP Actions to Reduce Customer Use - Stage 5

Stage 5 Shortage Crisis: Savings up to 50%
1. All measures implemented in Stages 1-4 2. Source of supply for the System is severely curtailed to the level that requires each customer to restrict their water use for only human health and safety purposes (up to 50%) 3. All activities are intensified and production is monitored daily for compliance with necessary reductions (up to 50%) 4. All Consumption Reduction Methods from previous stages and intensified as needed 5. 25% water shortage surcharge 6. Update current water shortage condition response measures based on Board approvals and direction, state policy directives, emergency conditions, or to improve customer response 7. Catastrophic Event (Supply reduction up to 50%): Implement Applicable Actions for Catastrophic Events (such as boil water order)

Table 6-6: WSCP Actions to Reduce Customer Use - Stage 6

Stage 6 Emergency Shortage: Savings greater than 50%
1. All measures implemented in Stages 1-5 2. Source of supply for the System is severely curtailed to the level that requires each customer to restrict their water use for only human health and safety purposes. Customer rationing may be implemented. (>50%) 3. All activities are intensified and production is monitored continually for compliance with necessary reductions (up to >50%) 4. All Consumption Reduction Methods from previous stages and intensified as needed 5. 30% water shortage surcharge 6. Update current water shortage condition response measures based on Board approvals and direction, state policy directives, emergency conditions, or to improve customer response 7. Catastrophic Event (Supply reduction greater than 50%): Implement Applicable Actions for Catastrophic Events.

6.4.2 Demand Reduction Actions

The District has identified a range of available and feasible customer demand reduction actions that can be used adaptively and implemented with progressively greater intensity to meet the supply shortage challenges faced under each water shortage condition. These demand reduction actions are identified by the associated water shortage stage in which they may be implemented. Tables 6-1 through 6-6 summarize the District demand reduction actions associated with each water shortage stage and shortage level. An estimate of the action's effectiveness as related to that stage is indicated parenthetically.

Achieving demand reductions during water supply shortages will rely on maintaining a continuous proactive demand management strategy. The District's water efficiency program, leak detection program, and rate program provide the tools to manage demands. Maintaining these programs and efforts will greatly improve supply and demand management scenarios during water shortages.

Other response actions not specified in this Plan may also be identified by the District to implement the essential purposes of this Plan or the UWMP (see CWC 10632.2).

6.4.3 Supply Augmentation Actions

The following water supply augmentation mechanisms that could be used to support water system reliability have been described in UWMP Chapter 3. The following supply augmentation mechanisms may be used as response actions under a given water shortage condition, as determined by the District.

- Activate Emergency Intertie(s) with adjacent water suppliers
- Initiate water acquisitions per transfers and exchanges identified in alternative supplies in Chapter 3 including supplies that could be made available from San Juan Water District, Sacramento

Suburban Water District, Fair Oaks Water District, Sacramento County Water Agency, and Golden State Water Company.

6.4.4 Operational Changes

The following water system operational change may be used as response actions under a given water shortage condition, as determined by the District. Consider additional groundwater usage, as well as additional water transfers, increased pressure monitoring, and increasing leak detection and leak repair efforts.

6.4.5 Mandatory Prohibitions

This section is required to identify any mandatory prohibitions against specific water use practices that are in addition to state-mandated prohibitions and appropriate to the local conditions. The District maintains at all times the following restrictions to prevent wasteful water use practices, including intentional or unintentional water waste and unreasonable uses of water. These restrictions are also listed among the demand reduction actions on Tables 6-1 through 6-6.

Restrictions

1. Unnecessary and wasteful uses of water are prohibited.
2. No water runoff from property allowed.
3. All water plumbing, fixtures, or heating or cooling devices must not be allowed to leak or discharge. All known leaks must be repaired within seven (7) days or less depending on the severity of the leak.
4. Free flowing hoses are prohibited for any use, all hoses must have an automatic shut-off control nozzle capable of completely shutting off the flow of water.
5. Car washing must use a bucket and hose with an automatic shut-off control nozzle.
6. All pools, spas, decorative or ornamental fountains, ponds and water features must be equipped with a recirculation pump and maintained leak free. Internal and external water leaks must be repaired within seven (7) days or less depending on the severity of the leak.
7. All landscapes must be watered during cooler morning or evening hours to reduce evaporation and minimize landscape runoff. No watering allowed between the hours of 10 a.m. and 7 p.m.
8. No irrigating turf or ornamental landscapes during and 48 hours following measurable precipitation.

Recommendations

1. Pool covers should be used to minimize evaporation.
2. During summer, outdoor watering three days a week is usually sufficient for typical landscape.
3. Use high efficiency plumbing fixtures and washing full loads of laundry and dishes.
4. No serving of drinking water other than upon request in food and beverage establishments.

6.4.6 Emergency Operations Plan for Catastrophic Water Shortages

This section identifies actions to be undertaken by the District to prepare for, and implement during, a catastrophic interruption of water supplies. In addition to climate, other events that can cause water supply shortages are earthquakes, chemical spills, flooding, dam failures, waterline ruptures, and energy outages at treatment and pumping facilities, which could cause a water shortage severe enough to trigger a Stage 1-6 water supply shortage condition.

The District has an adopted an Emergency Operations Plan, which provides procedures and guidance to District personnel in responding to emergency situations including catastrophic events, both natural and manmade. The plan provides procedures for preparing, mobilizing, and employing District resources and coordinating outside resources during an emergency. The District provides periodic training, including simulated events and responses to keep personnel fully trained on implementation of emergency procedures. Mobilization is consistent with Standardized Emergency Management and the Incident Command System.

In addition to specific actions to be undertaken during a catastrophic event, the District performs maintenance activities, such as annual inspections for earthquake safety, and budgets for emergency items, such as auxiliary generators, to prepare for potential events.

The following is a summary of actions cross-referenced against specific catastrophes for three of the most common possible catastrophic events: regional power outage (such as Public Safety Power Shutoff or "PSPS" events), natural disasters (such as earthquake, flood or storm damage, or fire), and malevolent acts.

Table 6-7: Response Actions during Catastrophic Events

Possible Catastrophe	Summary of Potential Actions
Regional Power Outage	• Isolate areas that will take the longest to repair and/or present a public health threat. Arrange to provide emergency water. • Establish water distribution points and ration water if necessary. • If water service is restricted, attempt to provide potable water tankers or bottled water to the area. • Make arrangements to conduct bacteriological tests, in order to determine possible contamination. • Utilize backup power supply to operate pumps in conjunction with elevated storage.
Natural Disaster	• Assess the condition of the water supply system. • Complete the damage assessment checklist for reservoirs, water treatment plants, system transmission and distribution. • Coordinate with Governor's Office of Emergency Services utilities group or County to identify immediate firefighting needs. • Isolate areas that will take the longest to repair and/or present a public health threat. Arrange to provide emergency water. • Prepare report of findings, report assessed damages, advise as to materials of immediate need, and identify priorities including hospitals, schools and other emergency operation centers. • Take actions to preserve storage. • Determine any health hazard of the water supply and issue any "Boil Water Order" or "Unsafe Water Alert" notification to the customers. • Cancel the order or alert information after completing comprehensive water quality testing. • Make arrangements to conduct bacteriological tests, in order to determine possible contamination.
Malevolent acts	• Assess threat or actual intentional contamination of the water system. • Notify local law enforcement to investigate the validity of the threat. • Get notification from public health officials if potential water contamination. • Determine any health hazard of the water supply and issue any "Boil Water Order" or "Unsafe Water Alert" notification to the customers, if necessary. • Assess any structural damage from an intentional act. • Isolate areas that will take the longest to repair and or present a public health threat. • Arrange to provide emergency water.

6.4.7 Seismic Risk Assessment and Mitigation Plan

Beginning January 2020, CWC Section 10632.5 mandates urban water suppliers include in their UWMP a seismic risk assessment and mitigation plan to assess the vulnerability of each of the various facilities of a water system and mitigate those vulnerabilities. This requirement can be met by submittal of a copy of the most recent adopted local hazard mitigation plan or multi-hazard mitigation plan under the federal Disaster Mitigation Act of 2000 (Public Law 106-390) if the local hazard mitigation plan or multi-hazard mitigation plan addresses seismic risk.

Carmichael Water District intends to submit a copy of the Sacramento County Local Hazard Mitigation Plan (LHMP 2016), which addresses seismic risk and liquefaction potential for Sacramento County, including the District's service area. Additionally, Sacramento County is currently partnering with the Cities of Sacramento, Citrus Heights, Elk Grove, Folsom, Galt, Isleton, Rancho Cordova and several special districts to update the countywide LHMP 2016. The updated LHMP is anticipated to be finalized later in 2021, at which time the District will submit it as well.

The LHMP 2016 Hazard Identification Assessment for Sacramento County in the Carmichael Water District service area indicates that earthquake probability is "occasional" (1-10% chance of occurring next year) and liquefaction probability is "unlikely" (>1% chance of occurring next year). Both earthquake and liquefaction significance are concluded to be "low" (minimal potential impact).

6.5 Communication Protocols

The District maintains an established and effective communications program to inform its customers, neighbors, and other stakeholders of water service issues, updates, and policies. Implementation of the WSCP will utilize the existing communication program structure to inform customers and others of the declared shortage stage and respective actions and restrictions in place.

The Board of Directors meetings addressing the Annual Assessment and any potential water shortage declaration will be noticed using normal Board of Directors meeting public notification procedures. The meeting will also be announced through regular notification protocols.

Once a shortage stage as been declared by the Board of Directors, the District will notify its customers and others through a range of efforts. The stage and restrictions will typically be identified in a press release, customer billing statements, newsletters, and posted on the District's website. Specifically, the District's website will be updated to feature the shortage declaration, restrictions, and resources available to customers from the District and other entities to help meet the restrictions. Subsequent Board of Directors meetings will include a review of the shortage condition, customer response results, and discussion and recommendations for potential modifications. The District will also coordinate with Sacramento County the adjacent water suppliers, and other public agencies as necessary, to declare a local emergency with respect to anticipated water supplies and demands in the event conditions necessitate.

The District's communications protocols may include, but are not limited to, some or all of the following locally relevant actions. These communications protocols will be used at the discretion of District staff based on then-current and anticipated water shortage conditions:

- Publishing information on the District's website.
- Responding to telephone inquiries.
- Providing bill inserts and direct mailings above and beyond those legally required.
- Directly calling customers.
- Developing materials for non-English speaking customers.
- Preparing social media posts to communicate District actions.
- Advertising actions on other local audio and video media.
- Coordinating voluntary and mandatory water conservation activities with other local and regional governing bodies.

Public outreach actions will be intensified according to water shortage stage and based on customer response. These actions may include:

- Initiate public campaign through usual media content. Develop/revise message and content to reflect current water shortage stage issues and requirements.
- Utilize regional partnerships (primarily Regional Water Authority) to coordinate messaging and implementation of water shortage stages, as appropriate.
- Update District website with current demand reduction information.
- Push info to media outlets (radio, print, web, TV) with message and results to date.
- Develop and distribute water shortage information to customers.
- Update messaging to communicate water shortage reduction targets.
- Increase school presence by offering presentations and materials.
- Display signs alerting public of reduction drought stage.
- Offer presentations to all local civic groups, HOAs, and neighborhood associations. Work with groups to post District literature or links on respective websites, email lists, or meetings.
- Send special mailings to customers communicating current water shortage stage and requirements.
- Continue public outreach with local media outlets regarding water shortage conditions and requirements.

6.6 Compliance and Enforcement

Compliance is generally assured by on-going customer outreach and education. District staff has discretion to enforce the provisions of the WSCP using warnings, and by issuing citations to water customers in consideration of the specific circumstances, including the current water shortage stage. Violations may include watering on the wrong day of the week or midday, watering on the correct day of the week but wasting water into the street, using water to clean sidewalks, driveways, parking lots and other hardscapes, and not having shutoff nozzles on hoses. Financial penalties, flow restrictors, and disconnected water service are among the options available to the District to ensure compliance with the required water shortage actions. Appeals processes are also available for those that are subject to the enforcement.

Enforcement measures include, among others:

- Water patrol staff looking for properties in violation of the emergency water restrictions.
- Water patrol staff takes time-stamped photos of the property in violation of emergency water restrictions.
- A letter is sent to the party responsible for the water bill, notifying them of the violation and giving them a deadline to make the necessary adjustments to gain compliance.
- If a second or subsequent violation occurs penalties may be imposed.

The following lists the fines and fees for violation of the WSCP requirements. Violations and penalty assignment are at the discretion of the District. It is the District's intent to promote awareness and provides assistance to its customers to meet both normal and drought stage requirements. Should customer actions warrant, the District will issue violations and levy fees and fines as appropriate. Customer may appeal to the District, who will act in a timely manner to resolve the issue.

Each day that a violation occurs may be considered a separate offense. In cases of severe flooding or property damage the District may discontinue water service prior to any verbal or written communication. In such as case, fines and fees may be imposed at the District's discretion.

Penalties for failure to comply with any provisions of the WSCP are as follows:

1. First Violation: The District will provide a written or verbal warning and a copy of WSCP requirements to the account owner. It is up to the discretion of the District to also attempt to contact the resident verbally regarding the violation.
2. Second Violation: A second violation is punishable by a fine of fifty dollars ($50). Nonpayment will be subject to the same remedies as nonpayment of basic water rates.
3. Third Violation: A third violation is punishable by a fine of two hundred dollars ($200). Nonpayment will be subject to the same remedies as nonpayment of basic water rates.
4. Fourth and Subsequent Violations: A fourth and any subsequent violation is punishable by a fine not to exceed five hundred ($500). Nonpayment will be subject to the same remedies as nonpayment of basic water rates. In addition, the District may choose to install a flow restrictor or disconnect service.

Table 6-8 summarizes these penalties.

Table 6-8: Penalities and timing

Penalty	Stage When Penalty Takes Effect
Written or verbal warning	First violation
$50 Fine	Second violation
$200 Fine	Third violation
Up to $500	Fourth violation
Disconnection of service	Fourth violation (at District discretion)

Discontinuing Service: The District may disconnect a customer's water service for willful violations of mandatory restrictions in this WSCP, subject to current state regulations concerning water shutoffs. Under current District policy the customer will receive written notice of intent to disconnect service. The customer will have five business days to correct violation and pay all accrued fines and fees.

District will disconnect service after the sixth business day after receipt of notice to the customer. If service is disconnected Shut Off/Disconnection/Reconnection fees will apply based on current fiscal year fee schedule. All other applicable fines listed above shall apply.

All fines and fees must be paid in full prior to service reconnection. Nonpayment will be subject to the same remedies as nonpayment of basic water rates.

6.7 Legal Authorities

The District is authorized to implement and enforce the water shortage response actions in this WSCP by its enabling statues.[44] This includes the legal authority to implement the water shortage response actions required to meet the specific circumstances posed by the water shortage stages described in Subsection 6.3, above.

In addition, the District is able to exercise general powers granted to water distributors in CWC §§350-359. CWC §350 authorizes the governing body of a distributor of a public water supply to declare a water shortage emergency whenever it finds and determines that the ordinary demands and requirements of water consumers cannot be satisfied without depleting the water supply of the distributor to the extent there would be insufficient water for human consumption, sanitation, and fire protection. Upon a finding of such an emergency condition, the distributor can adopt such regulations and restrictions on the delivery and consumption of water as will conserve the water supply for the greatest public benefit, with particular regard to domestic use, sanitation, and fire protection (CWC §353). The regulations and restrictions remain in force and effect until the supply of water available for distribution within such area has been replenished or augmented, and restrictions may include the right to deny new service connections and discontinue service for willful violations (CWC §355 and §356). The District also coordinates with Sacramento County and the adjacent water suppliers for the possible proclamation of a "local emergency" under California Government Code, California Emergency Services Act (Article 2, Section 8558).

6.8 Financial Consequences

The Act requires an analysis of the impacts of implementation of this WSCP and likely financial consequences to the District. This section addresses aspects of revenue reduction, expense increases, and additional costs that may arise, and identifies financial response actions.

6.8.1 Revenue and Expenditure Impacts

The District has established water rates that support its on-going operation and maintenance activities, as well as the capital projects required to provide a safe and reliable water supply to its customers.

[44] California Water Code sections 20500 *et seq*., 1943 (Irrigation District Law).

Residential customers are billed per unit of water used under a tiered rate structure. Multifamily and commercial, industrial and institutional customers are billed per unit of water used under a uniform rate structure. Because water rates are tied to customers' normal water consumption activities, significant reductions in demand due to customer conservation measures associated with a water shortage condition will result in a reduction of revenue to the District. In addition to the revenue reductions, the District will also experience an increase in expenses resulting from augmented communication actions, increased enforcement activities, and the administration of water shortage management actions identified in the WSCP. At the same time, a decrease in expenses related to power costs, raw water costs, and chemicals to treat the water would also occur.

The Carmichael Water District 2020 Business Plan and Capital Facilities Fee Study (Study) includes an estimate of the financial impact to the District under each water shortage stage for the following:

- Reduced Water Sales Revenue
- Reduced Power and Chemical Costs
- Increased Conservation Program Costs
- Increased Water Purchase Costs

The Study proposes a multi-pronged corrective strategy which includes:

- Reduction in Capital Spending
- Increase in Revenue from Surcharges (described in the following section)

Additionally, the District maintains a minimum of four (4) months operating reserves and approximately two (2) million dollars in reserves that can be used as an emergency fund for water in the event of water shortages. However, if the District experienced a significant water shortage and reduced water demand over the longer-term, the rate structure or drought surcharges would be reevaluated as required.

6.8.2 Drought Rate Structures and Surcharges

The District has adopted water shortage surcharges that are applied as a percentage increase to the water usage rates in effect if and when a water shortage is declared by the District's Board of Directors. The fixed bimonthly service charges are not affected by the rate surcharges. Any implementation of a water shortage surcharge would be temporary, lasting only during the period of water shortage. Under the water shortage surcharges, customers achieving required water use reduction goals may have lower water bills than they would have with normal water rates and normal water usage. Customers that do not meet water use reduction goals may see higher water bills. The water shortage surcharge is expected to mitigate the financial consequences of water shortages, but also is expected to serve as a pricing signal and provide an additional incentive for customers to reduce water use as appropriate.

Table 6-9 presents the adopted water shortage rate surcharge percentages and illustrates how they would apply to the proposed water usage rate for January 2021.[45] The same surcharge percentages would apply to any water usage rates as they may be adopted in subsequent years for normal supply conditions.

Table 6-9: CWD 2021 Rate Schedule

	Normal Supply Conditions	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Use Reduction Goals	None	0%-10%	10%-20%	20%-30%	30%-40%	40%-50%	>50%
Assumed Use Reduction	None	5%	15%	25%	35%	45%	55%
Water Shortage Surcharge (1)	N/A	N/A	5%	15%	20%	25%	30%
Example Usage Rate (2)	$1.65	$1.65	$1.73	$1.90	$1.98	$2.06	$2.15
Bimonthly Service Charge	(no changes would apply to Service Charges)						

(1) Water shortage charges are an incremental increase in the water usage rates. Bimonthly Service Charges are not affected

(2) Due to changes in costs and loss of water sales

6.9 Monitoring and Reporting

The District will conduct regular monitoring and reporting to ensure WSCP implementation is effective and responsive to conditions as they unfold. The District will then use this information to restore and maintain the water supply and demand balance. Similar to the supply and demand projections used to establish a shortage condition, the District will monitor the same data to determine effectiveness and efficacy.

Monitoring activity will include, but is not limited to:

- Gathering monthly or bi-weekly customer water use data.
- Preparing technical assessments of customer water use and identifying deficiencies.
- Analyzing trends in water supply availability, including meteorological events, regional water supply coordination actions, and statewide regulatory trends.
- Assessing water conservation activities and the effectiveness of enforcement actions as applicable to achieving conservation objectives.

Data reporting will include preparation of written reports and presentations, as necessary, for District management meetings and other public meetings summarizing key information and data, including but not limited to:

- Actual water demands compared to projected demands by customer class and in total.
- Actual supply availability and utilized compared to projected availability for each supply source.
- Projected supply availability for next 12 months for each supply source.

[45] Carmichael Water District Water Rate Schedule – Effective January 1, 2021 (January 19, 2021).

- Monthly reporting of water production and conservation, as required by the State Water Resources Control Board.

These and other data will be regularly evaluated by staff to assess the effectiveness of response measures and to identify the need for any changes or modifications to the declared water shortage stage or actions based on the results. District staff will report to the Board of Directors on a monthly basis, or as needed, on water supply and demand conditions. With regard to monitoring and reporting, staff may determine the need for additional monitoring and reporting measures, or the need to develop or amend ordinances, or update the WSCP as a whole. Any WSCP update or modification will be conducted through the Board of Directors public meeting process, unless specific conditions require otherwise.

6.10 Re-evaluation and Improvement Procedures

The District will continually review and assess its procedures for implementing the WSCP. Specifically, the District will use the monitoring and reporting protocols identified above as a quality assurance and quality control measure to understand the effectiveness of water conservation activities. These re-evaluation and improvement procedures will include developing reports, memoranda, and presentations that assess the effectiveness of water conservation actions and the WSCP. These materials will be provided to the Districts customers and decision-makers for consideration. Public comments on the published materials and management considerations should be incorporated into the development and implementation of future actions. These protocols will be continually assessed and updated by District management staff.

6.11 Special Water Feature Distinction

For purposes of water shortage contingency planning and implementation, the District considers "special water features" those that are artificially supplied with water, including ponds, lakes, waterfalls, and fountains. Such special water features are considered distinct from swimming pools and spas (as defined in subdivision (a) of Section 115921 of the Health and Safety Code).

The District has determined that special water features are a relatively small discretionary use but may be restricted under all identified water shortage conditions. Water shortage response actions will focus on health and safety issues and balancing continuation of these uses with the severity of the water shortage condition. The relative total water use from these sources is a consideration for how special water features and swimming pool uses could be curtailed during specific water shortage conditions. For instance, when swimming pool filling and refilling would exceed a customer's use allocation under the various drought stages, then these actions are prohibited and can be subject to enforcement actions.

6.12 Plan Adoption, Submittal, and Availability

The WSCP has been adopted, submitted, and is available as required by the Urban Water Management Planning Act. As a stand-alone document, the WSCP is also subject to the following separate adoption, submittal, and availability processes, and whenever it is separately amended or revised in the future. The District may refine or amend this WSCP as necessary and in compliance with the normal public notice and adoption. The District has followed all applicable law in adopting the WSCP. The current adopted WSCP

shall be available to District customers and to Sacramento County and the adjacent water suppliers within 30 days of its adoption. A copy of the current WSCP is available for public inspection during business hours at the District's office (subject to current COVID 19 restrictions). The current WSCP is posted and available for download at https://carmichaelwd.org/about-us/water-shortage-contingency-plan/.