CARMICHAEL WATER DISTRICT

2010 Urban Water Management Plan

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Carmichael Water District

2010 Urban Water Management Plan

Prepared by

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Comprehensive Water Planning

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CHAPTER 1. INTRODUCTION

The Carmichael Water District (District) has a long history of providing water for irrigation, municipal, and commercial purposes to its residents and businesses. The District, located about ten miles east of downtown Sacramento along the north side of the American River, was formed in 1916 to supply irrigation water for farming throughout an eight square mile area of unincorporated Sacramento County. As the decades progressed, the community of Carmichael became more urbanized and the District became predominantly an urban water supplier.[1] The District currently serves about 11,500 af/yr to a population of 37,900[2] through 10,832 residential connections and hundreds of non-residential connections.

The District's 2010 Urban Water Management Plan (2010 UWMP) documents its water management planning efforts to ensure adequate water supply to meet demands over the next 25 years. The UWMP specifically assesses the availability of supplies to meet future demands during normal, single-dry and multiple dry years. Verification that future demands will not exceed supplies and assuring the availability of supplies in dry year conditions are critical outcomes of this UWMP.

Note To DWR

The Carmichael Water District has written this UWMP primarily as a water resources planning tool and secondarily to satisfy the requirements of the UWMPA.

The body of the document presents and discusses data that DWR requests in its 2010 UWMP Guidebook.

To facilitate review by DWR for compliance with the UWMPA, data from the body of the document has been transferred into DWR Tables consistent with the organization of the tables in Section N of the 2010 UWMP Guidebook. These tables are in **Appendix A-1**.

Also, this UWMP has been reviewed for adequacy according to the UWMP Checklist as contained in Section I of the 2010 UWMP Guidebook. A completed checklist is included in **Appendix A-2**.

1.1 Urban Water Management Planning Act

The Urban Water Management Planning Act (UWMPA) requires every urban water supplier to prepare an urban water management plan pursuant to California Water Code (CWC) § 10610 et seq.[3] Because the District is an urban water supplier, it is preparing its 2010 UWMP consistent with the UWMPA.

[1] The community of Carmichael is slightly larger than the service area of Carmichael Water District.
[2] From 2010 Census. See **Appendix B-6**.
[3] An "urban water supplier" is a supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually." CWC § 10617.

Specifically, District's 2010 UWMP describes and evaluates the reliability of its water supplies, the water use of its customers, its water demand management measures, and its long-term plan for efficient water use. The UWMP also presents baseline per-capita water use data and target conservation values as required by CWC §10608 et seq.

1.2 Public Participation and Agency Coordination

The UWMPA requires a water purveyor to coordinate the preparation of its UWMP with other appropriate agencies in and around its service area. This includes coordination with other water suppliers that share a common source, water management agencies, and relevant public agencies. The District coordinated preparation of its UWMP with the entities listed in **Table 1-1**. Copies of the various notifications are included in **Appendix B-2** and **B-3**.

Table 1-1 – Public and Agency Coordination

Coordinating Agencies and Entities	Participated in developing the plan	Commented on the draft	Attended public meetings	Sent a copy of the draft plan	Sent a notice of intention to adopt
Carmichael Chamber of Commerce					√
Citrus Heights WD					√
Fair Oaks WD					√
Sacramento Suburban WD					√
Sacramento Co. Planning and Community Development Office					√
Sacramento Co. Water Agency					√
Sacramento Ground Water Authority					√
Sacramento Regional Co. Sanitation District					√
Sacramento Area Sewer District					√
San Juan Unified School District					√
Regional Water Authority					√
General Public					√

Note: The UWMP draft was made available on www.carmichaelwd.org

1.3 Public Hearing and Plan Adoption

Prior to adoption of its UWMP, the District held a public hearing regarding its UWMP on May 16, 2011. Before the hearing, the District made a draft of the UWMP available for public inspection at its office on Fair Oaks Boulevard. General notice of the public hearing was provided through publication of the hearing date and time in the Sacramento Bee on May 4 and May 11[4] and posting of the hearing at the District's office. The District Board of Directors received comments at the public hearing.

As part of its public hearing, the District received community input regarding its implementation plan for complying with the water conservation requirements contained

[4] See **Appendix B-2** for copies of the published notices.

in CWC § 10608.20 et seq., including the implementation plan's economic impacts.[5] Also, at the public hearing, the District presented the method for determining its urban water use target pursuant to CWC § 10608.20(b), which it formally adopted on May 16 2011.

The Carmichael Water District adopted its 2010 UWMP on June 20, 2011[6] A copy of the adopted 2010 UWMP will be provided to Sacramento County and the California State Library, and posted onto the District's website by August 30, 2011.

1.4 Resource Maximization and Import Minimization

The Carmichael Water District uses various water management tools to maximize the use of its available water resources. Specifically, the District focuses on increasing water use efficiency and upgrading water supply and delivery facilities. The District will implement efficient water management programs as appropriate to ensure compliance with recently adopted state mandates requiring increased efficiency in both the indoor and outdoor sectors.

1.5 Interagency Coordination

1.5.1 Water Forum

Community leaders, along with water managers from Sacramento, Placer and El Dorado counties negotiated the Water Forum Agreement (WFA), which is a comprehensive package of linked actions that will achieve two coequal objectives: (1) Provide a reliable and safe water supply for the region's economic health and planned development through to the year 2030; and (2) Preserve the fishery, wildlife, recreational, and aesthetic values of the Lower American River. The District participated in the development of, and is a signatory to, the Water Forum Agreement. As one of the signatories, the District has agreed to specific water management actions under a range of hydrologic events that are linked primarily to runoff in the American River Basin and inflow to Folsom Reservoir. Pursuant to the Water Forum provisions, the District has also developed best management practices that are consistent with the Demand Management Measures in the UWMPA.

1.5.2 Sacramento Groundwater Authority

Carmichael Water District participates as one of the members of the Sacramento Groundwater Authority (SGA) in the Central Unit. SGA is a joint powers authority created to collectively manage groundwater resources in the North Area Groundwater

[5] CWC § 10608.26
[6] The resolution adopting the 2010 UWMP is in **Appendix B-1**.

Basin, which includes Sacramento County north of the American River. In 2003, SGA adopted a groundwater management plan that identifies management objectives for the North Area Groundwater Basin and includes several components aimed at monitoring and managing groundwater levels and quality in that basin. In 2008, SGA updated its groundwater management plan (GMP) to ensure that management objectives and responses remain responsive to developing needs. The groundwater management plan is designed to achieve an overarching objective of the Water Forum Agreement related to the North Area Groundwater Basin – groundwater production that is within the groundwater basin's 131,000 af/yr[7] annual average sustainable yield as estimated in the Water Forum Agreement. The District is committed to producing groundwater consistent with the principles of the GMP.

SGA members have also recently developed a Water Accounting Framework (Framework), which establishes a set of policies and procedures that will encourage and support conjunctive use operations within the SGA area. The Framework will facilitate the long-term sustainability of the underlying groundwater basin as a source of public water supply. The Framework recognizes investments by the SGA member agencies in the development of conjunctive use programs and supports groundwater banking programs that enhance the long-term sustainability of the groundwater basin. The Framework includes an initial sustainable pumping estimate for purveyors, like Carmichael Water District, located in the "Central Unit" of the SGA area. The initial sustainable pumping estimate is a pumping goal for all purveyors designed to maintain a stable groundwater elevation, and is not meant to limit any one purveyor's ability to produce groundwater to meet the demands of its customers. SGA has also assigned a "basin sustainability goal" to each purveyor in the Central Unit as an annual target groundwater use reduction quantity. SGA intends to condition its endorsement of purveyor groundwater banking and exchange programs on a purveyor achieving its "basin sustainability goal." Central Unit purveyors will attempt to start achieving their respective goals by 2012. Further details are provided in Chapter 3 regarding the District's goals.

1.5.3 Regional Water Authority

The Regional Water Authority (RWA) is a joint powers authority that serves and represents the interests of 22 water providers in the greater Sacramento, Placer, El Dorado and Yolo County regions. The Authority's primary mission is to help its members protect and enhance the reliability, availability, affordability and quality of water resources. RWA has launched significant programs and services on a regional scale,

[7] This value was estimated based on long-term average water use, supply conditions, and facilities in the basin at the time of the WFA. This value was not intended to be a fixed value that could not be modified as conditions and assumptions changed in the basin.

including: (1) A water efficiency program designed to help local purveyors implement best management practices on a regional basis; (2) implementation of the American River Basin Regional Conjunctive Use Program to build and upgrade water facilities throughout the region to better manage surface and groundwater resources; and (3) development of an Integrated Regional Water Management Planning Program to continually identify the regional projects and partnerships that will help the region best meet its future water needs.

1.7 Plan Organization

This UWMP is organized as follows:

- Chapter 2 provides a description of the District's service area, demographic characteristics and climate;
- Chapter 3 describes the District's current and future water supplies and the reliability of the supplies;
- Chapter 4 details the demands on the District's system, including the past and future estimated demands;
- Chapter 5 discusses the District's demand management measures;
- Chapter 6 outlines the District's water shortage contingency plan;
- Chapter 7 compares the District's supplies and demands in normal and dry years.
- The Appendices include background information and supporting documents

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CHAPTER 2. SERVICE AREA, DEMOGRAPHICS AND CLIMATE

2.1 Carmichael Water District Service Area

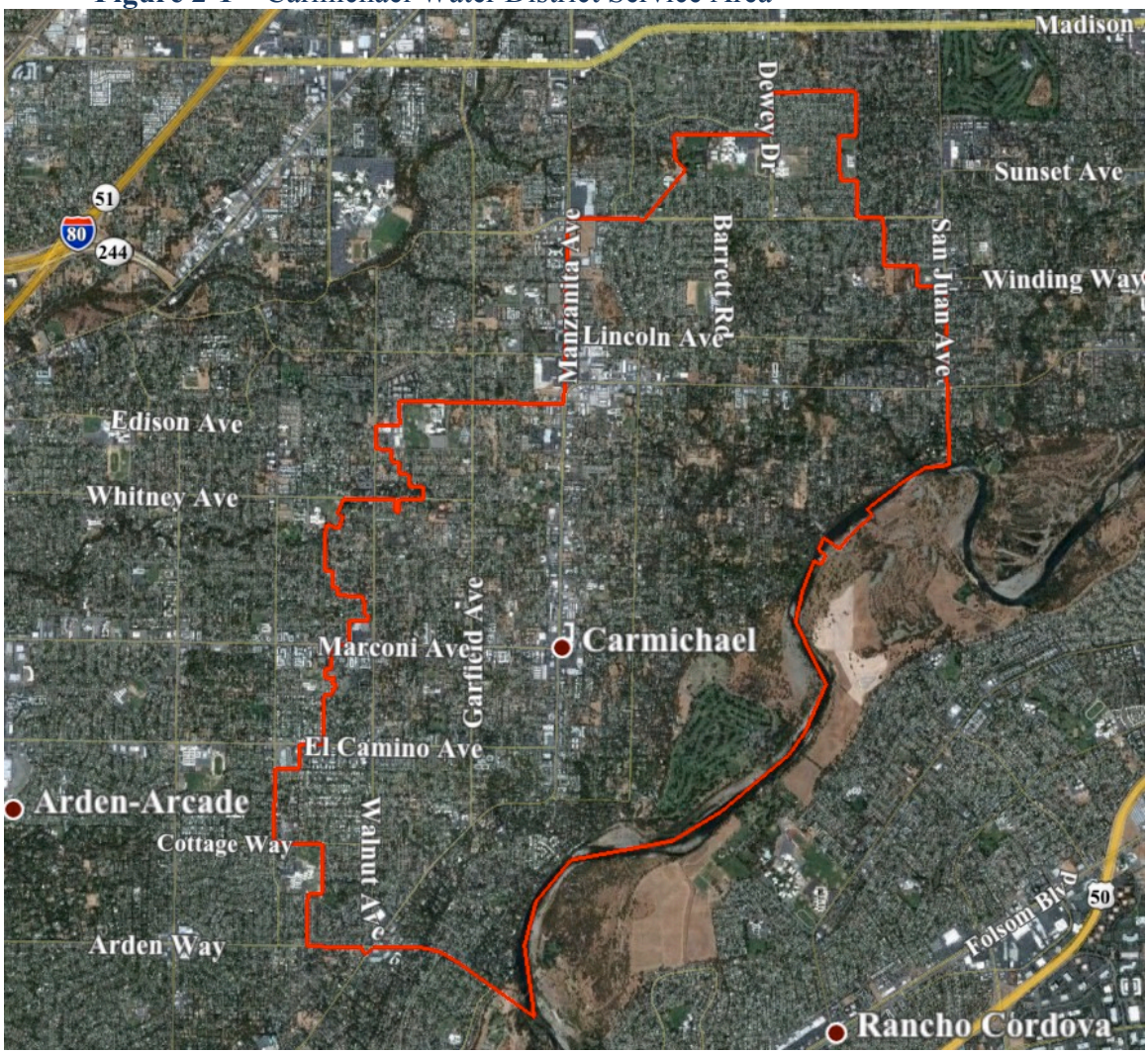
2.1.1 Service Area Description

The Carmichael Water District was formed in 1916 to provide water to what was then Carmichael Colonies 1 and 2. The District serves an eight square mile area located in the community of Carmichael, an unincorporated suburban area of Sacramento County, California (see **Figure 2-1**). The Carmichael Water District is located about 10 miles northeast of downtown Sacramento and 12.5 miles west of Folsom Reservoir. The southern district boundary runs for about 4.25 miles along the American River and is bordered entirely by other Sacramento area water purveyors, including Citrus Heights Water District, Fair Oaks Water District, Sacramento Suburban Water District, and Golden State Water Company.

Land uses in the Carmichael Water District service area are primarily residential, with about 79 percent of the service area in residential uses based on Sacramento County's land-use designations. About 6 percent of the service area is commercial and the remainder is a combination of parks and schools. Only about 5 percent of the District's service area is "undeveloped," based on Sacramento County's General Plan designations.

As of 2010, Carmichael Water District served 10,832 residential connections. The Carmichael Water District service area is substantially built out, having little undeveloped land, so limited growth is expected. This growth will occur as a result of isolated infill, lot split development projects, and redevelopment presented in the Sacramento Area Council of Governments (SACOG) Blueprint.

Figure 2-1 – Carmichael Water District Service Area



Note: Created using Google Earth Pro

2.1.2 Service Area Demographics

The population served by the District includes a mix of users and user classes. This includes residential, as well as commercial and public customers. Population estimates were derived from census data following the methods set forth by DWR. The historic population for the District's service area is presented in the left side of **Table 2-1**.

Table 2-1 also includes a population projection through build out (BO) which should occur around 2050 according to SACOG's Blueprint plans. Notably, the 2020 population estimate of 38,223 persons is due to nearly no development other than infill occurring. It should be noted that the population is expected to grow with the SACOG planned redevelopment in the District. The SACOG Blueprint calls for around 60 acres of commercial space to be converted to mixed use. Around 1,800 new Dwelling Units

(DUs) are expected without reducing the amount of commercial space. These additional dwelling units result in around a 10% population increase by BO.

Table 2-1 – Carmichael Water District Population Projection

Year	Population	Year	Population
2000	37,200	2010	37,899
2001	37,702	2015	38,061
2002	37,865	2020	38,223
2003	37,911	2025	39,285
2004	38,095	2030	40,347
2005	38,042	2035	41,409
2006	37,989	BO	42,309
2007	37,954		
2008	38,134		
2009	38,357		
*2010	38,354		

Note: * 2010 Population on the left side is estimated from the number of connections and 2000 census data. Right column 2010 Population is from 2010 census data and right column future estimates are calculated from the addition of housing units.

2.1.3 Climate

Climate data for the Carmichael Water District service area was obtained from local reporting stations. Standard monthly average evapotranspiration data was obtained from the California Irrigation Management Information System (CIMIS) station located in Fair Oaks, California, which is approximately six miles to the east of the Carmichael Water District service area. Annual evapotranspiration for the period 1998-2010 measured 50.67 inches.

Average precipitation and temperature data was obtained from the National Oceanic and Atmospheric Administration climate station located at Sacramento International Airport. For the period 1998-2010, average annual rainfall was measured as 17.13 inches. The wettest months are December, January and February, and the driest months are typically July and August.

For the same time period, average daily maximum temperature was recorded by month. Typically, July and August are the hottest months of the year with an average high temperature of about 93 degrees Fahrenheit. December and January are typically the coolest months of the year, with an average annual temperature of about 55 degrees.

All evapotranspiration (ETo), rainfall and temperature data is provided in **Table 2-2**.

Table 2-2 – Carmichael Water District Service Area, Climate Data

Month	Standard Monthly Average ETo[1] (inches)	Average Rainfail[2] (inches)	Average Temperature[3] (Fahrenheit)
January	1.04	3.18	54.0
February	1.63	3.72	59.3
March	3.38	1.92	66.3
April	4.42	1.40	71.0
May	6.36	0.63	81.5
Jun	7.45	0.08	88.3
Jul	8.03	0.00	93.4
Aug	7.13	0.07	92.3
Sep	5.23	0.08	87.7
Oct	3.39	0.65	77.8
Nov	1.61	1.90	63.6
Dec	1.00	3.50	55.1
Annual	50.67	17.13	74.2

1. DWR CIMIS Data, Fair Oaks Station #131, 1998-2010.

2. NOAA, www.wrcc.dri.edu/summary/smf.ca.html, Sacramento Intl. Airport (KSMF), 1998-2008.

3. NOAA, www.wrcc.dri.edu/summary/smf.ca.html, Sacramento Intl. Airport (KSMF), 1998-2008.

CHAPTER 3. WATER SUPPLY CONDITIONS

3.1 Water Supply Sources

Chapter 3 describes the Carmichael Water District's existing and planned water supplies. Currently, Carmichael Water District conjunctively manages surface water and groundwater by relying primarily on its American River surface water supplies so that groundwater resources remain sufficient should there be a need to rely on groundwater more heavily in dry conditions. The Carmichael Water District's surface water supplies are secured through two licensed water rights and one permitted water right.[8] The three rights are summarized in **Table 3-1**.

Table 3-1 – Carmichael Water District Surface Water Rights

Water Right	Priority Date	Diversion Rate (cfs)	Diversion Period	Quantity (af/yr)	Water Source
SWRCB License # 1387	9/18/15	15 cfs	1/1-12/31	10,859	American River
SWRCB License # 8731	7/29/68	10 cfs	5/1-11/1	3,669	American River
SWRCB Permit # 7356	3/1/48	25 cfs	3/15-10/15	18,099	American River
	3/1/48		1/1-12/31		American River

3.1.1 License 1387

The Carmichael Water District has diverted water under License 1387 since 1915 to meet demands in its service area. The licensed water right provides for a year-round diversion of 15 cfs, which is the equivalent of 10,859 af/yr. License 1387 has provided the Carmichael Water District with a highly reliable water supply from the American River. The Carmichael Water District anticipates the supply will remain reliable, even though it is potentially vulnerable to seasonal or climatic changes, which could have an impact on runoff in the American River.

3.1.2 License 8731

The Carmichael Water District has also diverted water under License 8731 since 1968 to meet other demands in its service area. The licensed water right provides for a diversion

[8] Copies of Licenses 1387 and 8731, as well as Permit 7356, are contained in **Appendix C-1**.

of 10 cfs from May 1 to November 1. Assuming a continuous diversion for this time period, the total divertible quantity of water is about 3,669 acre-feet. License 8731 has provided the Carmichael Water District with a highly reliable water supply from the American River and the Carmichael Water District anticipates the supply will remain reliable, even though it is potentially vulnerable to seasonal or climatic changes, which could have an impact on runoff in the American River.

3.1.3 Permit 7356

The Carmichael Water District holds Permit 7356 for diversion of 25 cfs from the American River with a priority date of March 1, 1948. Carmichael has diverted and used water under this permit for beneficial purposes within the District.

3.1.4 Legal, Environmental, Water Quality and Climatic Factors Affecting Supply

In 1996, the State Water Resources Control Board issued an order extending the time in which Carmichael Water District could show application of water to beneficial use under Permit 7356 to December 31, 2005. In 2005, Carmichael Water District again filed for another extension of time to show application of water to beneficial use. Importantly, the Carmichael Water District can show that that water under permit 7356 is being used during the winter and spring, and also to help meet peak day demands between June and September when Carmichael Water District pumps about 40 cfs from the American River. Given the documented groundwater contamination underlying the Carmichael Water District, surface supplies remain highly valuable. Also, conjunctive use of surface and groundwater provides storage for dry year use and benefits contamination containment efforts by increasing hydrologic head to keep groundwater contamination from migrating away from current groundwater extraction and treatment systems.

3.2 Groundwater Supplies

Groundwater is an existing and planned supply for Carmichael Water District. For the past five years (2006-2010), Carmichael Water District has relied on groundwater for about 15-30% of its total annual supply. While groundwater, as a percentage of total supply, has recently decreased compared to the percentage reported in Carmichael Water District's 2005 UWMP, it remains an important resource for Carmichael Water District's conjunctive water management strategy. Carmichael Water District has used surface water supplies in lieu of groundwater where possible in order to protect its groundwater supplies for future use.

3.2.1 Groundwater Production Facilities

Carmichael Water District operates seven groundwater production wells, with five of these wells providing the primary groundwater supply for daily peak demand management, and two wells serving as backup wells that are activated when necessary to maintain adequate system pressure.

Table 3-2 – Groundwater Production Wells

Well Name	Max. Production (gpm)
Garfield	1,100
La Vista	1,400
Winding Way	1,350
Barrett School	1,300
Willow Park	1,400
Subtotal	**6,550**
Dewey	1,250
Ladera Way	1,350
Total	**9,150**

3.2.2 Groundwater Management Plan

Carmichael Water District participates in the Sacramento Groundwater Authority (SGA), which is a joint powers authority created to collectively manage groundwater resources in the North Area Groundwater Basin. The North Area Groundwater Basin includes Sacramento County north of the American River. In 2003, SGA adopted a groundwater management plan (GMP) that identifies management objectives for the basin and includes several components aimed at monitoring and managing groundwater levels and quality in the North Area Groundwater Basin.[9] In 2008, SGA updated its groundwater management plan to ensure that management objectives and responses remain responsive to developing needs. The groundwater management plan is designed to achieve an overarching objective of the Water Forum Agreement related to the North Area Groundwater Basin – groundwater production that is within the annual average sustainable yield of the groundwater basin. This yield was estimated in the Water Forum Agreement to be 131,000 af/yr.[10] Carmichael Water District is committed to producing groundwater consistent with the principles of the GMP.

3.2.3 SGA Water Accounting Framework

SGA members have developed a Water Accounting Framework (WAF), which establishes a set of policies and procedures that will encourage and support conjunctive

[9] The Sacramento Groundwater Authority's Groundwater Management Plan is contained in **Appendix C-2**.
[10] This value was estimated based on long-term average water use, supply conditions, and facilities in the basin at the time of the WFA. This value was not intended to be a fixed value that could not be modified as conditions and assumptions changed in the basin.

use operations within the SGA area of jurisdiction to facilitate the long-term sustainability of the underlying groundwater basin as a source of public water supply.[11] The Framework recognizes investments by the SGA member agencies in the development of conjunctive use programs and supports groundwater banking programs.[12] The WAF supports groundwater banking through operating rules for a model groundwater bank and a groundwater basin monitoring program. Carmichael Water District is an active participant in SGA, the development of the water accounting framework, and the monitoring program.

The Framework includes an "initial sustainable pumping estimate" for purveyors in the "Central Unit" of the SGA area, which includes the Carmichael Water District.[13] The initial sustainable pumping estimate is a pumping goal for all purveyors designed to maintain a stable groundwater elevation and is not meant to limit any one purveyor's ability to produce groundwater to meet the demands of its customers.[14] It is based on extractions and groundwater level observations based on facilities in the basin as of 2004. Carmichael Water District's initial sustainable pumping estimate is 6,646 af/yr.[15] SGA has also assigned a "basin sustainability goal" to each purveyor in the Central Unit, which is an annual production quantity that represents the difference between the quantity each Central Unit purveyor was producing prior to SGA's formation (1993-1997), and that purveyor's sustainable pumping estimate. Carmichael Water District's basin sustainability goal is 870 af/yr.[16] SGA intends to condition its endorsement of purveyor banking and exchange programs on a purveyor achieving its "basin sustainability goal." Central Unit purveyors will attempt to start achieving their respective goals by 2012.

3.2.4 Groundwater Basin Description

The Carmichael Water District pumps groundwater from the North American Subbasin, as defined by the California Department of Water Resources (DWR) in Bulletin 118 (2003). The North American Subbasin is not adjudicated. The North American Subbasin is bounded on the west by the Feather and Sacramento rivers, on the north by the Bear River, on the south by the American River, and on the east by the Sierra Nevada. A map showing the area of the North American Groundwater Subbasin is included in **Appendix C-3**.[17] SGA's groundwater authority boundary exists throughout a portion of the North

[11] Sacramento Groundwater Authority, Water Accounting Framework, Phase III Effort, June 10, 2010, p. 1.
[12] *Id*.
[13] *Id*. at 3.
[14] *Id*.
[15] Sacramento Groundwater Authority, Water Accounting Framework, Phase III Effort, June 10, 2010, Exhibit 2, Table 1.
[16] Sacramento Groundwater Authority, Water Accounting Framework, Phase III Effort, June 10, 2010, Exhibit 2, Table 1.
[17] Figure 2, Sacramento Groundwater Authority, Groundwater Management Plan, December 2008.

American Groundwater Subbasin that extends from the American River to the Sacramento-Placer County line. SGA refers to this area as the "North Area Basin."

The SGA GMP includes a description of the hydrogeology of North Area Basin. Specifically, Bulletin 118-3 identifies and describes the various geologic formations that constitute the water-bearing deposits underlying Sacramento County. The water-bearing formations include an upper, unconfined aquifer consisting of the Riverbank, Turlock Lake and Laguna formations, as well as a lower, semi-confined layer consisting of the Mehrten formations. The formations are typically composed of lenses of inter-bedded sand, silt and clay, interlaced with coarse-grained stream channel deposits.[18]

The SGA GMP includes a discussion of the groundwater levels in the central portion of the North Area Basin, which it defines as the area bounded on the west by the Natomas Central Mutual Water Company and Rio Linda/Elverta Community Water District and on the east by San Juan Avenue. For about 40-50 years up through the mid-1990s, groundwater production in the North Area Basin resulted in a general lowering of the groundwater levels near the center of the North Area Basin.[19] The cone of depression coalesced around an area to the west of the Carmichael Water District service area and the elevation settled at a low of about 40 feet below mean sea level.[20] Even though the central portion of the North Area Basin has experienced a decline in groundwater elevations, DWR has not identified the Northern American Groundwater Subbasin as overdrafted, nor has it projected it would become overdrafted.[21]

Since the mid-1990s, groundwater elevations have stabilized throughout the area overlying the regional cone of depression and, in some cases, groundwater elevations are continuing to increase slightly.[22] Recent conjunctive use activities have resulted in providing new surface water supplies to water purveyors historically producing groundwater in the central portion of the North Area Basin.[23] Although water purveyors in the region will rely more heavily on groundwater during dry periods, the net increase in available surface water will result in a maintained or improved amount of groundwater in storage in the basin over the long term.[24] As shown in **Appendix C-4**, groundwater elevations range from about 10 feet above mean sea level (msl) and 40 msl.

[18] Sacramento Groundwater Authority, Groundwater Management Plan, December 2008, p. 7.
[19] *Id*. at 12.
[20] *Id*.
[21] See California's Groundwater Bulletin 118, Sacramento Valley Groundwater Basin, North American Subbasin (DWR Subbasin 5-21.64), January 2006.
[22] *Id.* at 53.
[23] *Id*.
[24] *Id*.

3.2.5 Historic Groundwater Production

Carmichael Water District produces groundwater conjunctively with surface water to meet customer demands. As shown in **Table 3-3**, for the past five years, Carmichael Water District has produced between about 1,500 and 3,500 af/yr. While recent values show a declining trend in groundwater production as part of planned in lieu surface water use, Carmichael Water District will continue to rely on its available groundwater resources, as discussed in Section 3.2.6.

Table 3-3 – Historic Groundwater Production

Year	Production (af/yr)
2006	3,519
2007	2,867
2008	1,581
2009	1,609
2010	1,518

3.2.6 Groundwater Production Projection

Carmichael Water District's available groundwater supply during the planning horizon of the 2010 UWMP will be governed primarily by Carmichael Water District's participation in SGA's Water Accounting Framework. As discussed in Section 3.2.2, the WAF includes a sustainable pumping estimate for Carmichael Water District of 6,646 af/yr.[25] Thus, for purposes of the 2010 UWMP, the planned groundwater supply available to Carmichael Water District will be 6,646 af/yr. Carmichael Water District will produce groundwater in a conjunctive use fashion, relying primarily on surface water, with a percentage of its supply coming from groundwater. In the near future, Carmichael Water District anticipates pumping less than its estimated available supply of 6,646 af/yr, yet, it is planning on the total supply quantity being available in the event of any limitation on its ability to use its surface water supplies.

Carmichael Water District anticipates pumping a quantity of groundwater consistent with the recent balance between surface and groundwater use. As shown in **Table 3-4**, for the period 2006-2010, groundwater comprised about 20% of total water supplies used to meet customer demands.

[25] Again, this value was estimated based on long term average water use, supply conditions, and facilities in the basin at the time of the WFA. This value was not intended to be a fixed value that could not be modified as conditions and assumptions changed in the basin.

Table 3-4 – Groundwater and Surface Water Balance

Year	Supply			% of Total Supply	
	Groundwater (af)	Surface Water (af)	Total (af)	GW%	SW%
2006	3,519	8,971	12,490	28%	72%
2007	2,867	9,509	12,376	23%	77%
2008	1,581	10,422	12,003	13%	87%
2009	1,609	8,965	10,574	15%	85%
2010	1,518	8,217	9,735	16%	84%
Avg.				19%	81%

Table 3-5 provides an estimate of future groundwater production in a normal year, building on the average historic balance between surface and groundwater use. With the introduction of a water supply from the groundwater extraction and treatment facility at Ancil Hoffman (as discussed in Section 3.3), the historic balance is adjusted slightly to arrive at an estimate of the percentage of the total supply to be met by groundwater. Assuming the GET L-A facility produces about 390 af/yr, the GET L-A supply is about 3-4% of the historic supply quantity. The historic surface and groundwater percentages are therefore reduced by 2% each such that the groundwater percentage is about 18% of total supply. The projected groundwater production is estimated based on the demand projection in Table 4-7, which is equivalent to the supply because it includes both the estimated end-user demand and a loss factor.

Table 3-5 – Groundwater and Surface Water Production Projection

Year	Production (af/yr)
2015	1,752
2020	1,738
2025	1,738
2030	1,739
2035	1,760

3.3 Groundwater Extraction and Treatment

In February 2004, Aerojet detected N-Nitrosodimethylamine (NDMA) in a monitoring well located near Grant and Hollister Avenues in Carmichael, California. NDMA is a byproduct of combustion from solid rocket fuel and is believed to be a possible carcinogen. Since 2004, Aerojet has installed seven monitoring wells to identify the extent of the contaminant plume that is migrating north from its rocket and chemical manufacturing facility located about eight miles east of Carmichael Water District service area. Of the seven monitoring wells, four wells have not detected contaminants and three wells - Amy Avenue, Ancil Hoffman Park and Grant Avenue - have detected NDMA in

concentrations ranging from 2 parts per trillion (ppt) to a high of 93 ppt.[26]

In July 2005, Carmichael Water District and Aerojet signed a Memorandum of Understanding (MOU) for a groundwater remediation project. The goal of the MOU is to prevent groundwater contaminant plumes from reaching the District's groundwater supplies at no cost to the District's customers. Carmichael Water District and Aerojet will achieve this goal by capturing and remediating groundwater.

The first groundwater extraction and treatment facility – the Bajamont Way Groundwater Extraction and Treatment Plant (GET L-B) - came on line in 2007. The plant uses ultraviolet reactors to remove NDMA. Other treatment processes include granular-activated carbon (GAC) filtration to trap volatile organic compounds. The design also allows Carmichael Water District to add ion exchange units in the future (if needed) to treat perchlorate (another potential contaminant) and hydrogen peroxide to extend the life of the GAC beds. Following treatment, the water is discharged to the American River. Currently, GET L-B produces about 1,120 af/yr on a consistent monthly pattern throughout the year.

Aerojet, Carmichael Water District, and Sacramento County Parks have collaborated to construct a second groundwater extraction and treatment facility (GET L-A), which is located at Ancil Hoffman Park. The GET L-A facility uses the same technology as the GET L-B facility to remove NDMA – exposure to ultra violet light. Once treated, the water is used for irrigation of the Ancil Hoffman golf course. The volume of water treated is sufficient to meet about half of the golf course's non-potable irrigation water needs from May through September, and all of the non-potable irrigation water needs from October through April. Any water not used for irrigation is discharged to the American River. Currently, GET L-A produces about 390 af/yr for irrigation purposes on a consistent monthly pattern throughout the year.

For planning purposes, Carmichael Water District will reflect the long-term supply availability from each GET facility in a unique manner. For GET L-B, the Carmichael Water District is exploring opportunities to either use the treated groundwater directly or obtain credit for the groundwater supply that is "lost" through groundwater pumping and discharge to the American River so that Carmichael Water District can divert or exchange the quantity of "lost" water in the future. For GET L-A, the Carmichael Water

[26] California's Public Health Goal for NDMA is 0.003 parts per billion (ppb). A PHG represents the levels of contaminants in drinking water that would pose no significant health risk to individuals consuming the water on a daily basis over a lifetime. PHGs are advisory but must be used as the health basis to update the state's primary drinking water standards – Maximum Contaminant Levels (MCLs).

District anticipates 390 af/yr being available on a long-term basis to meet non-potable irrigation water demands in the Carmichael Water District service area.

3.4 Desalination

The District does not have or plan on developing desalinated water as a water supply source.

3.5 Transfer and Exchange Opportunities

The purpose of this section is to describe the opportunities for exchanges or transfers of water on a short-term or long-term basis. Water exchanges and transfers are an integral part of a comprehensive water management strategy. This section will break down the water exchange and transfer discussion into two sections: (1) Objectives; and (2) Mechanisms to meet those objectives. The District does not have any existing exchange or transfer agreements in place.

3.5.1 Water Exchange and Transfer Objectives

Carmichael Water District has three primary objectives in assessing water exchange and transfer opportunities. The District considers these objectives as both a water provider that could make water available for other users as well as a water receiver in obtaining water supplies for certain beneficial purposes.

The District would consider water transfer opportunities in the context of improved dry year reliability. There are several unknowns related to dry year reliability that may affect the District in the future including hydrological changes related to climate change, the Water Forum Agreement implementation, groundwater contamination, and regulatory-induced shortage issues associated with existing water supplies. The District may pursue water transfers and exchanges to address these potential issues should they arise.

The District may also pursue water transfers and exchanges in the interest of managing its water assets in order to provide local, regional and statewide benefits. Delta water supply issues, climate change, fisheries issues, and aging infrastructure may all impact numerous purveyors' water management planning activities. The District is open to pursuing opportunities to improve statewide, regional and local water planning objectives through water transfers and exchanges.

The District may consider water transfers and exchanges as a viable water supply option for potential new growth within or without its existing boundaries that has not been contemplated in the planning horizon presented in this UWMP. Although the District does not intend to expand its service area or provide any permanent supplies outside its

service area, in the event such a potential action were to happen or unforeseen significant increased industrial development occurs with the service area (due to high water using industries) the District may consider entering water exchange or transfer arrangements.

3.5.2 Mechanisms to Meet Objectives

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

3.5.2.1 Conservation Mechanisms

The District is undertaking aggressive activities to meet water conservation objectives. These conservation activities include accelerated meter installation, assessing infrastructure and end-user water conveyance and use. All water supplies conserved through the District's efforts will be retained by the District and potentially made available for alternative uses as provided under California Water Code Section 1011.

3.5.2.2 Water Management Mechanisms

The District is actively engaged in conjunctive use activities and may manage its surface water and groundwater supplies to make water supplies available for alternative uses. The District is pursuing groundwater banking and storage arrangements in the context of regional cooperation and SGA's water management activities. These banking and storage opportunities have been developed in order to flexibly and reliably manage the District's entire water supply portfolio for beneficial purposes within and without its service area.

3.5.2.3 Water Forum Agreement

The District may manage water to meet the Water Forum objectives. Such management may include engaging in exchange arrangements in order to meet Lower American River flow objectives for other water purveyors or providing water to those purveyors that are obligated to meet those objectives. Such short-term arrangements may also include controlling water below the confluence of the American River and the Sacramento River and applying that water to other beneficial uses.

3.5.2.4 Conveyance and Wheeling Mechanisms

The District will work with regional purveyors and others to assess conveyance and wheeling arrangements that may impact water transfer and exchange opportunities. Such conveyance and wheeling arrangements may improve water supply reliability and have economic advantages.

3.6 Recycled Water Opportunities

The County of Sacramento collects (County Sanitation District No. 1) and treats (Sacramento Regional County Sanitation District) the wastewater generated within the County at a regional wastewater treatment plant located 15 miles south of the District in the City of Elk Grove. The Sacramento Regional County Sanitation District currently has the capacity to process 3 million gallons per day (future expansion is permitted up to 10 million gallons per day) of recycled water. The current water recycling program is a partnership between the Sanitation District and Sacramento County Water Agency. The Sanitation District operates the plant and provides recycled water to Sacramento County Water Agency for distribution to parks, schools, commercial sites and landscaped medians within the City of Elk Grove.

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

The District will also continue to work with the Sacramento Regional County Sanitation District to define potential intra-regional or extra-regional uses for the treated wastewater that the Sanitation District produces. The Sanitation District is actively investigating such opportunities, which may include delivery of treated wastewater to a variety of destinations. These future destinations may also be considered part of Carmichael Water District's efforts to recycle water – although potentially to destinations outside the District's service area.

3.7 Current and Projected Water Supplies

The current and projected water supplies available to Carmichael Water District, as discussed Sections 3.1 through 3.6 are provided in **Table 3-6**. The total available supply based on Carmichael Water District's surface water rights, groundwater production authority, and GET production agreements with Aerojet is 40,783 af/yr.

Table 3-6 – Current and Projected Water Supplies

Water Supply (AF/Yr)	2010	2015	2020	2025	2030	2035
American River (License 1387)	10,859	10,859	10,859	10,859	10,859	10,859
American River (License 8731)	3,669	3,669	3,669	3,669	3,669	3,669
American River (Permit 7356)	18,099	18,099	18,099	18,099	18,099	18,099
Groundwater	6,646	6,646	6,646	6,646	6,646	6,646
GET L-A	390	390	390	390	390	390
GET L-B	1,120	1,120	1,120	1,120	1,120	1,120
Total	40,783	40,783	40,783	40,783	40,783	40,783

3.8 Supply Reliability

This section assesses the reliability of the water supplies projected in **Table 3-5**. The UWMPA requires an assessment of supply reliability in a normal water year, a single-dry water year, and during a period of multiple-dry water years. Carmichael Water District assesses supply reliability based on its experience and historic hydrologic records of precipitation and runoff in the American River watershed. District experience indicates that the District has typically met 75% of its demands with surface water from the Lower American River.

3.8.1 Normal Year

District experience indicates that in a normal year, its two licensed rights and one permitted right for surface water supplies from the American River are 100% reliable. Carmichael Water District diverts water under all three rights on an annual basis to meet annual demands as well as peak demands between June and September, which are often as high as 40 cfs.

As for Carmichael Water District's groundwater resources, the Water Accounting Framework established Carmichael Water District's sustainable pumping estimate based on average historic pumping conditions, which if maintained in the future would result in a sustainable aggregate yield from the basin. Thus, Carmichael Water District anticipates that its groundwater supply is 100% reliable in normal water years.

The water supplies from GET L-A and GET L-B are considered 100% reliable in average water years. Aerojet groundwater modeling indicates that Carmichael Water District could pump groundwater at the maximum rate of existing groundwater production facilities (in place at the time of modeling) – 14,159 af/yr – without an adverse impact on planned remediation performance.[27] Given that Carmichael Water District is planning to pump no more than 6,646 af/yr of groundwater in a normal year, the GET facilities should be able to produce a consistent quantity of water in normal years through 2035.

[27] CWD, 2005 UWMP, p. 23.

3.8.2 Single Dry Year

Accurate precipitation records have been kept in the Sacramento area since 1849. The most severe drought during the last 155 years occurred during the 1928-1934 period. The second and third most severe droughts are the last two of record, occurring in 1976-1977 and 1987-1994. During the 1976-1977 period, there is no indication that the Carmichael Water District's surface or groundwater supplies were limited. Thus, the Carmichael Water District assumes that supplies will be 100% reliable in a dry year similar to the 1976-1977 period.

3.8.3 Multiple Dry Year Period

Accurate precipitation records have been kept in the Sacramento area since 1849. The most severe drought during the last 155 years occurred during the 1928-1934 period. The second and third most severe droughts are the last two of record, occurring in 1976-1977 and 1987-1994. Although the 1928-1934 period is still the most severe drought from a precipitation standpoint, the 1987-1993 drought produced the most severe impacts on California's available water supplies. During the 1987-1993 drought period, there is no indication that the Carmichael Water District's surface or groundwater supplies were limited. Thus, the Carmichael Water District assumes that supplies will be 100% reliable in a multiple dry year period similar to the 1987-1993 period.

3.8.4 Water Forum Impacts on Supply Availability

While Carmichael Water District projects highly reliable supplies in normal, single dry years and during multiple dry year periods under its water rights, Carmichael Water District's participation in the Water Forum Agreement MOU may have an impact on the quantity of surface water it diverts from the American River.[28] As a signatory to the Water Forum Agreement MOU, Carmichael Water District would: (1) divert and use up to its licensed amount [of surface water from the American River] of 14,400 af/yr in "most years;"[29] (2) divert and use up to its licensed amount [of surface water from the American River] of 14,400 af/yr in "drier years;"[30] and (3) divert and use up to its licensed amount [of surface water from the American River] of 14,400 af/yr the "driest years."[31] The Water Forum Agreement also provides that by 2030, under most, drier and driest years, Carmichael Water District demand will be reduced to the historic baseline of 12,000 af/yr by implementation of urban water conservation best management practices.

[28] The UWMPA uses the term "normal" to describe an "average" year while the Water Forum Agreement uses the term "most" to describe an average year.
[29] "Most years" is defined as years when the projected March through November unimpaired inflow to Folsom Reservoir is greater than 950,000 acre feet.
[30] "Drier years" is defined as years when the projected March through November unimpaired inflow to Folsom Reservoir is less than 950,000 acre feet and equal to or greater than 4000,000 acre feet.
[31] "Driest years" is defined as years when the projected March through November unimpaired inflow to Folsom Reservoir is less than 400,000 acre feet.

Also, in drier and driest years, there is no diversion reduction requirement for Carmichael Water District because 12,000 af/yr (of demand) is equivalent to its baseline diversion.

3.8.5 Water Supply Projects and Programs

Carmichael Water District, in coordination with Aerojet, recently completed two major groundwater extraction and treatment facilities, as discussed in Section 3.3. These facilities will help ensure the reliability of its groundwater supply by maintaining the quality of the water in the basin. In the short-term, Carmichael Water District does not have specific water supply reliability projects planned, but will pursue projects as appropriate to maintain the reliability of its water supplies.

3.8.6 Summary of Supply Reliability

Based on the forgoing analysis, the reliability of the Carmichael Water District's supplies is summarized in **Table 3-7**.

Table 3-7 – Summary of Water Supply Reliability

Source	Normal Year		Single Dry Year		Multiple Dry Years	
	Reliability	Amount	Reliability	Amount	Reliability	Amount
American River (License 1387)	100%	10,859	100%	10,859	100%	10,859
American River (License 8731)	100%	3,669	100%	3,669	100%	3,669
American River (Permit 7356)	100%	18,099	100%	18,099	100%	18,099
Groundwater	100%	6,646	100%	6,646	100%	6,646
GET L-A	100%	390	100%	390	100%	390
GET L-B	100%	1,120	100%	1,120	100%	1,120
Total		40,783		40,783		40,783

CHAPTER 4. WATER DEMAND CONDITIONS

Understanding the quantities and characteristics of the demand for water, now and into the future, is essential to enable the District to adequately plan and manage its water supplies in the most effective manner. This section of the 2010 UWMP presents the current and future water demands for the District and describes their derivation. This section is organized as follows:

- Historic and Current Water Demands – This subsection presents data reflecting the historic and current water demand conditions for residential and non-residential customers in the District.
- Future Water Demands – This subsection presents the derivation of future demands for potable water within the District's service area, including land-use classifications, unit demand factors, and estimation of non-revenue water.
- Summary of Water Demands – This subsection presents a summary of the projected current and future water demands in five-year increments.
- Future Target Water Use – This subsection presents the calculation of baseline per-capita water use values, as required in §10608.16 et seq., and the resulting 2015 and 2020 water use targets.

4.1 Historic and Current Water Demands

Table 4-1 shows historic water demands within the District's service area for the past five years along with the sources of supply used to meet demands. As described in detail in Chapter 3, surface water supplies are obtained through the District's surface water rights. The District also operates groundwater wells to meet emergency and summer peaking demands.

Table 4-1 – Carmichael Water District Historic Water Demand

Year	Population	Active Connections	Groundwater (AF)	Surface Water (AF)	Total Supply (AF)
2006	37,989	10,729	3,521	8,975	12,496
2007	37,954	10,719	2,868	9,509	12,377
2008	38,134	10,770	1,580	10,418	11,998
2009	38,357	10,833	1,609	8,966	10,575
2010	38,354	10,832	1,518	8,214	9,732

4.1.2 Current Demand Factors

This subsection describes the determination of unit demand factors for existing District customers. Demand factors are represented as the average demand in acre-feet per dwelling unit per year. Residential demand factors are broken into categories based on the type of residence such as high density and low density, where high density represents apartments or condominiums and low density represents more traditional single-family homes. High density residences share common landscaped areas and have very little or no individual landscape demand, and also tend to have less people per dwelling unit than the lower-density dwelling units. These factors result in smaller per dwelling unit (DU) water demand. Low-density DU demands associate with more typical subdivisions where homes are on medium to large lots with individual landscaping and typically large turf areas. These DUs usually have more people per unit (e.g. housing a family) and, combined with outdoor landscaping, generally have greater per dwelling unit water demands.

Non-residential use is developed in a similar fashion to residential demand. Due to the variance between types of commercial connections, though, demands are developed as equivalent dwelling units (EDUs) or on a demand per acre basis[32].

To enable the unit water demand to reflect the impact of external drivers affecting future indoor and outdoor use (see **Section 4.2)**, the factors are broken into the same land use classes currently used for Sacramento County land-use planning. Future indoor residential land-use categories are estimated to account for future implementation of conservation measures as discussed in **Section 4.2**.

Based upon an analysis of 2010 data for all residential dwelling units within the District, the historic indoor unit demand factor for the largest demand segment (medium density homes or RD-5) was determined to be approximately .67 af/du/yr, which at 3.54 people per dwelling unit, equates to 169 gallons per capita per day.[33]

The demands for each dwelling unit category are estimated by dividing the water demand by the number of households for each of the dwelling unit types. **Table 4-2** presents the resulting calculated unit demand factors.

[32] Non-residential use includes all commercial, schools, parks, open space, and Ancil Hoffman golf course. Since these demands vary with the types of commercial establishments and the specific industries, the EDU basis provides a useful method to reflect the average demand per acre.
[33] The number of people per category of dwelling unit was obtained from population analysis.

Table 4-2 – Current Demand Factors

Dwelling Unit Type	Dwelling Unit (gal/day)	Demand Factor (AF)
High Density RD-40	219	0.25
High Density RD-20	144	0.16
High Density RD-10	296	0.33
Medium Density RD-5	521	0.58
Low Density RD-2	1,411	1.58

Note: RD-40 demand has a higher demand factor than RD-20. This is due to there only being one RD-40 development in the District.

4.2 Future Water Demands

4.2.1 Current and Future Mandates

External forces will ensure future residential development achieve lower unit water demands than those seen historically in the District's service area. Recently enacted State statutes and efficiency mandates will also drive the use of more efficient fixtures and products used in residential development. This subsection identifies and describes the key drivers that support use of unit demand factors that are lower than current values.

4.2.1.1 Water Conservation Objectives

On November 10, 2009, Governor Arnold Schwarzenegger signed SBX7 7, which now requires each urban water supplier to select one of four methods for determining water conservation targets for 2020.[34] This bill establishes a statewide goal of achieving a 20-percent reduction in urban per capita water use by 2020. As part of the statutes, the District must establish a water conservation target based on determination of historic baseline use. This determination is detailed in **Section 4.5**.

Achieving the District's 2020 conservation target will require the District to continue and potentially increase water conservation measures in its existing service area, and also require new service areas to use efficient indoor infrastructure and landscape features. The implementation of conservation measures by existing customers will be the main force to help the District meet its identified target use.

4.2.1.2 Indoor Infrastructure Requirements

In January 2010, the California Building Standards Commission adopted the statewide mandatory Green Building Standards Code (CAL Green Code) that requires the installation of water-efficient indoor infrastructure for all new projects beginning after January 1, 2011. CAL Green Code was incorporated as Part 11 into Title 24 of the California Code of Regulations.[35] The CAL Green Code applies to the planning, design,

[34] California Water Code § 10608.20

[35] The CAL Green Code is Part 11 in Title 24. All references in this UWMP will be to the Chapter and Section numbers that appear in the Draft document which may be obtained by visiting the California

operation, construction, use and occupancy of every newly constructed building or structure. Thus, all future construction will need to satisfy the indoor water use infrastructure standards necessary to meet the CAL Green Code.

The CAL Green Code requires residential and non-residential water efficiency and conservation measures for new buildings and structures that will reduce the overall potable water use in the building by 20 percent. The 20 percent water savings can be achieved in one of the following ways: (1) installation of plumbing fixtures and fittings that meet the 20 percent reduced flow rate specified in the CAL Green Code, or (2) by demonstrating a 20 percent reduction in water use from the building "water use baseline."[36]

4.2.1.3 California Model Water Efficient Landscape Ordinance

In 2006, the California Legislature enacted the Water Conservation in Landscaping Act, which requires the Department of Water Resources to update the Model Water Efficient Landscape Ordinance (MWELO)[37]. On September 10, 2009, the Office of Administrative Law (OAL) approved the updated MWELO, which requires that a local agency adopt the provisions of the MWELO or adopt their own equally or more effective ordinance by January 1, 2010. Because Sacramento County is a "local agency" under the MWELO, it must require "project applicants" to prepare plans consistent with the requirements of MWELO for review and approval. The County of Sacramento originally prepared its water conservation requirements with respect to landscaping in 1990 as county code section 14.10. This code applies to new or rehabilitated commercial, institutional, parks, and multifamily housing in the District's service area. It is important to note that this does not include single-family homes which are numerous in the District.

The MWELO provisions are likely to have a significant effect on the landscape design and resulting outdoor water demand by requiring preparation of a Landscape Design Plan with a water budget that is 70 percent of reference evapotranspiration (ETo).[38] The

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Building Standards Commission web site at:
http://www.documents.dgs.ca.gov/bsc/CALGreen/2010_CA_Green_Bldg.pdf

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

[37] Gov. Code §§ 65591-65599

[38] California Code of Regulations (CCR), Tit. 23, Div. 2, Ch. 27, Sec. 492.4. The MWELO provides the local agency discretion to calculate the landscape water budget assuming a portion of landscape demand is met by precipitation, which would further reduce the outdoor water budget. For purposes of this UWMP, precipitation is not assumed to satisfy a portion of the outdoor landscape requirement because the

provisions of the MWELO are applicable to new construction with a landscape area greater than 2,500 square feet.[39] The MWELO "highly recommends" use of a dedicated landscape meter on landscape areas smaller than 5,000 square feet, and requires weather-based irrigation controllers or soil-moisture based controllers or other self-adjusting irrigation controllers for irrigation scheduling in all irrigation systems.[40] The MWELO provides a methodology to calculate total water use based upon a given plant factor and irrigation efficiency.[41] Finally, MWELO requires the landscape design plan to delineate hydrozones (based upon plant factor) and then assign a unique valve for each hydrozone (low, medium, high water use).[42]

It is difficult to predict the ultimate impact of the MWELO requirements on water demand. While the requirement is for development of a landscape design plan that uses plants and features that are estimated to use no more than 70 percent of ETo, some provision must be made for the inherent tendency to overwater even with irrigation controllers installed, piecemeal changes in landscape design, reductions in irrigation efficiency through product use, and limited resources for enforcement in the absence of dedicated irrigation meters.

For these reasons, future outdoor water use is assumed to be about 85 percent ETo over a long-term period. This value was selected based on a study that supports the assumption that customers tend to apply 16 percent more water to the landscape than it actually needs.[43] While weather-based irrigation controllers may reduce this number such that only about 2 percent more water is being applied than is needed, some consideration needs to be made for the factors described above that will impact water use, outside of a controlled study, even when using a weather-based irrigation controller. These factors will likely result in overuse somewhere between 2 percent and 16 percent. Given the uncertainty regarding these impacts, the "overuse" percentage of 16 percent was used to adjust the MWELO Landscape Plan requirement.

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determination of an appropriate effective precipitation factor is highly uncertain given the various landscape slopes, terrain composition, concurrent watering schedules, etc.

[39] CCR Tit. 23, Div. 2, Ch. 27, Sec. 490.1.

[40] CCR Tit. 23, Div. 2, Ch. 27, Sec. 492.7(a)(1)(A)-(B).

[41] In calculating Estimated Total Water Use, the MWELO requires use of at least a 71% irrigation efficiency factor. Assuming 71% irrigation efficiency, the average plant factor must be 0.50. It would be possible to stay within the water budget if the average plant factor were higher than 0.50 by designing a system with an irrigation efficiency higher than 71%. The relationship between a Plant Factor (PF) and Irrigation Efficiency (IE) in the Applied Water formula is: AW=(ETo*PF)/IE.

[42] CCR Tit. 23, Div. 2, Ch. 27, Secs. 492.3(a)(2)(A) and 492.7(a)(2).

[43] http://www.irwd.com/Conservation/FinalETRpt[1].pdf.

4.2.1.4 Metering and Volumetric Pricing

In 2003, the California Legislature enacted legislation that set in motion the requirement for water purveyors to install meters on all service connections to residential and nonagricultural commercial buildings constructed prior to January 1, 1992 (all buildings constructed post-1992 were required to have a meter placed at construction).

The California Urban Water Conservation Council (CUWCC) recommends assuming a 20 percent water savings for accounts with meter retrofits and volumetric rates.[44] Twenty percent is an appropriate level of water savings when these measures are applied to existing residential accounts where no volumetric billing occurs. The District is currently in progress with the conversion of their system to a completely metered system. Since the retrofit program began in the middle of the decade, there has been a large reduction in use from users switched to the volumetric billing system. As the majority of the service area has existed since before meters were required, it is assumed that the majority of the conservation needed to meet the targeted 20 percent reduction goal will come from this metering program.

4.2.1.5 California Urban Water Conservation Council and Water Forum Agreement Conservation Element Best Management Practices

The District applied for membership in the CUWCC in May of 2011 and is anticipating being a full member as of September 2011. The District is not currently a signatory to the CUWCC Best Management Practices (BMP) Memorandum of Understanding (MOU), but is a signatory to the Water Forum Agreement (WFA). In 2009, the WFA updated the WFA Conservation Element. Under that revised Element, signatories would replace their respective WFA water conservation plans with the CUWCC MOU, including the CUWCC BMPs. Due to this, the District has modified existing BMPs and implemented others in preparation of becoming a member of the CUWCC. The District plans to start submitting council reports in 2012 (further details on the District's conservation efforts can be found in **Section 5**).

4.2.2 Residential

Because a vast majority of the existing customers are in homes built before the last decade, the future unit demand factor is assumed to change mostly from drivers such as the implementation of volumetric billing, Cal Green Code, and MWELO. A reflection of the impact of these drivers is presented as the unit demand factors for new residences in **Table 4-3**.

[44] BMP 1.3, Memorandum of Understanding Regarding Urban Water Conservation in California, California Urban Water Conservation Council, December 10, 2008.

Table 4-3 – Future Residential Unit Demand Factors

Dwelling Unit Type	Dwelling Unit (gal/day)	Demand Factor (AF)
High Density RD-40	143	0.16
High Density RD-20	143	0.16
High Density RD-10	281	0.32
Medium Density RD-5	495	0.55
Low Density RD-2	1340	1.50

Note: New RD-40 development has much lower demand than existing due to the existing RD-40 being an older property, while new developments will follow new CAL Green building requirements.

4.2.3 Non-Residential

The non-residential sector water demand is evaluated on a historic delivery basis. Since the District is near build out it is assumed that there will be no new commercial, school, or park construction. There is planned redevelopment of some current commercial spaces to mixed use but the effect is simply adding residential space on top of commercial space. It is assumed that there will be no major changes to non-residential demands. The following land use types are lumped into one category known as non-residential.

- *Commercial:* Commercial customers in the District vary greatly by type and the resulting demand is a representative average. The demand is derived by analyzing historic delivery data. The commercial category is expected to see some demand reduction due to reasons discussed in **Section 4.2.1** but redevelopment may bring higher water use commercial interests.

- *Parks:* For the Park category, minimal area is devoted to indoor uses and hardscapes. The demand for parks is derived by analyzing historic delivery data. Parks are not expected to see any changes in demands.

- *Open Space:* The open space and trails category is considered 100 percent landscape. The demand for open space is derived by analyzing historic delivery data. The District's open space is not expected to see any changes in demands.

- *School:* Schools are calculated by analyzing historic delivery data. Since the land within the District's service area is nearly built out, it is unlikely that a new school will be added to the system.

- *Ancil Hoffman Golf Course:* This golf course is the only course within the District and is handled as a single entity. The District recently began providing water from a new groundwater extraction and treatment (GET) facility located at the course to serve irrigation demands (see **Section 3.3)**. The demand, however, remains unchanged.

All non-residential demands are provided in **Table 4-4**.

Table 4-4 – Non Residential Demands

Land Use	Yearly Demand (gallons)	Yearly Demand (AF)
Commercial	209,294,097	642
Schools	59,467,808	183
Parks	39,036,950	120
Open Space	23,461,272	72
Golf Course	50,536,232	155
Total	381,796,358	1172

4.2.4 Anticipated Reduction in Current Unit Water Demand Factors

Current unit water demand factors represent the demands of existing development. Most of the District's residences are older and built before efficient plumbing fixtures and water meters were required. The majority of efficiency increases will be from current users. This increase in efficiency is from a numbers of sources including rebate programs for plumbing retrofits and appliances. Increases in efficiency occur outside of rebate programs through natural attrition. Remodels, appliance upgrades, and fixture style changes all contribute to efficiency increases due to retailers and manufactures focusing on sales to contractors who are required to use code compliant building materials. The trends in both current and future demands over time are presented in **Table 4-5.**

Table 4-5 – Change in Residential Demand Factors Over Time

Existing Demands (AF/Yr)	2010	2015	2020	2025	2030	2035
High Density RD-40	0.25	0.24	0.24	0.24	0.23	0.23
High Density RD-20	0.16	0.16	0.16	0.16	0.16	0.16
High Density RD-10	0.33	0.33	0.32	0.32	0.32	0.32
Medium Density RD-5	0.58	0.58	0.57	0.56	0.55	0.55
Low Density RD-2	1.58	1.56	1.54	1.52	1.50	1.50
Future Demands (AF/Yr)	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
High Density RD-40	--	0.16	0.16	0.16	0.16	0.16
High Density RD-20	--	0.16	0.16	0.16	0.16	0.16
High Density RD-10	--	0.32	0.32	0.32	0.32	0.32
Medium Density RD-5	--	0.55	0.55	0.55	0.55	0.55
Low Density RD-2	--	1.50	1.50	1.50	1.50	1.50

4.3 Projected Water Demands

4.3.1 Introduction

Water demand projections within the District's service area were developed for the 2010 UWMP. The existing demands are estimated to show a reduction due to natural attrition

of customers switching to more efficient appliances and fixtures, volumetric billing implementation, as well as the District's on-going conservation efforts.

4.3.2 Planned Construction

The area in and around the District is near build-out with few new housing units expected. The few that would occur would be from infill as well as subdivision of larger lots. A 2001 SACOG estimate predicted less than 300 new housing units by 2025 for the community of Carmichael (and would be reflected as less in District).[45] A recent regional planning effort by SACOG, the Blueprint, which plans to add housing units in addition to infill and subdivision, identifies an additional 15,958 units through mixed-use redevelopment. However only about 60 acres of this plan are within the District's service area. Using the SACOG data, an estimate of the anticipated growth in residential dwelling units was made. The result indicates the District should expect about 2,100 additional dwelling units (DUs) by 2050.[46] A summary of the expected growth is presented in **Table 4-6** as a running total of new DUs from 2010 with the Blueprint based redevelopment not starting until 2020.

Table 4-6 – New Development for Carmichael Water District

Dwelling Unit Type	2015	2020	2025	2030	2035
High Density RD-40	0	0	450	900	1350
High Density RD-20	0	0	0	0	0
High Density RD-10	0	0	0	0	0
Medium Density RD-5	55	110	165	220	275
Low Density RD-2	5	10	15	20	25

Note: These numbers represent a running total of new construction and not the incremental development in that five-year period.

4.3.3 The Future of Existing Demands

As discussed in **Section 4.2.5**, the changes in existing demands are likely to be the driving force in demand reduction within the District. Reduction of consumption is mandatory for meeting new state goals. This reduction is accounted for in the total demand calculations.

4.3.4 Non-Revenue Water Demands

The demand factors presented earlier in this section represent the demand for water at each customer location. To fully represent the demand, non-revenue water must also be included. Often, non-revenue water represents water that is lost due to system leaks, fire

[45] Sacramento County General Plan- Housing Element, pg 11-7, Table 11-3. Projections 2005-2025.
[46] The Blueprint estimated densities of 20 to 50 DU/Acre. Using 30 DU/Acre for the 60 acres within the District results in an estimate of 1,800 new dwelling units. The 2001 SACOG data estimated infill projects would result in about 300. Combined, the prediction is for about 2100 new dwelling units.

protection, construction water, unauthorized connections and inaccurate meters. In most instances, the predominant source of non-revenue water is from system losses. For purposes of estimating future demand from new connections, the non-revenue water value is assumed to be 8 percent.[47]

4.3.5 Projected Water Demands for Carmichael Water District

Based on the combination of existing and future residential and non-residential land uses and the anticipated unit demand factors for each land use class, a representation of future demand can be developed. **Table 4-7** provides the summation of this analysis and the resulting expected demands for each 5-year planning horizon.

Table 4-7 – Projected Water Demands for Carmichael Water District

Water Demand	2010	2015	2020	2025	2030	2035	BO
Acre Feet	9,718	9,642	9,566	9,569	9,571	9,691	9,770

The water demand projections depicted in **Table 4-7** include existing uses as well as anticipated residential and non-residential land uses.

4.3.6 Low Income Water Demands

California Water Code §10631.1 requires water suppliers to include a projection of water use by lower income households as defined by Health and Safety Code §50097.5. The housing element of the Sacramento County General Plan provides the income distribution used for this analysis.[48] This housing element, adopted in December 2008, uses data from the year 2000. The income limits for "lower income" are to come from Department of Housing and Policy Development. Only values for 2006 through 2010 are available so the percent of low income was used from the same housing element table. The housing element provided 45 percent of the population of Carmichael as low income. For lack of more recent income distributions, this 45 percent is assumed to remain constant into the future. Using 45 percent of the projected population, a weighted average of demand factors from the high density housing units of approximately 0.30 AF/Yr, and 3.54 people per housing unit, the current and future demand from "lower income" customers is estimated (see **Table 4-8)**.

[47] The 8 percent value reflects the quantity of water supplied by the District's distribution system, but not accounted for in customer meter quantities. For purposes of estimating this quantity when viewed from the customer meter looking back to the "beginning" of the water supply distribution system, a value of 9% is multiplied by the customer demands, then added to those demands to reflect a total projected demand.

[48] Sacramento County General Plan- Housing Element, pg 11-3, Table 11-1. Income

Table 4-8 – Lower Income Demands

AF/Yr	2010	2015	2020	2025	2030	2035	BO
Total Retail Treated	9,718	9,642	9,566	9,569	9,571	9,691	9,770
Lower Income	1,436	1,436	1,436	1,383	1,338	1,298	1,262
% of Treated	14.8%	14.9%	15.0%	14.4%	14.0%	13.4%	12.9%

Note: Low Income demand factor adjusted to show the addition of more RD-40 from Blueprint.

4.4 Future Target Water Use

Pursuant to California Water Code §10608.20 et seq., an urban retail water supplier must (1) document baseline daily per capita water use, (2) develop both an urban water use target and an interim water use target, and (3) document compliance daily per capita water use.[49] Documentation of compliance must include the basis for determining the estimates, including references to supporting data.

4.4.1 Baseline Daily Per Capita Water Use Analysis

"Baseline per capita daily water use" is "an urban retail water supplier's estimate of its average gross water use, reported in gallons per capita per day and calculated over a continuous 10-year period ending no earlier than December 31, 2004, and no later than December 31, 2010."[50] "Gross water use" is defined as the total volume of water, whether treated or untreated, entering the distribution system of an urban retail water supplier, excluding recycled water, water in long-term storage, water conveyed to another urban water supplier, and possibly water delivered for agricultural use.[51]

The District has estimated its "Baseline per capita daily water use" by assessing the volume of water supplied to the distribution system and population numbers rooted in 2000 Census data and following DWR's Category 3 methodology. For more information see the Population Analysis Memo included in **Appendix B-6** of this UWMP.

4.4.1.1 Distribution System

For this analysis, the District's "distribution system" includes the networked, pressurized conveyance systems that feed surface water from the treatment plant and groundwater

[49] An "urban retail water supplier" is a water supplier that directly provides potable municipal water to more than 3,000 end users or that supplies more than 3,000 acre-feet of potable water annually. CWC 10608.12(p). Carmichael Water District supplies water directly to more than 3,000 end users.
[50] CWC § 10608.12(b)(1). This analysis currently only analyzes baseline daily per capita water use through 2009. At the point all relevant 2010 data is available, the calculations should be updated for purposes of inclusion in the 2010 UWMP. It is unlikely that use of the 2010 data will change the baseline daily per capita water calculations such that the District would select a new baseline period, but the 2010 data may be instructive when considering the existing per capita water use of the District's customers in the distribution system.
[51] CWC § 10608.12(g).

from the production wells to the customers. A graphical representation of the distribution system can be found in **Section 2** as **Figure 2-1**.

4.4.1.2 Gross Water Use

To calculate "gross water use," inflow data for the period 1995-2010 was totaled for the District inflow totals plus well production and compared to the recorded sales at the customers' meters. Total water supplies entering the distribution system are provided in **Table 4-9**.

Table 4-9 – Water Entering District's Distribution System

AF/Yr	2005	2006	2007	2008	2009	2010
City Wells	2,736	3,521	2,868	1,580	1,609	1,518
Surface Water	9,721	8,975	9,509	10,418	8,966	8,214
Total	12,457	12,496	12,377	11,998	10,575	9,732

The District does not have a source of recycled water. Also, because the District's treated water distribution system storage is equal to approximately maximum day demand, and is intended to shed peaks and provide storage for short duration emergencies, there is not a significant change in the District's treated water storage volumes over the course of the year. Therefore, there is no adjustment made for water in long-term storage. Because the District does not serve treated water for agricultural purposes, there is no adjustment made for such deliveries as well. Gross water use for the District is provided in **Table 4-9** as the Total numbers.

4.4.1.3 Population Analysis

The Department of Water Resources has identified three acceptable methodologies for estimating population during the period 1995-2010 for purposes of calculating baseline daily per capita water use. Due to The District's distribution system not matching any City limits, Department of Finance (DOF) tables are not used. SACOG does operate a GIS system and tracks population however this system does not consider the District's boundaries. All population-based calculations in this UWMP are estimated using 2000 Census data adjusted by changes in connections to reflect other years. In the Population Analysis Memo attached in **Appendix B-6** this estimate was conferment to be within 1.2% of the actual 2010 Census population of the District service area.

Table 4-10 – Carmichael Water District Population

Year	Population
2000	37,200
2001	37,702
2002	37,865
2003	37,911
2004	38,095
2005	38,042
2006	37,989
2007	37,954
2008	38,134
2009	38,357
2010	38,354
2010 Census	37,899

4.4.1.4 Baseline Water Use Calculation

Using the Gross Water Use data provided in **Table 4-9** and the population data provided in **Table 4-10**, annual daily per capita water use was calculated, and the results are summarized in **Table 4-11**.

Table 4-11 – Carmichael Water District Daily Per Capita Water Use

Year	Daily Per Capita Use (gpcd)
1995	309
1996	326
1997	328
1998	289
1999	287
2000	308
2001	302
2002	290
2003	296
2004	321
2005	292
2006	294
2007	291
2008	281
2009	246
2010	227

From these annual figures, the baseline daily per capita water use was calculated for the six 10-year time periods ending no earlier than December 31, 2004 and no later than December 31, 2009. The results are provided in **Table 4-12**. Based on a review of the results, the District will select the 1995-2004 base line daily per capita water use as its baseline period. The per capita water use during this period averaged 306 gallons per capita per day.

Table 4-12 – District Baseline Daily Per Capita Water Use

Period	gpdc
1995-2004	306
1996-2005	304
1997-2006	301
1998-2007	297
1999-2008	296
2000-2009	292
2001-2010	284

4.4.2 Water Use Target

Pursuant to CWC § 10608.20(a), the District plans to adopt the following urban water use target: (1) 80% of its baseline per capita daily water use. The District must meet its urban water use target by December 31, 2020, and its interim water use target by December 31, 2015.[52]

4.4.2.1 20% Reduction Target Calculation

One method that may be used to determine the District's "water use target" is to estimate eighty percent of the District's baseline daily per capita water use.[53] Using this target, 80% of the District's baseline daily per capita water use is 244 gallons per capita per day (gpcd). The District must also achieve an "interim water use target," which is the midpoint between its baseline daily per capita water use and its water use target.[54] Using the same water use target, the District's interim water use target is 275 gpcd. The District must achieve its water use target by December 31, 2020 and its interim water use target by December 31, 2015.[55]

Table 4-13 – Water Use Target and Interim Water Use Target

Baseline Period	2020 Compliance Year	2015 Compliance Year
	80% of Baseline	90% of Baseline
1995-2004	244	275
1996-2005	243	273
1997-2006	241	271
1998-2007	238	267
1999-2008	237	267
2000-2009	234	263
2001-2010	227	255

[52] An urban retail water supplier's "interim urban water use target" is the midpoint between the urban retail water supplier's base daily per capita water use and the urban retail water supplier's urban water use target for 2020. (CWC § 10608.12(j)).
[53] CWC § 10608.20(b)(1).
[54] CWC § 10608.12(j).
[55] CWC § 10608.24(a)-(b).

4.4.2.2 Alternative Target Calculation

The District is also given three other choices for choosing baseline water use targets pursuant to CWC § 10608.20 (b). These 4 methods collectively make up the approved methods for deciding on a baseline water use target. Method 1 is the 20% reduction target in **Section 4.4.2.1** and the other targets will be discussed in this section.

Method 2 is based on performance standards and requires extensive calculations and information including total landscape areas. This provision allows for 55 gpcd for indoor use, a credit per landscape acre, and a 10% reduction for CII users. This method is not well suited to the District due to the number of older houses with less efficient fixtures. Even with extensive rebate programs, it is unlikely that enough customers could be converted to high efficiency fixtures by 2020 to meet the 55 gpcd indoor demand. Outdoor use reduction is difficult to estimate without extensive meter studies and site audits.

Method 3 is 95% of the state hydrologic region target of 176 gpcd for the Sacramento region which falls substantially lower than the method 1 requirement. With the method 1 target differing by around 30% and from the baseline by over 40%, method 3 is considered inappropriate for the District.

Alternatively, the District may adopt a target based on the methodology developed by the Department of Water Resources pursuant to CWC § 10608.20 (b)(4) (i.e., "Method 4"). DWR issued *Provisional Method 4 for Determining Water Use Targets* on February 16, 2011, which an urban water supplier selecting Method 4, must use to calculate its water use target. DWR developed the Method 4 Target Calculator to facilitate calculation of an urban water supplier's water use target. The Method 4 Target Calculator helps an urban water supplier calculate potential water savings in three unique sectors with a fourth potential reduction: (1) residential indoor; (2) commercial, industrial and institutional (CII), (3) landscape water use, water loss and other unaccounted for water sectors, and (4) unmetered connections. The combined potential savings from these sectors is subtracted from an urban water supplier's Base Daily Per Capita Water Use to develop its target. By using estimates in the method 4 calculator, a value similar to the 20% in method 1 begins to emerge. However with the introduction of the number of unmetered connections this number changes greatly. This is because method 4 calculates a 20% reduction for all unmetered connections in the middle of the base period (1999-2004 depending on which target is used). Due to the majority of the meter installations occurring even after 2007 method 4 is considered inappropriate for the District.

4.4.2.3 Selection of a Water Use Target

Based on the analysis of all of the target methods, the District will select the 2020 water use target estimated using Method 1. Due to the difficulties in complying with or

obtaining data for methods 2, method 3, and method 4, the District has chosen method 1 as the baseline target calculation method. This was decided officially at the public hearing on May 16, 2011 at the District office.

4.4.2.4 Minimum Water Use Reduction Requirement

The District must also comply with a minimum water use reduction requirement.[56] The District's 2020 water use target is 244. For each of the four five-year periods ending December 31, 2007, 2008, 2009 and 2010, 95% of average daily per capita water use was greater than 244 gpcd. Because the District's selected water use target is less than 95% of the average per capita water use for the four five-year periods ending December 31, 2007, 2008 and 2009, as shown in **Table 4-14**, the District will use 244 gpcd as its water use target.

Table 4-14 – 95% of 5-Yr. Baseline

5-Yr. Average Base Daily Per Capita Use		95% of Base Daily
Period	**gpcd**	**gpcd**
2003-2007	299	284
2004-2008	296	281
2005-2009	281	267
2006-2010	268	254

4.4.3 Compliance Daily Per Capita Water Use

The District is to report to DWR on its progress in meeting its urban water use targets as part of its UWMPs submitted pursuant to CWC § 10631.[57] Thus, the District will need to report on its progress in both its 2015 and 2020 UWMPs, which are to be submitted to DWR by December 31, 2015 and December 31, 2020 respectively. As part of the progress reports, the District should include its "compliance daily per capita water use," which is the gross water use during the final year of the reporting period, reported in gallons per capita per day.[58] Documentation of compliance must include the bases for determining the estimates, including references to supporting data.

[56] CWC § 10608.22 provides that "An urban retail water supplier's per capita daily water use reduction shall be no less than 5 percent of base daily per capita water use over a continuous five-year period ending no earlier than December 31, 2007 and no later than December 31, 2010."
[57] CWC § 10608.40.
[58] CWC § 10608.12(e).

CHAPTER 5. WATER DEMAND MANAGEMENT MEASURES

5.1 District Participation

Carmichael Water District implements a best management practices program to ensure efficient water use throughout its service area. CWC § 10631 requires that an UWMP include a description of the urban water supplier's water demand management measures (DMM). CWC § 10631(f) identifies 14 DMMs for urban water suppliers to address. CWC § 10631 also provides that members of the California Urban Water Conservation Council (CUWCC) shall be deemed in compliance with the UWMPA demand management measure requirements by complying with all the provisions of the CUWCC MOU and by submitting the annual reports.[59] The Carmichael Water District is not currently a signatory to the CUWCC MOU, however, the District applied for membership in the CUWCC in May 2011 and is anticipating full membership after September 2011.

The District has been a Sacramento Area Water Forum (Water Forum) signatory since 2000 and has been operating its water conservation program consistent with its purveyor specific agreement under the Water Forum. The District supports the published Best Management Practices (BMPs) of the Water Forum Water Conservation Plan. The Water Forum BMPs include 16 specific practices, which the participating water purveyors have the option to implement using Water Forum criteria or criteria at least as effective. Since 2005, the Water Forum has started to revise the Water Conservation Element of the Water Forum Agreement. Based on the version of the Water Conservation Element approved by the Water Forum Plenary on May 13, 2009, the Water Forum signatories agree that compliance with the CUWCC MOU satisfies the Water Forum Conservation Element. Therefore, the Water Forum will no longer judge compliance with the Water Conservation Element by considering whether a purveyor is implementing the sixteen Water Forum BMPs, and will only consider whether a purveyor is implementing the BMPs contained in the CUWCC MOU, and those in any future amendments of the CUWCC MOU. Once the District becomes a member of the CUWCC, the Water Forum will assess its water demand management program accordingly.

Due to the differences between the CUWCC and the Water Forum related to the best management practice/demand management measure coverage requirements, the District is providing a description of the DMMs it is currently implementing, those it has scheduled for implementation, and those it is not implementing (and will ultimately seek an exemption for once it joins the CUWCC). The DMMs are identified in **Table 5-1** by District DMM number, UWMPA letter, and CUWCC BMP number.

[59] CWC § 10631(j).

Table 5-1 – DMM Implementation Status

Demand Management Measure	District BMP	UWMP Act DMM	CUWCC BMP	Implementing Consistent with CUWCC	Scheduled for Implementation Consistent with CUWCC	Deferral from Implementation
Interior and Exterior Water Audits and Incentive Programs for Single Family Residential, Multi-Family Residential and Institutional Customers	1	A	3.2	X		
Plumbing Retrofit of Existing Residential Accounts	2	B	3.1	X		
Distribution System Water Audits, Leak Detection, and Repair	3	C	1.2	X		
Non-Residential Meter Retrofit	4	D	1.3	X		
Large Landscape Water Audits and Incentives for Commercial, Industrial, Institutional, and Irrigation Accounts	5	E	5		X	
Landscape Water Conservation Requirements for New/Existing Commercial, Industrial, Institutional, and Multi-Family Developments	6	E	5		X	
High Efficiency Washing Machine Rebate Program	Not Used	F	3.3			X
Public Information	7	G	2.1	X		
School Education	8	H	2.2	X		
Commercial and Industrial Water Conservation	9	I	4		X	
Wholesale Agency Program	Not Used	Not Used				
Conservation Pricing	11	K	1.4		X	
Landscape Water Conservation for New/Existing Single Family Homes	12			X		
Water Waste Prohibition	13	M	1.1.2	X		
Water Conservation Coordinator	14	L	1.1.1	X		
Not Used by Water Forum	15	n/a	n/a	n/a	n/a	n/a
Ultra-Low Flush Toilet Replacement Program for Non-Residential and Residential Customers	16	N	3.4			X

5.1.1 AB 1420 and CUWCC Compliance

Until recently, the Water Forum BMP targets differed from the CUWCC targets. Due to the historic differences between the CUWCC and the Water Forum in BMP coverage, the District recently documented its efforts to comply in the future with the CUWCC coverage requirements. While the primary purpose of self-certification effort was to obtain an eligibility determination from DWR for state grant funding, it documents Carmichael Water District's plan for ultimately complying with the CUWCC coverage requirements. While DWR did determine that the District is eligible to receive funding, the 2010 UWMP Guidebook indicates that an urban water supplier should still describe the specific actions it is taking to comply with the UWMPA DMM requirements and provide documentation for any DMM the urban water supplier is not implementing.

5.2 Best Management Practices

For the purpose of responding to the UWMPA, the District will address the UWMPA's 14 DMMs and the District's corresponding BMPs in the following sections. This section will also document Carmichael Water District's plans to satisfy the CUWCC coverage requirements for each BMP to: (1) remain eligible for grant funding; (2) efficiently transition to CUWCC membership; and (3) remain consistent with the Water Forum

BMP requirements. The descriptions below summarize the District's BMPs. More detailed documentation regarding BMP implementation is contained in **Appendix B-4**.

5.2.1 DMM A – Interior and Exterior Water Audits and Incentive Programs for Single Family Residential, Multi-Family Residential and Institutional Customers

DMM A is consistent with Carmichael Water District's BMP #1.

Implementation Description: The Carmichael Water District offers water audits to all newly metered customers and provides water conservation measures based on the results of the audits. Once all customers in the District are metered, water use records will be used to identify the top 20% of water users in each customer type for water audits, if not previously audited under the meter program. Carmichael Water District makes available interior and exterior water audit materials and seasonal irrigation schedules by hydrozone to its customers.

Implementation Schedule: The District began implementing this BMP in 1998. The District goal under the Water Forum Agreement is 250 audits per year. Carmichael Water District will continue BMP implementation consistent with the CUWCC requirements during July 2011 and will ultimately complete implementation by July 2021. The District has budgeted accordingly to ensure implementation of this BMP.

Methods to Evaluate Effectiveness: Historically, Carmichael Water District has surveyed past program participants to determine if audit recommendations were implemented. Once the District is fully metered, it will provide an opportunity for the District to monitor the water use of those surveyed to determine effectiveness. In the future, Carmichael Water District will evaluate this BMP's effectiveness by tracking use of the customers surveyed and having received Water Sense showerheads and faucet aerators.

5.2.2 DMM B – Residential Plumbing Retrofit

DMM B is consistent with Carmichael Water District's BMP #2.

Implementation Description: Carmichael Water District provides its customers information about achieving water savings by retrofitting plumbing fixtures. The District also offers toilet leak test kits to all change-of-account customers who visit the District office.

Table 5-2 – Retrofit Kits Distributed

Year	2006	2007	2008	2009	2010
# of devices distributed	1,000	1,000	1,000	900	900

Implementation Schedule: Carmichael Water District currently implements this BMP. In July 2011, Carmichael Water District will continue implementation of this BMP consistent with the CUWCC requirements of BMP 3, which requires that the District provide incentives or ordinances for replacement of toilets using 3.5 gallons per flush (gpf) or more with current Water Sense Specification (WSS) toilets. Carmichael Water District has budgeted accordingly to implement this BMP.

Methods to Evaluate Effectiveness: Carmichael Water District implements BMP 2 along with BMP 1 because BMP 1 promotes similar indoor plumbing retrofit actions as BMP 2. Effectiveness in the future will be evaluated by considering whether 3.5 gpf toilets are replaced at a rate greater than that achieved through retrofit on resale ordinance until 2014 or 75% market saturation is achieved.

5.2.3 DMM C – System Water Audits, Leak Detection and Repair

DMM C is consistent with Carmichael Water District's BMP #3.

Implementation Description: Carmichael Water District monitors the percentage of unaccounted for water and repairs system leaks when found. Historically, Carmichael Water District has had an unaccounted for water percentage below 5% of total water production. From 2006-2010, Carmichael Water District documented the extent of its water losses related to system leaks. The water losses are shown in **Table 5-3**. It also performed surveys and conducted repairs as shown in **Table 5-3**.

Table 5-3 – Unaccounted for Water, Surveys and Repairs

Action	2006	2007	2008	2009	2010
Unaccounted for water (acre-feet)	12.1	114.4	16.1	1.6	1.6
Miles of mains/lines surveyed	28	29	4	15	15
# of mainline repairs (as a result of surveys)	4	5	1	1	2
# of service line repairs (as a result of surveys)	0	2	0	0	0

Implementation Schedule: Carmichael Water District measures unaccounted for water, surveys main and service lines and repairs lines as well. Currently, Carmichael Water District's audit, leak detection and repair program meets the CUWCC coverage requirement. Carmichael Water District will continue to implement this BMP consistent with the CUWCC requirements for water audits

Methods to Evaluate Effectiveness: Monitoring the percentage of unaccounted for water is one method that Carmichael Water District will use to evaluate the effectiveness of this BMP. Once Carmichael Water District is fully metered, it will be able to monitor the unaccounted for water percentage more consistently and efficiently.

5.2.4 DMM D – Metering with Commodity Rates

DMM D is consistent with Carmichael Water District's BMP #4.

Implementation Description: The District is in the process of conducting a meter retrofit program and is retrofitting more than 10% of its customers per year. Once metered, customers will be billed on a volumetric basis (using commodity rates) within one year.

Implementation Schedule: Commercial properties have been metered since 2000. Apartments, schools and parks have been metered since 2001. Metering for duplexes, triplexes, fourplexes and mobile homes was completed in 2004. All condominiums were metered in 2005. The remainder of Carmichael Water District will be fully metered by 2012. The number of meters installed, and the number of accounts with commodity rates are included in **Table 5-4**.

Table 5-4 – Number of Meters Installed and Accounts

Action	2006	2007	2008	2009	2010
# of retrofit meters installed	665	1,063	1,254	860	1,511
# of accounts with commodity rates	3,271	5,477	7,455	8,303	10,005

Methods to Evaluate Effectiveness: Carmichael Water District will evaluate the effectiveness of its meter retrofit program by monitoring its annual water production to assess long-term trends in water demand.

5.2.5 DMM E – Large Landscape Conservation Programs

This DMM is consistent with Carmichael Water District's BMPs #5 and #6.

Implementation Description: Currently, Carmichael Water District offers large landscape water audits and system check-ups. A considerable portion of landscape-related customer outreach in the region is achieved through the Regional Water Authority. RWA conducts landscape workshops, an annual media campaign to notify residents to make seasonal adjustments to its irrigation schedules, and develops materials for member agencies. Carmichael Water District also advises customers of the need to seasonally adjust sprinkler timers and encourages the use of CIMIS station information to assist with wise landscaping water use.

Implementation Schedule: Carmichael Water District has performed large landscape surveys/audits on a limited basis and the current program does not meet the CUWCC's compliance levels. Carmichael Water District is seeking to participate in the Proposition 84 grant opportunities and will be including funding for this program as part of the District's 2011-2012 budget.

Methods to Evaluate Effectiveness: Historically, Carmichael Water District has surveyed past program participants to determine if audit recommendations were implemented. Once the District is fully metered, it will provide an opportunity for the District to monitor the water use of those surveyed to determine effectiveness. In the future, Carmichael Water District will evaluate this BMP's effectiveness by tracking use of the customers surveyed.

5.2.6 DMM F – High-Efficiency Washing Machine Rebate Programs

Under the water conservation element of the Water Forum Agreement, Carmichael Water District has proposed to defer rebates for high-efficiency clothes washers and allocate funds to accelerate the installation of residential meters.[60] The deferral proposal shows the savings benefits from accelerated metering compared with metering requirements and the conservation potential associated with rebates for high-efficiency washers. The analysis has deemed a high-efficiency washing machine rebate program to be not cost-effective. Once Carmichael Water District becomes a CUWCC signatory, it will be seeking an exemption for this BMP.

5.2.7 DMM G – Public Information Programs

DMM G is consistent with the Carmichael Water District's BMP #7.

Implementation Description: The public information programs educate and inform the general public about the roles water plays, either directly or indirectly, within the community. These include working with social groups, political and business leaders to increase the level of water awareness; establishing a favorable relationship with the media by responding promptly to requests for information; speakers' presentations to community organizations; and presence at community events.

Table 5-5 – Public Information Programs

Action	2006	2007	2008	2009	2010
Bill inserts/Newsletters/Brochures	Yes	Yes	Yes	Yes	Yes
Bill water use comparison	Yes	Yes	Yes	Yes	Yes
Demonstration gardens	Yes	Yes	Yes	Yes	Yes
Special events, Media events	Yes	Yes	Yes	Yes	Yes
Speaker's Bureau	Yes	Yes	Yes	Yes	Yes
Program to coordinate w/ other groups	Yes	Yes	Yes	Yes	Yes

Carmichael Water District also participates in the RWA's Regional Water Efficiency Program (RWEP). RWA has implemented a regional water conservation program for the past 10 years. The RWEP has been supported through member dues and federal and state grant funds.

[60] See **Appendix B-4** for Deferral Proposal.

The overall goal of the RWEP is to maximize customer participation in water conservation programs. Historically and for the foreseeable future, the regional public information and school education program elements include: school outreach materials and presentations, media advertising campaigns, commercial consumer outreach, promotional materials, community events and fairs, evapotranspiration data availability, a Web site, and allied organizations outreach. For more details regarding the RWEP Public Information programs, see **Appendix B-4**.

Implementation Schedule: The public information program is an ongoing effort. Carmichael Water District will continue to implement this BMP consistent with the CUWCC requirements starting in July 2011 and it has budgeted accordingly to ensure efficient implementation through 2021.

Methods to Evaluate Effectiveness: No specific method of evaluating the effectiveness of this BMP has been identified at this time.

5.2.8 DMM H – School Education Programs

DMM H is consistent with the Carmichael Water District's BMP #8.

Implementation Description: Carmichael Water District conducts its own school education program by providing technical assistance in making classroom presentations. Carmichael Water District also invites teachers and students to participate in a free program in the spring of each year designed to teach students in grades K-8 about using water efficiently.

Since 2006, the District has worked in conjunction with the Kiwanis Club of Carmichael and Barrett Middle School to develop the "Carmichael Water Conservation Calendar". The goal of the art contest is to engage the students in educating our community about the importance of water conservation in Carmichael and California, while highlighting the students' artwork. The resulting calendar conveys a youthful view of the value of conserving water.

Carmichael Water District will continue to respond to requests for speakers or educational materials from schools. For the period 2006-2010, **Table 5-6** provides an estimate of the number of classroom visits by Carmichael Water District staff.

Table 5-6 – School Education Program Visits

Action	2006	2007	2008	2009	2010
# of classroom presentations	3	4	4	4	3

Carmichael Water District's participation in the Regional Water Authority's RWEP also provides a broad-based school education program. Specifically, the RWEP program has

focused mainly on K-8 programs. RWEP has continued to use the legacy Sacramento Bee Newspapers in Education (NIE), now called Media in Education (MIE) program that originated back in the mid-1990s as part of the Sacramento Area Water Works Association (SAWWA) program in order to meet the baseline requirements for school education outreach. It includes an annual Water Conservation Pledge and Quiz Contest. It is estimated that a total of 33,932 students have been educated since inception. For more detail regarding the RWEP School Education program, see **Appendix B-4**.

Implementation Schedule: The school education program is an ongoing effort. Carmichael Water District will continue to implement this BMP consistent with the CUWCC requirements starting in July 2011 and it has budgeted accordingly to ensure efficient implementation through 2021.

Methods to Evaluate Effectiveness: No specific method of evaluating the effectiveness of this BMP has been identified at this time.

5.2.9 DMM I – Commercial, Industrial and Institutional Conservation

DMM I is consistent with the Carmichael Water District's BMP #9.

Implementation Description: Carmichael Water District offers water use reviews and audits for its Commercial, Industrial and Institutional (CII) accounts and advises all commercial customers of the programs and encourages their participation and makes CII conservation materials available.

Implementation Schedule: Currently, Carmichael Water District does not offer incentives and therefore the current program does not meet CUWCC implementation requirements designed for achievement of a 10% savings compared to baseline water use in 10 years. Carmichael Water District plans to begin implementation of the CUWCC BMP in July 2011 and plans to meet the requirement by July 2021. Initially, fund allocation for the CII survey/incentive program will be limited because Carmichael Water District will still be allocating funds to its meter retrofit program.

Methods to Evaluate Effectiveness: Carmichael Water District will evaluate this BMP's effectiveness by tracking CII water use compared to baseline CII water use. Effectiveness will also be tracked by assessing the cost of the incentives Carmichael Water District offers compared to the water savings realized.

5.2.10 DMM J – Wholesale Agency Programs

Carmichael Water District does not provide wholesale water supplies and this DMM is therefore not applicable.

5.2.11 DMM K – Conservation Pricing

DMM K is consistent with Carmichael Water District's BMP #11.

Implementation Description: Volumetric rates were established in 1998. With the beginning of the meter retrofit program at the same time, Carmichael Water District customers were billed accordingly. Carmichael Water District has used a public outreach program to inform customers about the volumetric rate structure.

Implementation Schedule: Commercial accounts began paying volumetrically based rates in 2000, apartments, schools and parks began in 2001, and triplexes, fourplexes, mobile homes and condominiums were billed volumetrically starting in 2005. The meter retrofit program will result in Carmichael Water District being fully metered by 2012 and all metered customers being billed volumetrically within one year after meter installation.

Currently, Carmichael Water District's rate structure is set at 61% volumetric and 39% fixed for metered customers. Because the CUWCC requires an agency signing the MOU after December 31, 1997 to implement a 70% volumetric and 30% fixed rate structure within seven years of signing the MOU, Carmichael Water District is not currently in compliance, though it plans to meet the requirement within seven years of signing the MOU. Carmichael Water District is planning a rate structure in 2014/2015 after completion of its meter retrofit program.

Methods to Evaluate Effectiveness: Carmichael Water District will evaluate the effectiveness of its conservation pricing program by monitoring its annual water production to assess long-term trends in water demand.

5.2.12 DMM L – Water Conservation Coordinator

This DMM is consistent with Carmichael Water District's BMP #14.

Implementation Description: Carmichael Water District provides adequate resources to implement, administer and monitor conservation efforts. For the period 2006-2010, Carmichael Water District had the staff resources listed in **Table 5-7**. Carmichael Water District has a staff member who is an AWWA Certified Water Conservation Practitioner (Level II) as its Water Conservation Coordinator.

Table 5-7 – Water Conservation Coordinator Resources

Action	2006	2007	2008	2009	2010
# of full/part-time staff	2	2	2	2	2

Implementation Schedule: The District is implementing this BMP and will continue to do so consistent with the CUWCC MOU requirements.

Methods to Evaluate Effectiveness: No specific method of evaluating the effectiveness of this BMP has been identified at this time.

5.2.13 DMM M – Water Waste Prohibition

This DMM is consistent with the District's BMP #13.

Implementation Description: The District adopted a water waste prohibition by resolution in May 2010, as part of its Water Shortage Contingency Plan.

Implementation Schedule: The District is implementing this BMP and will continue to do so consistent with the CUWCC MOU requirements.

Methods to Evaluate Effectiveness: No specific method of evaluating the effectiveness of this BMP has been identified at this time.

5.2.14 DMM N – Residential Ultra-Low-Flush Toilet Rebate Programs

DMM N is consistent with the District's BMP #16.

Under the water conservation element of the Water Forum Agreement, the District has proposed to defer rebates for ultra-low-flush toilet rebate programs and allocate funds to accelerate the installation of residential meters.[61] The deferral proposal shows the savings benefits from accelerated metering compared with metering requirements and the conservation potential associated with rebates for ultra-low-flush toilet rebate programs. The analysis has deemed a ultra-low-flush toilet rebate program to be not cost-effective. Once the District becomes a CUWCC signatory, it will bee seeking an exemption for this BMP.

[61] See **Appendix B-4** for Deferral Proposal.

CHAPTER 6. WATER SHORTAGE CONTINGENCY PLAN

Carmichael Water District adopted a Water Shortage Contingency Plan (WSP) in 1992 and updated its plan in 2010. Carmichael Water District uses its Water Shortage Contingency Plan to guide its actions during drought periods and times of supply shortages. The complete version of the Water Shortage Contingency Plan can be found in **Appendix B-5**.

Carmichael Water District's Water Shortage Contingency Plan identifies five levels of water conditions and a goal for demand reductions to meet the projected supply in each stage. Carmichael Water District used the following principles to develop the demand reduction requirements for each stage:

- Maintain water quality, safe operating conditions, and fire flow capability at all times;
- Provide flexibility to residential customers to allow them to choose the best use of their water during decreased demand requirements;
- Preserve landscaping as much as possible, with permanent plantings such as trees and shrubs receiving more importance than replaceable plantings such as turf and annuals;
- Maintain public playing fields as long as possible; and
- Minimize economic impact to commercial, industrial, and institutional customers.

6.1 Stages of Action

In the event of a shortage, water conservation is implemented in stages based on the quantity of the supply available compared to the projected demand. Rationing stages may be triggered by a shortage in one water source or a combination of sources. **Table 6-1** summarizes the plan stages as defined in **Appendix B-5.**

Table 6-1 – Water Shortage Contingency Plan Stages

Stage	Triggering Conditions	Demand Reduction Goal
Normal	All demands can be met by the conjunctive use of groundwater and surface water. There are no other drought declarations or water shortage conditions by other water agencies in the region.	Customer demand is within assigned normal year budget or within 12,000 af/yr per WFA.
Stage 1 - Water Alert	A shortage is predicted to occur in the coming months and customers should begin demand cutbacks. Several water agencies in the region have declared a shortage requiring up to 10% cutback.	Up to 10%
Stage 2 - Water Warning	Supply is up to 25 percent less than normal demand. Several water agencies in the region have declared a shortage requiring up to a 50% cutback.	Up to 25%
Stage 3 - Water Crisis	Supply is up to 50% less than normal demand. Another water agency in the region has declared a shortage requiring up to 50% or more in demand cutback.	Up to 50%
Stage 4 - Water Emergency	One of supply sources is unavailable. Supply more than 50% less than normal demand. Another water agency in the region has declared a shortage requiring up to 50% or more in demand cutback.	Initial cutback set at 50% pending District's evaluation of supply loss

6.2 Prohibitions, Penalties and Charges

Carmichael Water District's Water Shortage Contingency Plan contains a response plan to achieve the demand reduction goals for each stage in **Table 6-1**. The response plan includes specific prohibitions, recommended actions and various public relations efforts for the District depending on the water condition stage. As water supply conditions become worse, the water use restrictions become more severe in an attempt to align available supplies with anticipated water demands.

Carmichael Water District uses increasingly strict water use prohibitions to manage water demands. **Table 6-2** details the water use prohibitions and the stage at which those prohibitions become mandatory. Note that each prohibition from an earlier stage applies to a later stage as well.

Table 6-2 – Water Waste Prohibitions

Examples of Prohibitions	Stage When Mandatory
No water runoff from property	Normal
Free flowing hoses for any use are prohibited	Normal
No filling of swimming pools, fountains or ponds, except for maintenance of levels	2
No turf irrigation allowed; No sprinkler irrigation allowed	3
No pasture and wild space irrigation	3
No new landscape installations allowed	3
No irrigation allowed	4

The Carmichael Water District's Water Shortage Contingency Plan also outlines the available penalties should a customer violate provisions of the ordinance. The penalties and the associated stage when the penalties take effect are listed in **Table 6-3**.

Table 6-3 – Penalties for Violations of Contingency Plan

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

While Carmichael Water District's Water Shortage Contingency Plan does rely on specific prohibitions and the potential for penalties to manage demands, the Water Shortage Contingency Plan relies heavily on consumption reduction mechanisms designed to engage customers in a cooperative fashion and also improve the efficiency of their water delivery infrastructure. Various consumption reduction methods are listed in **Table 6-4**, along with the projected savings Carmichael Water District anticipates when the method is combined with other specific responses under the given stage.

Table 6-4 – Consumption Reduction Methods

Consumption Reduction Methods	Stage It Becomes Effective	Projected Savings
Outdoor landscape audit for 1.0+ acre parcels; 0.5 ac. parcels; 0.3 ac. parcels	1, 2, 3	10%, 25%, 50%
Water audit and plumbing retrofit for top 20% of water users	1	10%
Public information campaign regarding household water use	1	10%
Evaluate and enact drought surcharge rates	2	25%
Public outreach in schools, HOAs, civic groups, with signboards, website	2	25%
Publicize anonymous water waster reporting on website	2	25%
No irrigation between 9:00am and 7:00pm	3	50%
Odd addresses water on Tuesday and even on Wednesday	3	50%
Special mailing to customers notifying of drought stage	3	50%
No irrigation allowed	4	At least 50%

6.3 Minimum Supply Available

As discussed in Section 3, Carmichael Water District has highly reliable water supplies. Currently, Carmichael Water District is not projecting a shortage in its water supplies during either a single-dry or multiple dry year period. Yet, Carmichael Water District's participation in the Water Forum Agreement MOU may have an impact on the quantity of surface water it diverts from the American River. Thus, for purposes of a "minimum supply" availability analysis, it is assumed that the Water Forum Agreement MOU operates on Carmichael Water District's surface water diversions from the American River such that it is only has 14,400 af/yr available in surface water supplies. As shown in **Table 6-5**, the total estimated minimum supply available for the next three years is about 22,000 acre feet.

Table 6-5 – Three-Year Minimum Supply Available

Water Supply (AF/Yr)	2012	2013	2014
American River Licensed Rights	14,000	14,000	14,000
Groundwater	6,646	6,646	6,646
GET L-A	390	390	390
GET L-B	1,120	1,120	1,120
Total	22,156	22,156	22,156

6.4 Catastrophic Interruption

A catastrophic interruption is covered in the District's Emergency Response Plan. There are action plans for a number of events including earthquake, fire/explosion, medical emergency, flood, and others. The complete Emergency Response Plan is included as **Appendix B-7**. A summary of actions to be preformed in the event of a "loss of normal water supply" are as follows.

- Perform Notification
- Contact SMUD (if power related)
- Send Crews to Verify Generator Operation
- Arrange Generators for Wells
- Contact Agencies to Request Opening Inter-ties
- Consider Trucking Drinking/Bottled Water
- Consider Pumping River Water Into Hydrants (and issue boil order)

6.5 Revenue Impacts Under the WSCP

Carmichael Water District's Water Shortage Contingency Plan recognizes the potential costs associated with drought stage implementation and also the potential need to use drought surcharge rates to not only influence customer behavior but to cover the general reduction in revenue that is likely to result with a reduction in water demand. Even during a Normal Water Supply stage, and in each more restrictive stage as well, Carmichael Water District's Water Shortage Contingency Plan directs staff to assemble an implementation plan and budget and present and gain approval for additional budget requirements, and a drought rate structure, if necessary. Also, starting in Stage 2, Carmichael Water District's Water Shortage Contingency Plan directs staff to evaluate and enact drought surcharge rates if necessary, and to maintain those rates in subsequent stages.

6.6 Measuring Consumption Reduction

Carmichael Water District will use its available resources at each stage to monitor water use and assess the effectiveness of existing demand management measures and the potential need to exert a greater level of effort to control water demand. Carmichael Water District will use a "drought team," which comprises members of each department to manage its drought stage implementation efforts. This "drought team" will ensure financial services staff has a staffing plan, there is adequate budget, and customer service training is available at the appropriate level of effort based on the stage. Also, conservation program staff will prepare for an increased number of audits, customer contacts and rebate programs. Board of Directors notification of supply status at each stage is required to gain approval for additional budget and a drought rate structure, if necessary. The "drought team" will also develop a significant public outreach component in each stage with content and staffing assignments, and messaging beginning at least two weeks prior to the official start of a stage. The "drought team" is to meet once per week during Stages 1, 2, and 3 to review respective programs, results and issues.

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CHAPTER 7. SUPPLY & DEMAND INTEGRATION

The purpose of this chapter is to compare the total water supply sources available to the Carmichael Water District with the total projected water use over the next 20 years, in five-year increments, for a normal water year, a single-dry water year, and multiple dry water years.

7.1 Normal Water Year Supply Demand Comparison

Under this water supply scenario, the District would anticipate full availability of its surface supplies, as well as availability of groundwater to meet nominal peaking and other operational needs, as shown in **Table 7-1** for each five-year increment through 2035. Using the demand projections in **Table 4-7** the following comparison table was developed for a normal hydrologic year. As shown in **Table 7-1**, the District projects adequate water supplies through 2035 because water supplies remain stable and demand varies only slightly over this time period due to implementation of long-term water efficiency measures as well as the District's near build out condition.

Table 7-1 – Supply and Demand Comparison (Normal Year)

Demand (af/yr)	Current	2015	2020	2025	2030	2035
Treated Demand	9,718	9,642	9,566	9,569	9,571	9,691
Total	9,718	9,642	9,566	9,569	9,571	9,691

Supply (af/yr)	Current	2015	2020	2025	2030	2035
American River (License 1387)	10,859	10,859	10,859	10,859	10,859	10,859
American River (License 8731)	3,669	3,669	3,669	3,669	3,669	3,669
American River (Permit 7356)	18,099	18,099	18,099	18,099	18,099	18,099
Groundwater	6,646	6,646	6,646	6,646	6,646	6,646
GET L-A	390	390	390	390	390	390
GET L-B	1,120	1,120	1,120	1,120	1,120	1,120
Total	40,783	40,783	40,783	40,783	40,783	40,783

Difference	31,065	31,141	31,217	31,214	31,212	31,092
Difference as % of Supply	76%	76%	77%	77%	77%	76%
Difference as % of Demand	320%	323%	326%	326%	326%	321%

7.2 Single Dry Year Supply and Demand Comparison

In a single dry year condition, the District anticipates no reduction in surface water supplies consistent with the projection in **Table 3-7**. Based on the reliability analysis presented in Chapter 3, the District is projecting full availability of its annual entitlement from the American River – 32,627 af/yr.

As for the District's water demand in a single dry year condition, the District's treated water demand is increased to reflect the generalized expansion of the landscape irrigation season due to limited rainfall in the single driest year. An adjustment factor of 5 percent is applied to the normal-year demands based on various analyses of the difference between maximum evapotranspiration (ETo) and average ETo over an average 5-10 year period. As shown in **Table 7-2**, the District projects adequate water supplies through 2035 because water supplies remain stable and demand increases only slightly over this time period due to implementation of long-term water efficiency measures.

Table 7-2 – Supply and Demand Comparison (Single Driest-Year)

Demand (af/yr)	Current	2015	2020	2025	2030	2035
Treated Demand	10,204	10,124	10,044	10,047	10,050	10,176
Total	10,204	10,124	10,044	10,047	10,050	10,176

Supply (af/yr)	Current	2015	2020	2025	2030	2035
American River (License 1387)	10,859	10,859	10,859	10,859	10,859	10,859
American River (License 8731)	3,669	3,669	3,669	3,669	3,669	3,669
American River (Permit 7356)	18,099	18,099	18,099	18,099	18,099	18,099
Groundwater	6,646	6,646	6,646	6,646	6,646	6,646
GET L-A	390	390	390	390	390	390
GET L-B	1,120	1,120	1,120	1,120	1,120	1,120
Total	40,783	40,783	40,783	40,783	40,783	40,783

Difference	30,579	30,659	30,739	30,736	30,733	30,607
Difference as % of Supply	75%	75%	75%	75%	75%	75%
Difference as % of Demand	300%	303%	306%	306%	306%	301%

7.3 Multiple Dry Year Supply and Demand Comparison

Under this water supply scenario, the District anticipates many of the same conditions that were assumed for the single-dry year analysis, including: (1) adequate supplies (see Chapter 3), and (2) increases in projected demands as represented in the driest-year scenario. However, to represent a multiple dry year period, a five-year water supply projection is made for each 5-year reporting increment. Water supplies within each year of the five-year block follow a pattern of four dry years, followed by one normal year.

To reflect the demands in each of the intervening years in the five-year block, the following assumptions are made:

- The fifth year, a normal year, reflects the estimated demand for the next standard 5-year increment (e.g. the 2015, 2020, 2025, etc. demand from **Table 7-1** through **7-3** for each zone).

- Demand in the four prior years reflects a linear growth between each 5-year standard increment, but with the demand adjustments made to increase some demands.

This resulting analysis has been represented in **Table 7-3**. The analysis only covers the 5-year blocks through 2035. During each multiple dry year period projected in **Table 7-3**, the District anticipates adequate water supplies being available.

Table 7-3 – Supply and Demand Comparison (Multiple Dry Years)

Demand (af/yr)	Current	2015	2020	2025	2030	2035
Treated Demand	10,204	10,124	10,044	10,047	10,050	10,176
Total	10,204	10,124	10,044	10,047	10,050	10,176

Supply (af/yr)	Current	2015	2020	2025	2030	2035
American River (License 1387)	10,859	10,859	10,859	10,859	10,859	10,859
American River (License 8731)	3,669	3,669	3,669	3,669	3,669	3,669
American River (Permit 7356)	18,099	18,099	18,099	18,099	18,099	18,099
Groundwater	6,646	6,646	6,646	6,646	6,646	6,646
GET L-A	390	390	390	390	390	390
GET L-B	1,120	1,120	1,120	1,120	1,120	1,120
Total	40,783	40,783	40,783	40,783	40,783	40,783

Difference	30,579	30,659	30,739	30,736	30,733	30,607
Difference as % of Supply	75%	75%	75%	75%	75%	75%
Difference as % of Demand	300%	303%	306%	306%	306%	301%

Part A: 2011 through 2015					
Demand (af/yr)	2011	2012	2013	2014	2015
Total	10,188	10,188	10,188	10,188	9,642
Supply (af/yr)	2011	2012	2013	2014	2015
Total	40,783	40,783	40,783	40,783	40,783
Difference	30,595	30,595	30,595	30,595	31,141
Difference as % of Supply	75%	75%	75%	75%	76%
Difference as % of Demand	300%	300%	300%	300%	323%

Part B: 2016 through 2020					
Demand (af/yr)	2016	2017	2018	2019	2020
Total	10,108	10,108	10,108	10,108	9,566
Supply (af/yr)	2016	2017	2018	2019	2020
Total	40,783	40,783	40,783	40,783	40,783
Difference	30,675	30,675	30,675	30,675	31,217
Difference as % of Supply	75%	75%	75%	75%	77%
Difference as % of Demand	303%	303%	303%	303%	326%

Part C: 2021 through 2025					
Demand (af/yr)	**2021**	**2022**	**2023**	**2024**	**2025**
Total	10,045	10,045	10,045	10,045	9,569
Supply (af/yr)	**2021**	**2022**	**2023**	**2024**	**2025**
Total	40,783	40,783	40,783	40,783	40,783
Difference	30,738	30,738	30,738	30,738	31,214
Difference as % of Supply	75%	75%	75%	75%	77%
Difference as % of Demand	306%	306%	306%	306%	326%

Part D: 2026 through 2030					
Demand (af/yr)	**2026**	**2027**	**2028**	**2029**	**2030**
Total	10,048	10,048	10,048	10,048	9,571
Supply (af/yr)	**2026**	**2027**	**2028**	**2029**	**2030**
Total	40,783	40,783	40,783	40,783	40,783
Difference	30,735	30,735	30,735	30,735	31,212
Difference as % of Supply	75%	75%	75%	75%	77%
Difference as % of Demand	306%	306%	306%	306%	326%

Part E: 2031 through 2035					
Demand (af/yr)	**2031**	**2032**	**2033**	**2034**	**2035**
Total	10,075	10,075	10,075	10,075	9,691
Supply (af/yr)	**2031**	**2032**	**2033**	**2034**	**2035**
Total	40,783	40,783	40,783	40,783	40,783
Difference	30,708	30,708	30,708	30,708	31,092
Difference as % of Supply	75%	75%	75%	75%	76%
Difference as % of Demand	305%	305%	305%	305%	321%

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