City of Vacaville

2020 Amended Urban Water Management Plan

June 2021

Rev. June 2023

Adopted August 2023

KJ Revised DRAFT EDITS – June 12, 2023

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Date plan submitted to the Department of Water Resources: June 2021, 2020 UWMP Amendment submitted September 2023

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The water supplier is a: Municipality

The water supplier is a: Retailer

Utility services provided by the water supplier include: water treatment, storage, and distribution; wastewater treatment

Is this agency a U.S. Bureau of Reclamation contractor? Yes

Is this agency a State Water Project contractor? Yes

1 Introduction and Overview

This Urban Water Management Plan (UWMP) provides information on past, present, and future water sources and demands, and acts as a guide for the City of Vacaville (City) to plan for adequate water supply in the future. This UWMP provides a comparison of available water supplies to projected water demands through 2045, and addresses conservation measures the City has implemented to ensure a safe and reliable water supply. This plan will be used to provide a basis for determining that sufficient water supply is available for future proposed development.

1.1 UWMP Summary

The City is midway between Sacramento and San Francisco along Interstate 80 in Solano County. It has dry, hot summers, and wet, cool winters. Most of the City is residential, with commercial uses along Interstate 80. The City continues to grow, and it is important to ensure enough water supply is available to serve the growing population. The City's population is projected to continue to increase over the next twenty-five years with a total growth of 30% from 2020 to 2045. Commercial and industrial sectors are also projected to develop at a higher rate than they have in past years.

The City's projected water use is based on estimated population growth and future development identified in the City's General Plan. Projected water use incorporates on-going water conservation, water efficient landscaping, and building code requirements. The City's 2020 water use was particularly high compared to the five prior years, but the 2020 water conservation target set in the 2010 UWMP is still met. The COVID-19 pandemic brought changes to the City's water use. Stay-at-home orders caused an increase in the City's daytime population, resulting in a significant increase in residential water use. Industrial water use also increased due to pharmaceutical production related to treatment of COVID-19. As living patterns return to more normal conditions post-pandemic, the City anticipates water use will be reduced.

The City has multiple sources of water available for its use. The City uses Solano Project water from Lake Berryessa, State Water Project and Settlement Water, and groundwater from local wells. These water sources allow the City to manage use of the water supply based on each source's availability. The City uses more surface water during wet years, and can rely more on groundwater during dry years. Groundwater conditions are consistently monitored and levels have been stable for over a decade. The City is also planning to develop recycled water as a future supply for irrigation and industrial uses. The City has plans in place to respond to events like droughts, wildfires, or earthquakes that could impact its water sources. The combination of water sources makes the City's total water supply reliable.

The City does not expect any water supply shortages in future years, even in a drought. A drought risk assessment showed that even in five consecutive dry years, the City has enough supply to meet customer demands. The City also has the ability to put measures in place to reduce demand in response to water shortages, if necessary. The City continues to promote

water conservation and works to reduce water losses to optimize use of the City's available water supplies.

1.2 Legislation

The following plan has been prepared in accordance with State of California (State) Assembly Bill 797 (Urban Water Management Planning Act). The bill, adopted in 1983, requires all water suppliers in California with more than 3,000 customers or a demand exceeding 3,000 acre-feet (AF) annually to prepare and adopt an urban water management plan (UWMP). Since originally adopted in 1983, the Urban Water Management Planning Act has been modified by several bills, and this UWMP incorporates all requirements of the Act in its current state.

1.3 Document Organization

This 2020 UWMP has been prepared based on guidance provided by the California Department of Water Resources (DWR) in their Urban Water Management Plan Guidebook 2020 (2020 UWMP Guidebook) (DWR, 2021). DWR's Urban Water Management Plan Checklist, as provided in the 2020 UWMP Guidebook, has been used to confirm the plan's compliance with applicable requirements. A copy of the completed checklist is included in Appendix A.

Chapter 1 — Introduction and Overview: This chapter provides a discussion on the basics of the UWMP and a general overview of the document.

Chapter 2 — Plan Preparation: This chapter describes the development of the UWMP, including information on public outreach and agency coordination.

Chapter 3 — System Description: This chapter provides background information on the City and a general description of the water system, service area, climate, population, and demographics.

Chapter 4 — Customer Water Use: Past, current, and projected water uses within the City are described in this chapter.

Chapter 5 — Conservation Target Compliance: This chapter documents the City's compliance with the State's 2020 per-capita water conservation mandate.

Chapter 6 — System Supplies: This chapter documents current and future water sources for the City, including groundwater, surface water, and imported water.

Chapter 7 — Water System Reliability: This chapter assesses the reliability of the City's water system through 2045, including in normal conditions, a single dry year, and five consecutive dry years.

Chapter 8 — Water Shortage Contingency Planning: This chapter outlines the City's enforcement prohibitions, methods, and ordinances to ensure adequate water supply during drought years or other shortage situations, as included in its Urban Water Shortage Contingency Plan.

Chapter 9 — Demand Management Measures: This chapter provides a description of actions the City takes to promote conservation and reduce demand on its water supply.

Chapter 10 — Plan Adoption and Submittal: This chapter details the UWMP public hearing, adoption, and submittal process.

2 Plan Preparation

2.1 Basis for Plan Preparation

The City served over 29,000 customers a total of 18,295 acre-feet (AF) of water in 2020. Both of these values are greater than 3,000, so the City is deemed an "urban water supplier" in accordance with California Water Code Section 10617 and is required to prepare an UWMP. Information on the City's system is summarized in Table 2-1.

Table 2-1. Public water system summary (DWR Table 2-1)

Public Water System Number	Public Water System Name	Number of Municipal Connections 2020	Volume of Water Supplied 2020, AF
CA4810008	City of Vacaville	29,170	18,295

2.2 Fiscal or Calendar Year and Units of Measure

Data reported in this UWMP is on a calendar year basis, and volumes are in acre-feet.

Table 2-2. Supplier identification (DWR Table 2-3)

Type of Supplier	Fiscal or Calendar Year	Units of Measure
Retailer	Calendar Year	Acre-feet (AF)

2.3 Coordination and Outreach

The City's UWMP is an individual UWMP and reports solely on its distribution service area. However, the City coordinates its efforts with local agencies in order to manage water sustainably in the region. The Solano County Water Agency (SCWA) is a wholesaler which supplies surface water to the City and other agencies in the region. SCWA provides its customers with projected water supply availability and reliability factors. Water demand projections that the City has developed as part of this plan have been shared with SCWA. The City also coordinates closely with the City of Fairfield, as the two cities jointly own a water treatment plant.

This UWMP has been developed in coordination with the City's Community Development Department to ensure that the plan is consistent with the *City of Vacaville General Plan* (*General Plan*), which was adopted on August 11, 2015 (City of Vacaville, 2015b). The City's Water System Master Plan was based on the land use information used in the development of the *General Plan* (NV5, Inc., 2018). Information was also provided by the Finance Department and the Public Works Department for the development of this plan. Based on comments received from DWR (January 11, 2023) regarding the SBx7-7 calculations which require a 20 percent reduction in per capita water use by 2020, this amended UWMP demonstrates that the City is in compliance with SBx7-7 and has met its target as shown in Section 5.

For the originally prepared 2020 UWMP, advertisements were placed in *The Reporter* (the local newspaper) and the draft plan was made available to the public for review and comment before City Council approval (see Appendices B and C). Copies of the draft plan were available at City offices as well as on the City website.

The same procedure, as required by DWR, was used to publicly release this Amended UWMP. Advertisements for the Amended UWMP were placed in *The Reporter* (the local newspaper) and the amended UWMP was made available to the public for review and comment before City Council approval (see Appendix B). Copies of the amended UWMP were available at City offices as well as on the City website.

3 System Description

3.1 General Description

The City of Vacaville, founded in 1850, is located centrally between Sacramento and San Francisco along Interstate 80. The City water service area is approximately 30 square miles in size with a population of approximately 101,000, which makes it the third largest city in Solano County (California Department of Finance, 2022).

The City's water utility system was purchased from Pacific Gas and Electric Company in 1959 by issuing voter-approved water revenue bonds. Since purchasing the system, the City has systematically improved and upgraded it. As additional lands are annexed into the City, the water utility system is expanded to serve these new areas. The water utility system is a self-supporting City enterprise that provides potable water to customers within the City. The water utility is run by the Utilities Department with support from other City departments.

The City's water system consists of two surface water treatment plants, thirteen groundwater wells (ten active), nine storage reservoirs, five booster pump stations, and over 340 miles of distribution and transmission pipelines. One of the two water treatment plants, the North Bay Regional Plant, is jointly owned by the City of Vacaville and the City of Fairfield. The City of Fairfield is responsible for operation of the plant. The City receives water from several sources, including Solano Project water from the Lake Berryessa reservoir, State Water Project water and Settlement Water from the North Bay Aqueduct, and groundwater from local City production wells. Detailed information on the water system facilities and the operation of the system as a whole can be found in the City's Water System Master Plan (NV5, Inc., 2018).

The City's potable water supply service area is aligned with the city limits, with a few exceptions (Figure 3-1). There are approximately forty residential parcels in Solano County that are served water by the City, primarily along Winding Way and Vine Street. These additional parcels make the service area approximately 0.5% larger than city limits. Given that these are residential uses and not high water users, this difference is considered negligible for the purposes of the analyses in this UWMP. The California State Prison – Solano (CSP-S) and the California Medical Facility (CMF), both within City limits, are only partially supplied by the City's water system. The difference in water supply for these facilities is accounted for in water use and population projections, and is described in detail in Section 3.3 and Section 5.1.1.

Most of the City's service area is comprised of single-family residential neighborhoods, with a retail corridor along Interstate 80 and a mix of uses in the downtown area. There is a significant amount of vacant land within the existing service area that is designated for commercial and industrial development in the northeastern portion of the City. The service area is expected to continue to grow over the next twenty-five years based on the land use projections in the City's *General Plan* (City of Vacaville, 2015b). The current projected ultimate urban boundary of the City would encompass nearly thirty-six square miles. Most of this growth is expected on the east side of the existing City limits.

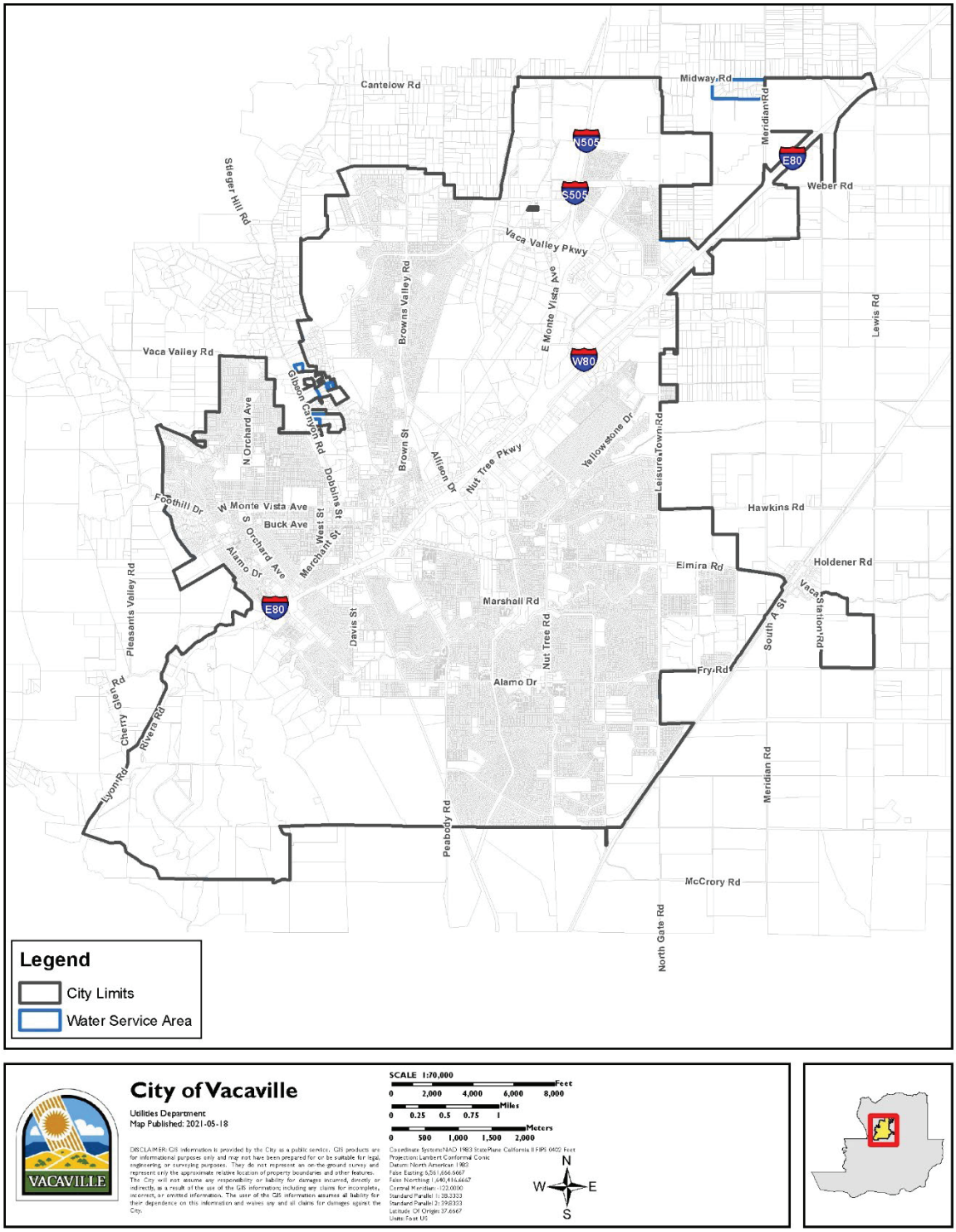

Figure 3-1. Water system service area boundary

3.2 Climate

The climate in the City is characterized by dry, warm to hot summers, with wet, cool winters. The City experiences warm springs, summers, and early falls; winters can be foggy and cold, but snow is exceedingly rare. Average monthly temperatures range from lows around 40°F to highs above 95°F. Annual average precipitation in the City is approximately 26 inches, 86% of which occurs from November through March (Western Regional Climate Center, 2010).Temperatures during the winter only occasionally drop below freezing. Monthly average climate information is provided in Table 3-1.

The climate has significant influence on the water demands in the City. Winters are characterized by relatively low water demand, while the summers have substantially higher demand. Irrigation in the summer is a major contributor to the higher summer demand.

Table 3-1. Average climate data

Month	Average Precipitation, in.*	Average EvapoTranspiration, in.†	Average Temperature, °F	Average Maximum Temperature, °F	Average Minimum Temperature, °F
January	5.33	1.55	47.6	55.9	39.3
February	5.23	2.24	52.0	62.9	42.0
March	3.53	3.72	56.2	67.7	44.6
April	1.30	5.10	60.7	74.1	47.3
May	0.74	6.82	67.3	82.2	52.4
June	0.10	7.80	73.4	89.9	57.0
July	0.00	8.68	77.8	95.9	59.6
August	0.06	7.75	76.6	94.8	58.5
September	0.27	5.70	73.5	90.5	56.6
October	1.20	4.03	65.9	80.3	51.5
November	3.13	2.10	55.0	65.6	44.4
December	5.23	1.55	47.8	56.2	39.3
Annual	**26.12**	**57.0**	**62.9**	**76.3**	**49.4**

* (Western Regional Climate Center, 2010)
† Vacaville falls within Reference EvapoTranspiration Zone 14 (DWR, 1999).

3.2.1 Climate Change

Changing climate has the potential to have significant impacts to the City's use of water resources (City of Vacaville, 2016b) (Kennedy/Jenks Consultants, 2019) (West Yost Associates, 2020). Impacts from climate change are still being determined, but projections for the region include:

- Increased variability in temperature, with an overall increase in temperature. Daily average high temperatures are estimated to increase by 8-14 degrees Fahrenheit by the end of the century.
- Changes in timing and frequency of annual precipitation, with more extreme wet and dry conditions, including more frequent, severe, and prolonged droughts.
- Increased wildfire frequency.

As part of the *Westside Sacramento Integrated Regional Water Management Plan Update* (Kennedy/Jenks Consultants, 2019), potential impacts from climate change to water management were prioritized based on those likely to be of the most concern in the region. These included increased flooding, changes in water demand, decreased water supply reliability, and water quality changes. It is difficult to quantify expected climate-related changes to water demand, but changes are expected.

Peak flood flows are likely to increase under projected climate change conditions. There is an overall decreasing trend in annual total precipitation and an increasing trend in wintertime flows that could increase the flood flows in the City (Kennedy/Jenks Consultants, 2019). The City has 1.7 square miles of land within the 100-year floodplain and 5.07 square miles within the 500-year floodplain; a total of over 20% of the City is in a flood hazard area (City of Vacaville, 2016b). Flooding in the City can result in road blockages and traffic disruptions, potentially limiting access to the City's water facilities (City of Vacaville, 2016b). Some of the City's water treatment and production facilities partially fall within 100-year and 500-year floodplains for Old Alamo Creek and Ulatis Creek (West Yost Associates, 2020).

Temperature in the region is projected to increase by five to six degrees Fahrenheit over the next ninety years (Kennedy/Jenks Consultants, 2019). Increasing temperatures without an increase in precipitation could result in increased water used for landscaping within the City. Additionally, projected increases to temperature will likely result in a higher portion of rain over snow in the winter and earlier melting of the snowpack (City of Vacaville, 2016b). While snow is not part of the normal precipitation in the City, the City is impacted by changes in snowfall patterns in the Sierra Nevada mountain range. Decreasing summer water flow resulting from earlier snowmelt in the greater Northern California area could decrease water available to the City through the State Water Project, as this water supply system is snowmelt and climate-sensitive (Kennedy/Jenks Consultants, 2019). The availability of imported surface water as well as local surface water and groundwater improves the resiliency of the City's groundwater supplies. A reduction to availability of any one of those water supplies can reduce the City's overall drought resiliency.

An increased threat of wildfire in combination with more intense rain events could result in reduced surface water quality in the City. Sediments often containing mercury and other nutrients exposed by wildfire and carried by stormwater could make surface water more difficult to treat, although water quality monitoring may not be sufficiently discrete to be able to discern trends at this time (Kennedy/Jenks Consultants, 2019). Wildfires also can inhibit access and operation of City water production and storage facilities, including more frequent electricity outage events (West Yost Associates, 2020).

Potential impacts of climate change are incorporated into water use projections, water supply projections, and the City's drought risk assessment, as discussed in Sections 4.5, 6.8, and 7.5, respectively.

3.3 Population

Future City population is projected through build out based on projections identified in the City's *General Plan*. The City's *General Plan and Energy and Conservation Action Strategy Final EIR* projects a population of 112,000 residents at the horizon year of 2035, which excludes the prison population (City of Vacaville, 2014). As indicated in Section 3.1, there are a few residential parcels within the water service area but outside of City limits. However, population at these parcels is estimated to be no more than 0.1% of current City population and so would have negligible impact on population projections. Therefore, population projections are kept at the *General Plan* numbers for consistency across documents.

A five-year growth rate was extracted from benchmarks in this population projection and applied to the City's 2020 population to project population through 2045. An average prison population of 3,838 (2016 through 2020) was added to the residential population to create a total City population projection. The City's current and projected population is shown in Table 3-2, showing an anticipated growth of approximately 30% through from 2020 to 2045.

Table 3-2. City population – current and projected

Year	2020	2025	2030	2035	2040	2045
Population	102,386	105,749	111,850	118,325	125,197	132,492

As identified in Section 3.1, because CSP-S and CMF also have water supplied by SID separately from the City's water system, not all of their population is considered within the City's service area. The values in Table 3-2 are adjusted to account for this difference in population; this process is described in detail in Chapter 5 as part of the water conservation target compliance verification. A summary of this projected service area population is provided in Table 3-3.

Table 3-3. Service area population – current and projected (DWR Table 3-1)

Year	2020	2025	2030	2035	2040	2045
Population	100,731	103,325	109,426	115,901	122,773	130,068

3.4 Demographics

According to the 2014-2018 American Community Survey 5-Year Estimates, the average household size in the City of Vacaville is 2.77, slightly lower than the statewide average household size of 2.96. The percentage of persons over age 65 has increased from 8.3% to 13.6% between 2000 and 2018. This increase is consistent with the baby boomers entering retirement age. The median age for Vacaville increased from 33.9 to 37.3 years between

2000 and 2018. This is slightly older than the statewide median average of 36.3 years (U.S. Census Bureau, 2018).

Approximately 73% of Vacaville's population identified as white, 13% identified as black, 11% as Asian, 2.4% as American Indian, and 1.5% as Hawaiian or other Pacific Islander. Of these, approximately 25% identified as being of Hispanic origin and 8% reported being two or more races. Of Vacaville residents, approximately 12% identified as foreign-born and 20% reported a primary home language other than English (U.S. Census Bureau, 2018).

In 2018, the median Vacaville household income was $82,197 and the median family income was $96,107. Around 3.1% of Vacaville citizens over 16 years old are unemployed, below the statewide average of 4.2%. Around 89% of City residents have a high school diploma or higher, with approximately 24% having a bachelor's degree or higher (U.S. Census Bureau, 2018).

Single-family homes make up approximately 79% of the City's housing units, with 21% of the housing units being multi-family. The majority of housing in Vacaville was constructed after 1970, with a large period of construction between 1970 and 1990 (City of Vacaville, 2015a). Approximately 70% of the total housing stock in the City was built prior to 1990, prior to increased water conservation guidelines for construction that came into place in 1992.

3.5 Land Use

Water use projections used in this UWMP are based on the land uses identified in the City's *General Plan*. Efforts were coordinated with the City's Community Development Department to best identify current and projected land uses within the City's existing service area and the anticipated growth areas. The Community Development Department provided the Utilities Department with a parcel-based land use database in 2016 that identified existing and buildout land use projections. This information was used to develop water demand factors for existing and future land uses, as well as identify overall water demand expected in the future so the City can identify needs for increased supply sources. Detailed information on this process is available in the City's Water System Master Plan (NV5, Inc., 2018).

Water demands from the commercial and industrial sectors of the City are projected to increase at a higher rate over the next twenty-five years compared to demands from residential, public, and institutional uses. However, residential uses are expected to continue to comprise over 60% of the water demand of the City. The projected increase in water demand from low and medium density housing is the largest increase in water demand, roughly equivalent to the projected increase from the commercial and industrial sectors combined. High-density residential uses are projected to increase at a higher rate than low and medium density housing over the next twenty-five years; however, total demand from high-density residential uses is never expected to exceed 20% of the overall residential water demand.

4 Customer Water Use

Information on past, current, and projected potable and no-potable water use within the City is described in this chapter. The City currently provides only potable water, so all past and current water use numbers are for potable water use only. Recycled water is included in long-term water projections as a future source of supply; this supply is described in more detail in Section 6.3.

4.1 Past Water Use

Water use within the City over the last five years has steadily increased (Table 4-1), which was expected as drought restrictions were lifted in 2016 and the City continues to see new development.

Table 4-1. Past water use, AF

Use Type	2016	2017	2018	2019
Single Family	7,243	8,107	8,558	8,468
Multi-Family	1,536	1,666	1,680	1,691
Commercial	1,006	1,055	1,046	1,103
Industrial	773	722	715	773
Institutional/Governmental	664	936	1,200	1,255
Landscape	1,435	1,645	1,891	1,766
Other	34	36	278	100
Total	**12,691**	**14,167**	**15,368**	**15,156**

4.1.1 Distribution System Water Losses

Water is lost from the City's distribution system through leaks and through the reduced accuracy of water consumption recording at water meters. Water meters continue to be replaced with newer models to reduce losses; see Section 9.1.2 for more details on this program.

The City has been calculating water loss in the distribution system since 2005 and uses the American Water Works Association (AWWA) Method and the associated quantification worksheet. The amount of water lost in each of the last five years is provided in Table 4-2.

Table 4-2. Past water losses, AF (DWR Table 4-4)

Reporting Period Start Date	Volume of Water Loss
01/2016	905
01/2017	1,374
01/2018	1,054
01/2019	1,285
01/2020	1,355

4.2 Current Water Use

Water use for 2020 has been identified by use category based on metered data across the City, and is summarized in Table 4-3.

Table 4-3. Actual demands for potable water in 2020, AF (DWR Table 4-1)

Use Type	Water Demand
Single Family	9,703
Multi-Family	1,819
Commercial	1,005
Industrial	921
Institutional/Governmental	1,254
Landscape	2,165
Other	73
Losses	1,355
Total	**18,295**

4.3 Projected Water Use

Projected water use within the City's service area was determined based on a percentage increase each five-year period consistent with the service area population projections identified in Table 3-3. These future water use projections are provided in Table 4-4. Water use projections incorporate ongoing water savings seen from the Vacaville Water Efficient Landscape Ordinance (City Municipal Code Division 14.27, Appendix D) and from the adopted *Urban Water Shortage Contingency Plan* (Chapter 8). Projections also reflect the future growth scenario identified in the City's *General Plan* and evaluated in the City's *2018 Water System Master Plan* (NV5, Inc., 2018).

Because the City's water use in 2020 was abnormal due to the COVID-19 pandemic, water use projections for 2025 through 2045 were based on a baseline estimate of what water use would have been in 2020 without the pandemic. The City anticipates overall water use to decline as the pandemic ends and working and living conditions return to conditions more

similar to those in 2019. Based on past water use from 2016 through 2019, including losses (Table 4-1 and Table 4-2), an average increase of 6.54% in water use was seen each year. This percent increase is slightly conservative for the estimated change from 2019 to 2020, because it incorporates the large increase seen from 2016 to 2017 at the tail end of the last drought. Using this percentage, 2020 water use was projected to be approximately 17,500 AF, 96% of the actual 2020 water use. This value was used as the baseline for the 2025 through 2045 projections. Annual projections fall below the 2020 water conservation target of 164 gpcd.

Table 4-4. Projected potable water use, AF (DWR Table 4-2)

Use Type	2025	2030	2035	2040	2045
Single Family	9,875	10,458	11,077	11,734	12,431
Multi-Family	1,852	1,961	2,077	2,200	2,331
Commercial	1,023	1,083	1,148	1,216	1,288
Industrial	937	993	1,051	1,114	865
Institutional/Governmental	1,276	1,351	1,431	1,516	1,606
Landscape	2,204	1,589	1,727	1,479	1,264
Other	74	79	83	88	94
Losses	1,379	1,460	1,547	1,639	1,736
Total	**18,620**	**18,974**	**20,141**	**20,985**	**21,614**

In 2020, all water supplied by the City was potable water. However, the City plans to develop a recycled water supply in future years, and has projected future recycled water use within the service area based on the City's Recycled Water Master Plan (Carollo Engineers, 2020). These non-potable water projects are included in Table 4-5. Recycled water as a future supply is discussed in more detail in Section 6.3.

Table 4-5. Projected total water use – potable and non-potable, AF (DWR Table 4-3)

Water Type	2025	2030	2035	2040	2045
Potable	18,620	18,974	20,141	20,985	21,614
Recycled	0	745	745	1,140	1,825
Total	**18,620**	**19,719**	**20,886**	**22,125**	**23,439**

4.3.1 Characteristic Five-Year Water Use

To plan for the next five years, estimated water use through 2025 assuming normal, non-drought conditions is provided in Table 4-6 below. Estimated use is based on a per-capita water use of 164 gpcd and a consistent annual percent increase to reach the projected water use for 2025.

Table 4-6. Estimated five-year total water use, AF

2021	2022	2023	2024	2025
18,076	18,210	18,346	18,482	18,620

4.4 Lower Income Water Use

This UWMP includes projected water use for lower income households, defined as households whose income is 80% or less of the median income in the City. Lower income households and projections are included in the overall residential projections of the *General Plan* and the 2015-2023 Housing Element (City of Vacaville, 2015a) (City of Vacaville, 2015b). Since these residential projections were used to calculate future water use projections, water needs for lower income households are included in the overall potable water demand projections shown in Table 4-4.

The 2015-2023 Housing Element states that the City will grant priority for service allocation to proposed developments that include housing units affordable to very-low and low income households (New Construction Implementing Policy H.1-I22). Therefore, the City does not project any limitation on lower income housing based on water supply availability.

4.5 Climate Change

Possible climate change scenarios identified under Section 3.2.1 have the potential to impact water use within the City in future years. The City expects to see increased landscape irrigation throughout the City in response to increases in temperature and increased wildfire frequency. Projected water use in the future reflects that the City may use water at a level closer to the 2020 water use target of 164 gpcd (Section 5.1), rather than reduced values the City has seen in recent years.

5 Conservation Target Compliance

In February 2008, Governor Arnold Schwarzenegger introduced a plan for improving the Sacramento-San Joaquin Delta, a component of which was to achieve a 20% reduction in per-capita water use statewide by the year 2020. In November 2009, Senate Bill X7-7 (SBx7-7) (DWR, 2009) was signed into law, addressing urban and agricultural water conservation. SBx7-7 required water suppliers to calculate a baseline per-capita water use and per-capita water use targets for 2015 and 2020 in their 2010 UWMPs. The City established its 2020 target in the 2010 UWMP (City of Vacaville, 2011), and modified it with the 2015 UWMP (City of Vacaville, 2016a).

5.1 Baselines and Targets

The baseline period for SBx7-7 is required to be the average annual per-capita water use calculated over a period of ten years ending between 2004 and 2010. The City's ten-year period was taken from 2000 to 2009. The five-year baseline period required for confirmation of the selected 2020 target use needed to be a continuous five-year period ending no earlier than 2007 and no later than 2010. The City's five-year period was taken from 2004 to 2008.

Multiple methods were available to calculate the baseline per-capita water use and the 2015 and 2020 target values. The City evaluated the different methods as identified in the *Methodologies for Calculating Baseline and Compliance Urban Per-capita Water Use* (DWR, 2016) and ultimately decided to use Method 3 to calculate its 2020 per-capita water use. This method was based on regional target values identified in the *Methodologies* document, where the City fell primarily in the Sacramento River hydrologic region with a small portion in the San Francisco Bay hydrologic region. Table 5-1 summarizes the baseline and the 2020 target per-capita water use values, which have not changed from the values in the 2015 UWMP. A full description of the methodology, including calculations, was completed with the 2015 UWMP and is provided in Appendix E of this document.

Table 5-1. Baselines and targets summary (DWR Table 5-1)

Baseline Period	Start Year	End Year	Average Baseline, GPCD	Confirmed 2020 Target, GPCD
10-15 year	2000	2009	188	164
5 Year	2004	2008	193	164

The City's 2015 interim per capita water use target was calculated to be 176 gpcd, which the City met with an actual per capita water use of 132 gpcd in 2015.

5.1.1 Service Area Population

City limits are almost exactly aligned to the service area boundary during the baseline period and in 2020. Therefore, the City population data identified in Section 3.3 is used for estimating service area population for calculation of per-capita water use.

The City population projections in Table 3-2 include the population of CSP-S and CMF. Not all of the water needed for these facilities is supplied by the City; a portion of the water demand for these facilities is met by the Solano Irrigation District (SID). Therefore, the total City population is adjusted to remove the portion of the prison population that is served by SID. To determine the fraction of the CSP-S and CMF population that is served by the City, the total population of the prison is adjusted by the proportion of water served by the City to the total amount of water delivered to the facilities. Where Pop_{PC} is the portion of the prison population that is served by the City, Pop_{PT} is the total population of the facilities, V_{City} is the volume of water delivered by the City, and V_{SID} is the volume of water delivered by SID (Equation 1).

$$Pop_{PC} = Pop_{PT} \times \frac{V_{City}}{V_{City}+V_{SID}} \quad (1)$$

The service area population of the City (Pop_{SA}) used to determine a per-capita baseline water use and water use targets is the total City population (Pop_{CT}), plus the difference between the total and adjusted prison populations (Equation 2). The calculation of the service area population from 2000 to 2020 is provided in Table 5-2.

$$Pop_{SA} = Pop_{CT} - Pop_{PT} + Pop_{PC} \quad (2)$$

Table 5-2. Determination of service area population

Year	Total Prison Population Pop_{PT}	Water Delivered by City, AF V_{City}	Water Delivered by SID, AF V_{SID}	Prison Population Served by City Pop_{PC}*	Total City Population† Pop_{CT}	Service Area Population Pop_{SA}
2000	8,810	488	1,148	2,628	87,551	81,376
2001	9,031	454	1,191	2,494	90,262	83,720
2002	9,071	835	1,240	3,650	91,817	86,393
2003	9,049	377	1,258	2,088	92,807	85,840
2004	9,230	513	1,200	2,766	93,350	86,886
2005	9,112	571	1,111	3,098	93,954	87,940
2006	9,039	697	1,031	3,645	93,129	87,735
2007	9,110	279	1,160	1,768	92,980	85,638
2008	8,580	203	1,022	1,422	93,069	85,911
2009	7,698	157	884	1,164	92,493	85,959
2010	7,683	193	752	1,587	92,428	86,317
2011	7,740	381	555	3,145	92,310	87,715

Year	Total Prison Population Pop_{PT}	Water Delivered by City, AF V_{City}	Water Delivered by SID, AF V_{SID}	Prison Population Served by City Pop_{PC}*	Total City Population† Pop_{CT}	Service Area Population Pop_{SA}
2012	6,660	239	408	2,465	92,887	88,692
2013	6,247	592	270	4,296	93,232	91,281
2014	6,076	316	537	2,249	93,815	88,988
2015	6,189	132	602	1,114	94,702	89,627
2016	6,712	169	593	1,492	95,509	90,289
2017	6,269	426	368	3,364	96,945	94,040
2018§	6,557	649	125	5,496	97,685	96,624
2019§	6,910	768	174	5,632	98,066	96,788
2020	5,179	679	319	3,523	102,386	100,731

* Prison population for CSP-S and CMF from December monthly reports prepared by the California Department of Corrections and Rehabilitation (California Department of Corrections and Rehabilitation, 2021).
† Total City population estimate for 2020 was updated in 2022 following the California Department of Finance's revisions to population estimates to benchmark values to 2020 U.S. Census data (California Department of Finance, 2022). These data were released after the original 2020 UWMP submission deadline.
§ The prison water treatment plant had major maintenance and upgrades completed in 2018 and 2019, so the facilities used more water supply from the City than normal. This is not indicative of an upward trend in water supply used from the City's system.

5.2 2020 Compliance

Based on a gross water use of 18,295 AF and a service area population of 100,731, the City's actual 2020 per-capita water use was 162 gpcd, lower than the 2020 target of 164 gpcd (Table 5-3). The City did achieve compliance with its target reduction. This information is reported in the standardized SBX7-7 2020 Compliance Form (Appendix F).

Table 5-3. 2020 compliance (DWR Table 5-2)

Actual 2020 GPCD	2020 Target, GPCD	Did Supplier Achieve Targeted Reduction for 2020?
162	164	Yes

6 System Supplies

This chapter describes and quantifies the City's existing and future water supply sources, including surface water, groundwater, and recycled water.

6.1 Purchased and Imported Water

The City has three separate sources of purchased or imported surface water, including the Solano Project, the State Water Project, and Settlement Water, described below.

6.1.1 Solano Project

The Solano Project was constructed by the U.S. Bureau of Reclamation in 1958. The main feature of this project is Monticello Dam, which provides storage for 1.6 million acre-feet of water in Lake Berryessa. Water from Lake Berryessa is diverted through the Putah Diversion Dam to the 33-mile Putah South Canal, which transports water to the eight SCWA-member agencies for Solano Project water. The water rights permits for the Solano Project are held by the U.S. Bureau of Reclamation in trust for the Solano Project water users. SCWA has a long-term master water supply agreement with the U.S. Bureau of Reclamation that currently expires in 2025 but is renewable (Kennedy/Jenks Consultants, 2021). The water rights permits further state that when the permits are converted to a license, the license will be issued in the name of Solano Project water users. Unlike most federal water projects, the water rights to the Solano Project "belong" to the Solano Project water users.

SCWA, acting as a water wholesaler, has entered into agreements with cities, districts, and other agencies to provide water from the Solano Project. The Solano Project contracting agencies, along with their annual entitlements, are shown in Table 6-1.

Table 6-1. Solano Project water contract annual entitlements, AF

Agency	Annual Entitlement*
Fairfield	9,200
Suisun City	1,600
Vacaville	5,750
Vallejo	14,600
SID	141,000
Maine Prairie Water District	15,000
UC Davis	4,000
California State Prison – Solano	1,200
Estimated Project Operating Loss	15,000
Total	**207,350**

* Value approximates a firm yield during the driest hydrologic period on record (1916-1934).

In addition to its entitlement from SCWA, the City entered into a Master Water Agreement with SID in 1995, which was amended in 2001, 2010, and 2018. Pursuant to the agreement, the City receives an increasing supply from SID through the year 2039 and a consistent supply thereafter until the year 2050. The annual schedule for water available from SID to the City is listed in Table 6-2.

Table 6-2. Annual water entitlements for the SID Master Water Agreement, AF

Year	Entitlement	Year	Entitlement
2015	3,125	2030	7,125
2016	3,325	2031	7,425
2017	3,525	2032	7,725
2018	3,725	2033	8,025
2019	3,925	2034	8,325
2020	4,125	2035	8,625
2021	4,425	2036	8,925
2022	4,725	2037	9,225
2023	5,025	2038	9,525
2024	5,325	2039	9,825
2025	5,625	2040-2050	10,050
2026	5,925		
2027	6,225		
2028	6,525		
2029	6,825		

6.1.2 State Water Project

Surface water the City receives from the State Water Project is delivered through the North Bay Aqueduct, a State Water Project facility. The Solano County branch of the North Bay Aqueduct was completed in 1988, and it is owned and operated by DWR. The aqueduct is twenty-eight miles long starting from Barker Slough in the Delta and ending in Napa County.

The City receives up to two water allocations from the State Water Project: “Table A” water and the North of Delta allocation. SCWA acts as the contractor for all State Water Project allocations within Solano County, so all of the City’s water from the State Water Project is supplied through SCWA.

Each State Water Project contractor’s contract with DWR contains a “Table A,” which lists the maximum amount of annual allocated water supply. The Table A amounts are used to determine the City’s proportionate share, or “allocation,” of the total State Water Project water supply that is determined to be available each year. The City’s allocation includes a baseline 6,100 AF/yr and an additional 2,878 AF/yr that was a permanent transfer purchased

from the Kern County Water Agency in 2001. The total Table A allocations for all cities within Solano County are listed in Table 6-3.

Table 6-3. State Water Project maximum Table A allocation to Solano County cities, AF

City	Maximum Allocation
Benicia	17,200
Fairfield	14,678
Suisun City	1,300
Vacaville	8,978
Vallejo	5,600
Total	**47,756**

The water supply from the State Water Project is less reliable than the water supply from the Solano Project because of the large scale of the project. Shortages occurring anywhere in the State Water Project impact the City's supply. In the event of shortages, SCWA allocates water proportionally to each City's share of the overall contract with DWR.

The City also receives water through a separate North of Delta Settlement finalized in December 2013. As a result of this settlement, DWR issues a separate State Water Project annual allocation for SCWA, Napa, and Yuba City. This additional allocation cannot exceed the annual Table A amounts listed in Table 6-3, but is an incremental allocation above the Table A allocations (Kennedy/Jenks Consultants, 2021). The incremental amount varies each year and is less in drier years. Table 6-4 shows the additional increment for the years since the implementation of this allocation. Any additional percentage received is distributed proportionally to the Solano County cities served by SCWA.

Table 6-4. North of Delta allocation

Year	Additional Percentage
2014	0%
2015	5%
2016	15%
2017	0%
2018	10%
2019	10%
2020*	10%

*As of April 1, 2020

6.1.3 Settlement Water

Settlement Water is an additional water source provided by DWR under a May 2003 settlement of area-of-origin water right applications made by the cities of Fairfield, Benicia, and Vacaville.

The agreement provides for delivery of up to 31,620 AF per year of water from the Sacramento River and Sacramento-San Joaquin Delta Estuary to the three cities (Table 6-5). This settlement agreement expires December 31, 2035, with the option to renew.

Settlement Water is not available when the Standard Water Right Term 91 is in effect. Because of this, along with water quality issues and delivery challenges, only 14% of the allocation is used by the City in an average year. During the drought from 2012 through 2016, the City only had 5% of the Settlement Water available on average, with no Settlement Water available in both 2013 and 2015.

Table 6-5. Annual allocation of Settlement Water in Solano County, AF

Agency	Annual Allocation
Fairfield	11,800
Benicia	10,500
Vacaville	9,320
Total	**31,620**

6.2 Groundwater

The City currently operates eleven wells to pump groundwater from the basin underlying the City. This section provides a description of this groundwater basin and how the groundwater is managed.

6.2.1 Basin Descriptions

The City overlies portions of two DWR-designated groundwater basins. The City primarily overlies the northwestern portion of the Solano Subbasin, one of the southern subbasins in the larger Sacramento Valley Basin. A small area in the southern portion of the City overlies the Suisun-Fairfield Valley Basin, but the City does not own or operate any wells within this area. A portion of the City lies west of the Solano Subbasin boundary and does not overlie any area currently designated by DWR as a groundwater basin. All of the existing and proposed municipal wells are located exclusively in the Solano Subbasin. The geologic conditions of the basins are described in detail in the 2016 Groundwater Supply Sufficiency Technical Memorandum prepared by Luhdorff & Scalmanini Consulting Engineers (Luhdorff & Scalmanini, Consulting Engineers, 2016) (Appendix G).

Neither the Solano Subbasin nor the Suisun-Fairfield Valley Basin is adjudicated by the State. DWR released updated basin prioritization in 2019 classifying California's groundwater basins into four different priority categories based on eight factors identified in California Water Code Section 10933(b). The Solano Subbasin is designated a medium

priority basin, and the Suisun-Fairfield basin is designated a low priority basin (DWR, 2020a). Neither basin is considered to be in overdraft conditions, nor is either basin adjudicated.

6.2.2 Groundwater Management

Historically, the City has successfully managed its surface water and groundwater supplies to avoid overuse of the groundwater resources. As new wells have been drilled, the City has located the wells to reduce the potential for local pumping depressions. The City also conjunctively manages its groundwater and surface water resources to use both resources effectively and sustainably.

In the original Master Water Agreement between the City and SID (see Section 6.1.1), "base year" groundwater levels were established based on spring groundwater levels measured during 1992 and 1993. These levels were determined to be levels to which the groundwater aquifer had recovered in response to an estimated sustainable level of pumping. Groundwater levels have remained relatively stable compared to these levels, declining some in drought years when additional groundwater supplies are needed, and recovering in subsequent years with more precipitation. Based on analysis of historic groundwater levels and groundwater pumping rates within the City, it was determined that pumping at a rate of 7,000 AF annually could be sustained to meet normal year water demand without negatively affecting the groundwater levels (Luhdorff & Scalmanini, Consulting Engineers, 2011). Up to 8,000 AF annually could be sustained as the City expands its well field to the northeast area of town and puts more distance between operating well sites.

More detail on the establishment of these "base year" levels and how the City manages its groundwater resources is provided in the City's *Groundwater Management Plan Update* adopted in 2011 (Luhdorff & Scalmanini, Consulting Engineers, 2011) (Appendix H). The *Groundwater Management Plan Update* provides the framework and related actions required to maintain a high quality, reliable, and sustainable groundwater supply in the City.

6.2.3 Groundwater Monitoring

Groundwater monitoring efforts are a critical component of managing the City's water resources. The California Statewide Groundwater Elevation Monitoring (CASGEM) program establishes a permanent, locally managed program of regular and systematic monitoring in California's alluvial groundwater basins. SCWA is the designated monitoring entity for the Solano Subbasin, and submits regular reports of groundwater elevations to DWR. The City has cooperated with SCWA for many years by coordinating and reporting water level data for a network of eleven monitoring wells within the City. The monitoring wells include wells drilled in different geologic formations beneath the City, helping give a more complete understanding of the groundwater conditions in the wider area. Groundwater levels within the City have been observed to be stable for almost a decade (Luhdorff & Scalmanini, Consulting Engineers, 2020).

Monitoring land subsidence paired with groundwater level measurements leads to a deeper understanding about the groundwater resource and the general conditions of the aquifer

underlying the City. Data from land surface elevation monitoring in the City shows mostly stable conditions with very small changes throughout the year (Luhdorff & Scalmanini, Consulting Engineers, 2020). Monitoring at one of the City's well sites was installed in June 2012 and has had an average yearly rate of subsidence of 0.0578 inches per year. However, since October 2016, land service elevation has been increasing at a rate of 0.131 inches per year, reversing the long-term trend (Luhdorff & Scalmanini, Consulting Engineers, 2020).

6.2.4 Sustainable Groundwater Management Act

In September 2014, the California Legislature passed the Sustainable Groundwater Management Act, which established a groundwater management structure within California and empowered local agencies to manage groundwater basins sustainably. The City formed an exclusive Groundwater Sustainability Agency (GSA) in April 2017 to manage the groundwater resources beneath and within the City limits. The Sustainable Groundwater Management Act also required any agencies within medium and high priority basins to prepare Groundwater Sustainability Plans by January 2022. The City's GSA has been collaborating and continues to work with other GSAs within the Solano Subbasin (Figure 6-1) to develop a single Groundwater Sustainability Plan which will identify how the agencies will manage local groundwater resources (SCWA, 2021a). The other GSAs part of this effort are:

- Solano Irrigation District GSA
- Solano Subbasin GSA
- Northern Delta GSA
- County of Sacramento GSA

Because the City does not operate any wells within the Suisun-Fairfield Valley Basin, the City has not been involved in any coordinated groundwater management activities in that basin. The Suisun-Fairfield Valley Basin is not required to prepare a Groundwater Sustainability Plan because it is a low priority basin.

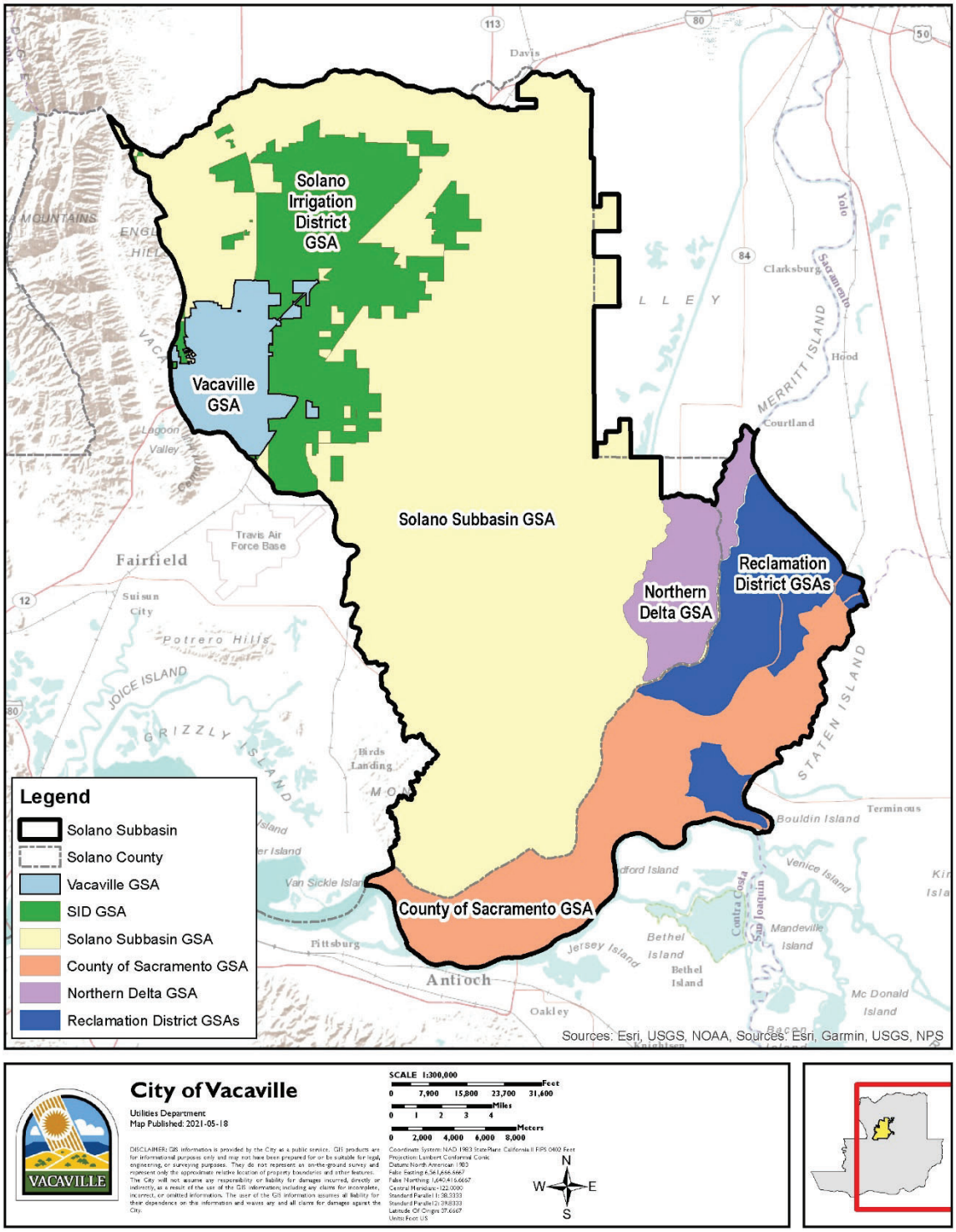

Figure 6-1. Groundwater sustainability agencies within the Solano Subbasin

6.2.5 Historical Groundwater Pumping

Since 1968, the City's annual groundwater pumping within the Solano Subbasin has varied from a low of 2,862 AF in 1968 to a high of 8,156 AF in 1983. Currently, approximately 5,000 AF of groundwater is withdrawn each year. Annual groundwater production for each of the past five years is summarized in Table 6-6. The amount of groundwater pumped is divided by the geologic formation in which the wells are drilled.

Table 6-6. City annual groundwater pumping, AF (DWR Table 6-1)

Groundwater Location	2016	2017	2018	2019	2020
Basal Tehama (Wells 2-16)	4,696	4,998	4,778	5,004	4,847
Non-Basal Zone (Well 1 & DeMello)	89	64	55	97	137
Total	**4,785**	**5,062**	**4,833**	**5,101**	**4,984**

6.3 Wastewater and Recycled Water

6.3.1 Wastewater Collection, Treatment, and Disposal

The City owns and operates the wastewater collection system within the City of Vacaville and the Easterly Wastewater Treatment Plant, located southeast of the community of Elmira. The plant serves both the City and the community of Elmira. The Easterly Wastewater Treatment Plant (EWWTP) is a tertiary treatment and blending elimination facility with a rated dry weather flow capacity of 15 mgd. The City's National Pollutant Discharge Elimination System Permit No. CA0077691 requires that filtration and advanced disinfection of effluent must occur during the dry season (May 1 through October 31), consistent with Title 22 reclamation requirements. Treated effluent from the plant is discharged into Old Alamo Creek to the north of the plant, and ultimately flows into Cache Slough.

In 2020, the total volume of wastewater that entered the plant was 8,412 AF. The volume discharged into Old Alamo Creek totaled 8,154 AF (Table 6-7). The difference of 258 AF is primarily caused by onsite use of chlorinated effluent at the EWWTP; this water is used for irrigation and washdown of treatment structures. This usage can reach up to 1 MGD in summer months, but varies daily.

Table 6-7. Wastewater treatment and discharge within service area in 2020, AF

Wastewater Treated	Discharged Treated Water	Recycled Within Service Area	Recycled Outside of Service Area	Instream Flow Permit Requirement*
8,412	8,154	0	0	0

6.3.2 Recycled Water System Description

Recycled water is not currently being provided by the City. However, since 2014, the City has installed recycled water pipelines and required developments to install recycled water pipelines in key areas in anticipation of recycled water use in the future. There are approximately twenty miles of recycled water pipelines in place within the City (Carollo Engineers, 2020).

6.3.3 Potential and Projected Recycled Water Uses

In 2017, the City began work on a Recycled Water Master Plan that would identify and evaluate the feasibility of using tertiary effluent from the EWWTP for a wide range of potential recycled water uses for a variety of potential customers. As part of this effort, the City considered and analyzed eight potential uses for recycled water to determine which would best meet the City's needs and objectives. The City identified urban irrigation and agricultural reuse as the best options, with the potential to incorporate direct industrial reuse and downstream diversions in the future based on customer needs. Of these uses, only urban irrigation and direct industrial reuse would take place within the current water service area

The City adopted the *Recycled Water Master Plan Feasibility Study* in April 2021 (*Recycled Water Master Plan*), which outlines a proposed recycled water project (Carollo Engineers, 2020). The proposed recycled water project would provide approximately 2,830 AF of tertiary-treated recycled water from the EWWTP for a variety of beneficial recycled water uses including agricultural irrigation, urban irrigation, and industrial reuse. The project anticipates that 1,825 AF of the recycled water would be used within the City's existing and projected service area (Table 6-8); the remainder would be for sale to entities outside of the City's service area. Uses within the service area are projected to be landscape irrigation and industrial reuse. The *Recycled Water Master Plan* includes a detailed analysis of the potential uses of recycled water and why landscape and irrigation and industrial reuse were selected as the most technically and economically feasible options for recycled water use within the City's service area (Carollo Engineers, 2020).

Table 6-8. Recycled water direct beneficial uses within service area, AF (DWR Table 6-4)

Beneficial Use Type	Potential Beneficial Uses of Recycled Water	2020	2025	2030	2035	2040	2045
Landscape irrigation	Irrigation of parks and streetscapes	0	0	745	745	1,140	1,510
Industrial use	Cooling tower and boiler use	0	0	0	0	0	315
Total		**0**	**0**	**745**	**745**	**1,140**	**1,825**

Note: All recycled water supply is at a tertiary level treatment.

6.3.4 Actions to Encourage and Optimize Future Recycled Water Use

The *Recycled Water Master Plan* will be implemented at a project-level basis in the future. However, before the development of the recycled water system can begin, the City must take specific and regulatory mandated steps. Recent approval of this plan allows staff to begin those steps.

The proposed project identified in the *Recycled Water Master Plan* includes approximately nine miles of new recycled water distribution pipelines that would connect with the City's existing recycled water pipelines. This proposed distribution system would have two pipeline branches ranging in size from 6-inch to 20-inches in diameter. A new diversion structure and wet well, storage tank, pump station, and filling station would need to be constructed at the City's EWWTP, and an additional off-site tank and booster pump station would need to be constructed as the system expanded in the future.

Actions to develop and expand future recycled water use are described in Table 6-9 below. Planned implementation years are tentative, as the timing of each action is dependent both on prior actions taken and on the demand for recycled water at future dates. More detail about each of these actions is covered in Chapter 9 of the *Recycled Water Master Plan*.

Table 6-9. Methods to expand future recycled water use (DWR Table 6-6)

Action	Description	Planned Implementation Year	Expected Increase in Recycled Water Use (AF)
Pipeline Installation	Continue requiring installation of recycled water pipelines with subdivision construction.	2021	0
Identify Funding	Identify funding options to develop recycled water system, including loans, grants, or Prop 218.	2025	0
Develop Recycled Water Use Ordinance	Develop and adopt a recycled water use ordinance to cover service parameters, maintenance requirements, design standards, and enforcement language.	2025	0
Regulatory and Permitting Applications	Submit information to appropriate state agencies for the regulatory and permitting process.	2030	0
Infrastructure Construction	Construct a new storage tank and pump station at the EWWTP, along with approximately 8,000 feet of pipeline to connect to existing recycled water lines.	2030	745
Pipeline Construction	Construct 28,000 feet of pipeline to extend recycled water system to locations identified within near-term demand service areas.	2040	395

Action	Description	Planned Implementation Year	Expected Increase in Recycled Water Use (AF)
Infrastructure Construction	Construct additional storage tanks and a booster pump station. Construct 12,000 feet of pipeline to extend recycled water service to locations identified within long-term demand service areas.	2045	685

6.4 Desalinated Water

The City has determined that there are no opportunities available to it for future use or development of desalinated water sources.

6.5 Water Exchanges and Transfers

The City works through SCWA to purchase water for short-term and long-term use. One example is the purchase of additional entitlements of State Water Project water from the Kern County Water Agency, outlined in Section 6.1.2. As a wholesaler, SCWA keeps the City appraised of any unscheduled water that may become available for short-term use. The City also works through SCWA to transfer water to any other agencies as opportunities arise. Water transferred to the City from SID is identified in the Master Water Agreement described in Section 6.1.1. The City has a good working relationship with SID and is notified of supply changes based on the terms of the agreement.

6.6 Future Water Projects

The City's *2018 Water System Master Plan* identifies projects needed to support the continued growth of the City in accordance with the *General Plan* projections. Implementation of the master plan and construction of these projects will ensure the City continues to be able to provide an adequate water supply for the existing City and planned growth within the City's sphere of influence, even under multiple-dry year conditions

6.7 Summary of Existing and Planned Sources of Water

While the sources of water for the City will remain the same, the volume of water allocations will continue to increase over the years per the existing agreements to accommodate the projected growth in the City. The actual water supplied to the City as well as the total allocated amounts are provided below in Table 6-10.

Table 6-10. Actual 2020 water supplies (DWR Table 6-8)

Water Supply	Description	Actual Volume, AF	Water Quality	Total Right or Safe Yield, AF
Groundwater	City of Vacaville	4,984	Drinking Water	7,000
Purchased or Imported Water	Solano Project	9,159	Drinking Water	9,875
Purchased or Imported Water	State Project Water	2,875	Drinking Water	8,978
Purchased or Imported Water	Settlement Water	1,277	Drinking Water	9,320
Total		**18,295**		**35,173**

Projected water supplies for the City by the various sources through 2045 are provided in Table 6-11.

Table 6-11. Projected water supplies, AF (DWR Table 6-9)

Water Supply	2025		2030		2035		2040		2045	
	Reasonably Available Volume	Total Right or Safe Yield	Reasonably Available Volume	Total Right or Safe Yield	Reasonably Available Volume	Total Right or Safe Yield	Reasonably Available Volume	Total Right or Safe Yield	Reasonably Available Volume	Total Right or Safe Yield
Groundwater	7,300	7,300	7,700	7,700	8,100	8,100	8,100	8,100	8,100	8,100
Solano Project	11,307	11,375	12,798	12,875	14,289	14,375	15,705	15,800	15,705	15,800
State Water Project	7,451	8,978	7,451	8,978	7,451	8,978	7,451	8,978	7,451	8,978
Settlement Water	1,454	9,320	1,454	9,320	1,454	9,320	1,454	9,320	1,454	9,320
Recycled Water	0	0	745	2,830	745	2,830	1,140	2,830	1,825	2,830
Total	**27,512**	**36,973**	**30,148**	**41,703**	**32,039**	**43,603**	**33,850**	**45,028**	**34,535**	**45,028**

6.8 Climate Change Impacts

The City has a high level of redundancy in its water supply sources, with surface water from the Solano Project and State Water Project, and groundwater from local production wells. This diversity and redundancy increases the City's resilience to future impacts of climate change. The potential for more severe and more frequent droughts, as identified in Section 3.2.1, has the highest likelihood to impact the City's water supply. Longer-duration severe drought conditions would stress all three sources of water (West Yost Associates, 2020).

6.9 Energy Intensity of Water Supply

As required by California Water Code Section 110631.2.(a), information is provided on the energy used to manage the City's water supplies.

All City facilities are billed for electricity individually, and this metered usage was used to calculate the energy consumed. The volume of water is calculated from flowmeters at the City facilities. The City supplies treated water only and does not supply any untreated water; all information in Table 6-12 is for treated water only.

Table 6-12. Water supply energy intensity by management process (DWR Table O-1A)

	Extract and Divert	Place into Storage	Treatment	Distribution	Total
Volume of Water Entering Process (AF)	4,983	1,123	13,307	18,292	**18,292**
Energy Consumed (kWh)	3,622,675	384,616	4,991,524	0	**8,998,815**
Energy Intensity (kWh/AF)	**727**	**343**	**375**	**0**	**492**

The City similarly measures the volume of wastewater through different parts of the process, and has electricity billing information by site. Information on the energy intensity of the wastewater process is provided as it will be relevant to any future recycled water supply (Table 6-13).

Table 6-13. Wastewater energy intensity by management process (DWR Table O-2)

	Collection and Conveyance	Treatment	Discharge and Distribution	Total
Volume of Wastewater Entering Process (AF)	8,412	8,412	8,154	**8,412**
Energy Consumed (kWh)	305,539	9,070,635	0	**9,376,174**
Energy Intensity (kWh/AF)	**36**	**1,078**	**0**	**1,115**

7 Water System Reliability

This chapter assesses the City's water supply reliability under various conditions.

7.1 Constraints on Water Sources

7.1.1 Solano Project

The contracts with the public entities that use Solano Project water provide for the sale and distribution of water made available by the U.S. Bureau of Reclamation each year. The U.S. Bureau of Reclamation is contractually committed to delivering the full contract amount of water supply from the Solano Project unless the water supply does not physically exist (e.g. an empty reservoir). All Solano Project contractors, whether they are municipal or agricultural, are impacted by water supply reductions on an equal basis. These contractual constraints were previously discussed in Section 6.1.1.

The quality of surface water varies seasonally, typically being more turbid during the winter months. This limits treatment of Solano Project water at the City's Water Treatment Plant to summer months only. The North Bay Regional Plant has been specifically designed to handle this variable water quality and can treat water year-round.

7.1.2 State Water Project

State Water Project water is made available to the City by DWR through SCWA, and is subject to the overall restrictions of the State Water Project, as well as contractual constraints discussed in Section 6.1.2. DWR issued *The Final State Water Project Delivery Capability Report 2019* which covers reliability factors related to the State Water Project, including hydrologic conditions, environmental impacts, water quality, and legal constraints (DWR, 2020b).These constraints were then incorporated into applicable delivery reliability factors for SCWA members (Kennedy/Jenks Consultants, 2021) (Appendix I).

7.1.3 Settlement Water

Based on the agreement with DWR, Settlement Water is highly reliable during normal years, and the City can anticipate receiving 100% of its allocation under normal conditions. However, based on the agreement terms, Settlement Water is not available when Standard Water Right Term 91 is in effect, and is therefore highly unreliable in single-dry and multiple-dry years (Kennedy/Jenks Consultants, 2021).

7.1.4 Groundwater

Based on a 2016 evaluation of groundwater supply sufficiency, the City has determined that in order to manage the local groundwater supply sustainably, around 8,000 AF can be pumped annually (Luhdorff & Scalmanini, Consulting Engineers, 2016). On a short-term basis (single-dry or multiple-dry years), the City could pump up to 9,700 AF and still have groundwater conditions return to normal with a return to a normal or wet precipitation year.

Details regarding the model simulations and management practices are available in Appendices G and H.

Groundwater is monitored by the City and member agencies of SCWA that withdraw from the basal zone of the Tehama Formation in order to maintain groundwater levels and prevent overdraft conditions. The ongoing monitoring program and groundwater management efforts are being evaluated and described in more detail in the Solano Subbasin Groundwater Sustainability Plan that is currently being developed and will be finalized by January 31, 2022. To date, none of these groundwater constraints are known to conflict with what will be outlined in the Groundwater Sustainability Plan.

Groundwater is typically higher in hardness and mineral content than surface water sources, but is less seasonally variable than surface water sources, so no seasonal constraints apply to groundwater quality. Groundwater treatment includes chlorination and fluoridation at the wellhead. The chlorination of groundwater is to ensure a sufficient chlorine residual in the distribution system to prevent proliferation of harmful organisms.

7.1.5 Recycled Water

Constraints on the availability of recycled water are not fully known at this time, as the City is in the early phases of developing recycled water as a future water source.

7.1.6 Water Quality

High quality water is supplied to customers in the City, as described in the City's Annual Drinking Water Quality Reports (City of Vacaville, 2020). The quality of the City water supply is not expected to change significantly over the next twenty-five years.

7.2 Reliability by Type of Year

In this section, the reliability of the City's surface water and groundwater supplies is evaluated. The sources are analyzed for their availability during a normal year, a single dry year, and a five-consecutive-year drought. The three conditions are described as follows:

- *Normal year*: A year, or an averaged range of years, that most closely represents the median water supply available to the City.
- *Single dry year*: The year that represents the lowest water supply available to the City.
- *Five-consecutive-year drought*: The driest five-year historical sequence for the City.

As previously stated, the amount of water entitled to the City is increasing until the maximum entitlement is reached by year 2040. Each source has a different availability during a normal year, a single dry year, and a five-consecutive-year drought. Information on supply entitlement and availability is shown in tables for each source below.

7.2.1 Solano Project

The Solano Project differs from other reservoir projects in California based on the reservoir storage relative to the watershed yield. This means it may take a relatively long time to deplete the reservoir, but in turn, it takes a relatively long time to fill the reservoir. Due to the amount of reservoir storage as a function of its yield, the long-term reliability for the Solano project is excellent.

Based on the high degree of reliability and historical records, the City anticipates receiving 99% of its Solano Project entitlement and SID agreement water during an average year, 98% of the entitlement during a single-dry year, and 93% during multiple-dry years (Kennedy/Jenks Consultants, 2021). Reliability estimates for the Solano Project were developed based on historic hydrology from 1906-2019, Lake Berryessa inflows, and the Sacramento Valley Index for hydrologic year types (Kennedy/Jenks Consultants, 2021). Reliability of the Solano Project is summarized in Table 7-1 below.

Table 7-1. Basis of water year data (Solano Project) (DWR Table 7-1)

Year Type	Base Year	Supply Volume Available, AF	Percent of Average Supply
Average Year	2020	9,816	100%
Single Dry Year	2020	9,727	99%
5-Year Drought 1st Year	1994	9,164	93%
5-Year Drought 2nd Year	1994	9,164	93%
5-Year Drought 3rd Year	1994	9,164	93%
5-Year Drought 4th Year	1994	9,164	93%
5-Year Drought 5th Year	1994	9,164	93%

Note: Percentages listed in the table are a percent of average supply, not a percent of official allocation, and so differ from percentages discussed in the text.

The average year supply reliability is based on an average percent allocation during average hydrologic years from 1906 to 2020, the period evaluated under an update to a Solano Project reliability analysis in 2020 (Kennedy/Jenks Consultants, 2021). Single dry year reliability is similarly based on an average percent allocation for single dry years from 1906 to 2020. Multiple dry year reliability is determined based on an average percent allocation over the five-year dry period with low inflow to Lake Berryessa from 1990–1994 (Kennedy/Jenks Consultants, 2021).

The volumes listed in Table 7-1 for a single dry year and for multiple-dry years reflect the 2020 volume of water supplied to the City by SID. As described in detail in Section 6.1.1, this volume will increase annually until 2040 based on the contract. These increased volumes will be used in future supply and demand analysis but are simplified for the purpose of understanding supply reliability in this section.

7.2.2 State Water Project

The amount of State Water Project available to the City is determined each year by DWR. The available water supply is based on water modeling completed by DWR that take into account overall State Water Project storage in reservoirs, overall demand, hydrology, operational requirements, and regulatory constraints (Kennedy/Jenks Consultants, 2021). The available supply is highly variable. The extremely dry period from January 2013 to the end of 2014 was one of the driest two-year periods on record, and in 2014, State Water Project allocation to the City was a historically low 5%. The 2021 allocation has also been set at 5%, and as such, this has been used as a conservative assumption for the worst-case scenario for single dry and multiple dry years.

The reliability the State Water Project, incorporating both Table A allocations and the North of Delta allocation, is provided in Table 7-2 below.

Table 7-2. Basis of water year data (State Water Project for SCWA) (DWR Table 7-1)

Year Type	Base Year	Supply Volume Available, AF	Percent of Average Supply
Average Year	2003	7,451	100%
Single Dry Year	2015	449	6%
5-Year Drought 1st Year	2020	4,040	54%
5-Year Drought 2nd Year	2020	2,693	36%
5-Year Drought 3rd Year	2020	449	6%
5-Year Drought 4th Year	2020	1,347	18%
5-Year Drought 5th Year	2020	2,693	36%

Note: Percentages listed in the table are a percent of average supply, not a percent of official allocation, and so differ from percentages discussed in the text.

Average supply is based on average deliveries from 1922 to 2003, the period evaluated by DWR in the *2019 State Water Project Delivery Capability Report* (DWR, 2020b). The single dry year reliability is based on single dry years of 2015 and 2021, as a realistic and conservative estimate for a single dry year supply of State Water Project water. Multiple dry year reliability is based on actual percentage deliveries occurring over the last ten years, reflective of current operations of the State Water Project (Kennedy/Jenks Consultants, 2021).

7.2.3 Settlement Water

Reliability of Settlement Water is determined on the historic allocations since 2009, based on data availability and reliability, and is provided in Table 7-3 below.

Table 7-3. Basis of water year data (Settlement Water) (DWR Table 7-1)

Year Type	Base Year	Supply Volume Available, AF	Percent of Average Supply
Average Year	2020	1,454	100%
Single Dry Year	2015	0	0%
5-Year Drought 1st Year	2012	1117	77%
5-Year Drought 2nd Year	2013	0	0%
5-Year Drought 3rd Year	2014	433	30%
5-Year Drought 4th Year	2015	0	0%
5-Year Drought 5th Year	2016	635	44%

Average supply is based on average availability from 2009 through 2020 for normal and wet condition years. Supply reliability for a single-dry year is based on the worst-case scenario seen in 2013 and 2015, when no water was made available. Multiple-dry year reliability is based on water availability during the five-year drought from 2012 through 2016.

7.2.4 Groundwater

Available supply of groundwater is described in detail in the *2016 Groundwater Supply Sufficiency Technical Memorandum* (Luhdorff & Scalmanini, Consulting Engineers, 2016) (Appendix G). Increased pumping during dry years will cause groundwater levels to decrease, but based on the results of the groundwater model, groundwater levels will return to normal levels once pumping decreases to normal year rates. Reliability of supply is provided in Table 7-4.

Table 7-4. Basis of water year data (Groundwater) (DWR Table 7-1)

Year Type	Base Year	Supply Volume Available, AF	Percent of Average Supply
Average Year	2015	7,000	100%
Single Dry Year	2015	8,320	119%
5-Year Drought 1st Year	2015	8,320	119%
5-Year Drought 2nd Year	2015	8,320	119%
5-Year Drought 3rd Year	2015	8,320	119%
5-Year Drought 4th Year	2015	8,320	119%
5-Year Drought 5th Year	2015	8,320	119%

Average year supply availability is determined on modeling based on original groundwater levels in 1992 and 1993, and updated with more complete data collected from 2002 through 2015 (Luhdorff & Scalmanini, Consulting Engineers, 2016). Available volume for a single

dry year and multiple dry years has been increased above average year supply to balance the reduction in surface water supplies, but still within the constraints of the groundwater basin identified in Section 7.1.4 and within on projected capacity of current and future production wells.

7.2.5 Recycled Water

Because recycled water has not yet been developed as a source for the City, reliability cannot be based on prior years. However, once it is an active source, recycled water is projected to be fully reliable even in dry years as the City also owns and operate the wastewater treatment plant.

Table 7-5. Basis of water year data (Recycled water) (DWR Table 7-1)

Year Type	Supply Volume Available, AF	Percent of Average Supply
Average Year	745	100%
Single Dry Year	745	100%
5-Year Drought 1st Year	745	100%
5-Year Drought 2nd Year	745	100%
5-Year Drought 3rd Year	745	100%
5-Year Drought 4th Year	745	100%
5-Year Drought 5th Year	745	100%

7.3 Water Service Reliability

This section compares projected water demand to available water supply during a normal year, a single dry year, and a five-consecutive-year drought. Projected water demands are presented in Section 4.3, and projected water supply availability is presented in Chapter 6.

Groundwater and surface water supplies are projected to meet or exceed projected water demands, even during extended drought conditions. Future water supply will be adequate to offset future water demands during a normal year, a single dry year, and a five-consecutive-year drought as illustrated in Table 7-6, Table 7-7, and Table 7-8.

Table 7-6. Normal year supply and demand comparison, AF (DWR Table 7-2)

	2025	2030	2035	2040	2045
Supply Total	27,512	30,148	32,039	33,850	34,535
Demand Total	18,620	19,719	20,886	22,125	23,439
Difference	**8,892**	**10,429**	**11,153**	**11,725**	**11,096**

Table 7-7. Single dry year supply and demand comparison, AF (DWR Table 7-3)

	2025	2030	2035	2040	2045
Supply Total	19,973	22,196	23,673	25,472	26,157
Demand Total	18,620	19,719	20,886	22,125	23,439
Difference	**1,353**	**2,477**	**2,787**	**3,347**	**2,718**

Table 7-8. Multiple dry years supply and demand comparison, AF (DWR Table 7-4)

		2025	2030	2035	2040	2045
Year 1	Supply totals	23,868	25,948	27,283	28,679	29,364
	Demand totals	18,620	19,719	20,886	22,125	23,439
	Difference	**5,248**	**6,229**	**6,397**	**6,554**	**5,925**
Year 2	Supply totals	21,671	23,751	25,086	26,215	26,900
	Demand totals	18,620	19,719	20,886	22,125	23,439
	Difference	**3,051**	**4,032**	**4,200**	**4,090**	**3,461**
Year 3	Supply totals	20,127	22,207	23,542	24,404	25,089
	Demand totals	18,620	19,719	20,886	22,125	23,439
	Difference	**1,507**	**2,488**	**2,656**	**2,279**	**1,650**
Year 4	Supply totals	20,859	22,939	24,274	24,869	25,554
	Demand totals	18,620	19,719	20,886	22,125	23,439
	Difference	**2,239**	**3,220**	**3,388**	**2,744**	**2,115**
Year 5	Supply totals	23,107	25,187	26,455	26,850	27,535
	Demand totals	18,620	19,719	20,886	22,125	23,439
	Difference	**4,487**	**5,468**	**5,569**	**4,725**	**4,096**

7.4 Regional Supply Reliability

In 2020, the majority of the City's water supply came local water sources, with 77% of the City's water coming from groundwater and the Solano Project. The remaining 23% consisted of State Water Project water and Settlement Water. The City continues to take actions to maximize use of local water resources and minimize the need to import water.

The City continues to develop groundwater production wells and rehabilitate existing wells to provide a reliable source of local groundwater. Development and rehabilitation will allow the City to maximize production of groundwater within the constraints developed under the regional Groundwater Sustainability Plan for sustainable management of groundwater.

The City also has a long-term contract with SID that provides increasing amounts of supply from the Solano Project over the next thirty years (Section 6.1.2), ensuring the City is using

that supply source to its maximum ability. This reduces the City's reliance on surface water supplies from the State Water Project by coordination with other local agencies.

The City is also developing recycled water as a new source of irrigation and industrial water, to reduce overall reliance on other water sources and be more drought-resilient. This has the added benefit of reducing the City's reliance on imported water sources.

7.5 Drought Risk Assessment

This drought risk assessment identifies the data and methods used, the basis for supply shortage conditions, a determination of the reliability of each water supply source, and a comparison of total water supplies and use during a potential drought.

7.5.1 Basis for Water Shortage Conditions

Water shortage conditions for this drought risk assessment are based on increased frequency and severity of drought conditions seen in recent years, conditions that are projected to continue due to climate change (Section 3.2.1). The City has also seen reduced availability of State Water Project water and Settlement Water in recent years due to constraints on the Sacramento Delta, and expects the reliability of these sources to decrease significantly under drought conditions. However, based on conjunctive use of the City's multiple surface water sources and groundwater from the Basal Tehama formation, groundwater is a reliable source that can be used to offset reductions in surface water when needed. This makes the City's overall water system reliability relatively high.

7.5.2 Water Source Reliability

Reliability for the City's water sources, assuming a potential of five consecutive drought years, was evaluated as part of a technical memo prepared for the City's wholesaler, SCWA (Kennedy/Jenks Consultants, 2021). This memo details the methodology used to project reliability for different water sources for the City, and is available in Appendix I. Reliability projections incorporate supply availability during more historical drought years, and potential changes on supply availability under climate change conditions.

The reliability of each supply source under drought related shortage conditions, based on historical availability and constrains identified in Section 7.1, is summarized in Table 7-9. The volume available for Solano Project water increases each year, even as the reliability percentage remains constant, because of the City's contract with SID for increasing supply each year.

Table 7-9. Supply reliability over next five years

Water Source	2021		2022		2023		2024		2025	
	Volume Available (AF)	Percent of Average Supply	Volume Available (AF)	Percent of Average Supply	Volume Available (AF)	Percent of Average Supply	Volume Available (AF)	Percent of Average Supply	Volume Available (AF)	Percent of Average Supply
Solano Project	9,056	93%	9,323	93%	9,590	93%	9,857	93%	10,124	93%
State Water Project	4,040	54%	2693	36%	449	6%	1,347	18%	2,693	36%
Settlement Water	1,117	77%	0	0%	433	30%	0	0%	635	44%
Groundwater	8,320	119%	8,320	119%	8,320	119%	8,320	119%	8,320	119%

Note: Volumes available may be slightly different from supply volumes listed in Section 7.2 due to rounding.

7.5.3 Water Supply and Use Comparison

The total water supply and use comparison for this drought risk assessment is presented in Table 7-10 below. This presents a potential scenario for five consecutive drought years beginning in 2021. Projected water use is compared to available supplies, identifying potential water shortfalls or surpluses under drought conditions. Actions identified under the City's *Urban Water Shortage Contingency Plan* (UWSCP) that the City may take to reduce demand are then accounted for to determine a revised surplus or shortfall accounts for any demand reduction measures that may be taken (Chapter 8).

The City is shown to have surplus water under all future years, even without implementing demand reduction measures, although in 2023, the worst-case scenario, there is not much surplus. Despite the surplus water, demand reduction measures are still planned to be implemented because of the overall supply reduction the City has projected. These demand reduction measures are still critical, as water demand and supply availability vary significantly month-to-month. Months during late summer and early fall have high temperatures and low rainfall, and reducing overall demand in the City is a critical part of supplying sufficient water to customers during drought years.

Descriptions of each of the values presented in Table 7-10 are provided below.

Gross Water Use: Gross water use is the City's projected water demand with no drought conservation measures implemented. Gross water use is projected for the next five years based on the City's 2020 per capita water use target of 164 gpcd, and increased by a consistent percentage over the next five years to the 2025 projection identified in Section 4.3.

Total Supplies: Supplies projected for the next five years under low supply conditions identified in Table 7-9.

Surplus/Shortfall without UWSCP Action: Gross water use is subtracted from total supplies to determine whether the City has a surplus or shortfall of water, prior to any demand reduction actions taken under the UWSCP.

Planned UWSCP Action – use reduction savings benefit: Estimated water savings based on demand reduction actions taken under the UWSCP.

Revised Surplus/Shortfall: The estimated UWSCP use reduction savings benefit is added to the surplus/shortfall without UWSCP action to provide an updated value for water surplus or shortfall for the City.

Percent Use Reduction from UWSCP action: The estimated UWSCP use reduction savings benefit divided by the gross water use.

Table 7-10. Five-year drought risk assessment (DWR Table 7-5)

2021	Total Volume, AF
Gross Water Use	18,076
Total Supplies	22,533
Surplus/Shortfall without UWSCP Action	4,457
Planned UWSCP Action - use reduction savings benefit	2,711
Revised Surplus/Shortfall	7,168
Percent Use Reduction from UWSCP action	15%
2022	**Total Volume, AF**
Gross Water Use	18,210
Total Supplies	20,336
Surplus/Shortfall without UWSCP Action	2,126
Planned UWSCP Action - use reduction savings benefit	3,642
Revised Surplus/Shortfall	5,768
Percent Use Reduction from UWSCP action	20%
2023	**Total Volume, AF**
Gross Water Use	18,346
Total Supplies	18,792
Surplus/Shortfall without UWSCP Action	446
Planned UWSCP Action - use reduction savings benefit	5,504
Revised Surplus/Shortfall	5,950
Percent Use Reduction from UWSCP action	30%
2024	**Total Volume, AF**
Gross Water Use	18,482
Total Supplies	19,524
Surplus/Shortfall without UWSCP Action	1,042
Planned UWSCP Action - use reduction savings benefit	5,545
Revised Surplus/Shortfall	6,587
Percent Use Reduction from UWSCP action	30%

2025	Total Volume, AF
Gross Water Use	18,620
Total Supplies	21,772
Surplus/Shortfall without UWSCP Action	3,152
Planned UWSCP Action - use reduction savings benefit	3,724
Revised Surplus/Shortfall	6,876
Percent Use Reduction from UWSCP action	20%

8 Water Shortage Contingency Planning

This chapter outlines progressive steps to be taken by the City to ensure adequate water supply during drought years or other water shortage emergencies, identified as part of the City's *Urban Water Shortage Contingency Plan* (UWSCP).

The City prepared and submitted its first UWSCP in January 1991 as part of the City's 1991 UWMP. The UWSCP was updated in August 2014 in response to the Emergency Drought Regulations issued on July 15, 2014 by the State Water Resources Control Board and amended in June 2015 to address additional water conservation measures in response to the drought. The City's UWSCP has been updated in accordance with the Urban Water Management Planning Act and California Water Code Sections 10610 and 10632, and is provided in full as a separate document at Appendix J.

The UWSCP is presented as Chapter 8 of the UWMP. However, the UWSCP is a stand-alone document that can be enacted or revised at any time separately from the UWMP.

8.1 Water Supply Reliability Analysis

This section evaluates the City's water supply reliability under various conditions as presented in Chapter 7. Chapter 7 contains an assessment on the water supply reliability for the City's four primary water supply sources: the Solano Project, the State Water Project, Settlement Water, and groundwater pumped from a basin underlying the City by eleven wells. Based on 2020 demand and supply data, projected supply is sufficient to meet projected demand for the next five years even if those years are consecutive dry years.

The water supply sources were analyzed for their availability during a normal year, a single dry year, and a five-consecutive-year drought.

8.1.1 Solano Project

The Solano Project differs from other reservoir projects in California based on the reservoir storage relative to the watershed yield. While it takes a relatively long time to fill the reservoir, in turn, it takes a relatively long time to deplete the reservoir. In addition to this water, a long-term agreement with SID provides increasing water rights through 2040. Due to the amount of reservoir storage as a function of its yield, as well as the SID agreement, the long-term reliability for the Solano project was determined to be excellent.

According to the assessment, the City anticipates receiving 99% of its Solano Project entitlement and SID agreement water during an average year, 98% of the entitlement during a single-dry year, and 93% during multiple-dry years. This data is summarized in Table 7-1.

8.1.2 State Water Project and Settlement Water

In 2014, State Water Project allocation to the City was a historically low 5%. For Settlement Water, single dry year supply reliability was based on a worst-case scenario in 2015 when no

water was delivered. For dry and multiple dry years the reliability ranged from 0% to 77% as a percent of average supply. This data is summarized in Table 7-2 and Table 7-3.

8.1.3 Groundwater

Increased pumping during dry years will cause groundwater levels to decrease, but groundwater levels are expected to return to normal levels once pumping decreases to normal year rates. Consequently, reliability of groundwater was also determined to be excellent. This data is summarized in Table 7-4.

8.1.4 Drought Risk Assessment

The drought risk assessment in Section 7.5 of the UWMP presents a potential scenario for five consecutive drought years beginning in 2021. Projected water use is compared to available supplies, identifying potential water shortfalls or surpluses under drought conditions and considers actions identified in this UWSCP that the City may take to reduce demand which are then accounted for to determine any demand reduction measures that may be taken.

In summary, the UWMP concluded that based on 2020 demand and supply data, projected supply is sufficient to meet projected demand for the next five years even if those years are consecutive dry years

8.2 Supply and Demand Assessment Procedures

Beginning in 2022, the Utilities Department will conduct an Annual Water Supply and Demand Assessment in order to 1) submit an annual report to DWR on July 1, 2022 and each July 1 thereafter, and 2) to determine if a water shortage condition exists requiring an appropriate water shortage response action.

8.2.1 Supply and Demand Assessment Procedures

The procedures for the supply and demand assessment that will be conducted each year will include the following elements:

- The Utilities Department will evaluate the water supply reliability for the current year and one dry year.
- A report on the water supply reliability for the current and projected water supply reliability for the next year will be prepared and submitted to the City Council.
- The report will include a determination as to whether or not a water shortage condition exists and if a water shortage response action is recommended.
- If a water shortage response action is recommended City Council may vote to activate, not activate, or amend the recommended action in accordance with the provisions of this UWSCP.

- The annual Supply and Demand Assessment report will be prepared and submitted to DWR by July 1. The format for the report is expected to be finalized in 2021.

8.2.2 Supply and Demand Assessment Key Data Inputs

The evaluation of the City's water supply reliability for the current year and one dry year will include the following key data inputs:

- Current year unrestrained demand (no conservation measures) considering weather/climate impacts, population growth projections, and any policies which may impact the ability to meet future or projected demands.
- Current year available supply, considering any hydrological and/or regulatory conditions in the current year and at least one dry year.
- Existing water system infrastructure and if there are any potential constraints
- Description and quantification of each water supply source included in the UWMP

8.2.3 Evaluation Criteria and Methodology

The following criteria shall be utilized when conducting the annual Supply and Demand assessment:

- The water reliability evaluation will generally commence in January each year. However, nothing in this plan will prohibit the assessment to start sooner if conditions warrant it.
- Data used in the evaluation will be captured via spreadsheet, computer model, or other available tool
- Any local conditions or uncertainties that impact supply or demand conditions will be taken into consideration

8.3 Water Shortage Conditions and Stages

This section discusses the establishment of the City's Water Shortage conditions and identifies the City's Water Shortage Stages.

8.3.1 Establishment of Water Shortage Conditions

The Vacaville Municipal Code (VMC) defines three water conservation conditions. The UWSCP addresses water conservation during normal, drought, and emergency conditions as defined below.

8.3.1.1 Normal Conditions (VMC Section 13.20.040)

The normal conservation condition is in effect any time when drought or emergency conditions are not in effect. Normal conditions will prevail when there is not a water shortage. Conservation practices are voluntary; however, compliance with the *City of*

Vacaville Water Efficient Landscape Requirements (Appendix D) and the Water Waste Prohibitions are required during normal conditions in accordance with the VMC.

8.3.1.2 Drought Conditions (VMC Section 13.20.050)

Drought conditions will be in effect when there is a water shortage necessitating a reduction in water use, either citywide or in a sub-area or land-use category within the City. Compliance with water conservation measures will range from voluntary to mandatory in accordance with the level of water shortage.

8.3.1.3 Emergency Conditions (VMC Section 13.20.060)

Emergency conditions will be in effect whenever there is a water shortage necessitating a reduction in water use of 50% or greater from the normal condition, either citywide or in a sub-area or land-use category within the City.

8.3.2 Water Shortage Stages

Water shortage stages may be declared by the City Council in response to one or more water supply conditions or events. A significant shortage in one water supply source or moderate shortages in a combination of water supply sources may trigger the declaration of a water shortage stage.

Each stage of water shortage corresponds with a water conservation response to a specified reduction in water supply. Each stage requires either a voluntary or mandatory reduction in water use by all customers which may include, mandatory limitations or prohibitions on specific types of water use

These stages have been updated to comply with the six Standard Water Shortage Stages established by DWR in 2019. The criteria for triggering the City's water shortage stages based on water supply is shown in Table 8-1.

Table 8-1. Water shortage contingency plan levels (DWR Table 8-1)

Shortage Stage	Percent Shortage Range	Water Shortage Response Action
Normal	0%	Voluntary conservation
1	0%–10%	Conservation measures including outreach, education, and incentives
2	11%–20%	Promotion of incentives, water use surveys; water waste monitoring and reporting; improved billing and tracking of usage; suspend hydrant flushing; accelerate system leak detection
3	21%–30%	Restrictions on outdoor irrigation; water usage patrols; high water use reporting; cease operation of non-recirculating water features
4	31%–40%	Restrictions on outdoor irrigation; Restrict/cease outdoor water use; residential and commercial water use allocations; excessive use penalties; restrictions on development and landscaping; curtail business use;
5	41%–50%	Require covers and other restrictions on pools; decrease water use allocations; restrict installation of turf grass; supply augmentation
6	50%+	Decrease water use allocation

Normal Conditions: At this stage there is no identified reduction in available water supply sources. Water customers are encouraged through multiple outreach sources to use water efficiently in order to achieve voluntary water conservation.

Stage 1 (voluntary): This stage may be declared when a reduction in total available water supply sources of 10% occurs. At this stage water customers shall be asked to conserve water through a voluntary reduction in water use of up to 10%.

Stage 2 (voluntary to mandatory): This stage may be declared when a reduction in total available water supply sources of 11% up to 20% occurs. At this stage water customers shall be asked to conserve water by up to 20% through employment of both voluntary and mandatory conservation measures including incentives, water use surveys, improved billing, and suspension of hydrant flushing.

Stage 3 (mandatory): This stage may be declared when a reduction in total available water supply sources of 21% up to 30% occurs. At this stage water customers shall be required to conserve water through a mandatory reduction in water use of up to 30%. In addition to the measures taken in Stage 2, customer usage may be monitored and communications made to customers to reduce their water use. Limitations may be placed on outdoor irrigation. Residents and businesses may be directed to cut back on non-essential use of water. Shortage Response Actions listed in Section 8.4 may be applied as needed to achieve the desired water use target.

Stage 4 (mandatory to emergency): This stage may be declared when a reduction in total available water supply sources of 31% up to 40% occurs. At this stage water customers shall

be required to conserve water through a mandatory reduction in water use of up to 40%. Additional limitations and/or restrictions to outdoor irrigation may be implemented. In addition to the measures taken in Stage 3, residential and commercial water use allocations may be implemented and penalties for use of in excess of those allocations may be levied. Shortage Response Actions listed in Section 8.4 may be applied as needed to achieve the desired water use target.

Stage 5 (mandatory, emergency): This stage may be declared when a reduction in total available water supply sources of 41% up to 50% occurs. Residents and businesses will be required to cease all non-essential use of water. In addition to the measures taken in Stage 4, residential and commercial water use allocations may be adjusted to achieve the desired water use target. The City may enact measures to augment the available water supply sources.

Stage 6 (mandatory, emergency): This stage may be declared when a reduction in total water supply sources exceeds 50%. In addition to the steps taken at Stage 5, residential and commercial water use allocations will be adjusted to achieve the desired water use target.

Water Emergency: A water supply emergency may be declared at any time when there is a reduction in total available water supply sources resulting from an emergency drought condition, catastrophic interruption such as a natural disaster, power outage or bio-terrorism attack on the City's water treatment and distribution system occurs. At this stage water use may be restricted based on the impact to the available water supply.

Water conservation action stages may also be triggered by local, state, or federal action impacting the management of the City's water supply sources. The City Manager or his/her Designee, which will typically be the Director of Utilities, shall use multiple sources of information to make a recommendation to the City Council on the implementation of one or more specific water shortage stages.

8.4 Water Shortage Response Actions

This section identifies existing and available response actions the City may enact in response to a water shortage.

8.4.1 Water Demand Reduction Measures

8.4.1.1 Water Waste Prohibitions

VMC Chapter 13.20 includes specific water use restrictions. Accordingly, no user of the City's water system may knowingly make, cause, use, or permit the use of water from the system in a manner that violates the VMC as cited below:

- Excessive water runoff due to landscape irrigation activities.
- Washing of sidewalks, driveways, walkways, parking lots, and all other hard-surfaced areas by direct hosing except for removal of hazardous materials for protection of public health and safety.

- Washing of vehicles, equipment, structures, and other items without the use of a shutoff nozzle.
- The escape of water through breaks or leaks within the water users' plumbing or system that is not repaired within twenty-four hours of discovery.
- Fire hydrants used for purposes other than firefighting, water quality, maintenance, sanitation, and construction.

8.4.1.2 Water Conservation Measures

The City has an established Water Conservation program in partnership with SCWA which promotes the efficient use of water through public outreach, education, rebates, and incentives, and effective management of its water supply and distribution system. The program is consistent with industry best practices and includes the following measures:

- Water Efficiency Use information and education through the City's website, utility billing, local media, and public events
- Distribution of water efficient fixtures and resources
- Rebates for turf replacement, high efficiency clothes washers, irrigation controllers, pool covers, laundry to landscape applications, rain barrels, rain sensors, and hot water recirculating systems
- Water Wise residential surveys
- Commercial indoor/outdoor rebate programs
- School education programs

In the event a water shortage stage is declared, in addition to the ongoing water conservation measures employed by the City, the additional measures below may be taken:

- Expansion of public information campaign
- Directed promotion of water use surveys
- Enhanced water conservation information on billing
- Enhanced water efficiency education
- Encourage customers to identify and repair leaks in a timely manner

8.4.1.3 Water Use Restrictions

During Drought stages, the City Council can implement additional water use restrictions as appropriate to achieve the desired level of conservation. Potential and additional restrictions include:

- Defer construction of new City parks unless specific factors determined by the City Council authorize such construction.

- Prohibit the installation of landscaping, other than turf, unless irrigated with a drip irrigation system or a similar system with the equivalent savings in water usage.
- Prohibit new setback landscaping at commercial and industrial sites. Deferred installation agreements may be required to ensure construction of the setback landscaping when the water drought or emergency is over.
- Decrease or stop hydrant flushing
- Expand system leak detection program
- Require hotels, motels and all public establishments offering lodging to post drought notices including the option to opt out of linen service.
- Require restaurants to serve water to customers only upon request of their patrons.
- Prohibit operation of fountains and water using ornamental structures unless equipped with a recirculating pump. Depending upon the severity of the shortage, the City may prohibit the operation of ornamental water using structures.
- Limit watering and irrigation of plants, trees, and landscaping to specified days and/or hours of the day, pursuant to regulations set by the Director of Utilities. Depending upon the severity of the water shortage, this may include limiting water utilization only for trees and plants watered by drip irrigation or hand-held buckets/hoses, or prohibition of all irrigation completely.
- Depending upon the severity of the water shortage, limit other outdoor water use such as, but not limited to, the washing of equipment or vehicles to specified times during the day, on specified days only, at commercial washes only where recycling of water is maintained, or prohibit all outdoor uses of water altogether.
- Prohibit the installation of turf grass.
- Depending upon the severity of the water shortage, require all swimming pools and spas to have a cover, limit refilling of pools and spas to only those with covers, or prohibit the issuance of any new building permits for a pool or spa.
- Depending upon the severity of the water shortage, prohibit the construction of new golf courses and reduce or prohibit new residential construction.

The above demand reduction actions and their estimated percent shortage gap reduction impacts are summarized in Table 8-2.

Table 8-2. Demand reduction actions (DWR Table 8-2)

Shortage Level	Demand Reduction Action	Estimated percent reduction of shortage gap	Additional explanation	Penalty, charge, or other enforcement
0-6	Other - require automatic shut off of hoses	1%		Yes
0-6	Other - prohibit use of potable water for washing hard surfaces	3%		Yes
0-6	Landscape - restrict or prohibit runoff from landscape irrigation	5%	Includes prohibition of irrigation during/after rain	Yes
1, 2	Expand public information campaign	0%	Informational	No
1, 2	Expand public information campaign	0%	Water Education	No
1, 2	Provide rebates for turf replacement	5%		No
1, 2	Provide rebates for landscape irrigation efficiency	1%	Irrigation controller rebates	No
1, 2	Provide rebates on plumbing fixtures and devices	1%	High efficiency washer rebates	No
1, 2	Provide rebates on plumbing fixtures and devices	1%	Rain barrel, rain sensor, hot water system, pool cover rebates	No
1, 2	Other	1%	Distribution of water efficient fixtures	No
1, 2	Offer water use surveys	1%		No
1, 2	Landscape – other landscape restriction or prohibition	1%	Landscape efficiency regulations	Yes
1, 2	Other – customers must repair leaks, breaks, and malfunctions in timely manner	2%		Yes
2	Reduce system water loss	2%	Enhance leak detection	No
2	Decrease line flushing	0.5%	Suspend hydrant flushing	No
3	Increase water waste patrols	5%	Code enforcement staff	Yes
3	Landscape – prohibit certain types of landscape irrigation	5%	Limit outdoor irrigation	Yes
4	CII – other CII restriction or prohibition	0.5%	Curtail business use of water	Yes
4	Water features – restrict water use for decorative water features	0.5%	Cease operation of non-circulating water features	Yes

Shortage Level	Demand Reduction Action	Estimated percent reduction of shortage gap	Additional explanation	Penalty, charge, or other enforcement
4	Landscape – prohibit all landscape irrigation	10%	Additional Restriction of/cease outdoor irrigation	Yes
4	Other - prohibit vehicle washing except at facilities using recycled or recirculating water	1%		Yes
4–6	Other	7.5%	Residential/commercial water use allocations	Yes
4–6	Implement or modify drought rate structure or surcharge	2.5%	Excessive use penalties	Yes
5	Landscape – other landscape restriction or prohibition	1%	Restrictions on turf installation, landscaping	
5	Moratorium or net zero demand increase on new connections	0%	Restrictions on additional use	Yes
5	Pools and spas - require covers for pools and spas	0.5%		Yes
5	Pools – allow filling of swimming pools only when appropriate cover is in place	0.5%		Yes

8.4.2 Water Supply Augmentation Actions

Chapter 6 of the UWMP discusses the City's conjunctive management of groundwater and surface water sources to use both effectively and sustainably and avoid overuse of either resource.

Chapter 6 further details the City's efforts started in 2017 to evaluate the use of tertiary treatment from the EWWTP for potential recycled water use for a variety of purposes. Although recycled water is not currently being used within the City, recycled pipeline have been installed in anticipation of future use and availability.

The City works through SCWA to purchase water for short-term and long-term needs. One additional entitlement available through SCWA is State Water Project water purchased from the Kern County Water Agency.

Table 8-3. Supply augmentation actions (DWR Table 8-3)

Shortage Level	Supply Augmentation Actions	Estimated percent reduction of shortage gap	Comments
0-6	Transfers	Dependent upon availability	Kern County Water Agency

8.4.3 Operational Changes

The City will continue to evaluate operational and maintenance procedures in order to identify opportunities for improved efficiency in water delivery and reducing system water loss.

8.4.4 Emergency Response Plan

The City of Vacaville developed a Utilities Department Emergency Response Plan in August 1991and has maintained and updated the plan on a regular basis, with the most recent update occurring in April 2014. The City continues to maintain a comprehensive plan which outlines the water system response plan in the event of a natural disaster, a Citywide power outage, or a bio-terrorism attack on the City's water treatment and distribution system.

The Utilities Department emergency operations center, when activated, coordinates damage surveys, gathers information, and conducts responses to the damaged processes and system. The Emergency Response Plan includes the following elements:

- List of water system components (wells, distribution system, storage tanks)
- Measures to be taken prior to and following an emergency event
- List of City emergency operation personnel
- Information regarding coordination with police and fire department personnel
- List of water testing laboratories, water system contractors, and pipe repair and installation contractors
- Utility service numbers for traffic signal repairs, gas and electrical repairs, and water works suppliers

In the event of a catastrophic interruption or other emergency, the City Council can direct the implementation of the Emergency stage of water conservation action.

In accordance with the America's Water Infrastructure Act of 2018, the City has completed a risk and resilience assessment for multiple catastrophic events that could result in a disruption of the water supply including, but not limited to, earthquakes (seismic), fires, hazardous chemical release, flood, and pandemic (West Yost Associates, 2020). The assessment process includes the development of a Water Emergency Response Plan that will be adopted in June of 2021. The Water Emergency Response Plan outlines emergency response actions and mitigation measures for these and other catastrophic events.

8.5 Communication Protocols

The City will communicate any significant changes to, or shortages in, available water supply sources, as well as any disruption of service, to its water customers; the general public; and local, regional, and state government agencies as required and necessary.

Communications and/or updates may be made through the City's website, social media posts, utility billing inserts or supplements, and press releases in local newspapers, radio or television stations.

8.6 Compliance and Enforcement

The City will endeavor to achieve water use reduction targets when possible through voluntary compliance measures which will include existing and enhanced water conservation communication, education, outreach, and incentive programs.

8.6.1 Compliance and Enforcement Protocols

In the event that water target reductions are not met and/or water shortages occur that cannot be met simply through voluntary measures, the City may enact compliance and enforcement protocols to ensure compliance. These measures may include:

- Water waste and/or water enforcement patrols
- Warning and citation protocols
- Fines for water waste of up to $500 per incident
- Penalties/surcharges for excessive water use in the event of a declaration of water shortage and implementation of water use restrictions or allocations.

8.6.2 Penalties for Excessive Use

Under the Normal condition, water rates shall be established and modified from time to time with the objective of fully compensating for the acquisition, treatment, and distribution of water through revenues collected from customers, and promoting beneficial use of the water. There are no penalties for high water use under the Normal condition.

In Drought and Emergency conditions in which a water conservation stage is declared and conservation goals set, penalties, in the form of surcharges on the water bill, may be assessed for water use in excess of the conservation goal and/or water use allocation. For any instance in which the customer's use exceeds the conservation goal and/or the water use allocation, that customer will be assessed a surcharge of 25% of the variable water charges for that billing period as a penalty for excessive water use.

The procedures for the administration, implementation, enforcement, and appeal of fines and penalties are contained in VMC Section 13.20.030.

8.7 Legal Authority

The UWSCP complies with VMC Chapter 13.20 titled "Water Conservation in Normal, Drought and Emergency Conditions" (Appendix K). The VMC is referenced or quoted throughout the UWSCP where appropriate. The ordinance establishes the application of the UWSCP to all water users and authorizes the appropriate City officers to administer and enforce the provisions of the plan.

8.7.1 Authority

The Utilities Department, through the Director of Utilities, shall be responsible for administration and enforcement of the provisions of the UWSCP. The Department will monitor and determine when a water shortage exists or is projected to exist, and make a recommendation to the City Manager.

8.7.2 Declaration of Water Shortage Condition or Emergency and implementation of Water Shortage Response Actions

Upon determination of a water shortage or emergency, the City Manager shall notify the City Council of the determination of the condition along with recommendations for enactment of water shortage response actions outlined in Section 8.4.

The Utilities Department shall coordinate with any City, County, or agency within which it provides water supply services for the possible proclamation of a local emergency.

Before implementation of water shortage response actions, City Council shall schedule and hold a public hearing which shall be noticed in compliance with City protocols. The public shall be notified of 1) the City's intent to implement a water shortage response action, and 2) the measures included in the proposed response action.

Following the public hearing, the Council may, by resolution, determine that a water shortage condition or emergency exists and what water shortage response action outlined in Section 8.4 shall be put into effect during the water shortage or emergency condition. This action may include the imposition of fines, penalties, and surcharges to be applied during the condition.

8.7.3 Withdrawal of Water Shortage Condition and Water Shortage Response Actions

Water shortage response actions will continue to be in effect until the Utilities Department has determined that water shortage conditions have improved. Upon recommendation from the Department and City Manager, the City Council may, by resolution, declare a reduction or elimination of the water shortage response action.

8.8 Financial Consequences of UWSCP

The City of Vacaville manages the Water Utility with the intent of maintaining revenue neutrality. The City's goal is to bill its customers only for the costs to operate and maintain an efficient water system that meets the public health requirements of its customers and promotes a high quality of life and vibrant economy.

Reductions in water use due to water conservation measures will typically result in a corresponding decrease in revenues to the Water Utility. Potential revenue reduction projections under several drought stage scenarios are shown in Table 8-4. For purposes of this table, figures are based on fiscal year 2019/2020 revenues and expenses.

Table 8-4. Revenue reduction projections

Water Shortage	Normal	10%	20%	30%	40%	50%
Water Volume Revenues	$12,170,800	$10,953,700	$9,736,600	$8,519,500	$7,302,500	$6,085,400
Reduced Revenues	-	$1,217,000	$2,434,200	$3,651,200	$4,868,300	$6,085,400
Additional Water Conservation Expenses	-	$10,000	$25,000	$185,000	$200,000	$200,000

Once the City's water conservation reduction goal is established, the corresponding budget impact will be calculated. If revenue reductions become significant, the City Council may be asked to consider adjusting water rates and/or implementing a water conservation surcharge in order to offset reduced revenues and increased expenses. Any water rate adjustments considered by the City Council would be administered in accordance with the requirements of Proposition 218.

In the event additional water purchases were to become necessary, the cost for these purchases will be included as an expense and recovered through the net increase.

8.9 Monitoring and Reporting

8.9.1 Normal Conditions

In Normal stage water supply conditions, production figures are recorded daily and reviewed by the Water Operations Section. Totals are reported monthly and incorporated into the water supply report.

8.9.2 Drought Conditions

During Drought stage water supply conditions, daily production figures are provided to the Water Operations Section of the Utility Department. The Water Operations Section provides the weekly production figures to the Water Conservation Coordinator. The Water Conservation Coordinator compares the weekly production to the 2013 base year data to verify reduction goals are being met. Weekly and monthly reports are generated and provided to the Director of Utilities. The Director of Utilities will notify the City Manager and City Council if water reduction goals are not met, so corrective action can be taken.

8.9.3 Emergency Water Shortage Conditions

During an Emergency conditions shortage or interruption of service, Drought stage procedures will be followed, with the addition of a daily production report to the Director of Utilities. During a disaster shortage the Emergency stage applies.

8.10 UWSCP Refinement Procedures

The UWSCP is meant to be an adaptive management plan that is subject to evaluation and refinement as needed to ensure that the provisions and measures contained in the plan are effective and achieving the desired results of effectively managing the City's water supply during water shortage conditions. Water shortage response actions will include the appropriate level of water shortage risk tolerance and be periodically evaluated to ensure the strategies employed are appropriate for the water shortage level.

Data collected from the normal, drought, and emergency water shortage conditions will be evaluated and considered in determining whether to implement, maintain, extend, amend, or terminate a water shortage response action and/or to amend one or more elements of the UWSCP.

8.11 Special Water Feature Distinction

For the purposes of this UWSCP, decorative or recreational water features that are artificially supplied with water or use recycled water, such as fountains, ponds, lakes, and waterfalls shall be categorized separately from swimming pools and spas. Water shortage response actions for each category are listed and shall be applied as shown in Section 8.4.

9 Demand Management Measures

This section provides brief descriptions of the City's Demand Management Measures (DMMs) that the City has implemented or is in the process of implementing. The City has been actively engaging in measures and initiatives to conserve water since 1991, including participation in a regional Water Conservation Committee that includes other cities and agencies in Solano County, as well as SCWA, the City's water wholesaler.

The DMMs are administered in conjunction with the five Best Management Practices as outlined by the California Water Efficiency Partnership (CalWEP, formerly the California Urban Water Conservation Council) as well as reported to the United States Bureau of Reclamation (USBR).

9.1 Demand Management Measures

9.1.1 Water Waste Prohibition

The City identifies and prohibits the waste of water through VMC Chapter 13.20 (Water Conservation in Normal, Drought, and Emergency Conditions), Ordinance 1877, and Section 8.4.

Specifically, the following uses of water are prohibited by the above regulations:

- Excessive water runoff due to landscape irrigation activities.
- Washing of sidewalks, driveways, walkways, parking lots, and all other hard-surfaced areas by direct hosing except for removal of hazardous materials for protection of public health and safety.
- Washing of vehicles, equipment, or structures without the use of a shutoff nozzle.
- The escape of water through breaks or leaks within the water users' plumbing or distribution system that is not repaired within 24 hours of discovery.
- The use of a water fountain without a circulating pump.
- Outdoor irrigation 48 hours before or after significant precipitation.

Any customer violating the regulations and/or restrictions on water use set forth in the ordinance is subject to enforcement ranging from a written warning for the first violation to increasing fines in $50 increments for each subsequent violation to a maximum fine of $500. In the event of multiple violations, additional measures may include flow restriction and/or temporary disconnection of water service.

During Drought and Emergency stages, City Council may also add supplemental water use restrictions, as appropriate, to achieve the desired level of conservation.

These regulations are monitored and enforced by the City's Code Compliance section.

The City maintains a database of the number of customers contacted and cited for violations as a method for determining the effectiveness of this measure.

9.1.2 Metering

The City is fully metered and therefore usage for all new and existing water connections is tracked and all customers are billed based on their volume of use. Since the City does not have any unmetered connections it does not have a program for retrofitting unmetered connections.

Table 9-1 provides a summary of the number of meter connections per account classification.

Table 9-1. Water connections – meter information

Account Classification	Number of Potable Connections Metered
Single Family	26,480
Multi-Dwelling	684
Commercial	1,099
Industrial	81
Institutional	276
Landscape	550
Total Urban Connections (2020)	**29,170**

The City maintains a database to ensure every new and existing connection is metered and billed for water use.

9.1.3 Conservation Pricing

The City had maintained a two-tiered inclining block pricing structure since 1991 as a means to promote water conservation. However, in accordance with State Proposition 218 and recent case law stemming from *Capistrano Taxpayers Association, Inc. vs. the City of San Juan Capistrano*, in 2016, the City converted from an inclining block structure to a uniform block pricing structure for all customer categories.

In 2020 the City was in its last year of a five-year rate increase that assumed ongoing water consumption reduction of 20%. Future planned rate studies will factor in continued water conservation as part of the rate analysis.

The City will continue to evaluate water consumption data to determine the impact of a uniform rate structure on water usage while continuing to target 20% overall water consumption throughout the City.

9.1.4 Public Education and Outreach

The City's public information program includes the following components:

- Maintaining a dedicated water conservation webpage on the City's website to educate the public on the City's water conservation practices, policies, and procedures as well as provide tips and resources for promoting water conservation (City of Vacaville, 2021);
- Providing educational displays, information booths, and speakers at public events;
- Public service announcements on local media including public television, radio, newspapers, webpage; and social media;
- Providing speakers to employees, community groups, and the media;
- Providing current and comparative water use information on water bills;
- Providing billing samples with easy to follow instructions;
- Providing water conservation education and information through water billing inserts or printing directly on bills.

As a member of the regional Water Conservation Committee, Vacaville participates in and promotes the following programs:

- Supporting the Putah Creek Discovery Corridor partnership, a "place of discovery" demonstration/activity site that promotes environmental and water conservation;
- Water efficient landscaping workshops;
- Water Efficient Landscaping rebates in which residents can qualify for rebates of up to $1,000 for converting their existing lawns to water efficient landscapes;
- High Efficiency Washing Machine rebates of up to $100;
- Distribution of complimentary water conservation tools including shower timers, moisture meters, fixtures, spray nozzles; and water conservation informational handouts.

The City also partners with the cities of Vacaville, Suisun, Dixon, and Fairfield to implement the Solano Water Education Program, administered through the Solano Resource Conservation District to provide in-school and off-site water conservation education workshops and activities to K-12 students, teachers, and parents (Solano Resource Conservation District, 2021). The program focuses on educating participants on the water cycle, local water sources, water and wastewater treatment, and water conservation. Partner programs include large-scale water conservation assembly presentations by the Zun Zun and Rock Steady water education programs. This also includes Project WET (Water Education for Teachers), which focuses on providing workshops specifically for teachers (Project WET

Foundation, 2021). This year's workshops provided six hours of water conservation training for participating educators.

The City also participates in an annual water conservation video contest in which students from throughout the county compete to have their original videos featured on the SCWA website and YouTube (SCWA, 2021b). Cash prizes are given to the top student winners and their teachers on behalf of their schools.

The City also financially supports the California Water Awareness Campaign through its participation in the regional Water Conservation Committee.

The City annually collects, assesses, and reports relevant data to determine program effectiveness, including, but not limited to:

- Number of visits to conservation websites.
- Number of programs, materials, and publications distributed.
- Number of participants at workshops and public events.
- Annual budget for program.

9.1.5 Programs to Assess and Manage Distribution System Real Loss

The City conducts validated distribution system water audits annually in order to reconcile water production figures with consumption records. After accounting for unmetered uses, the City estimates its system losses and performs distribution system leak detection in an attempt to minimize those losses. The City's system audit program consists of the following:

Annually complete a pre-screening system audit as follows:

- Determination of metered sales;
- Determination of other system verifiable uses;
- Determination of total supply into system;
- Determination of estimated loss based on the above data.

In addition to the above, the City conducts annual line and hydrant flushing in order to maintain water quality, appropriate system pressure, and assure proper working conditions.

The City collects the following information to determine the effectiveness of this measure:

- Prescreening audit results and supporting documentation.
- In-house records of audit results with completed and validated AWWA Audit Worksheets for each completed audit period.

9.1.6 Water Conservation Program Coordination and Staffing Support

The City has maintained a Water Conservation Program and coordinator since 1989. Under the Water Conservation Coordinator, the City promotes residential and commercial, industrial, and institutional water conservation in order to achieve regular and mandated water consumption targets. Programs include water systems management, public and school education, regional water conservation programs, workshops, and rebate programs. The current water conservation coordinator is Ramiro Jimenez, Utilities Administrative Manager with the Utilities Department. He is supported by four administrative and technical support staff members. He can be contacted at:

Ramiro Jimenez
Utilities Administrative Manager/Water Conservation Coordinator
City of Vacaville Utilities Department
P.O. Box 220
Elmira, CA 95625
(707) 469-4123
Email: ramiro.jimenez@cityofvacaville.com

In 2020, the City budgeted $100,000 of the Water Conservation staff time towards implementation of the various DMMs for the City.

9.1.7 Other Demand Management Measures

The City currently employs additional demand management measures not discussed in the preceding sections that include, but are not limited to:

- Indoor/outdoor residential water use surveys which provide detailed histories of water consumption; check for leaks; evaluate fixture and landscape conditions; measure flow rates; provide high-efficiency fixtures as requested/required; and provide free literature, water savings devices, and materials to help promote water efficient use and landscaping.
- Establishment and monitoring of water budgets for 93 large landscape accounts primarily consisting of parks, schools, and community and private facilities. To date, the City has smart weather-based irrigation controllers at all fifteen City parks and one business park. The controllers receive data from one of the three California Irrigation Management Information System stations located in the region.
- The *Water Efficient Landscape Requirement*s program that requires a water budget for all landscape areas (except single-family backyards). The regulations establish a budget based on the season and the ratio of high, medium, low, and hardscape areas contained within the designated landscape area. Provisions of the *Water Efficient Landscape Requirements* are codified in VMC Division 14.27 (Appendix D).

9.2 Demand Management Measure Implementation

Over the past five years, the City has maintained and implemented its DMMs as follow.

9.2.1 Water Waste Ordinances

The VMC and Water Conservation Ordinances have been in effect since 1991 and are regularly enforced through proactive and responsive enforcement via the City's Code Compliance section. In 2014, Ordinance 1877 was adopted updating the Water Conservation regulations outlined in VMC Chapter 13.20. The City may increase Code Compliance enforcement and administrative staff specifically to address and enforce the water waste prohibition regulations.

The Utilities Department maintains an electronic inbox for citizens to report water waste.

9.2.2 Metering

The City has required meters for all new connections since the inception of the utility in 1959. In 2013, the City replaced 14,300 existing analog meters with Automatic Meter Reading meters.

9.2.3 Conservation Pricing

From 2010 through January of 2016, the City utilized a two-tier inclining block rate structure as a method for promoting water conservation. With the change to a single uniform rate structure commencing in February 2016 to comply with state mandates and case law, the City implemented a 5.5% rate increase that incorporated ongoing water conservation of 20% as a result of continued water conservation measures and an annual increase in water rates through 2020.

Although the inclining block pricing has been eliminated, VMC Section 13.20.040 maintains the City's ability to modify prices in order to fully compensate for the acquisition, treatment, and distribution of water including promoting the beneficial use of that water. This section of the code further confirms that water efficient landscape requirements and state mandated water conservation measures, including SB 606 and AB 1668, will continue under normal conditions as well as drought and emergency conditions.

9.2.4 Public Education and Outreach

The City continued to regularly participate in its public education and outreach programs in the last five years:

- Water conservation education and information through water billing inserts and direct messaging on bills and emails were sent out quarterly to 29,000 customers.
- Public service announcements on local media including public television, radio, newspapers, webpage, and social media were sent out quarterly each year.

- Staff disseminated information and resources at over a dozen public and private regional events annually, including Earth Day, Fiesta Days, Kid's Fest, City Health Faire, and the Solano County Fair.
- The City annually participated in multiple public water education workshops in partnership with SCWA.
- Approximately 2,400 water efficient fixtures and 6,000 tools and handouts were distributed to residents and water customers.
- Only 26 Water Efficient Landscaping rebates were awarded in 2020, a significant reduction due to COVID-19 restrictions. However, interest remains strong and rebates issued are expected to increase significantly in 2021 and beyond.
- In the 19/20 school year 23 assemblies and 125 classroom presentations, along with water education materials and resources, were provided and/or distributed to 11,700 Vacaville students and teachers. Presentations and activities, including the 2020 high school water conservation video contest, were conducted both in person and remotely in the last months of the year in accordance with social distancing protocols.
- The dedicated water conservation webpage on the City's website continued to be maintained and updated to facilitate providing water conservation regulations, tips, and resources.

9.2.5 Distribution System Loss

Approximately 10% of the City's water distribution system was evaluated annually over the past five years. Based on the system water supply and verifiable metered usage data, water loss for 2020 was estimated at 7%.

9.2.6 Water Conservation Program Coordination

The Water Conservation Coordinator and support staff spent up to 30% of their total time annually on dedicated water conservation programs.

9.3 Planned Implementation to Achieve Water Use Targets

The City plans to continue to administer its existing DMMs in order to achieve and maintain 20% water conservation.

Specifically, the City will continue to maintain and implement the following programs:

- Maintenance and enforcement of Water Waste Prohibitions;
- Replacement of existing meters as required and installation of new meters on all City water connections;
- The use of conservation water pricing and when warranted, penalties for excessive use, to promote conservation;

- Voluntary and mandatory water conservation measures, including irrigation restrictions and water use allocations, to promote and/or mandate conservation;
- Public education and outreach including regional media, the City's billing system, local school districts, the City's website, and the regional Water Conservation group, to promote conservation;
- Maintenance of a system leak detection and loss prevention program to identify and repair leaks in order to maintain and improve upon the current system loss amount;
- Continued support and administration of a Water Conservation program with dedicated administrative and support staff;
- Promotion and implementation of residential surveys;
- Maintenance of Large Landscape program water budgets; and
- Continued implementation and maintenance of the City's Water Efficient Landscape Requirements.

9.4 Member of CalWEP and USBR Contracting Agency

As a member of CalWEP, the City complies with all requirements of the *2008 Memorandum of Understanding Regarding Urban Water Conservation in California*. Further, as a contracting retail water agency with the USBR, the City submits its annual best management practice reports annually as required by the contract. The DMMs in this chapter correspond to the best management practices that were electronically submitted to the USBR for 2020 in April 2021.

10 Plan Adoption and Submittal

This chapter provides details regarding the public hearing, adoption process, and implementation of this UWMP.

10.1 Notice of Public Hearing

The City mailed out notifications to ten nearby agencies and districts sixty days in advance of the public hearing held on June 8, 2021. Cities and county notifications are summarized in Table 10-1 below, and the letter and full list of recipients are included in Appendix B. Notifications were also sent out to Maine Prairie Water District, Solano County Water Agency, and the Solano Irrigation District.

Table 10-1. Notification to Cities and Counties (DWR Table 10-1)

City/Agency Name	60 Day Notice	Notice of Public Hearing
City of Benicia	✓	✓
City of Dixon	✓	✓
City of Fairfield	✓	✓
City of Rio Vista	✓	✓
City of Suisun City	✓	✓
City of Vallejo	✓	✓
County Name		
Solano County	✓	✓

Per Government Code Section 5055, a notice of public hearing was published twice in the local newspaper (*The Reporter*) on May 22 and May 29, 2021, to notify all customers of the public hearing. Notice was also posted on the City's website. A copy of the draft plan was also made available for public review at City offices and on the City's website prior to the public hearing. Copies of the public notices are included in Appendix B.

10.2 Public Hearing and Adoption

A public hearing for this UWMP and the UWSCP was held on June 8, 2021, to provide an opportunity for City water users and the general public to learn about this UWMP and ask questions about the City's water supply and its plans to continue to provide a reliable and safe water supply.

This UWMP and the UWSCP were adopted by the City Council on June 8, 2021. Copies of the resolutions to adopt this plans are provided in Appendix C.

10.3 Submittal

A copy of this UWMP and the UWSCP will be submitted to DWR within 30 days of adoption and by July 1, 2021. The adopted documents will be submitted electronically to DWR through the WUE Data Portal. A CD of the adopted plan will also be submitted to the California State Library within 30 days of adoption.

10.4 Public Availability

No less than 30 days after submitting the UWMP and UWSCP to DWR, copies of the adopted documents will be provided to the City and Solano County, and made available to the public at the following locations in the City:

City Manager's Office
Vacaville City Hall
650 Merchant Street
Vacaville, CA 95688

Utilities Department
Easterly Wastewater Treatment Plant
6040 Vaca Station Road
Elmira, CA 95625

Electronic copies will also be made available for review on the City's website at: https://www.ci.vacaville.ca.us/government/utilities/reports-and-plans

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