Sustainability Roadmap 2020–2021

Department of Water Resources

Progress Report and Plan for Meeting the Governor's Sustainability Goals for California State Agencies


DEPARTMENT OF WATER RESOURCES
STATE OF CALIFORNIA

Department of Water Resources Roadmap

Sustainability Road Map 2020–2021

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Although the focus of this report is the impact on State facilities and operations, it is important to note that for some State agencies, *climate change affects their mission as well*. DWR's mission statement declares, "DWR is responsible for managing and protecting California's water resources. DWR works with other agencies to benefit the State's people and to protect, restore and enhance the natural and human environments." DWR's mission will be *severely challenged by climate change impacts.* Despite these challenges, DWR is committed to its mission and continues to meet climate change challenges. The following paragraphs highlight DWR's climate leadership accomplishments.

Climate Leadership and Preparedness

Comprehensive Climate Change Vulnerability Assessment: In carrying out its mission, DWR has identified the preservation and restoration of ecological systems as key components in adapting to climate change vulnerabilities. The DWR Vulnerability Assessment (VA) (2019), the first for a large State infrastructure agency, includes a detailed analysis of those vulnerabilities. The VA evaluates, describes, and quantifies — where possible — DWR's vulnerabilities to increases in wildfire, extreme heat, and sea-level rise. Further, DWR reviews how changes in hydrology and ecosystems will impact DWR's facilities, operations, and other activities.

In 2020, DWR completed its initial Climate Change Adaptation Plan (AP) to address climate-driven hazards to the most vulnerable DWR facilities, managed lands, operations, and staff activities. The AP provides adaptation strategies and initiatives including infrastructure improvements and enhanced maintenance and operation procedures for our facilities, and in addition, revised health and safety procedures, and improved habitat management to reduce climate change vulnerabilities and build climate resilience.

DWR's work in reducing greenhouse gas emissions (GHG) has garnered five national climate leadership awards, indicating that DWR continues to provide exemplary climate change leadership.

DWR has included climate change in its engagement and planning process, with DWR's Division of Regional Assistance working extensively with local communities, vulnerable populations, and disadvantaged communities to provide technical and financial support. Additionally, DWR's California Water Plan, updated every five years, contains climate change guidance for the California water community. DWR has nine funding programs that include climate change considerations in their funding criteria.

Vulnerability and Adaptive Capacity

DWR designs and constructs facilities to withstand a broad range of expected increases in temperature even though DWR does not anticipate that the structures themselves will be affected. Further, DWR's new facility planning has integrated climate change effects into facility specifications and operations.

Nevertheless, DWR is vulnerable in the following areas:

Heat impacts on DWR field employees' health. However, DWR has determined that adequate flexibility in operations and staffing as well as heat risk procedures are already in place to mitigate this risk up to the middle of the century.

Potential hydrologic changes will affect operation of the State Water Project (SWP). These hydrological changes include the loss of snowpack because of precipitation falling as rain instead of snow, snow melting faster, larger volumes of runoff entering reservoirs during the winter and early spring and less runoff arriving in late spring and early summer. Further, these changes could lead to higher downstream flow during flood events and reduced late summer storage levels.

Climate change brings both changes in temperature and precipitation, which are critical operational factors. Higher temperatures act to increase evapotranspiration, sublimation, and snowmelt rates, while decreasing soil moisture and snowpack. This, in turn, leads to reduced water storage and changed water runoff patterns.

Changes in precipitation may affect average annual precipitation rates or the frequency, magnitude, and duration of extreme events. These changes can affect water quantity and quality and, in turn, the ecosystems and water systems dependent on the watersheds.

Overall, climate change will affect entire ecosystems. For example, wildfire in the Upper Feather River Watershed threatens DWR operations. One of five key watersheds for the State Water Project (SWP), the Feather River Watershed is extremely vulnerable to wildfire. Elsewhere in the state, DWR relies on natural or green infrastructure, such as flood plains, tidal marshes, and levees. Climate change will affect these structures as the ecosystems change.

Zero-Emission Vehicles (ZEVs)

DWR continues to transition to a ZEV fleet. DWR has struggled with ZEVs as most of DWR's fleet consists of light duty pickups. With new electric pickups becoming available in 2020, DWR is waiting on DGS to offer ZEV pickups. DGS expects to release its list of approved electric light-duty pickups sometime in 2022.

Of special importance in DWR's transportation efforts is the significant impact of DWR's switch to a non-fossil fuel based, low carbon-content fuel, known as renewable diesel. Renewable diesel is an engineered molecule that has all the properties of a fossil fuel diesel molecule but does not have the sulfur or nitrogen emissions. Renewable diesel meets all the low carbon and low emissions requirements in California. Since 2018, DWR has reduced its use of fossil fuel diesel from 100 percent in 2016 to 7 percent in 2020.

Energy

Retail Energy Use

DWR's retail energy use has dropped and, except for the emergency repair work at Oroville spillway and Thermalito, DWR has met the 20 percent retail energy reduction. Since 2010, DWR has completed 10 major energy efficiency projects for a one-time cost of $228,081, with an annual savings of $168,394 and an energy savings of 3,910,000 thousand British thermal units (kBTUs), or 26 percent of DWR's total retail use.

Demand Response Programs

DWR participated in demand response programs at 38 percent of its buildings and reduced energy demand by approximately 21 kW.

On-site Renewable Energy Generation

On-site renewable generation is proceeding apace, with DWR proposing nine locations for 11,531 kilowatts (kW) of solar capacity for a projected renewable energy production of 3,642,396-kilowatt hours (kWh) annually.

Zero Net Energy Buildings

DWR has seven facilities in operation that are Zero Net Energy (ZNE) compliant. Some of the facilities that meet ZNE targets are laboratories designed to test the SWP water quality, the Lake Oroville Visitor Center, Sutter Maintenance Yard, Monument Hill Boat Launch, Romero Overlook, and Cedar Spring Dam Maintenance Station. Because of their low occupancy and low frequency of use, these facilities are smaller and make up 25 percent of DWR's total DWR building area.

DWR has and continues to take measures toward achieving ZNE for 50 percent of its existing building space by 2025. DWR has prepared a feasibility study and implementation plan to improve the energy use intensity (EUI) of its buildings and facilities.

DWR meets the power use effectiveness (PUE) requirements for its data center. The Natural Resources Data Center, located at 1416 Ninth Street in Sacramento, is approximately 6,000 square feet, with temperature control maintained between 76–84 degrees, and operates under the Class A1-A4 guidelines. All installed network switches meet current energy efficiency standards. DWR/CNRA Data Center is 97 percent virtualized and 3 percent physical.

New and existing State buildings must incorporate Monitoring Based Commissioning (MBCx) to support cost effective and energy efficient building operations via an Energy Management Control System (EMCS). State agencies managing State-owned buildings must pursue MBCx for all facilities over 5,000 square feet with EUIs exceeding the thresholds described in Management Memo 15-04. However, DWR does not have any Monitoring Based Commissioning controls installed in its existing buildings because of the challenges listed above regarding building EUIs and the age of DWR's buildings. This is a priority going forward.

DWR has been relying on utility on-bill-financing (OBF) programs, such as those offered by Southern California Edison (SCE) and Pacific Gas and Electric (PG&E), to provide funding for energy efficiency upgrade and improvement projects. In

addition to participating in such electric utility-offered programs to provide funding for retail efficiency-improvement projects, the proposed feasibility studies and plan will identify the cost of energy-efficiency upgrade projects and offer funding recommendations. This planning will help DWR achieve the new, stringent EUI targets and ultimately Zero Net Energy for 50 percent of the square footage of existing State-owned building area by 2025. For funding related to developing on-site renewable generation projects, DWR plans to enter into power purchase agreements (PPA) with renewable developers.

Water Efficiency and Conservation

DWR facilities do not have submeters to separate potable and processed water use. DWR currently monitors and reports on 22 State-owned facilities. Seven facilities reside along the SWP's open canals and reservoirs and rely on water available from the aqueduct. Additionally, four facilities are in remote locations where municipal water is unavailable, relying on groundwater to operate and maintain daily functions. Water use to operate these facilities is based on factors such as individual buildings within a site, function type, and the number of occupants. DWR's water use for 2020 was 15,706,300 gallons.

Top Water Users

Typically, DWR's top water use comes from DWR visitor centers. But because of the pandemic, DWR's top water use shifted to the Operation and Maintenance (O&M) Centers, which used 10,788,100 gallons, accounting for 69 percent of DWR's water use.

Landscaping

Landscaping needs account for a large amount of water use; however, without irrigation water being separated from total water use because there is a lack of submeters, it is difficult to know how much water is devoted to landscaping. DWR facilities have nearly 570,000 square feet of landscaping surface area, 84 percent of which is located at its five Field Division O&M centers. Of the current landscaping, nearly 50 percent is turf grass. The San Joaquin O&M Center is the largest landscaped area, with 133,800 square feet of total landscaping. DWR's biggest challenge is integrating landscape and irrigation improvement projects into its capital improvement plan as well as scheduling personnel to implement such projects. In the interim, DWR has been applying for various available funding programs, including State-sponsored programs. To date, the response to DWR's

funding requests has resulted in either DWR being "Not Eligible" or the requested funds being already exhausted.

Large Landscapes Greater Than 20,000 Square Feet

DWR has six facilities with large landscapes totaling nearly 535,000 square feet. There are no water budgets or personnel who are United States Environmental Protection Agency (EPA) WaterSense (or equivalent) certified for these facilities. Creating water budgets and getting certified staff are a priority for water efficiency on these landscapes.

Critical Groundwater Basin and Urban Water Shortage Contingency Plans

In 2019, DWR had four buildings in the San Joaquin Valley, a valley designated as a critical groundwater basin by the sustainability groundwater Management Act (SGMA). These facilities used 1,496,800 gallons of groundwater. Currently, only two of the four buildings have an Urban Water Shortage Contingency Plan.

DWR plans to conduct on-site inspections to obtain detailed information on boiler and chiller inventory, personnel training, and maintenance and inspection criteria. On many sites, the current heating and cooling units are insufficient and/or are at the end of their useful life. The Operations and Maintenance Division plans to upgrade using existing maintenance funds or by finding additional funding programs to replace outdated equipment.

Green Operations

Greenhouse Gas Reductions

DWR began reporting its GHG emissions to the California Climate Registry in 2007 and then transitioned to the national Climate Registry in 2010. By 2012, DWR had formally committed to reducing its GHG emissions to 50 percent below 1990 levels by 2020 and 80 percent below 1990 levels by 2050. DWR's Greenhouse Gas Emissions (GHGe) reductions are award-winning, with DWR being the only public agency to ever receive the prestigious national Climate Leadership Award from the United States Environmental Protection Agency and the Center for Climate and Energy Solutions for excellence in greenhouse gas management (Goal Setting certificate). This award recognizes organizations that publicly report and verify organization-wide GHG inventories and set aggressive GHG emissions reduction goals. This award is even more noteworthy given DWR's role in operating the State Water Project (SWP).

DWR is already well ahead of schedule for achieving its 2020 and 2050 GHG Emissions reduction goals. The Greenhouse Gas Reduction Plan (GGERP) projected that 2015 emissions should be around 2.1 million metric tons of carbon dioxide equivalent (CO2e) to be on track to achieve the reduction goals by 2020. In fact, DWR achieved its target emissions reductions for 2020 in 2015, five years ahead of schedule.

Environmentally Preferred Purchasing

DWR's Environmentally Preferred Purchasing (EPP) program is also noteworthy, with all of DWR's 47 designated buyers having completed the EPP training. DWR is taking several steps to increase both its EPP purchasing percentages and its State Agency Buy Recycled Campaign percentages.

While DWR still has challenges in meeting all green operations goals, especially in the areas of Indoor Environmental Quality (IEQ) and Integrated Pest Management (IMP), DWR is committed to the continued implementation of green operations strategies and goals.

Karla Nemeth

Executive Director

CHAPTER 1 — CLIMATE CHANGE ADAPTATION

Executive Order B-30-15 directs State agencies to integrate climate change into all planning and investment. Planning and investment can include the following:

- Infrastructure and capital outlay projects.
- Grants.
- Development of strategic and functional plans.
- Permitting.
- Purchasing and procurement.
- Guidance development.
- Regulatory activity.
- Outreach, and education.

This report focuses on the first three of these activities, and follows the guidance created by the Technical Advisory Group developed under EO B-30-15 to assist State agencies to complete this task.

Further, Executive Order N-19-19 directs the reduction of GHG emissions in State operations.

Climate Change Risks to Facilities

For all infrastructures, it is important to assess the risk that a changing climate poses to an asset or project (e.g., sea-level rise or increasing daily temperatures). It is also important to recognize the impact that an infrastructure project has on the surrounding community and the impacts on individual and community resilience (e.g., heat-island impacts).

To determine how climate change will affect a given project or plan or existing infrastructure, DWR will consider the following screening questions.

1. What is the lifetime of the facility, planned project, or plan?
2. Will the project be affected by changing average climate conditions or increases in extreme events over its lifetime? California is susceptible to

many climate risks, with many locations at risk from multiple impacts, such as wildfire and mudslides in the same year. It is important to consider the possibility of single climate impacts as well multiple, compounding events that may cause you to plan more conservatively.

3. What are the consequences of that disruption? When answering this, consider how the project/site will be used in its useful lifetime.
4. Will that disruption affect vulnerable populations, critical natural systems, critical infrastructure, or other assets?
5. Will that disruption cause irreversible effects or pose an unacceptable risk to public health and safety?

DWR's Climate Change Vulnerability Assessment (VA; California Department of Water Resources 2019) assesses the numerous climate-driven hazards that represent potential threats to DWR facilities, managed lands, operations, critical natural systems, and staff activities. The analysis draws from the extensive existing body of knowledge about climate change and evaluates, describes, and quantifies — where possible — DWR's vulnerabilities to expected increases in wildfire, extreme heat, and sea-level rise, as well as expected changes in hydrology and ecosystems that will impact DWR's facilities, operations, and other activities. Through a standardized approach, DWR assessed various climate-driven hazards that examined exposure, sensitivity, and adaptive capacity to determine overall vulnerability from wildfire, extreme heat, sea-level rise, long-term and persistent hydrologic changes, and habitat and ecosystem services degradation.

DWR's Climate Change Adaptation Plan (AP; California Department of Water Resources 2020) prioritizes and addresses climate change vulnerabilities to DWR owned and operated facilities and activities throughout the state and establishes a process to guide DWR's climate change adaptation. The AP includes tools to track, evaluate, and reflect upon DWR's adaptation activities and goals over time as well as strategies and actions to protect staff, business operations, and assets vulnerable to the impacts of climate change. Specifically, the AP identifies priority actions to reduce the climate change vulnerabilities of four key assets critical to DWR's core function: (1) staff safety; (2) State Water Project (SWP); (3) Upper Feather River Watershed; and (4) landscapes (ecosystems and habitats). In addition to identifying adaptation actions for these four key assets, the AP highlights DWR efforts that promote climate adaptation at local and regional levels throughout CA as well as investments to advance scientific and analytical capacity to address future uncertainties.

This report focuses on the risks to DWR-owned and privately leased facilities, while the VA and AP can be referred to for more in-depth analysis of DWR's vulnerabilities and climate change adaptation activities.

Understanding Climate Risk to Existing Facilities

Using Cal-Adapt and the data provided by DGS, DWR has assessed the data on how the climate impacts outlined below are projected to change at each existing facility (see Figure 1).

To ensure consistency in planning for climate impacts, DWR used the latest climate change information. In many cases, Cal-Adapt is the most updated source of climate change data/projections for the State of California.

Background on Climate Projections: Global Circulation Models (GCMs) are used to project future climate conditions. Models project future climate conditions under different future emission scenarios called *Representative Concentration Pathways* (RCPs). Different RCPs essentially represent different rates and magnitudes of global GHG emission reduction.

Of the 32 internationally recognized course-resolution GCMs, the State of California has chosen four models to utilize in its climate studies for the Fourth Assessment.[1] The following four models were selected to capture a range of different climate futures:

- Model 1: HadGEM2-ES characterizes a warm and dry future (warm/dry).
- Model 2: CNRM-CM5 characterizes a cool and dry future (cool/wet).
- Model 3: CanESM2 characterizes an average future condition (average).
- Model 4: MIROC5 provides a complement to the above models, and covers a range of outputs.

For some of the more detailed vulnerability analyses that DWR conducted for its facilities, it used climate projections developed as part of California's Third Climate Change Assessment, but very little, if anything at all, has changed for these projections.

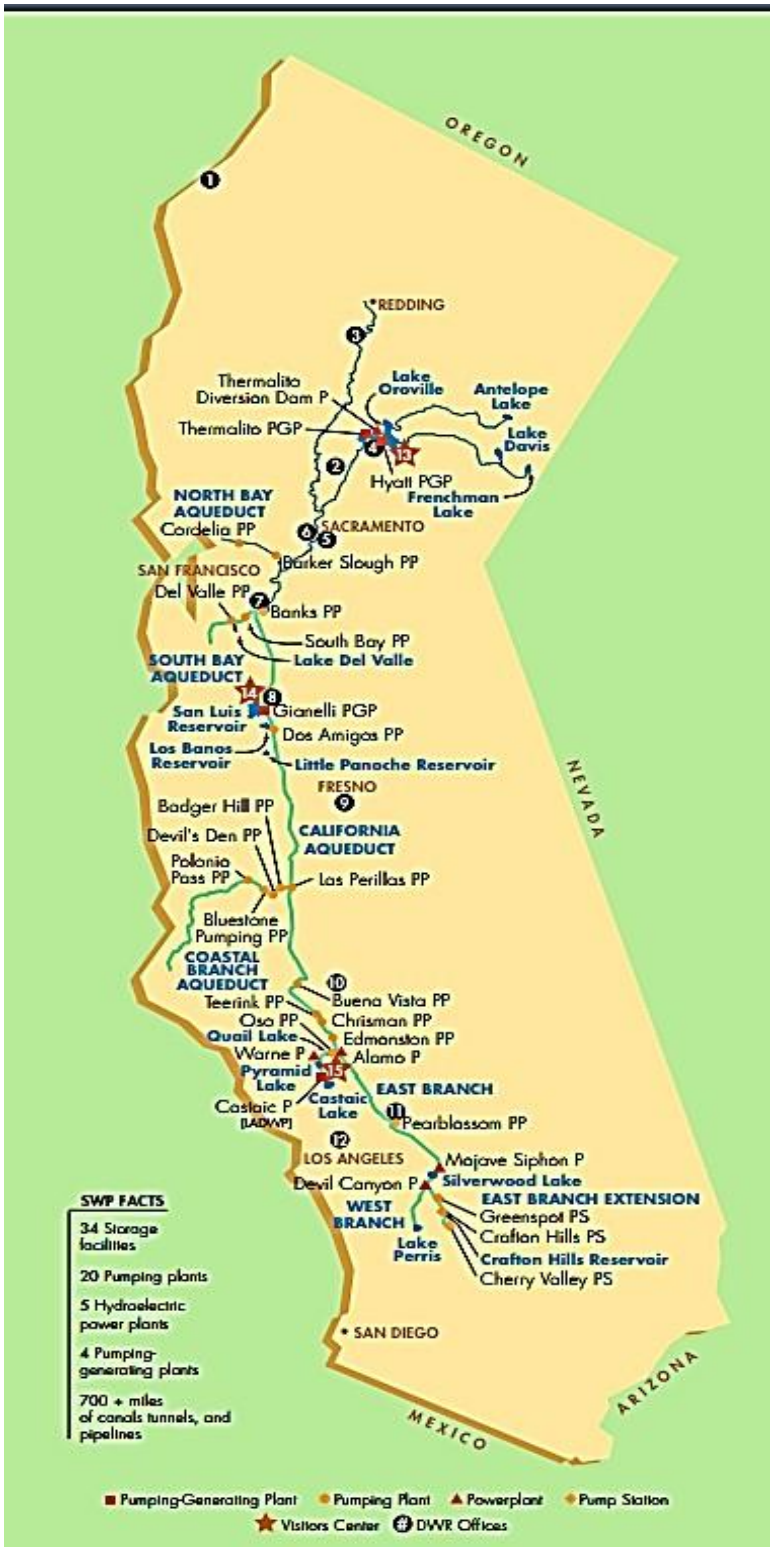
1 Pierce, D.W., D.R. Cayan, L. Dehann. June 2016. Creating Climate projections to support the 4th California Climate Assessment.

Risk from Changing Extreme Temperatures

Under a changing climate, temperatures are expected to increase — both at the high and low end. As a result, facilities will experience higher maximum temperatures and increased minimum temperatures. In addition to changing average temperatures, climate change will increase the number of extreme heat events across the state. Extreme events are already being experienced, and they are likely to be experienced sooner than changes in average temperatures.

While both minimum and maximum annual temperatures have and will continue to increase, the minimum temperatures across California have increased more (1.6 to 2.5 °F) than the maximums (0.4 to 1.4 °F) (California Department of Water Resources 2014). A study by Scripps Institution of Oceanography projected future temperatures across California. The results indicate that by 2060–2069 mean temperatures may be 3.4 to 4.9 °F higher across the state compared to the period 1985–1994 (Pierce et al. 2012; California Department of Water Resources 2014). Seasonal trends indicate a greater increase in the summer months (4.1 to 6.5 °F) than in the winter months (2.7 to 3.6 °F) by 2060–2069. While these changes in mean temperatures may contribute to many water management changes, it is the projected increase in maximum summertime temperatures and extreme heat events that poses the highest risk to the health and safety of DWR staff working outdoors.

Figure 1 Map of DWR Facilities



Tables 1.1 and 1.2 show the facilities expected to be most affected by increasing average temperatures and increased number of extreme heat events.

Table 1.1 Top 5 Facilities that Will Experience the Largest Increase in Extreme Heat Events

Facility Name	Northern Region Office	Delta Field Division	San Luis Field Division	San Joaquin Field Division	Southern Region Office
Extreme heat threshold (EHT)	108.6	103.8	102.4	105.7	98.6
Average # of days above EHT (1961-1990)	4.3	4.3	4.3	4.3	4.3
Average # of days above EHT (2031-2060)	14	20	30	28	13
Change from Historical to projected average # of days above EHT (2031-2060)	9.7	15.7	25.7	23.7	8.7
Avg. # days above EHT (2070-2099)	9.7	15.7	25.7	23.7	8.7
Change from historical to projected average # of days above EHT (2070-2099)	5.4	11.4	21.4	19.4	4.4
Increase in # of days above EHT by mid-century	36	38	58	54	30
Increase in Avg. # days above EHT by end of century	31.7	33.7	53.7	49.7	25.7

In addition to changing average temperatures, climate change will increase the number of extreme heat events across the state. Extreme events are likely to be experienced sooner than changes in average temperatures. Table 1.2a presents the top five facilities of concern for DWR and their exposure to temperature changes.

Table 1.2a Top 5 Facilities Most Affected by Changing Temperature — Annual Mean Max. Temp

Facility Name	Northern Region Office	Delta Field Division	San Luis Field Division	San Joaquin Field Division	Southern Region Office
Historical Annual Mean Max. Temp. (1961 – 1990)	75.89	74.21	72.8	77.38	76.02
Annual Mean Max. Temp. (2031 – 2060)	80.41	78.26	79.16	81.2	80.4
Change from Historical to Annual Mean Max. Temp (2031-2060)	4.52	4.05	6.36	3.82	4.38
Annual Mean Max Temp. (2070-2099)	84.31	82.5	82.23	85.47	84.14
Change from Historical to Annual Mean Max. Temp (2070-2099)	8.42	8.29	9.43	8.09	8.12

Table 1.2b Top 5 Facilities Most Affected by Changing Temperature — Annual Mean Min Temp

Facility Name	Northern Region Office	Delta Field Division	San Luis Field Division	San Joaquin Field Division	Southern Region Office
Historical Annual Mean Min. Temp. (1961 – 1990)	50.62	49.02	48.93	50.14	52.8
Annual Mean Min. Temp. (2031 – 2060) °F	55.02	53.56	53.16	54.13	57.42
Change from Annual Mean Min. Temp (2031-2060)	4.4	4.54	4.23	3.99	4.62
Annual Mean Min. Temp. (2070-2099 ^{0}F)	58.89	57.37	57.08	57.95	61.42
Change from Annual Mean Min. Temp (2070-2099)	8.27	8.35	8.15	7.81	8.62

Heating and Cooling Degree Days

A Heating Degree Day (HDD) is defined as the number of degrees by which a daily average temperature is below a reference temperature (i.e., a proxy for when heat would be needed). The reference temperature is typically 65 degrees Fahrenheit, although different utilities and planning entities sometimes use different reference temperatures. The reference temperature loosely represents an average daily temperature *above which* space heating is not needed. The average temperature is represented by the average of the maximum and minimum daily temperature. Similarly, a Cooling Degree Day (CDD) is defined as the number of degrees by which a daily average temperature exceeds a reference temperature. The reference temperature is also typically 65 degrees Fahrenheit, and different utilities and planning entities sometimes use different reference temperatures. The reference temperature loosely represents an average daily temperature *below which* space cooling (e.g., air conditioning) is not needed.

In this analysis (Tables 1.3a and 1.3b), the focus of temperature affects to DWR is on operations and individuals, rather than on the facilities themselves, as the facilities were built to withstand a broad range of temperature fluctuations that is encompassed within the expected increases from climate change. Operational challenges imposed by increasing temperatures include hydrological changes (i.e., type of precipitation and runoff timing) and potential health impacts to DWR staff, especially those working in the field.

Table 1.3a Top 6 Facilities that will be Most Impacted by Projected Changes in Heating Degree Days (HDD)

Facility Name	Heating Degree Days (1961–1990) (HDD)	Heating Degree Days (2031–2060) (HDD)	Heating Degree Days (2070–2099) (HDD)	Total of Decreased Heating Degree days by 2099
Beckwourth Subcenter	7,502	5,775	4,808	2,694
Cedar Springs Dam Maintenance Station	4,054	2,724	2,084	1,970
Water Quality Test Building	3,849	2,663	2,067	1,782
Oroville Operations and Maintenance Center	3,007	2,159	1,644	1,363
Lake Oroville Visitors Center (No Water)	3,007	2,159	1,644	1,363

Facility Name	Heating Degree Days (1961–1990) (HDD)	Heating Degree Days (2031–2060) (HDD)	Heating Degree Days (2070–2099) (HDD)	Total of Decreased Heating Degree days by 2099
Thermalito Annex	3,007	2,159	1,644	1,363

Table 1.3b Top 4 Facilities that will be Most Impacted by Projected Changes in Cooling Degree Days (CDD)

Facility Name	Cooling Degree Days (1961–1990) (CDD)	Cooling Degree Days (2031–2060) (CDD)	Cooling Degree Days (2070–2099) (CDD)	Total of Increased Cooling Degree days by 2099
Lost Hills Operations and Maintenance Subcenter	1,995	2,931	3,676	1,681
San Joaquin Operations and Maintenance Center (No Electricity)	1,995	2,931	3,676	1,681
Oroville Operations and Maintenance Center	1,307	2,262	2,998	1,691
Monument Hill Boat Launch (No Water)	1,307	2,262	2,998	1,691

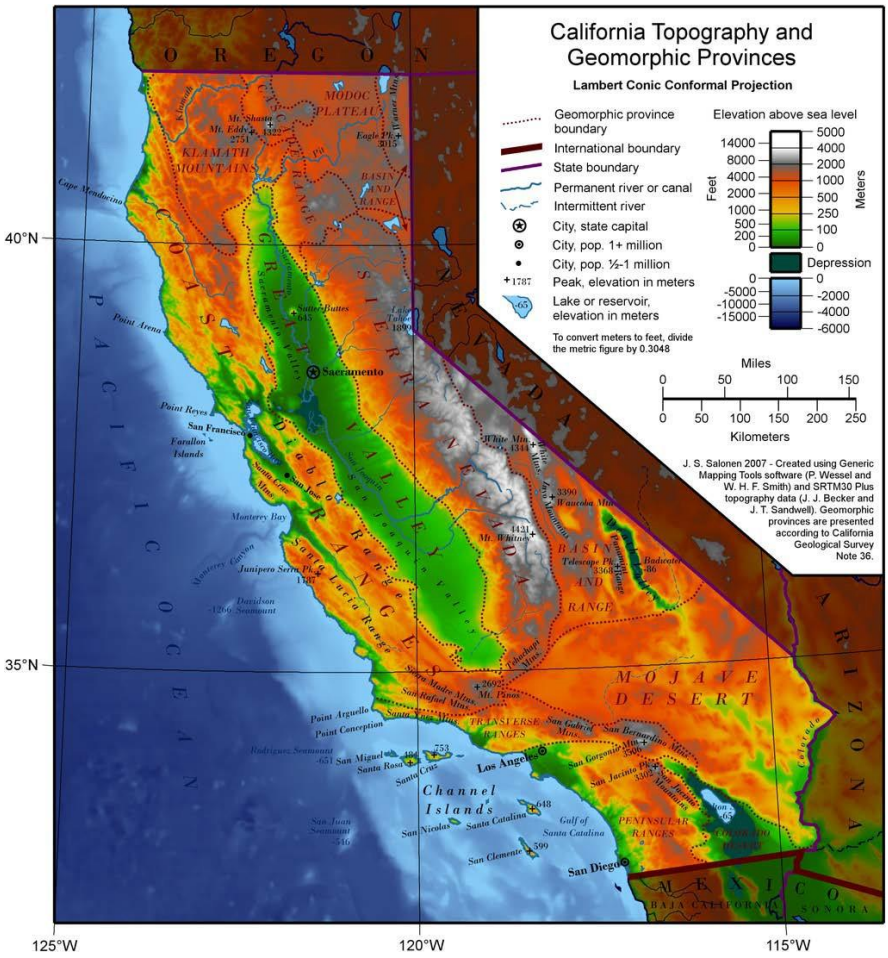
DWR performs numerous activities that require staff to work outside for extended periods, such as repairing or maintaining equipment and conducting biological surveys and monitoring. Extreme heat events can be disruptive to these activities. Sensitivity to warming temperatures will vary depending on the individual. Staff with existing health complications will be more sensitive to increases in temperature. In addition, staff currently working in cooler areas may be less acclimated to extreme heat events and may not have access to air conditioning to cool off if overheated. Therefore, staff working outdoors in the Delta or near the Southern Region Office may be more sensitive to the projected increases in temperature, although the San Luis and San Joaquin Field Division offices are expected to have the most dramatic increases in extreme heat days.

To assess human exposure to extreme heat events, DWR's Climate Change Program staff interviewed Regional Office staff and managers to obtain initial data and refine a screening survey on heat exposure. An "Extreme Heat Screening Questionnaire" was then sent to all DWR Branch Managers to identify which

branches have staff in the field between May and October. A more detailed survey was conducted to gather information on the types of activities occurring between May and October and how summer temperatures currently affect staff activities. The survey targeted supervisors, and in a few cases staff, identified in the initial questionnaire. The purpose of the survey was to help assess staff's current exposure to extreme heat and identify where DWR has flexibility, along with potential constraints, to reducing that exposure.

Most DWR outdoor work occurs in the Central Valley and the Southern Interior and Mojave Desert regions as shown in Figure 2.

Figure 2 California Topography Map Showing the Central Valley, the Southern Interior, and the Mojave Desert



While all staff working outdoors will be exposed to warming temperatures, projections for mid-century indicate that the increases will be either within the range or slightly above the range to which they are currently exposed. As

temperatures increase, outdoor staff activities may need to shift (i.e., either to a different time of day or to another work window) and implement the buddy system more frequently, and project delays associated with the need for more on-site cool down rest periods, schedule shifts, and longer acclimation periods for new staff may occur.

For construction as well as operations and maintenance activities, there may be delays in completing scheduled work activities, heat-related disruptions to the power grid that impact ability to operate (i.e., pumps go offline), short term increases in workload as scheduled activities get moved into shorter work windows, increased costs associated with higher staffing levels to offset the need for more on-site rest periods, and increases in staff sick days for existing health conditions exacerbated by heat and heat illness. Another set of activities that may be vulnerable are conducting sampling, monitoring, and various surveys, which could be especially problematic for real-time compliance monitoring.

Fortunately, DWR already has a fair amount of adaptive capacity to address the risk to staff from warming temperatures and extreme heat events. Based on the survey results presented in the VA, supervisors do have some ability to shift work schedules to the cooler portions of the day, and nearly half indicated that they could reschedule certain work activities. In addition, DWR has protective measures for staff in place via the implementation of the Heat Illness Prevention Plan (HIPP) and is employing the following strategies to strengthen high heat protection of staff:

- Quantify potential budget impacts of heat-related project delays and increased staffing costs, especially in areas where staff have numerous fieldwork days during summer.
- Collaborate with DWR's HIPP managers to explore how to incorporate increasing extreme heat in the HIPP.
- Establish protocols that ensure managers are aware of impending high heat days and establish plans to ensure the least amount of disruption to work progress.
- Ensure staff have high heat health and safety equipment in advance of work start date; including shade/cooling structures, water coolers, access to ice machines, and working air conditioners in vehicles.
- Continue educating staff in coordination with the DWR Safety Office about DWR's HIPP, signs of heat illness, and prevention of heat illness.

- Engage the DWR Safety Office on high heat planning and development of adaptation strategies.

Urban Heat Islands

Urban heat islands are areas with localized spikes in temperature, which impact human health, increase pollution, and increase energy demand. Urban heat islands occur during the hot summer months in areas with higher percentages of impervious surface and less vegetation. This is likely in areas with large parking lots, dense development, and lower tree density and shading. Urban heat islands can be mitigated through tree planting and other greening measures, cool roofs (e.g., lighter roofing materials that reflect light), cooler pavements, and other measures. Several of DWR facilities are in Urban Heat Islands (Table 1-4).

Table 1.4 Eight Facilities Located in Urban Heat Islands

Facility Name	Located in an urban heat island (yes/no)
Southern Region Office	Yes
Delta Field Division Headquarters	Yes
Southern Field Division Headquarters	Yes
Perris Reservoir Visitors Center	Yes
Cedar Springs Dam Office	Yes
North Bay Maintenance Center	Yes
Water Quality Test Building	Yes
West Sacramento Storage Yard	Yes

The area occupied by the facilities in Table 1.4 is relatively small, but does include the buildings and associated parking lots, which are paved. Landscaping is generally a part of all facilities but varies with region and climate. Furthermore, only the Southern Region Office is located within an exclusively urban area. As a result of meeting requirements for reduced water consumption at State facilities during the most recent drought, few efforts have focused on attempting to reduce the heat island impact through increased plantings. In some areas, such as the Delta Field Division Headquarters, water conservation efforts on grass landscape resulted in the conversion of a small field to dirt, which may contribute additional warming to Delta's urban heat island. Conversely, a new building at the Southern Field Division Headquarters is in an area previously consisting of a dirt field. The building and associated parking lot included a "cool" roof coating and permeable

concrete, which may lessen some impacts of the Headquarters' urban heat island index.

Risks from Changes in Precipitation

The impacts of climate change on the amount of precipitation that California will receive in the future are slightly less certain than the impacts on temperature. However, it is expected that California will maintain its Mediterranean climate pattern (dry summers and wet winters), but more precipitation will fall as rain than as snow. It is also likely that extremes will intensify for both drought and heavy precipitation events. Larger rains can result in flooding but will also result in shifts in runoff timing (earlier) and runoff volumes (higher). It will also result in decreased snowpack.

DWR used climate projections from CalAdapt to complete the following table for its facilities (Tables 1.5). The findings indicate only two DWR facilities directly affected by projected precipitation changes. This conclusion is moderated by the lack of extreme precipitation actual data from 1961–1990 and the lack of modeling results for 2031–2060 as well as lack of data from 2070–2090.

Table 1.5 Top 5 Facilities that will be Most Impacted by Projected Changes in Increased Precipitation

Facility Name	Annual Mean Max. Precip. (1961–1990) (in/yr)	Annual Mean Precip. (2031 – 2060) (in/yr)	Percent Change by mid-century	Annual Mean Precip. (2070–2099) (in/yr)	Percent change by end of century	Extreme Precip (1961–1990) (in/day)	Extreme Precip (2031–2060) (in/day)	Extreme Precip (2070–2090) (in/day)
Southern Field Division Headquarters	32.62	33.77	3.53	36.5	11.89	No Data	No Data	No Data
Delta Field Division Headquarters	11.5	13.41	16.61	14.28	24.17	No Data	No Data	No Data
Northern Region Office	21.99	25.95	18.01	27.19	23.65	No Data	No Data	No Data
Oroville Field Division Office	35.21	38.86	10.37	41.1	16.73	No Data	No Data	No Data

Facility Name	Annual Mean Max. Precip. (1961–1990) (in/yr)	Annual Mean Precip. (2031 – 2060) (in/yr)	Percent Change by mid-century	Annual Mean Precip. (2070–2099) (in/yr)	Percent change by end of century	Extreme Precip (1961–1990) (in/day)	Extreme Precip (2031–2060) (in/day)	Extreme Precip (2070–2090) (in/day)
Southern Region Office	18.11	18.75	3.54	20.86	15.18	No Data	No Data	No Data

DWR's individual facilities, including those in Table 1.5, have been built to withstand a wide range of precipitation events and are expected to withstand these changes in precipitation. For DWR, risks caused by changes in precipitation are most evident in the challenge of the State Water Project (SWP) to continue to manage streamflow and provide flood protection and water supply to the people of California.

Hydrologic changes caused by climate change pose serious challenges to DWR assets, particularly operation of the SWP. Climate change vulnerability throughout the water sector stems from both changes in temperature and precipitation. Higher temperatures act to increase evapotranspiration, sublimation, and snowmelt rates, and decrease soil moisture and snow accumulation. These effects combine to reduce snowpack and water storage and change runoff patterns. Changes in precipitation may affect average annual precipitation rates or the frequency, magnitude, and duration of extreme events. These changes can affect water quantity and quality, and, in turn, the ecosystems supported by the watershed and water systems dependent on the watersheds.

Loss of snowpack because of higher temperatures and reduced precipitation is of concern to California. Snowmelt provides an annual average of 15 million acre-feet ofwater, slowly released by melting from about April to July each year. Much of the state's water infrastructure, including the SWP, was designed to capture and store winter and spring runoff to reduce streamflows that cause flooding and to deliver the water during the drier summer and fall months when it is needed for water supply.

Projections now indicate that by the end of this century the Sierra snowpack may diminish by 48-65 percent from 1961–1990 levels (Pierce and Cayan 2013). This loss of snowpack, a result of precipitation falling as rain instead of snow and the remaining snow melting faster, will result in larger volumes of runoff entering

reservoirs during the winter and early spring and less runoff arriving in late spring and early summer, which could overwhelm the flood storage capacity of reservoirs during winter. This could lead to higher downstream flow during flood events and reduced late summer storage levels.

Climate change may also affect water demand for both agricultural and urban use. Warmer temperatures are likely to extend growing seasons, increase evapotranspiration, and reduce soil moisture — all of which will increase the amount ofwater needed for irrigation, urban landscaping, and environmental needs (U.S. Global Change Research Program 2014).

DWR's VA assessed climate vulnerability across a wide range of potential future climate conditions and found that operation of the SWP has high exposure to changing climate conditions. In the watersheds from which SWP water supplies originate, higher temperatures and changes in precipitation are expected to change inflows to SWP reservoirs — increasing winter runoff and decreasing spring and summer runoff. In the Sacramento-San Joaquin Delta (Delta), water supplies interact with the Delta's complex hydrology, which is influenced by sea level, tides, and flows from several rivers.

It is still unclear to what extent SWP facilities and operations can be adapted to ameliorate losses in performance resulting from climate change. Several structural improvements, such as the California Delta Conveyance, non-structural improvements, such as upper meadow restoration in the Upper Feather River Watershed, and operational improvements, such as forecast-based operations of reservoirs, are being explored. While a full analysis of the efficacy of these types of adaptation strategies has yet to be completed, initial assessments of some strategies appear promising.

Implementation of DWR's Climate Change Adaptation Plan advances building adaptive capacity of SWP operations under climate change. DWR is implementing the five-step process outlined in the Climate Risk Informed Decision Analysis (CRIDA), published by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) (Mendoza et al. 2018). The five steps were adapted in the context of the DWR Climate Change Plan and are:

Step 1. Structuring a Process for Vulnerability Assessment.

Step 2. Implementing a Bottom-up Vulnerability Assessment.

Step 3. Identifying and evaluating opportunities and formulating alternative plans.

Step 4. Comparing and recommending plans.

Step 5. Implementing climate resilient solutions and communicating residual risks.

Since the completing its VA, DWR has taken significant steps to investigate and to advance adaptation actions in order to develop the capacity needed to continue accelerating adaption planning and implementation to respond to long-term changes in hydrology and sea level. Such activities include:

- Ongoing investigations.
- Flood Informed Reservoir Operations.
- Delta Conveyance.
- Watershed-scale climate vulnerability and adaptation studies and adaptation action.
- Oroville carryover storage target increased by 400,000 acre-feet.
- Runoff forecast improvements including:
- Data acquisition and improved modeling.
- Expansion of Airborne Snow Observatory flights to the Feather River watershed.

Risks from Sea-Level Rise

Increasing global temperatures are contributing to rising sea levels. Rising sea levels will inundate coastal areas and cause increased flooding from storm surges. The California Ocean Protection Council (OPC) has issued the OPC Guidance for State agencies on what level of sea-level rise projections to consider in planning.

The Guidance provides estimates of sea-level rise for the California Coast for all active tide gauges based on a range of emission trajectories that are based on the report, Rising Seas in California: An Update on Sea-Level Rise Science. These data provide projections for use in low, medium-high, and extreme risk aversion decisions. Current guidance from the CA Coastal Commission suggests using the medium-high or extreme risk aversion when assessing the vulnerability of critical infrastructure.

Sea-level rise is a key climate change vulnerability incorporated into planning and decision-making wherever DWR owns or manages facilities or conducts operations of the SWP. DWR facilities have potential exposure to sea-level rise in the San Francisco Bay (Bay) and the Sacramento-San Joaquin Delta (Delta) regions and are discussed separately below. Because hazards and available data differ in these two areas, the methodologies for calculating exposure to sea-level rise hazards are likewise different for each area. In all cases, exposure assessed the probability of inundation or other damage from rising seas or storm surges. Note that sea-level rise is only one contribution of many to the actual water surface level at any given location and time; other factors include tides, storm surges, and atmospheric pressure (California Ocean Protection Council 2013, 2018). River outflows are more important in the Delta than in the Bay. The majority of DWR facilities identified as potentially vulnerable are in the Delta area.

San Francisco Bay

This region includes the San Francisco Bay inland to the confluence of the Sacramento and San Joaquin rivers (near the town of Antioch). DWR has very little infrastructure within the Bay itself. The facilities identified for inclusion in this study are all within the Suisun Marsh area.

In the Suisun Marsh, there are salinity control gates that have high exposure to sea-level rise, but because they are already in frequent contact with saltwater and designed to maintain their ability to function under those conditions, sensitivity was determined to be low. Conversely, natural lands impacts, such as upland-marsh habitat, depend on elevation. In addition, DWR owns and maintains several facilities within San Francisco Bay/Suisun Marsh that will be exposed to sea-level rise; however, these facilities have low sensitivity (owing to the existing frequent contact with water) and thus overall risk from increasing sea level is low (Table 1.6a).

Table 1.6a Suisun Marsh Facilities Exposure to Sea-Level Rise

Facility/Program	Asset Name	Approx. Elevation (AMSL[2])	Exposure Rating 2030	Exposure Rating 2050
Suisun Marsh	Salinity Control Gates	N/A	High	High
Suisun Marsh	Salinity Control Building	8	Low	Low

In summary, DWR owns and maintains several facilities within San Francisco Bay/Suisun Marsh exposed to sea-level rise, but these facilities have low sensitivity (owing to the existing frequent contact with water) and thus overall risk from increasing sea level is low. But the Suisun Marsh is already being impacted by changes from human activities and will be impacted in the future by increasing inundation of mud flats and low-lying areas, levee and dike failures, and greater variation in environmental conditions (Moyle et al. 2014). Sensitivity to these changes is high, and adaptive capacity complicated by a variety of factors such as multiple ownership and joint management entities, therefore Suisun Marsh itself is considered to have high risk.

Sacramento-San Joaquin Delta

The Delta is especially sensitive to the combined effects of multiple aspects of climate change. Areas within the Delta have water surface elevations that are affected by a variety of factors including mean sea level, tidal fluxes and freshwater inflows, barometric pressure, and temporary water fluxes from wind and storm surge. Because climate change can increase mean sea level, alter freshwater flows, and intensify wind and storm surge, the facilities in the Delta may be particularly vulnerable to the synergistic effects of multiple aspects of climate change.

A detailed modeling analysis of the combined effects of mean sea level, tidal fluxes, freshwater inflows, barometric pressure, and temporary water fluxes from wind and storm surge was beyond the scope of the analysis conducted for the VA. Furthermore, much of this analysis occurred as part of the Central Valley Flood Protection Plan (CVFPP) 2017 Update. The CVFPP 2017 Update included technical analyses of reservoir, riverine, and estuary simulations, hydrologic and economic analysis, and ecological assessments. One technical component of the plan is to evaluate the impact of hydrologic changes driven by climate change and sea-level

2 AMSL = Above Mean Sea Level

rise during large flood events on the State Plan of Flood Control Levees. While most of the State Plan of Flood Control levees exist outside of the Delta, flood protection facilities throughout the Central Valley have important implications for the amount and timing of flood flows entering the Delta. As part of the CVFPP 2022 Update, updated sea-level rise projections, with the latest understanding, use three new inland climate scenarios and sea-level rise projections consistent with *Making California's Coast Resilient to Sea Level Rise: Principles for Aligned State Action*, developed by the State Coastal Leadership Group on Sea-Level Rise (2020).

The DWR VA (2019) did include analysis to evaluate additional climate change exposure to DWR facilities in the Delta based on modeling and interpretation completed for the CVFPP 2017. The three major facilities in the Delta owned by DWR include the West Sacramento DWR Office, the North Bay Aqueduct, and the Clifton Court Forebay.

For each location, calculations took place at the closest available analysis point for the effect of increased stream flows resulting from climate change, the increased mean sea level, and the storm surge. The analysis viewed the change in water surface elevation from approximately 40 cm of mean sea-level rise plus flows from a 100-year flood event (a flood event that has a 1 percent probability of occurring in any given year) and the residual storm surge[3]. In these conditions, the West Sacramento DWR Office experiences an increase of approximately 0.6 feet expected from the Yolo Bypass and 1.1 feet in the Sacramento River. The North Bay Aqueduct intake expects to experience an increase in water surface elevation of 1 foot during a 100-year flood, mostly caused by the backwater effect of the Yolo Bypass.

On the south side of the Delta, DWR expects a much larger increase of 2.6 to 3.6 feet near the Clifton Court Forebay. This increase is the result of two reinforcing effects:

1. The San Joaquin River watershed is generally higher in elevation compared with the rest of the Sierra Nevada and has historically received more snow

3 Residual storm surge in this analysis is the amount of storm surge existing when the flood waters from a storm arrive in the Delta, several hours after the storm would have made landfall at the Delta causing the greatest storm surge.

and less rain at higher elevations; temperature increases will result in increased direct runoff as more of the watershed receives rain and less snow under mid-century conditions.

2. In this location of the Delta, the Sacramento River creates a backwater effect on Middle River, Old River, and Grantline Canal. As flows from the San Joaquin River reach the Delta, the backwater effects on both Middle and Old rivers and Grantline Canal create a hydraulic dam, which results in the San Joaquin flows backing up and raising water surface elevations even higher.
3. Facility exposures to sea-level rise evaluated the analysis above and based on their proximity to Delta waters and their elevation above mean sea level. Assets on Delta islands and assets in direct contact with Delta waters (e.g., control gates, pumping plants) were assumed to have high exposure during all periods. For these facilities, elevation is not included, and exposure lists as "high" for all periods. All other facilities within the Delta were analyzed based on their elevation and location (Table 1.6b).

Table 1.6b 27 Facilities Exposure Rating — Delta Area

Facility/Program	Asset Name	Approx. Elevation (AMSL)	Exposure Rating 2030	Exposure Rating 2050
SWP — Clifton Court	Clifton Court Check Structure	N/A	High	High
SWP — Banks Pumping Plant	Pumping Plant	N/A	High	High
SWP — John Skinner Fish Protection Facility	Skinner Fish Facility Screens	N/A	High	High
Bay-Delta Office — Other	Aeration Facility (South Delta Branch)	N/A	High	High
Flood Control Materials Depots	Twitchell Island Warehouse	-5	High	High

Facility/Program	Asset Name	Approx. Elevation (AMSL)	Exposure Rating 2030	Exposure Rating 2050
SWP — Barker Slough Pumping Plant	Control Building	23	Low	Low
SWP — Barker Slough Pumping Plant	Compressor Building	23	Low	Low
SWP — Clifton Court	Clifton Court Accessory Buildings	16	Low	Low
SWP — Banks Pumping Plant	Switchyard Control Building	144	Low	Low
SWP — Banks Pumping Plant	Area Control Center (Visitor's Center)	16	Low	Low
Delta O&M Center	Administration Center	143	Low	Low
Delta O&M Center	Plant Maintenance Shop	138	Low	Low
Delta O&M Center	Civil Maintenance HQ	137	Low	Low
Delta O&M Center	Vehicle Storage Building	136	Low	Low
Delta O&M Center	Mobile Equipment Repair	136	Low	Low

Facility/Program	Asset Name	Approx. Elevation (AMSL)	Exposure Rating 2030	Exposure Rating 2050
Delta O&M Center	Civil Maintenance Warehouse	136	Low	Low
Delta O&M Center	Heavy Equipment Storage	136	Low	Low
Delta O&M Center	Plant Maintenance Vehicle Storage	136	Low	Low
Delta O&M Center	Water Treatment Plant	144	Low	Low
Delta O&M Center	Guard Station Building	124	Low	Low
SWP — John Skinner Fish Protection Facility	Fish Holding Tank 1	11	Low	Low
SWP — John Skinner Fish Protection Facility	Fish Holding Tank 2	10	Low	Low
SWP — John Skinner Fish Protection Facility	Control Building	11	Low	Low
SWP — John Skinner Fish Protection Facility	Vehicle Storage Building	10	Low	Low
Flood Control Materials Depots	Brennan Island Warehouse	21	Low	Low

Facility/Program	Asset Name	Approx. Elevation (AMSL)	Exposure Rating 2030	Exposure Rating 2050
NCRO/DOE/DES	Office @ 3500 Industrial Blvd. West Sacramento	19	Low	Low

Facilities within the Delta that were determined to have high exposure were the Banks Pumping Plant, Skinner Fish Facility, numerous temporary barriers (Old River at Tracy, Head of Old River, Middle River, Grant Line Canal), and the Bay-Delta Office/South Delta Branch Aeration Facility (Table 1.6b). As with structures in the Suisun Marsh, these facilities have been designed and are operated with the presumption of frequent contact with brackish water and therefore were determined to have low sensitivity to sea-level rise.

Although Delta facilities themselves were determined to have low risk from sea-level rise directly, failure of levees within the Delta might jeopardize those structures. Several efforts are underway that are likely to increase the resilience of the Suisun Marsh and the Delta to future climate change impacts, either by planning for increased stresses on levees or by increasing habitat and "natural infrastructure" to sustain species and provide other critical ecosystem services. Key efforts are the Delta Levees Investment Strategy (DLIS) and projects being undertaken by DWR through its Delta Levees Programs and EcoRestore efforts.

Following passage of the Delta Reform Act of 2009, the Delta Stewardship Council launched the DLIS to update priorities for State investments in the Delta levee system, with the purpose of reducing the likelihood and consequences of levee failures and to protect people, property, and State interests. The DLIS is also intended to support and advance the coequal goals of improving water supply reliability, restoring the Delta ecosystem, and protecting and enhancing the values of the Delta as an evolving place.

California EcoRestore is another initiative that will help increase Delta resilience and increase the adaptive capacity of the Delta area. California EcoRestore will help coordinate and advance at least 30,000 acres of critical habitat restoration in the Delta and Suisun Marsh over the next four years. A broad range of habitat restoration projects will be pursued, including projects to address aquatic, sub-tidal, tidal, riparian, floodplain, and upland ecosystem needs.

California EcoRestore's initial goal is to initiate 30,000 acres of Delta habitat restoration, including 25,000 acres associated with existing mandates for habitat restoration, pursuant to federal biological opinions. The Delta Conveyance Project would allow construction of a tunnel to transport water from the Sacramento River upstream of the Delta to the existing pumping plants near Clifton Court Forebay, relieving pressure on the aging levees in the face of sea-level rise. These projects will be funded by the state and federal water contractors that benefit from the SWP and the Central Valley Project (CVP) systems as well as other sources. Additionally, 5,000 acres of habitat enhancements are being funded through Proposition 1 grants to local governments, non-profit organizations, and other entities who will support these habitat enhancements throughout the Delta. Funding will come primarily from the Delta Conservancy, the California Department of Fish and Wildlife (CDFW), and DWR.

In summary, overall vulnerability of DWR's facilities to direct sea-level rise is low and will continue to be low through mid-century, except for Suisun Marsh. However, failure of levees could change the vulnerability determinations. Vulnerability of operations is an ongoing area of study, and because of other ongoing efforts, such as the CVFPP process, which is seeking to address that question, this was not analyzed in the DWR VA (California Department of Water Resources 2019).

Risks from Wildfire

It is important to note that this section relies on studies completed prior to 2018. Since 2018, more than 40 percent of the area in the upper Feather River Watershed has burned an expanse over 100 times greater than anticipated by the studies. Appendix C1a consists of a report from the Sierra Nevada Conservancy detailing the impact of the mega fires that took place in the Sierra Nevada range since 2018. The report details the number of acres burned as well as burn severity and discusses the effect of these burns on California's water supplies. The reality of wildfire severity is greater than the studies predicted. Predicting the impact of a warming world on wildfire risk will need further study and better models than what currently exist. DWR will continue to work with climate change experts in this area.

Wildfire is a serious hazard in California. Several studies have indicated that the risk of wildfire will increase with climate change. Importantly, we are already seeing more extreme wildfire seasons that are longer and with more extreme wildfires. By 2100, if greenhouse gas emissions continue to rise, one study found

that the frequency of extreme wildfires would increase, and the average area burned statewide would increase by 77 percent.

Wildfire hazard is also a critical present issue. Five of California's six largest fires all occurred in 2020[4]. 2017 and 2018 previously set records as the most destructive fire seasons in California's history[5]. To contextualize how wildfire hazards already impact California's facilities, consider that 1 in 5 California children were affected by wildfire-related school closures during the 2018–2019 school year[6].

In identifying facilities most at risk, DWR considered: location, fire risk in surrounding areas, required operations, impacts of current fire events, the impact of disruption, access to facility during disruptions/wildfires in surrounding areas, and criticality of the facility and/or its operations.

Table 1.7 Nine Facilities Most at Risk to Current Wildfire Threats

Facility Name	Fire Hazard Severity Zone (low, medium, high, very high)
Antelope Valley Res-Plumas Co.	Very High
CA Aqueduct-Los Angeles County	Very High
CA Aqueduct-San Bernardino County	Very High
CA Aqueduct-Riverside County	Very High
Grizzly Creek-Plumas County	Very High
Environmental-Los Angeles County	Very High
Pyramid Lake Development	Very High
CA Aqueduct-West Branch, Castaic Reservoir	Very High
Trinity River Sediment Removal	Very High

4 https://www.fire.ca.gov/media/4jandlhh/top20_acres.pdf
5 https://www.fire.ca.gov/incidents/2017/ ; https://www.fire.ca.gov/incidents/2018/
6 https://calmatters.org/projects/california-school-closures-wildfire-middletown-paradise-disaster-days/?

Table 1.8 Five Facilities that will be Most Impacted by Projected Changes in Wildfire

Facility Name	Acres Burned (1961–1990)	Acres Burned (1991–2030) Actual	Projected Acres Burned (2031–2060)	Projected Acres Burned (2070–2099)
Upper Feather River Watershed	7,402	319,000	11,641	undetermined
Beckwourth Subcenter	11	None	14	15
Cedar Springs Dam Maintenance Station	9	None	14	15
Romero Overlook	11	None	14	12
San Luis Operations and Maintenance Subcenter (No Electricity)	11	None	14	12

Wildfire has always been a component of California's landscape. Statewide, DWR owns and operates infrastructure that has historically had some level of exposure to wildfire. Some of this infrastructure (e.g., pipelines, canals, levees) has very low sensitivity to wildfire; a fire could burn over the facility and cause little or no damage and might not even interrupt operations of the facility. For this reason, most of the facilities in Tables 1.7 and 1.8 are at low sensitivity to wildfire hazards despite being in areas zoned for very high fire hazards. Other types of DWR infrastructure, such as pumping plants and associated electrical equipment, are more sensitive to wildfire, potentially leading to short-term service interruptions or even longer-term outages.

Wildfire can also have significant impacts on landscapes not owned or managed by DWR but that are vitally important to the function of DWR facilities and operations; paramount among these is the Upper Feather River Watershed (UFRW) that supplies snowmelt runoff to Oroville Reservoir, which is at the highest risk to wildfire. The projected increase in acreage burned from wildfire under future climate change conditions (RCP 8.5 for Table 1.8) is evident from the modelled projections developed for the California Fourth Climate Assessment (Westerling 2018). Wildfire in the UFRW could result in increased sediment loading into streams and reservoirs, thereby affecting water quality, decreasing water supply capacity, and potentially disrupting services. Studies of wildfires in the Sierra Nevada during the past century indicate that wildfires are increasing and that fires have extended to higher elevations (Schwartz et al. 2015).

DWR analyzed the projected exposure and sensitivity of its facilities and operations to increased wildfire, and where relevant, adaptive capacity in the VA (2019). A majority of DWR facilities have some baseline/existing exposure to wildfire. The analysis approach used took into consideration both the baseline wildfire exposure and the degree to which the wildfire exposure is expected to change by mid-century as a result of climate change.

Relevant Studies Conducted to Date or in Progress

Many studies have shown that wildfires have already become more common, larger, and more severe (Miller, Safford, Crimmins, & Thode 2009) (California Environmental Protection Agency 2013) (Dennison, Brewer, Arnold, & Moritz 2014). This trend is expected to continue and intensify as the climate warms (Krawchuck & Moritz 2012) (Bryant & Westerling 2012) (Hurteau, Westerling, Wiedinmyer, & Bryant 2014), with the western US being particularly at risk (Dennison, Brewer, Arnold, & Moritz 2014).

The National Research Council (NRC) has estimated that for each degree Celsius (1.8 °F) of temperature increase, the size of the area burned in the western U.S. could quadruple (National Research Council 2011). The fire season is also increasing in length (Climate Central 2012), extending the period during which fire suppression and firefighting resources need to be expended. But land use changes (e.g., development in the wildland-urban interface), land management decisions, and vegetation types will also influence regional impacts (California Department of Forestry and Fire Protection 2010) (Bryant & Westerling 2014) (Westerling et al. 2014) (Abatzoglou & Williams 2016).

Wildfire Vulnerability Assessment Approach

This section describes the data sources and methodology for assessing the exposure and sensitivity of DWR facilities and operations to the increased incidence of wildfire influenced by climate change.

Exposure

Data for this wildfire exposure analysis were obtained from the study, *Fire and Climate Change in California* (Krawchuck & Moritz 2012), which was published as part of the California Energy Commission Public Interest Energy Research Program for California's Third Climate Change Assessment (California Energy Commission, 2012). The Krawchuk and Moritz dataset contains probabilities of one or more fires occurring within 30-year time periods from 1971–2000 (baseline period), 2010–

2039, 2040–2069, and 2070–2099 (future projections). This assessment will be updated pending new probabilistic projections from a California Energy Commission-funded study as part of an upcoming Fifth Climate Change Assessment.

For each of the three future periods, the researchers ran their model with climate data extracted from two Global Climate Models (also known as General Circulation Models or GCMs), the Geophysical Fluid Dynamics Laboratory (GFDL) and the Parallel Climate Model (PCM). They also used two greenhouse gas (GHG) emissions scenarios, A2 and B1, which represent possible future conditions of demographic development, socio-economic development, and technologic change, and two land use projections (business-as-usual and smart-growth). The model outcomes yielded the probability that one or more fires will occur during a 30-year period for each grid cell (approximately 1 kilometer [km] x 1 km) of the state under various future conditions.

To be conservative, at each grid cell the maximum modeled probability of wildfire was used from the suite of simulations available (i.e., maximum of PCM A2, PCM B1, GFDL A2, and GFDL B1).

Facilities and Lands

DWR compiled an asset list for the purposes of this study. This list represents the best-known locations of DWR facilities, and other major assets (see California Department of Water Resources 2019). All DWR facilities were mapped to assign fire probability at each location for each period.

The projected change in probability for the future period was plotted against baseline probabilities for each grid cell statewide.

Exposure curves were plotted as a function of baseline fire probability vs. projected change in fire probability from baseline, which serves to classify the exposure with respect to the relative magnitude of probability. The curves divide the space into very low, low, moderate, high, and very high exposure regions (Figure 3). Because this is a new approach by DWR to categorizing future exposure to changes in wildfire regime, these curves were defined based on the judgment of DWR staff in consultation with wildfire experts[7]. The curves in Figure 3 are polynomial equations with increasing y- intercepts and continuously

7 Personal communication with California Department of Forestry and Fire Protection (CAL FIRE) staff members Chris Keithley and David Sapsis. January 2014.

increasing slopes. This reflects an expert judgment that the level of exposure to wildfire regime change increases at an increasing rate.

Figure 3 Climate Change May Heighten Wildfire Exposure at an Increasing Rate

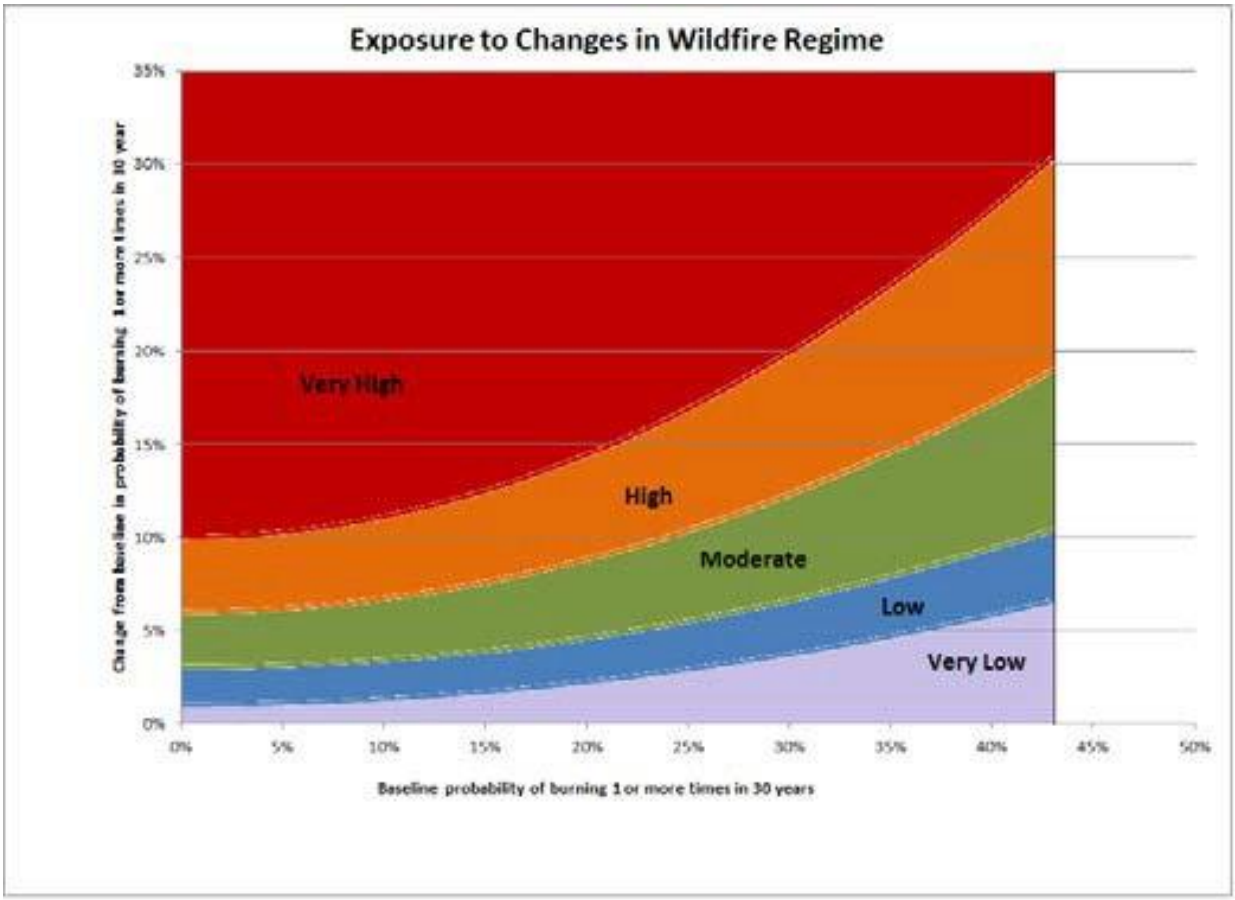
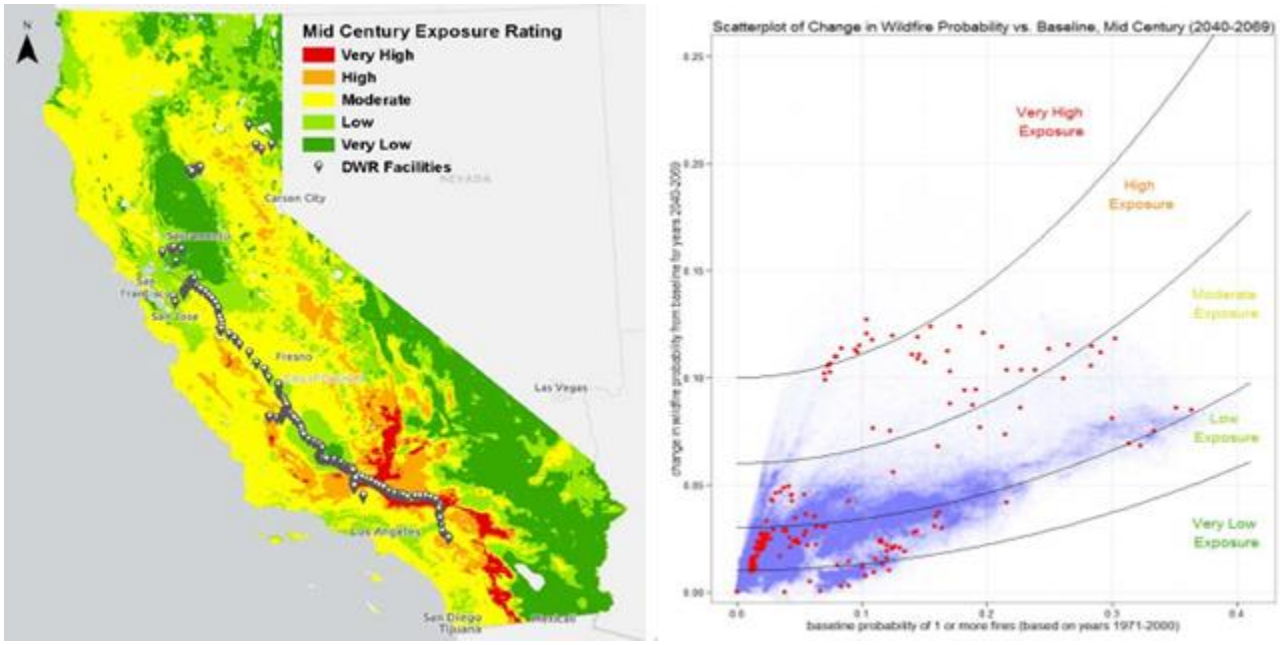


Figure 4 shows mid-century wildfire exposure to changes in wildfire regime. The black dots on the map represent DWR facilities. Each black dot on the left panel corresponds to a red dot on the right panel, purple dots (which appear as a cloud) on the right panel represent other grid cells throughout the state that do not contain DWR facilities. These facilities were further assessed for their sensitivity in the following sections.

Figure 4 Climate Change May Increase the Wildfire Exposure of Facilities at Mid-Century (2040–2069)



Note: Figure 4(a) represents mid-century (2040–2069) exposure ratings as a function of the change in wildfire probability from baseline years 1971–2000; Figure 4(b) depicts each grid cell displayed in Figure (a) as the baseline probability of occurrence of one or more fires and change in said probability by mid-century (the cloud of violet dots). The red dots on Figure (b) are plotted accordingly for DWR facility locations identified in Figure (a).

Operations

SWP operations could be affected by indirect impacts from wildfire, such as denuded landscapes with increased erosion potential. For example, some portions of the California Aqueduct may be at risk from mudslides related to the loss of stabilizing vegetation following a wildfire. Upper Feather River Watershed impacts also have the potential to affect operations and are discussed below.

Upper Feather River Watershed

As the primary source of water for the SWP, wildfire in the UFRW is of concern to DWR operations because of the possibility of changing runoff patterns, water quality issues, increased overland flow rates, and sediment yields.

Three SWP reservoirs in the upper watershed, Frenchman, Davis, and Antelope, are operated by DWR for recreation and water supply. Lake Oroville is operated by

DWR for water supply, flood control, hydropower, and recreation. Also, Pacific Gas and Electric Co. (PG&E) operates Lake Almanor and a series of reservoirs on the North Fork of the Feather River for hydropower, which are also part of the headwaters of the SWP.

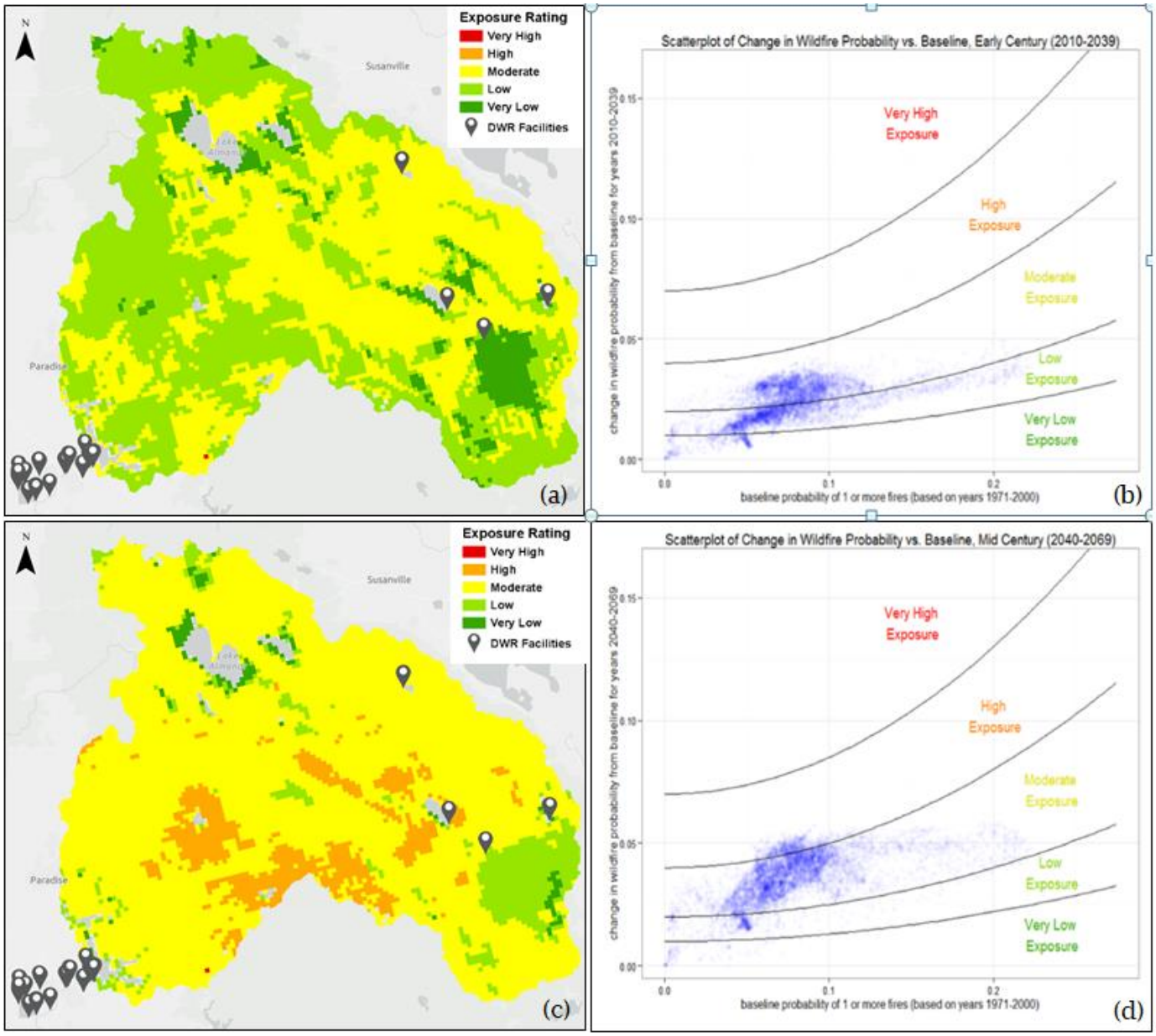
The UFRW is comprised of approximately 70 percent mixed conifer forest (pine, fir, and cedar species), which is at increasing risk of large, high-severity fires (Stoddard et al. 2015). Miller et al. (2009) found that mean and maximum fire size and total burned area in the Sierra Nevada have increased between the early 1980s and 2007. They also showed that forest fire severity (a measure of the effect of fire on vegetation) rose during the period 1984 to 2007, with the pattern concentrated in middle-elevation conifer forests. Stand-replacing fires ("high severity") at the beginning of the record burned at an average of about 17 percent, while the average for the last 10-year period was 30 percent. Miller et al. (2009) concluded that both climate change and increasing forest fuels explained the patterns they analyzed.

As was done to assess the statewide DWR facilities, the Krawchuk and Moritz dataset was used to evaluate the impacts of projected change in wildfire regime for the UFRW. The analysis demonstrates that the entire watershed experiences an increase in exposure level. In early century conditions, the watershed has mostly very low to moderate exposure to changes in wildfire regime, but by mid-century nearly all the watershed is projected to face a higher level of exposure (classified as "moderate"), notably that only small areas rank as high exposure and low exposure (Table 1.9a).

Table 1.9a Climate Change May Increase Wildfire Exposure Levels of the Upper Feather River Watershed (Early and Mid-Century)

Wildfire Exposure	Early Century (2010–39)	Mid-Century (2040–69)
Very Low	6.5%	2%
Low	46%	8%
Moderate	48%	80%
High	0%	10%
Very High	0%	0%

Figure 5 Feather River Watershed Wildfire Exposure May Increase Due to Climate Change (Early and Mid-Century)



Figures 5 (a) and (c) represent early-century (2010–2039) (a) and mid-century (2040–2069) (c) exposure ratings as a function of the change in wildfire probability from baseline years 1971–2000 for the Feather River USGS Hydrologic Unit Code (HUC)-8 watershed; figures 5 (b) and (d) depict each grid cell displayed in figures (a) and (c) as blue dots plotted per the baseline probability of one or more fires and change in probability by mid-century.

Sensitivity

Analysis of the sensitivity of DWR facilities, lands, and operations to the increased incidence of wildfire caused by climate change is discussed in the section below.

Facilities and Lands

With input from California Department of Forestry and Fire Protection (CAL FIRE) experts, an "Integrated Fire Analysis/Structure Risk Assessment" form was developed to assess various aspects of sensitivity of DWR facilities to current and future wildfire risk. Net wildfire risk was determined based on the integration of risk levels for three factors: roof type, hazard class, and property defense/ignition zone. A numerical scoring system was used to minimize subjective assessments. Site visits were conducted by DWR Climate Change Program staff and onsite facility managers to complete the Integrated Fire Analysis/Structure Risk Assessment form and evaluate the sensitivity of each of these facilities.

Operations

The sensitivity of SWP operations to changes in wildfire regime in the watershed is difficult to assess. Wildfires can change several properties of a watershed and can have short-term and long-term effects on the hydrology of the watershed depending on their severity and intensity (Gould et al. 2016). In general, the conditions of the watershed existing after the occurrence of a wildfire tend to result in increased inflows and contaminant loadings to receiving water bodies (Ice, Neary, & Adams 2004).

Because of the many ways that increased wildfire in the UFRW could affect SWP operations, it was beyond the scope of this assessment to produce a comprehensive sensitivity analysis of wildfire on SWP operations. Instead, a qualitative assessment of the ways in which a changing wildfire regime could influence SWP operations is provided.

Wildfires can increase surface runoff by destroying both the vegetation canopy and the organic litter on the soil surface, reducing the amount of precipitation that is intercepted by the canopy of leaves and the forest floor. Wildfires can also burn the surface of the soil and create a water-repellant soil layer that obstructs infiltration of water into the subsurface, increasing direct runoff and extending the recovery time for the watershed by reducing plant growth (Gould et al. 2016).

The loss of vegetation exposes the surface to the impacts of erosional processes. With reduced vegetative cover, runoff can create channel incisions that form a streamlined pathway for runoff and sediments to reach SWP reservoirs. Wildfires can also destroy root systems of vegetation along channel banks, leading to instability and greater potential for erosion (Gould et al. 2016). Further, Goode et al. (2012) suggested that under climate change, sediment yields in western semi-arid basins could be as much as 10 times greater than was observed in the 20th century. Although some coarse sediment is important for properly functioning geomorphic processes, a dramatic increase could affect aquatic ecosystem function, impair water quality, increase maintenance costs, and reduce reservoir capacity and life expectancy.

Surface runoff in watersheds affected by wildfires often transports contaminants that can result in long-term degradation of aquatic environments and negative impacts to recreational activities. Sediments often carry phosphorus and nitrogen from plant tissues, which can overstimulate growth of aquatic vegetation leading to depletion of oxygen levels. The deposition of ash can affect fish by limiting visibility, clogging gills, and/or affecting production and species composition of aquatic insects/food base.

Fire retardants, which often contain ammonia, nitrogen, and phosphorus, can be an additional source of nutrient pollution into aquatic systems (University of Wyoming 2013).

Watersheds often require a decade or more to recover from a large or intense wildfire (Agee 1996). In the UFRW, areas dominated by mixed conifer forests may be most affected because of their spatial extent, longer recovery period, and watershed characteristics that are more susceptible to impacts from wildfires. At lower elevations, irrigated agriculture may also be impacted. Carrying roughly 60 percent of the inflow to Oroville Reservoir, the North Fork of the Feather River may contribute to increased sediment loading and thereby reduce water quality[8].

8 Sacramento River Watershed Program. Upper Feather River Watershed. http://www.sacriver.org/aboutwatershed/roadmap/watersheds/feather/upper-feather-river-watershed. Accessed 9/1/2016.

Wildfire Vulnerability Assessment Results

The DWR VA (2019) determined the level of vulnerability to changes in wildfire occurrence through development of a risk assessment, followed by an evaluation of the capacity of DWR assets and operations to adapt to those changes. Facilities and lands were scored quantitatively based on a combination of exposure and sensitivity, using a scoring methodology presented further in the DWR VA (2019). Operations was qualitatively examined. Risk to staff was not assessed here.

Facilities and Lands

Risk

Much of the land surrounding SWP facilities is agricultural or grassland, although desert scrub and chaparral predominate in the Southern Region and forested lands surround the Oroville facility in the Northern Region. Urban and agricultural lands, particularly irrigated acreage, and low-fuel habitat types such as annual grassland and desert scrub are less sensitive to wildfire than other habitat types (CAL FIRE personal communication).

Site visits confirmed that the overall risk for most facilities and structures was low once all factors (roof type, hazard class, and property defense/ignition zone) were considered. But out of all DWR facilities examined, four sites near Oroville, two sites in the Upper Feather River, and three structures in the Southern Region scored risk values of "Moderate" to "High" (Table 1.8b). The risk to these facilities is from the combined effects of the habitat in the "Property Defense" zone adjacent to the structures and the "Vegetation Clearance" zone out to 200 feet from the structure. In the case of facilities in the Northern Region, vegetative classification in these zones with moderate risk was "pine," and for facilities in the Southern Region it was "chaparral." Both of those vegetation types are more likely to contain fuels that will carry a large wildfire (CAL FIRE personal communication).

Table 1.9b Four Regional DWR Facilities Have Moderate or High Risk to Wildfire.

Region	Facility	Structure Name	Risk Score*
NRO	Feather River Fish Hatchery	Office & MaintenanceShop	8
NRO	Edward Hyatt Power Plant	Warehouse Building (Butler)	11
NRO	Edward Hyatt Power Plant	Office Trailer	10
NRO	Edward Hyatt Power Plant	Security Trailer	10

Region	Facility	Structure Name	Risk Score*
NRO	Antelope Valley Dam & Reservoir	Instrumentation Building	11
NRO	Antelope Valley Dam & Reservoir	Outlet Control Building	11
SRO	William Warne Power Plant	Power Plant	9
SRO	William Warne Power Plant	Oil Storage Building	8
SRO	William Warne Power Plant	Weld Shop	8

*Combined scores of 7 or less = Low Risk; 8-11 = Moderate Risk; 12 or more = High Risk. See DWR VA (2019). DWR Integrated Wildfire Analysis.

State Water Plan Facilities Adaptive Capacity

The infrastructure for which DWR is responsible is largely immobile and therefore does not have a high inherent capacity to adjust to increased wildfire; however, the landscapes that surround most of the facilities are primarily agricultural, urban, or fire-adapted low-fuel habitat types that have low wildfire risk.

In all locations that were evaluated, existing management and maintenance practices protect infrastructure from the current wildfire exposure level. Current practices include the clearing of vegetation and implementation of fire contingency plans. For these nine sites that scored as moderate-high risk, DWR possesses the financial means to increase the level of intervention to reduce the sensitivity of these facilities to increases in wildfire exposure expected in the future.

Vulnerability

Overall, DWR's facilities are prepared for increased wildfire exposure through mid-century. Wildfire vulnerability for facilities will continue to be low, even under conditions of substantially increased wildfire potential.

Operations

DWR's operations consist of operation and maintenance of SWP facilities and an assortment of water supply and flood management infrastructure, including the SWP facilities. Wildfire could stop ongoing operations of any infrastructure if it is not built to withstand such an event.

Risk

Much of the UFRW that provides the water supply for the SWP is exposed to changing wildfire regimes, and there are myriad ways in which the operations of

the SWP could be sensitive to this increase in wildfire frequency and severity. For example, increased sediment inflow from the erosion of burned soils could possibly interrupt fieldwork and maintenance activities. Future extent of exposure and sensitivity of the UFRW will be determined by forest management practices that are outside of DWR's control. For these reasons, SWP operations are assumed to be at risk from changing wildfire regimes.

Watershed Adaptive Capacity

Existing management plans and emergency response plans are important indicators of adaptive capacity in a watershed. They encourage social and economic support and describe the current best practices to implement those strategies (Sham, Tuccillo, & Rooke 2013) (U.S. Forest Service 2013). While DWR operates several facilities in the Feather River Watershed, the majority (65 percent) of the watershed is publicly owned and managed by the U.S. Forest Service as part of the Plumas National Forest. The two primary management planning documents for this region that provide management actions for wildfire, including managing upland vegetation to reduce the risk of catastrophic wildfire, are the *Feather River Watershed Management Strategy, May 2004*[9] and the *Upper Feather River Integrated Regional Water Management Plan, November 2016*[10]*.*

The Feather River Watershed Management Strategy was prepared to help implement the Monterey Settlement Agreement of 2003. The document outlines priorities for watershed management and restoration activities. The recommended actions related to vegetation management (e.g., forest thinning) would likely reduce wildfire risk, though these benefits are not the target of the strategy (Sapsis et al. 2016). The Upper Feather River Integrated Regional Water Management Plan likewise details management actions and coordination opportunities that will result in decreased risk of high intensity wildfires.

In the lower portion of the Feather River watershed and area surrounding Lake Oroville, DWR has had a more active role in developing management plans related to wildfire. As a requirement of the FERC Project No. 2100 Settlement Agreement, DWR developed a *Fuel Load Management Plan, 2012* within the FERC project boundary. The plan identifies fuel load reduction strategies to provide land and resource managers with a strategic approach to reduce the potential for wildfire

9 Feather River Watershed Management Strategy: http://www.water.ca.gov/environmentalservices/docs/mntry_plus/FeatherRiverStrategy.pdf
10 Upper Feather River Watershed IRWM Plan: http://featherriver.org/.

within the FERC project boundary. The plan will be updated to account for changing conditions at least every 10 years.

Vulnerability

Overall, DWR's operation of the SWP is vulnerable to increased wildfire risk throughout the UFRW though mid-century and is a priority area of focus for adaptation planning. Adaptation planning for the UFRW will be complex because the watershed includes many different landowners and interests and DWR is not the dominant landowner or interest in the area. Any adaptation strategy employed in the watershed would require intense multi-stakeholder cooperation and coordination.

Staff

Because of the sporadic nature of wildfire and projected increases of wildfire frequency throughout California, DWR staff could potentially be at higher risk and more vulnerable to wildfire. Staff exposure to wildfire will be highly dependent on location; for example, in 2017, DWR staff were unable to report to work because their homes or their route to work were affected by the Devil's Canyon area fires in Southern California. Existing protocols for fieldwork and maintenance activities may need to be modified to create adaptive capacity to wildfire vulnerability to staff.

Other Considerations

Two topics were identified as potential vulnerabilities for DWR that are out of scope for the VA: electrical transmission interruption and sediment influx into reservoirs.

Adaptation Actions

Increasing wildfire frequency and intensity will continue to be a topic of research in California, given increased incidents in recent years during the drought and with higher temperatures. With additional information on sensitivities posed to operations, adaptation strategies could be developed to reduce risks of increasing wildfire, such as meadow restoration, controlled burns, and forest thinning. DWR is partnering to advance collaborative research to improve understanding on these topics.

In addition, to address the vulnerability of the Upper Feather River Watershed, DWR will continue to gather and prioritize specific strategies and barriers to

adaptation that stakeholders are exploring. DWR staff then will examine which of these strategies align with DWR activities and/or priorities. These mutual priorities will be presented to the Integrated Regional Water Management (IRWM) stakeholder group for further feedback and input.

Adaptation actions include the following collaborative activities:

External Collaboration

- Continue to attend quarterly IRWM meetings and coordinate with the Upper Feather River IRWM and stakeholders.
- Provide presentations of initial findings of stakeholder input and propose a ranking strategy for focus areas.
- Prioritize adaptation focus areas by IRWM members of initial outreach efforts by hosting a workshop session at an upcoming Upper Feather River Watershed IRWM meeting.
- Learn from other, similar watershed collaborative studies and efforts, such as those in the Yuba and Mokelumne watersheds, as well as in the Tahoe Basin.
- With the IRWM, actively seek grant and other financing opportunities that may be available in the non-governmental and private sectors.

Internal Collaboration

- Stakeholder priorities will be compared with and then linked to the Adaptation Plan (DWR 2020), Water Resilience Portfolio, and other DWR goals.
- IRWM group input will be considered for further investment in research, technical assistance, and specific projects in the watershed.

Continued involvement with the Upper Feather River Watershed IRWM and other stakeholders in the region will be key for DWR to help address climate change vulnerabilities and adaptation needs in the watershed.

Summarizing Natural Infrastructure Actions to Protect Existing Facilities

EO B-30-15 directs State agencies to prioritize the use of natural and green infrastructure solutions. Natural infrastructure is the "*preservation or restoration of ecological systems or the utilization of engineered systems that use ecological processes to increase resiliency to climate change, manage other environmental hazards, or both. This may include, but need not be limited to, flood plain and*

wetlands restoration or preservation, combining levees with restored natural systems to reduce flood risk, and urban tree planting to mitigate high heat days" (Public Resource Code Section 71154(c)(3)).

DWR's mission is to sustainably manage the water resources of California, in cooperation with other agencies, to benefit the state's people and protect, restore, and enhance the natural and human environments. In carrying out this mission, DWR has identified the preservation and restoration of ecological systems as an important component in adapting to the vulnerabilities presented by climate change. The DWR VA (2019) includes a detailed analysis of those vulnerabilities, and DWR has identified steps in its AP (2020) to advance adaption for supporting vulnerable ecosystems and habitats under DWR's auspices.

Important Natural Infrastructure that supports the facilities and responsibilities of DWR include those in the Delta (Yolo Bypass, Prospect Island, Twitchell and Sherman islands, Dutch Slough and Ironhouse), the Suisun Marsh (Blacklock, Overlook Club Property 322), the San Joaquin Valley Ecoregion, and the California Aqueduct's right-of-way property. DWR has many programs, projects, policies, and procedures in place that can help increase the resiliency of our managed lands in the face of a changing climate. The Central Valley Flood Protection Plan seeks to provide a comprehensive, long-term approach to improving riverine habitat and floodplains as part of an integrated flood management plan. The North Delta Flood Control and Ecosystem Restoration Project is another example of a project designed to support flood control improvements while also providing benefits to aquatic and terrestrial habitats, species, and ecological processes.

To meet DWR's obligations, ongoing and proposed habitat restoration projects in the Delta under the Fish Restoration Program Agreement, the Delta Levees Programs, the Operations Criteria and Plan (OCAP), the Suisun Marsh Habitat Management, Preservation, and Restoration Plan, also improve the resiliency of DWR's managed lands while contributing to the adaptive capacity of the Delta region as a whole. More specifics about these ongoing works and vulnerabilities are found in the DWR VA (2019) and EcoRestore project plans[11].

11 California EcoRestore

Understanding the Potential Impacts of Facilities on Communities

It is also important to recognize the potential impacts of infrastructure projects on communities.

Vulnerable Populations

Climate change disproportionately affects vulnerable communities, with certain populations experiencing heightened risk and increased sensitivity to climate change and having less capacity to recover from changing average conditions and more frequent and severe extreme events. A number of factors contribute to vulnerability, often in overlapping and synergistic ways. These can include several social and economic factors, and be determined by existing environmental, cultural, and institutional arrangements. Vulnerable populations can include, but are not limited to, people living in poverty, people with underlying health conditions, incarnated populations, linguistically or socially isolated individuals, communities with less access to healthcare or educational resources, or communities that have suffered historic exclusion or neglect.

While there is no single tool to identify vulnerable populations in an adaptation context, there are a number of state-wide, publicly available tools that when overlaid with climate projection data can help identify communities most at risk to a changing climate. Some of these tools, including a definition for vulnerable communities, are available in a resource guide developed by the Integrated Climate Adaptation and Resiliency Program in the Office of Planning and Research.

DWR facilities serve local populations in several ways. Directly, they provide local employment opportunities, in the form of working for DWR and working for independent employers that provide support for maintenance and operation of those facilities.

Indirectly, DWR facilities such as reservoirs and the California aqueduct provide recreational and fishing opportunities, which may be highly valued in vulnerable populations. Also, many service industries depend upon DWR employees in local communities. Most significantly, DWR facilities and operations provide water as a resource to vulnerable populations throughout the state, and disruptions to water deliveries because of climate change have the potential to greatly affect vulnerable populations.

Disadvantaged Communities

California is required to invest certain funding streams in disadvantaged communities (DACs). Many state programs that have DAC funding requirements use CalEnviroScreen, a tool that ranks census tracts based on a combination of social, economic, and environmental factors, to identify DACs. While it does not capture all aspects of climate vulnerability, it is one tool that is available, and does include several relevant characteristics. The department's facilities located in these communities can contribute or alleviate the vulnerability of these Disadvantaged Communities.

As shown below in Table 1.10, DWR used CalEnviroScreen to identify which facilities are located in disadvantaged communities.

Table 1.10 Twelve Facilities are Located in Disadvantaged Communities

Facility Name	CalEnviroScreen Score	Is it located in a disadvantaged community? Yes/No
Southern Region Office	90–95%	Yes
San Luis Field Division Headquarters	90–95%	Yes
Cedar Springs Dam Office (Silverwood Reservoir— Southern Field Division)	75–80%	Yes
Sacramento Maintenance Yard	90–95%	Yes
Lost Hills Operations and Maintenance Subcenter	85–90%	Yes
Romero Overlook	90–95%	Yes
Coalinga Operations and Maintenance Subcenter	80–85%	Yes
Cedar Springs Dam Maintenance Station	75–80%	Yes
Sacramento Maintenance Yard	90–95%	Yes
Water Quality Test Building	75–80%	Yes
Thermalito Annex	80–85%	Yes
West Sacramento Storage Yard	90–95%	Yes

The primary purpose of the facilities located in DACs in Table 1.10 are to support the operation of the SWP and do not provide immediate, critical services to the surrounding populations.

Understanding Climate Risk to Planned Facilities

For all new facilities planned by DWR, which is currently the four in the table below, the following six tables present their projected exposure to each of the previously discussed climate change impacts.

Table 1.11 (a-g) Climate Risks to New Facilities

a.1 Annual Mean Maximum Temperature

Facility Name	Historical Annual Mean Max. Temp. (1961–1990)	Annual Mean Max. Temp. (2031–2060)	Change from Historical to Annual Mean Max. Temp (2031–2060)	Annual Mean Max Temp. (2070–2099)	Change from Historical to Annual Mean Max. Temp (2070–2099)
Dutch Slough Tidal Marsh Restoration Project	73.47	79.75	6.28	N/A	N/A
Lookout Slough Tidal Habitat and Flood Improvement Project	73.7	78.7	5	N/A	N/A
Lower Elkhorn Basin Levee Setback Project	74.3	79.1	4.8	N/A	N/A
Rio Vista Estuarine Research Station	73.02	77.63	4.61	N/A	N/A

a.2 Annual Mean Minimum Temperature

Facility Name	Historical Annual Mean Min. Temp. (1961–1990) °F	Annual Mean Min. Temp. (2031–2060) °F	Change from Annual Mean Min. Temp (2031–2060)	Annual Mean Min. Temp. (2070–2099 °F	Change from Annual Mean Min. Temp (2070–2099)
Dutch Slough Tidal Marsh Restoration Project	48.55	52.97	4.42	N/A	N/A
Lookout Slough Tidal Habitat and Flood Improvement Project	47.1	51.7	4.6	N/A	N/A
Lower Elkhorn Basin Levee Setback Project	48.4	52.7	4.3	N/A	N/A
Rio Vista Estuarine Research Station	49.04	53.21	4.17	N/A	N/A

b. Annual Mean Maximum Precipitation

Facility Name	Annual Mean Maximum precipitation (1961–1990) (in/yr)	Annual Mean precipitation (2031–2060) (in/yr)	Extreme Precip (1961–1990) (in/day)	Extreme Precip (2031–2060) (in/day)
Dutch Slough Tidal Marsh Restoration Project	13.51	15.64	N/A	N/A
Lookout Slough Tidal Habitat and Flood Improvement Project	14.5	17	N/A	N/A
Lower Elkhorn Basin Levee Setback Project	18.3	21.6	N/A	N/A
Rio Vista Estuarine Research Station	12.93	15.4	N/A	N/A

c. Extreme Heat Threshold

Facility Name	Extreme heat threshold (EHT) °F	Average number of days above EHT (1961–1990)	Average number of days above EHT (2031–2060)	Increase in number of days above EHT
Dutch Slough Tidal Marsh Restoration Project	101.8	4.3	16	11.7
Lookout Slough Tidal Habitat and Flood Improvement Project	102.5	4	4	23
Lower Elkhorn Basin Levee Setback Project	103.4	4	24	20
Rio Vista Estuarine Research Station	101.3	4.3	16	11.7

d. Sea Level Rise

Facility Name	Area (California Coast, San Francisco Bay, Delta)	Sea Level Rise 0.0 m	Sea Level Rise 0.5 m	Sea Level Rise 1.0 m	Sea Level Rise 1.41 m
Dutch Slough Tidal Marsh Restoration Project	N/A	N/A	N/A	N/A	N/A
Lookout Slough Tidal Habitat and Flood Improvement Project	N/A	N/A	N/A	N/A	N/A
Lower Elkhorn Basin Levee Setback Project	N/A	N/A	N/A	N/A	N/A
Rio Vista Estuarine Research Station	N/A	N/A	N/A	N/A	N/A

e. Fire Hazard Severity Zone

Facility Name	Current Fire Hazard Severity Zone (low, medium, high, very high)
Dutch Slough Tidal Marsh Restoration Project	No Data
Lookout Slough Tidal Habitat and Flood Improvement Project	No Data
Lower Elkhorn Basin Levee Setback Project	No Data
Rio Vista Estuarine Research Station	No Data

f. Acres Burned

Facility Name	Acres Burned (1961–1990)	Acres Burned (2031–2060)
Dutch Slough Tidal Marsh Restoration Project	No Data	No Data
Lookout Slough Tidal Habitat and Flood Improvement Project	9.6	11
Lower Elkhorn Basin Levee Setback Project	22.8	27.2
Rio Vista Estuarine Research Station	No Data	No Data

g. Change in Heating and Cooling Degree Days

Facility Name	Heating/ Degree Days (1961–1990) (HDD)	Heating Degree Days (2031–2060) (HDD)	Decrease of HDD	Cooling degree day (1961–1990) CDD	Cooling Degree Days (2031–2060) CDD	Increase of CDD
Dutch Slough Tidal Marsh Restoration Project	2579	1629	(950)	1121	2117	+996

Facility Name	Heating/ Degree Days (1961–1990) (HDD)	Heating Degree Days (2031–2060) (HDD)	Decrease of HDD	Cooling degree day (1961–1990) CDD	Cooling Degree Days (2031–2060) CDD	Increase of CDD
Lookout Slough Tidal Habitat and Flood Improvement Project	2762	1365	(1397)	1083	2826	+1,743
Lower Elkhorn Basin Levee Setback Project	2634	1299	(1335)	1251	3036	+1,785
Rio Vista Estuarine Research Station	2637	1693	(944)	1030	2015	+985

A decade ago, DWR identified a need for consistent departmental analysis of climate change impacts on the wide array of project and program planning activities it conducts (Khan and Schwarz 2010). Since then, DWR has taken steps to assure that all DWR projects and programs use the same methodology in assessing Climate Risk. Climate change analysis can be complex, as it must account for large uncertainties about future climate conditions and their impacts. Phase II of DWR's Climate Action Plan provides a framework and guidance to ensure that all DWR planning activities meet standards for quality, scientific rigor, and consistency. Greenhouse gas analysis is performed on all DWR projects, and all projects comply with Phase I of DWR's Climate Action Plan, which guides projects and sets limits to emissions to meet reduction goals.

The facilities listed in Tables 1.10a–g are discussed briefly below in the context of how DWR is accounting for changing conditions in the facility siting, design, construction, and operation.

Dutch Slough Tidal Marsh Restoration Project

This ongoing project includes revegetation of a 1,178-acre tidal marsh area with riparian and wetland native plant species. Since no buildings are being constructed, planning for changing climate conditions is not applicable. The restoration of the tidal marsh is expected to benefit the environment by increasing

carbon sequestration, improving water quality, and benefiting sensitive Delta species such as Sacramento splittail and California black rail.

Lookout Slough Tidal Habitat Restoration and Flood Improvement Project

This project is a multi-benefit tidal restoration project at Lookout Slough, located in the Cache Slough Region northwest of Liberty Island. The project aims to restore the approximately 3,400-acre site to a tidal wetland, creating habitat and producing food for Delta Smelt and other listed fish species. In addition to the restoration of important tidal wetland habitat, the project will also provide flood protection by expanding flood conveyance and storage for the Yolo Bypass. The project is in the planning and permitting phase.

Lower Elkhorn Basin Levee Setback Project

DWR collaborated with State, federal, and local agencies and flood control districts to increase the capacity of the Yolo Bypass and Sacramento Bypass and improve public safety while enhancing habitat benefits by constructing a 7-mile setback levee. The project will contribute to the CVFPP goals of providing improved public safety for approximately 780,000 people by reducing river levels (stages) in the Sacramento River, increasing the capacity of the Yolo and Sacramento Bypasses near the urban communities of Sacramento and West Sacramento, as well as rural communities, Woodland, and Clarksburg. Improvements will also provide system resiliency and opportunities to improve ecosystem functions (i.e., increasing inundated floodplain habitat for fish rearing and improving the connection to the Sacramento Bypass Wildlife Area). Project construction began in 2020 and is expected to conclude in 2023.

Rio Vista Estuarine Research Station

This project includes building new facilities to support scientific programs within the Interagency Ecological Program. The project will include office and workspace for up to 160 employees, wet and dry laboratories, lab chemical storage, warehouse storage for lab samples and field equipment, boat and vehicle storage, and wet slips with docks and boat ramp. It is located at the decommissioned Army base at Rio Vista.

Planning for this project has included climate change analysis to ensure that it is protected from both the effects of sea-level rise and expected localized flooding

from 100-year storms. It is also designed as an energy-efficient building to minimize greenhouse gas emissions and water consumption. Planning for the project is ongoing, pending funding.

Table 1.12 New Facilities and Disadvantaged Communities and Urban Heat Islands

Facility Name	Located in a Disadvantaged Community (yes/no)	Located in an urban heat island (yes/no)
Dutch Slough Tidal Marsh Restoration Project	No	Yes
Lookout Slough Tidal Habitat and Flood Improvement Project	No	No
Lower Elkhorn Basin Levee Setback Project	Yes	No
Rio Vista Estuarine Research Station	No	No

The Lower Elkhorn Basin Levee Setback Project is the only facility in Table 1.11 located within a disadvantaged community. This levee setback and natural infrastructure project provides flood resilience for nearby urban and rural communities as well as opportunities for improved floodplain habitat for native fishes.

The Dutch Slough restoration project is the only planned project in Table 1.11 located in an urban heat island. This natural infrastructure project will help to reduce future heat island impacts by increasing vegetation in the area and benefiting native species by re-establishing a natural ecological network, especially for Delta species currently in decline.

The Rio Vista Estuarine Research Station will be energy efficient and include drought-tolerant and native plantings. All proposed facilities are being designed to withstand future increases in temperatures and the expected variability in precipitation.

Full Life Cycle Cost Accounting

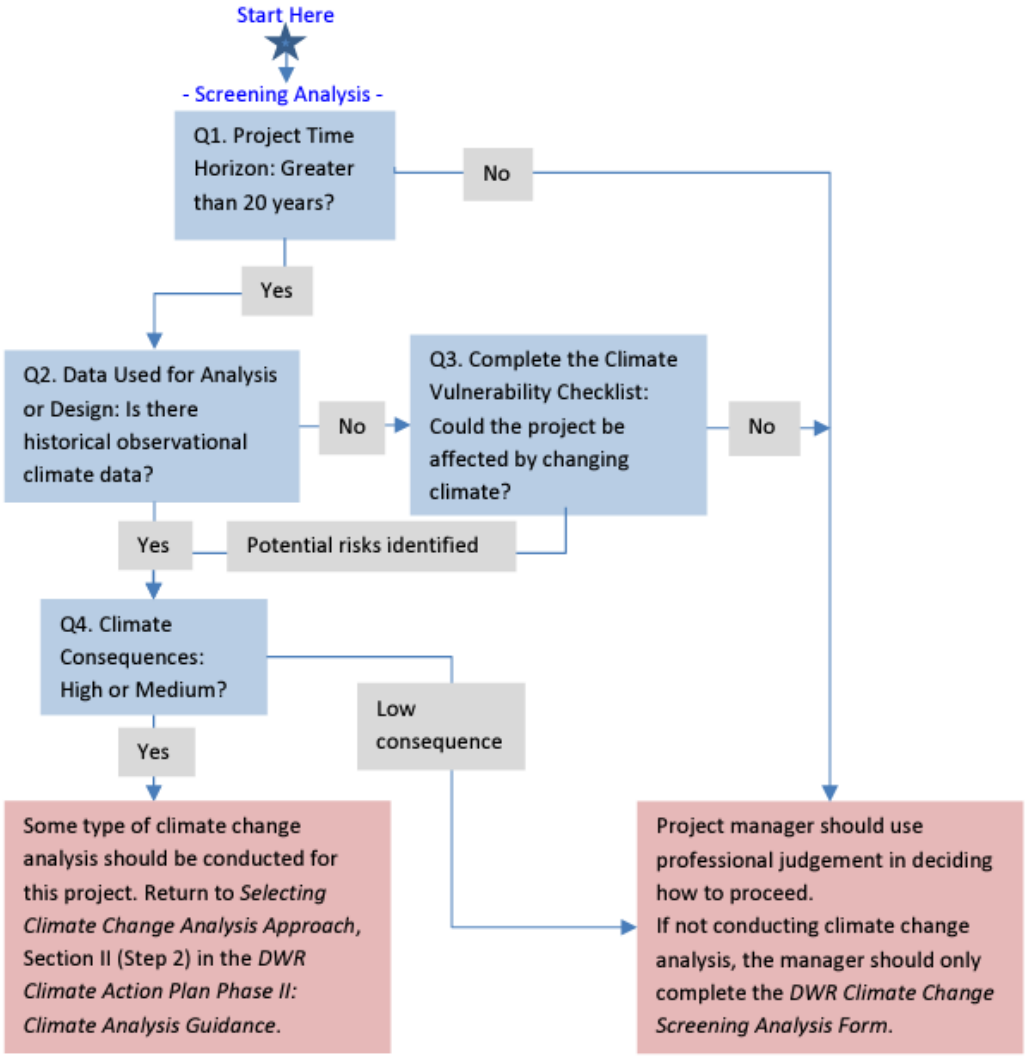
EO B-30-15 directs State agencies to employ full life cycle cost accounting in all infrastructure investment. Lifecycle cost accounting includes:

- Considering initial investment costs, as well as lifetime operation and maintenance costs under changing climate conditions, including changing average conditions and increases in extreme events.
- Applying non-market evaluation methods such as travel cost, avoided costs, or contingent valuation to capture hard to quantify benefits and costs

New facilities are being designed with analysis of appropriate local conditions, including those areas where localized flooding and/or sea-level rise is expected to play a role. DWR has participated with the Governor's Office of Planning and Research to plan for the challenge of incorporating life-cycle analysis to our facility planning process. This process will help guide and inform project teams and decision-makers whether the social benefits of the facility outweigh its social costs. For all DWR's new facilities and buildings, DWR has developed guidance as part of its Climate Action Plan Phase II (California Department of Water Resources 2018) to meet requirements for integration of climate change into department planning. This guidance includes a two-step process for DWR project managers to screen for and evaluate risks to planning and operational activities posed by climate change.

Following is the flow chart detailing the process for DWR project managers.

Figure 6 Screening Process for Climate Change Analysis for DWR Project Managers



Integrating Climate Change into Department Planning and Funding Programs

EO B-30-15 extends beyond infrastructure to broader planning efforts. The tables below indicate whether DWR has taken the following actions in its planning processes.

Table 1.13 Integration of Climate Change into 5 Areas of DWR Planning

Plan	Have you integrated climate?	If no, when will it be integrated?	If yes, how has it been integrated?
California Water Plan Update 2018	Yes	Not applicable	Extensively
DWR StrategicBusiness Plan	Yes	Not applicable	Climate Change objectives included
DWR Climate ActionPlan Phases I, II, III	Yes	Not applicable	GHG reduction targets,climate analysis guidance, Vulnerability Assessment completed,Adaptation Plan completed
Central Valley Flood Protection Plan (CVFPP)	Yes	Not applicable	Describes the probable impacts of projected climate change, projected land use patterns, and other challenges as required by California Water Code §9614
EcoRestore Project Plans	Yes	Not applicable	CEQA requirements on a per-project basis

Table 1.14 Engagement and Planning Processes for 8 DWR Programs and Plans

Plan	Does this plan consider impacts on vulnerable populations?	Does this plan include coordination with local and regional agencies?	Does this plan prioritize natural and green infrastructure?
IRWM	Y	Y	Y
CA Water Plan Update 2018	Y	Y	Y
Agricultural Water Use Efficiency/Agricultural Water Management Plans	Y	Y	N
Urban Water Use Efficiency/ Urban Water Management Plans	Y	Y	N

Plan	Does this plan consider impacts on vulnerable populations?	Does this plan include coordination with local and regional agencies?	Does this plan prioritize natural and green infrastructure?
Sustainable Groundwater Management/ Groundwater Sustainability Plans	Y	Y	Y
Water Storage Investment Program	Y	Y	Y
Central Valley Tributaries Program	Y	Y	Y
EcoRestore Project Plans	Y	Y	Y

DWR has included climate consideration in grants and other funding programs for many years. This includes direct grants, proposition funding, and local assistance programs.

Measuring and Tracking Progress

Changing climate conditions necessitate an adaptive management approach. An adaptive management approach is informed by tracking changing climate conditions and the performance of a plan or project. Building checkpoints into a project or plan timeline can help to create a system for regular review and, if needed, adjustments.

Tracking tools are important for climate adaptation to support effective and regular evaluation of progress, communicate adaptation activities to the public and internally, and to justify funding needs (Ford et al. 2013). Outcome-based measures of adaptation are typically specific to the adaptation strategy (such as reduction in vulnerability for a given asset). More broadly, DWR can track and report on adaptation progress for its adaptation activities using generalizable indicators and principles.

DWR's AP (2020) presents a set of three tools to track, evaluate, and reflect upon DWR's adaptation activities and goals. These tools include:

1. Typology or types of adaptation-supporting activities (e.g., construct or modify infrastructure).
2. Principles to serve as a foundation from which climate adaptation can be monitored and evaluated as it progresses (e.g., use of best available science).
3. Processes stages (i.e., understanding, planning, and managing) to guide adaptive management.

Table 1.15 Climate Change in 19 Funding Programs

Grant or funding program	Have you integrated climate change into program guidelines?	If no, when will it be integrated?	Does this plan consider impacts on vulnerable populations?	Does this program include coordination with local and regional agencies?
Water Storage Investment Program (Prop 1, Ch 8, CA Water Commission)	WSIP has regulation incorporating Climate Change, within the quantification of benefits and impacts and uncertainty analysis.	Regulations are effective as of March 7, 2017.	The Program does not specifically call out or define vulnerable populations in relation to project. State Water Board's Water Quality Priorities include a priority to provide water for basic human needs.	Yes

Grant or funding program	Have you integrated climate change into program guidelines?	If no, when will it be integrated?	Does this plan consider impacts on vulnerable populations?	Does this program include coordination with local and regional agencies?
California Safe Drinking Water Bond Law of 1988 (Prop 81)	No	Not Applicable. This program is in the process of being closed out.	Disadvantaged community and severely disadvantaged community are qualified for funding consideration.	Yes
Safe Drinking Water Contaminant Removal (Prop 50)	No	Not Applicable. This program is in the process of being closed out.	Disadvantaged community and severely disadvantaged community are qualified for funding consideration.	Yes
Flood Control Subventions (Proposition 1E)	No	Not Applicable. This program is in the process of being closed out.	Yes	Yes
Flood Corridor Program (Propositions 1E, 84 & 13)	No	Not Applicable. This program is in the process of being closed out.	No	Yes
Local Levee Assistance (Proposition 84)	No	Not applicable. Program is being managed to closeout.	No	Yes
Yuba Feather Flood Protection	No	Not Applicable. Program is closed out.	No	Yes

Grant or funding program	Have you integrated climate change into program guidelines?	If no, when will it be integrated?	Does this plan consider impacts on vulnerable populations?	Does this program include coordination with local and regional agencies?
Small Communities Flood Risk Reduction (Prop 1E)	Yes	Not Applicable	Yes	Yes
Central Valley Tributaries Program (Prop 1)	Yes	Not Applicable	Yes	Yes
Coastal Watershed Flood Risk Reduction Program (Prop 1)	Yes	Not Applicable	Yes	Yes
Floodplain Management, Protection, and Risk Awareness Grant Program	Yes	Not Applicable	Yes	Yes
Urban Flood Risk Reduction	Yes	Not Applicable	Yes	Yes
Water Desalination Grant Program	Yes	Not Applicable	This program does not have any specific requirements about impacts on vulnerable populations.	This program relies upon CEQA documents for climate change analysis. Coordination with local and regional agencies is not required.

Grant or funding program	Have you integrated climate change into program guidelines?	If no, when will it be integrated?	Does this plan consider impacts on vulnerable populations?	Does this program include coordination with local and regional agencies?
Water Use Efficiency Grants	No. Currently, no legal requirements to incorporate climate change into Urban Water Use Efficiency, but new guidelines are in development per AB 1668.	In future guidelines, when funding becomes available for new PSPs.	DWR's Grant committee "FAIR" develops standard language to be included in all funding program guidelines. These need to be developed.	Yes
Sustainable Groundwater Planning Grant Program	Yes. CA code of Regulations, Title 23, Division 2, Chapter 1.5, requires all Plans to include a climate change scenario evaluation.	Not Applicable	Yes. 10 percent of funding is reserved for severely disadvantaged communities and SDAC Projects are prioritized for funding.	Yes

Grant or funding program	Have you integrated climate change into program guidelines?	If no, when will it be integrated?	Does this plan consider impacts on vulnerable populations?	Does this program include coordination with local and regional agencies?
Proposition 1 Integrated Regional Water Management (Disadvantaged Community Involvement, Planning, and Implementation)	Yes. Climate change in 2016 2019 IRWM Guidelines.	Not Applicable	Yes. Providing funding for vulnerable communities is a statewide priority.	Yes

DWR uses these tools to frame and reflect on our plans of action to reduce vulnerabilities to its key assets, guide adaptation activity process improvements, and document lessons learned (e.g., barriers encountered, identifying potential strengths or weaknesses). These tools will help determine the resources allocated to and implemented among adaptation activities, whether some principles are applied more rigorously than others, the progression DWR is making towards its goals, and how DWR's adaptation activities are contributing to California's climate change adaptation efforts. Using these progress tracking tools, DWR will examine the full suite of DWR's adaptation activities at least every five years. Progress will be reported as part of progress reporting for the State's Climate Adaptation Strategy, Water Resilience Portfolio, DWR Strategic Plan, and future Climate Change Adaptation chapters in the Department's Sustainability Roadmap.

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CHAPTER 2 – ZERO-EMISSION VEHICLES

Department Mission and Fleet

This chapter demonstrates the progress that the California Department of Water Resources (DWR) has made toward meeting the Governor's sustainability goals related to Zero Emission Vehicles. This chapter identifies successful accomplishments, ongoing and future efforts, and outstanding challenges.

DWR's mission includes a twin focus on flood protection and water delivery. The flood protection function includes work on flood plains, dams, and levees, as these structures are usually in remote and hard-to-reach areas. The structures making up the State Water Project (SWP) include a 400-mile aqueduct, with dams, pumping stations, hydroelectric structures, and water delivery turnouts (large structures that deliver water to contracted municipalities). Together, these two functions direct DWR's choice of vehicle. Other DWR activities influencing vehicle choice include biological restoration projects, biological monitoring, snowpack monitoring, facility inspections, construction inspections, and maintenance operations.

Vehicle trips vary in length depending upon the job function, but DWR employees drive long distances on the job, including travel to remote work sites far from employee duty offices. In 2020, DWR employees averaged 9.5 million miles per year on work-related tasks. This travel consumed 766,561 gallons of gasoline and over 200,000 gallons of diesel fuel. The total fuel cost to DWR was over $3 million (see Table 2.1a).

OFAM data for DWR's fleet show a marked decrease in diesel fuel use because of the replacement of fossil fuel diesel with plant and food-based renewable diesel. Renewable diesel is made of nonpetroleum renewable resources, such as natural fats, vegetable oils, and greases, and has all of the properties of a fossil fuel diesel molecule but does not have the sulfur or nitrogen emissions. Renewable diesel functions in conventional combustion engines without the need for reengineering of the combustion engine. Renewable diesel meets all the low carbon, low emissions requirements in California.

Table 2.1a Total Purchased Fuel 2020

Purchased Utility	Quantity/ gallons	Cost ($)
Gasoline	766,561	$2,591,287
Diesel	40,533	$158,001
Renewable Diesel	199,288	$747,333
Total	1,006,382	$3,496,621

In understanding DWR's fleet composition, and the accompanying Graph 2.1, it is necessary to understand the vehicle classifications (Vehicle Weight Classifications for the Emission Standards Reference Guide 2019) shown below. The definition of a lightweight vehicle is any vehicle whose Gross Vehicle Weight Ratio (GVWR) (weight plus the weight of its payload) is less than 8,500 lbs.

Table 2.1b Vehicle Class Chart

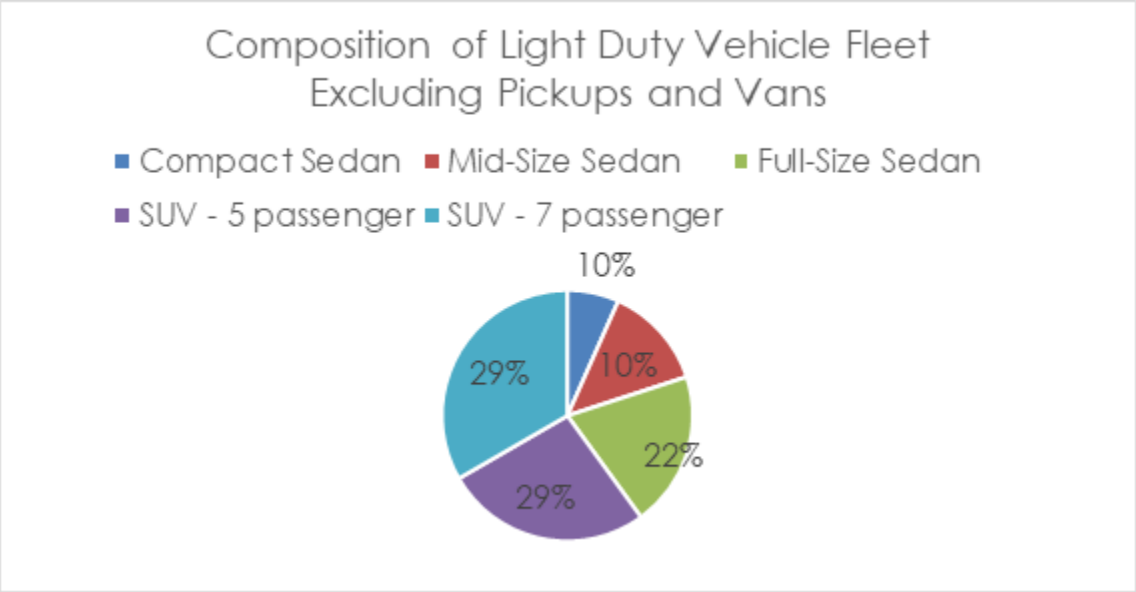
Vehicle Class	Gross Vehicle Weight Ratio
1	< 6,500 lbs.
2a	6,501 – 8,500 lbs.

DWR's fleet consists of a variety of vehicles ranging from sedans to tanker trucks, cranes, and pickup trucks. Of the large number of vehicles used by DWR, Office of Fleet Assets Management (OFAM) ZEV mandates only considers those vehicles weighing less than 8,500 lbs. DWR's 388 ZEV eligible vehicles consist of four categories: sedans, SUVs, pickups, and vans.

Table 2.1c DWR's 2020 Light Duty Vehicle Count by Asset Type

Asset Type	Asset Count
Sedans	64
Pickup Trucks	222
SUVs	90
Vans	12
Total	388

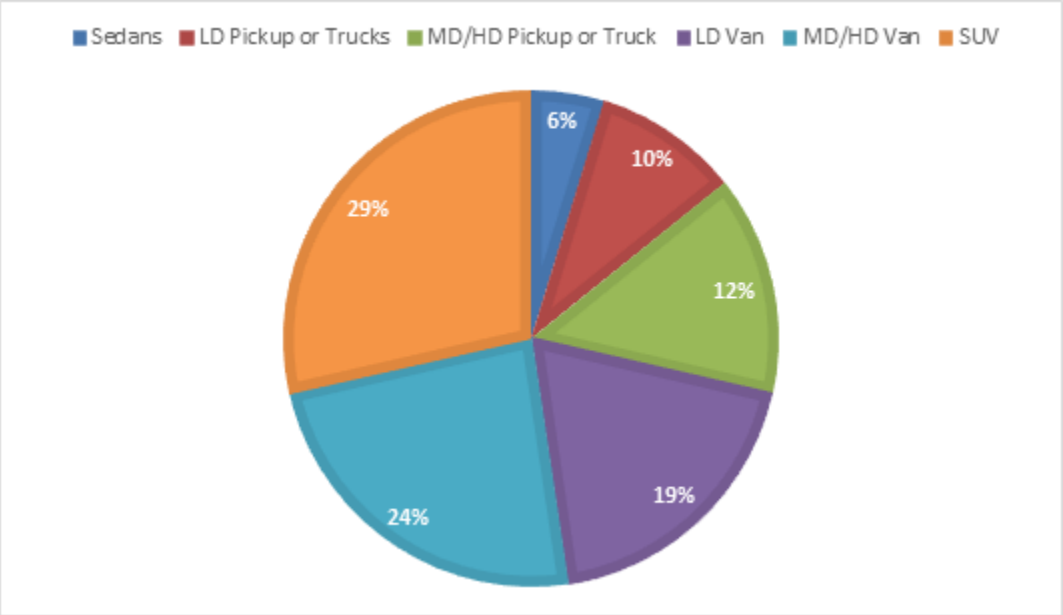
Graph 2.1 Composition of Light Duty Vehicle Fleet Excluding Pickups and Vans



DWR also has 464 heavy-duty pickup trucks, which are not included in the ZEV mandates, as their GVWR is more than 8,500 lbs. This is an important consideration, as OFAM provides the MPG numbers used in this report. DWR is unable to calculate MPG, only total fuel use. See Table 2.2.

But, as of July 2020, SAM section 4121.9 now requires State agencies to prioritize the purchasing of Medium Duty and Heavy Duty ZEVs vehicles into their fleets. Additionally, beginning December 31, 2025, departments are required, per Assembly Bill (AB) 739, to have 15 percent of newly purchased vehicles with a gross weight rating of 19,000 pounds or more be ZEVs. This percentage will increase to 30 percent by December 31, 2030. The medium and heavy-duty vehicles discussion will follow later in this chapter.

Graph 2.2 2020 Composition of DWR's Vehicle Fleet Including Medium and Heavy Weight Vehicles



Nevertheless, these heavy-duty pickups frequently are used as light duty pickups for the same mission critical purposes described above, and account for 34 percent of DWR's mileage.

DWR's 2020 MPG for those vehicles reported to OFAM was 24.28.

Table 2.2 Latest OFAM Fuel Consumption Data for DWR

Metric	Value	Unit
MPG	24.28	Miles/Gal
GHG	2,143.26	Metric Tons

But as stated previously, by not including the heavy-duty truck mileage in the OFAM MPG calculations makes DWR's MPG appear better than it actually is. Most of the real MPG improvement is from DWR's use of ZEV vehicles.

Employee-owned Vehicle Use

Frequently, DWR employees use their own vehicles for State-related travel. This may be for several reasons. One reason is that a sedan may be more practical and comfortable, but at the time of this report, DWR only had 64 sedans. If there are not enough sedans at a location at the time the employee wants to travel, the employee will use their own vehicle. Additionally, in past years, DWR's fleet had a

significant number of vehicles more than a decade old and employees chose to drive their own vehicles rather than drive an older vehicle. Finally, the price of gas also influences when an employee drives their own vehicle, with higher gasoline prices encouraging the use of the employee vehicle. Regardless of the reason, historically, DWR employees have logged over 1 million miles per year using their own vehicles. But this 2020 report does not include the mileage of these employee-owned vehicles.

Table 2.3 Light Duty Vehicles Currently Eligible for Replacement

Light Duty Vehicle Types	Sedans	Minivans	Pickups	SUVs, 5 passengers	SUVs, 7 passengers	Total
# of vehicles eligible for replacement	6	1	130	2	12	151

Table 2.4 Planned Light Duty ZEV Additions to the Department Fleet

Vehicle Type	21/22
Battery Electric Vehicle	16
Plug-in Hybrid Vehicle	31
Hybrids	10
Fuel Cell Vehicle	0
Percent of total purchases	N/A
Required ZEV Percentage	35%
Total number of ZEVs in Fleet	57

Medium- Heavy-Duty ZEV Adoption

Similar to the light-duty purchasing policy above, the adoption of MD/HD ZEVs is essential to meet GHG's reduction goals. As of July 2020, SAM section 4121.9 requires State agencies to prioritize the purchasing of MD and HD ZEVs vehicles into their fleets. Additionally, beginning December 31, 2025, departments are required, per Assembly Bill (AB) 739, to have 15 percent of newly purchased vehicles with a gross weight rating of 19,000 pounds or more be ZEVs. This percentage will increase to 30 percent by December 31, 2030.

Graph 2.3 Composition of Medium and Heavy-Duty Vehicle Fleet Subject to the ZEV First Purchasing Mandate

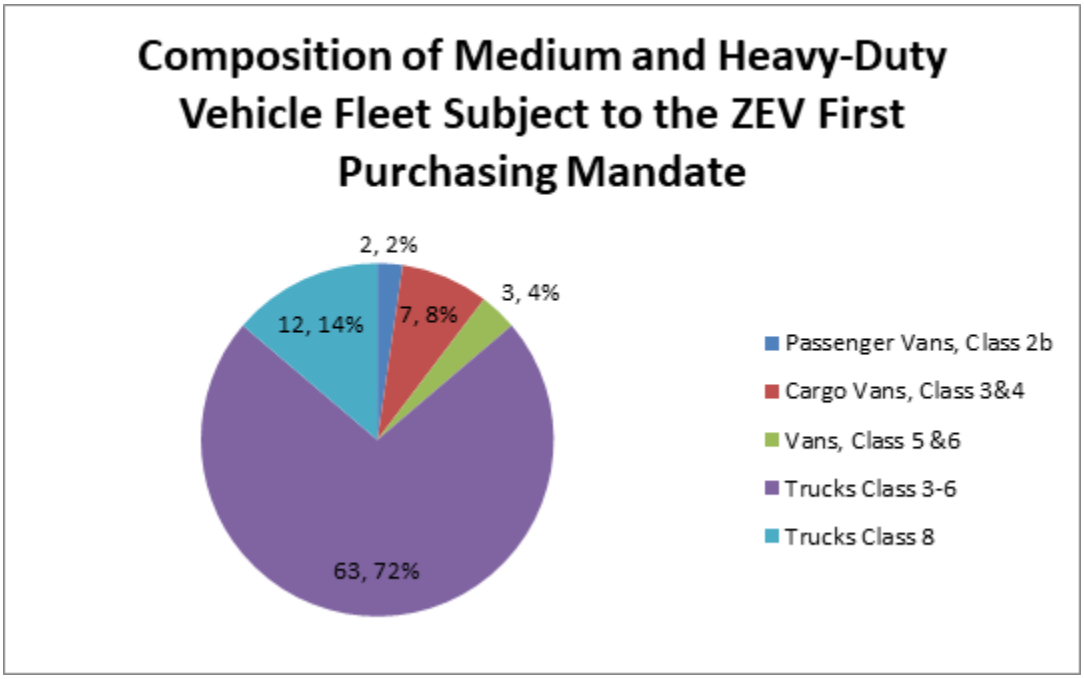


Table 2.5a MD/HD Vehicles in Department Fleet Currently Eligible for Replacement

	Vans, Class 2b	Vans, Class 3 & 4	Vans, Class 5 & 6	Trucks, Class 3-6	Truck, Class 8	Total
# of vehicles eligible for replacement	2	7	3	63	12	87

Designated Medium- and Heavy-Duty Vehicle Categories

Vans

- Passenger Vans — Class 2b
- Cargo Vans — Classes 3 & 4
- Cargo Step Vans — Classes 5 & 6

Trucks

- Truck (cab and chassis) — Classes 3-6
- Utility Truck — Class 4
- Box Truck — Class 6

- Refuse Truck — Class 8
- Tractor Truck — Class 8

Table 2.5b Vehicle Class Chart

Vehicle Class	Gross Vehicle Weight Ratio
2b	8,501 – 10,000 lbs.
3	10,001 – 14,000 lbs.
4	14,001 – 16,000 lbs.
5	16,001 – 19,500 lbs.
6	19,501 – 26,000 lbs.
7	26,001 – 33,000 lbs.
8	>33,001 lbs.

Medium and Heavy-Duty Fleet Vehicles

When utility vehicles and vans are included, 92 percent of the fleet consists of vehicles that are suited to rough terrain.

Many of DWR's heavy-duty pickups are utility or service trucks equipped with special tools and devices specific to DWR's fieldwork. The following figures show the similarity between the fossil fuel utility vehicle and the ZEV utility vehicle. Overall serviceability and travel range are equivalent. The Department of General Services (DGS) anticipates that heavy-duty vehicles will soon be available on contracts.

Figure 7 2016 Ford 550 Utility Truck — Diesel Fuel

Figure 8 Comparable 2017 ZEV Utility Vehicle

The table below shows the estimated number of MD/HD ZEVs that have been or are planned for DWR's fleet.

Table 2.6 Mandated ZEV Additions to the Department Fleet

MD/HD Vehicle Type	21/22	22/23	23/24	24/25
Battery Electric Vehicle	3			
Plug-in Hybrid Vehicle	0			
Fuel Cell Vehicle	0			

MD/HD Vehicle Type	21/22	22/23	23/24	24/25
Percent of total purchases	35%	40	45	50
Total number of ZEVs in Fleet				

ZEV Take-home Vehicles

Vehicles authorized for home storage, per SAM Section 4109, are subject to all applicable ZEV purchasing policies.

The electric vehicle range capacity is the criteria by which DWR aligns ZEVs to the home storage permittee. Two companies, EV Connect and Tesla, currently charge the vehicles. Monthly reports from both companies monitor users for correct charging practices.

Telematics Plan

Telematics is a method for monitoring vehicle use. Using GPS and onboard diagnostics, telematics provides valuable information that often results in fuel savings and improved vehicle utilization. Telematics is especially important for verifying that Plug-in Hybrid Vehicles are maximizing the use of battery electricity rather than gasoline. The rule requiring 50 percent of ZEVs purchased to be Battery Electric Vehicles (BEVs) is not in place for fleets making use of telematics for all ZEVs.

DWR is currently using telematics; however, the telematics DWR uses do not meet the requirements or supply the correct information required by DGS Fleet and Asset Management. In May of 2019, DGS signed a contract with Geotab, a provider of Internet of Things (IoT) and connected transportation. This is a single-source blanket purchase agreement (BPA) to supply the State of California and participating local government agency fleets with a telematics solution. State, municipal, and county fleets may purchase the technology through the State contract. With implementation of the new DGS contract, DWR will purchase and install telematics on all the DWR ZEVs and plug-in hybrid vehicles. DWR anticipates that this will occur in 2022.

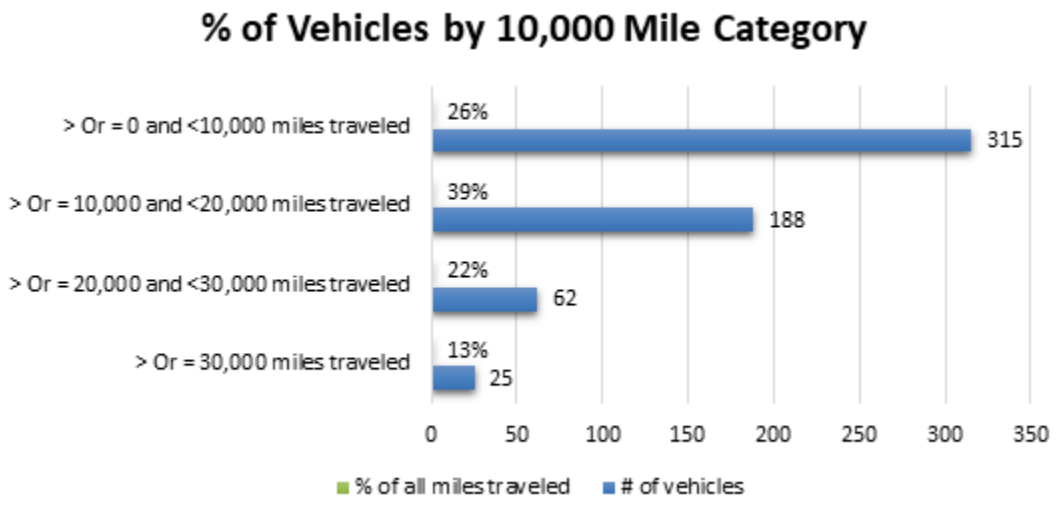
Based on a pilot project done by Geotab (GEOTAB 2017), here are the four key findings from the State of Utah pilot study of Geotab telematics:

1. There is a significant positive correlation between the installation of telematics units in agency customer vehicles and improvements in key cost-saving areas.

2. There appears to be a more positive correlation between driver behavior and real-time in-cab alerts.
3. At the current level of estimated savings, the pilot is more than paying for itself.
4. The State of Utah gains approximately $2.05 per vehicle per month additional savings above the cost of the program, according to an analysis performed at the University of Utah.

DWR expects to see similar savings and benefits as the state of Utah. Two areas of savings stand out in the report. First, is the ability of telematics to proactively measure idling and speeding and to use in-cab real-time driver coaching alerts, with supervisor feedback to discourage unnecessary idling and excessive speeding. Most of the fuel savings came from monitoring this aspect of vehicle travel. The second area is underutilization of vehicles. Monitoring this information helps fleet managers decide whether certain vehicles are replaceable by other mobility solutions. This aspect of monitoring is important, as one of DWR's transportation challenges is vehicle underutilization. The following chart highlights DWR's underutilization of vehicles (Graph 2.2).

Graph 2.4 DWR Vehicle Underutilization 2018



As Graph 2.4 demonstrates, 25 of DWR's 589 heavy and light-duty pickups make up 13 percent of all miles traveled, and 87 vehicles traveled 35 percent of all miles traveled. Using telematics will help balance mileage across all vehicles.

Public Safety Exemption

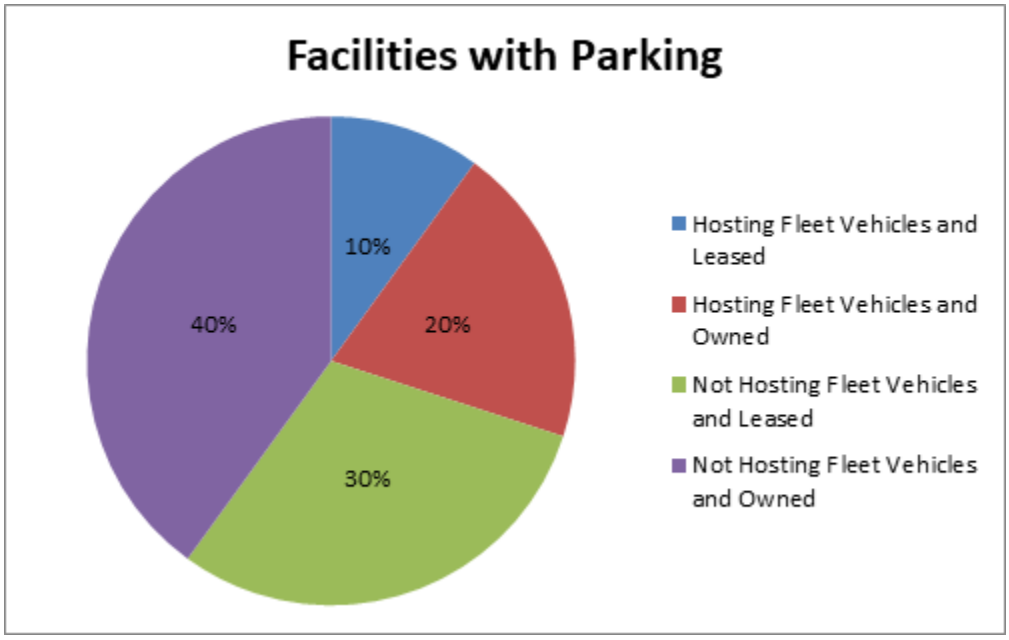
DWR does not have any sworn officers driving safety vehicles.

Department of Water Resources Parking Facilities

DWR's most common facilities are those of the State Water Project and those of its Flood and Maintenance yards. These facilities offer mostly employee parking, usually behind secure entrances. Some parking exists for visitors, usually in a separate area.

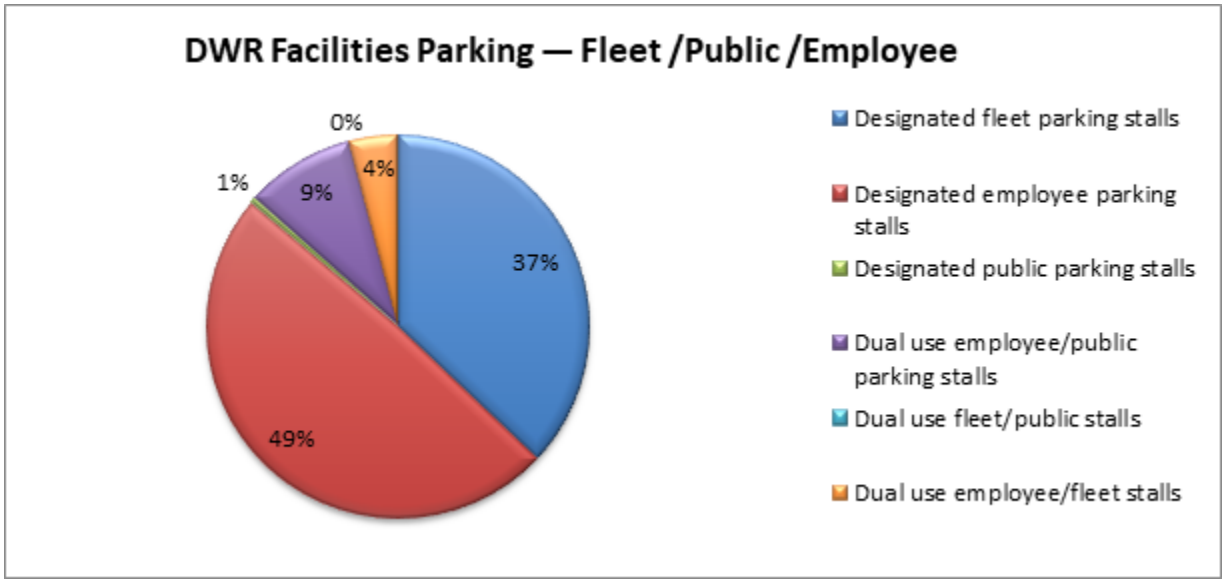
DWR has 28 facilities with a total parking capacity of 1,828 stalls. Of these, 885 are for fleet parking, 668 stalls are mixed parking for all user groups, 75 stalls are dual use for both fleet and public, 165 are for public use only, and 10 are designed for employee use only (Graph 2.5).

Graph 2.5 Parking Facilities



DWR owns and operates three visitors' centers at major reservoirs throughout the state, with 275 parking stalls, 70 of which are for public parking only.

Graph 2.6 DWR Facilities Parking by Type



Given the nature of the Department's fleet operations and the length of stay for visitors and employees, we have determined that it is appropriate that the chargers be a Level 2, 7200 watt, 240-volt charging station (L2). DGS

recommends at least 25 percent of chargers for employees be L2 and that 75 percent of fleet chargers be L2.

Based on estimates of future ZEV fleet purchases and a count of visitor and workplace parking spaces, it has been determined that the Department will need a total of 88 L2 chargers to adequately serve fleet vehicles and achieve the goals established in the ZEV Action Plan.

Table 2.7 lists the facilities with the most urgent need for electric vehicle (EV) charging.

Table 2.7 High Priority EVSE Projects

Facility Name	Total Parking Spaces	Existing L1 Charging Ports (2020)	Existing L2 Charging Ports (2020)	Total Charging Ports (2020)	EV Charging Ports Needed by 2025
Delta Field Division	225	0	0	0	10
San Luis Field Division	80	0	0	0	10
San Joaquin Field Division	155	0	0	0	10
Coalinga Sub Center	50	0	0	0	5
Lost Hills Sub Center	50	0	0	0	5

Note: The total number of parking spaces = 560. EV charging ports needed by 2025 = 40.

Outside Funding Sources for EV Infrastructure

DWR will work with the DGS Office of Sustainability Transportation Unit to install needed EV charging infrastructure at state owned facilities. DWR will also seek out utility, private, and non-profit electric vehicle supply equipment (EVSE) programs in the future to secure funds for building and installing the electrical infrastructure and electrical charging stations. Further, DWR is pursuing various funding sources for EVSE installation, including but not limited to: DWR internal funds, various utility incentives, Volkswagen Settlement funds, and California Energy Commission-funded EV charger incentives.

Hydrogen Fueling Infrastructure

Currently, DWR does not intend to install hydrogen-fueling infrastructure. Based on an analysis of DWR's facilities and vehicles, it makes more sense for DWR to convert to zero emission vehicles (ZEVs), especially as electric vehicles are becoming available in the light and heavy-duty pickup trucks that are the majority of DWR's fleet. Further, by sizing DWR's electricity needs to include electric vehicles, DWR can maximize its investment in microgrids for its facilities.

Comprehensive Facility Site and Infrastructure Assessments

Site Assessments establish the cost and feasibility of installing needed EV infrastructure. Table 2.8 lists the facilities with Site Assessments.

Table 2.8 Results of Site Assessments

Facility Name	L1 Chargers with Current Electrical System	L2 Chargers with Current Electrical System	Total cost for Project using Current Electrical System	L1 Chargers with Electrical System Upgrades	L2 Chargers with Electrical System Upgrades
Delta Field Division	0	0	0	0	10
San Luis Field Division	0	0	0	0	10
San Joaquin Field Division	0	0	0	0	10
Coalinga Sub Center	0	0	0	0	5
Lost Hills Sub Center	0	0	0	0	5

Note: The total number of L2 chargers with electrical system upgrades = 40.

EVSE Construction Plan

DWR identified five sites for the installation of new Level 2 chargers. Currently, DWR's operations and maintenance (O&M) engineering staff is designing the infrastructure build for five locations. When the infrastructure plans are completed, DWR will be sending the infrastructure build out to bid. The anticipated bid opening will be March 2020. Completion of the EVSE build will be December 2022.

EVSE Operation

DWR is in the process of finalizing the design for new charging stations. With the final installation of the charging stations, DWR will use the telematics program contract offered by DGS to collect and report EVSE data and assure that charging

stations are in working order. DWR has developed an employee electric vehicle-charging handbook detailing its EV charging policies, including the amount of time that an employee can charge an electric vehicle and other details of electric vehicle charging etiquette. DWR will not charge employees for their use of the EVSE.

CHAPTER 3 — ENERGY

This chapter demonstrates the progress the California Department of Water Resources (DWR) has made toward meeting the Governor's sustainability goals related to retail energy consumed at its owned buildings and facilities. This chapter identifies DWR's successful accomplishments, ongoing efforts, and outstanding challenges.

Department Mission and Built Infrastructure

DWR's mission is to manage sustainably the water resources of California, in cooperation with other agencies, to benefit the state's people and to protect, restore, and enhance the natural and human environments.

To accomplish part of its mission, DWR owns, operates, and maintains the California State Water Project (SWP), a utility-scale water conveyance system that provides raw water to 29 water contractors (municipalities and irrigation districts) throughout the state. The SWP infrastructure includes 34 water storage facilities, reservoirs, and lakes; 20 hydroelectric pumping plants; 4 hydroelectric pumping-generating plants; 5 hydroelectric power generating plants; and approximately 700 miles of aqueducts, canals, and pipelines.

The SWP has five field divisions covering the state, with its headquarters located in Sacramento. Each SWP field division includes an administrative center, an operations area control center, and several operations and maintenance (O&M) offices, shops, and facilities collectively used to manage, operate, and maintain the field division and the hydroelectric equipment and infrastructure within each of their boundaries.

Currently, the energy to operate DWR's SWP facilities (26 facilities totaling 96 structures and 563,244 sq. ft.) comes from retail sources, such as PG&E for example, whereas the energy used to operate the SWP's hydroelectric pumping plants comes from the state's wholesale energy market.

Table 3.1 Total Purchased Energy 2020

Purchased Energy	2003 Baseline Quantity	2020 Quantity	% Qty. Change
Electricity	3,284,131 kWh	2,867,164 kWh	-13%
Less EV Charging	n/a kWh	n/a kWh	n/a
Natural Gas	103,413 Therms	76,441 Therms	-26%
TOTALS	**21,546,754.97 kBtu Site**	**17,426,837 kBtu Site**	**-13%**

Table 3.2 Properties with Largest Energy Consumption

Building Name	Floor Area (ft^2)	Site Energy (kBTU)	Source Energy (kBTU)	Source EUI ($kBTU/ft^2$-yr)
Oroville Operations and Maintenance Center	55,820	4,441,678	9,849,534	176
Sacramento Maintenance Yard	32,100	3,445,620	7,362,381	229
Lost Hills Operations and Maintenance Subcenter	37,600	1,742,155	4,322,523	115
Southern California Operations and Maintenance Center	45,100	1,288,547	3,546,919	79
Coalinga Operations and Maintenance Subcenter	13,700	996,705	3,139,619	229
Total for Buildings in This Table	**184,230 ft^2**	**11,914,704 kBTU**	**28,220,976 kBTU**	—
Total for All Department Buildings	**563,244 ft^2**	**17,426,837 kBTU**	**39,147,745 kBTU**	—
% of Totals	**33%**	**68%**	**72%**	—

DWR has implemented energy efficiency upgrades at some of its field division O&M centers, including upgrading lighting systems and controls and installing occupancy sensors and programmable thermostats. These projects reduced DWR's grid-based energy purchases by 20 percent as measured against a 2003 baseline.

5-year Capital Plan

DWR's Water and Efficiency Branch has developed an energy-efficiency improvement plan designed to meet the EO mandates and is currently presenting this plan and its estimated costs to DWR Executive managers for approval and

implementation. DWR's Division of Operations and Maintenance, who would include any improvement plans into their 5-year capital improvement plan, may perform part of the implementation in-house.

General Challenges

DWR's buildings range in age from "old" to "very old," with the earliest building constructed in 1922. These aging buildings create challenges in meeting the Governor's goals because significant time, human resources, and funding are required to retrofit them to be compatible with new technology.

Although the EO requires monitoring both owned and leased buildings, to date, DWR has not been successful in collecting data related to its leased buildings. DWR continues to work toward collecting water and energy usage data from owners of leased buildings.

Zero Net Energy (ZNE)

State policies set forth the following milestones for state zero net energy buildings:

- 2017 — 100 percent of new construction, major renovations and build-to-suit leases beginning design after 10/23/2017 to be ZNE.
- 2025 — 50 percent of total existing building area will be ZNE.

As shown in Table 3.3, DWR has seven facilities in operation that are ZNE compliant. Some of the facilities that meet ZNE targets consist of laboratories designed to test the SWP water quality, the Lake Oroville Visitor Center, Sutter Maintenance Yard, Monument Hill Boat Launch, Romero Overlook, and Cedar Spring Dam Maintenance Station. Deliberately designed to be smaller spaces, because of their low occupancy and low frequency of use, these facilities make up 25 percent of DWR's total DWR building area.

DWR has and continues to take measures toward achieving ZNE for 50 percent of its existing building space by 2025. DWR has prepared a feasibility study and implementation plan to improve the energy use intensity (EUI) of buildings and facilities.

Table 3.3 Zero Net Energy Buildings

Status of ZNE Buildings	Number of Buildings	Floor Area (ft^2)	% of Building Area
Buildings Completed and Verified	7	59,572	12%
Building in Design or Under Construction	0	0	0%
Building Proposed for Before 2025 (but not yet in design)	0	0	0%
Additional Exist. Bldg. Area within 15% w/ EE projects Planned	6	215,920	38%
Totals for ZNE Buildings by 2025	13	275,492	49%
Totals for All Department Buildings by 2025	26	563,244	100%
% ZNE by 2025	50%	49 %	—

New Construction Exceeds Title 24 by 15 Percent

All new State buildings and major renovations beginning design after July 1, 2012, must exceed the current California Code of Regulations (CCR) Title 24, energy requirements by 15 percent or more.

In 2016, DWR built a 24,000 square feet Leadership in Energy and Environmental Design (LEED) Platinum-certified building at its Pearblossom location. This building serves as the O&M headquarters for DWR's Southern Field Division. In addition to the LEED certification, DWR also installed a 30-kilowatt solar photovoltaic (PV) system to provide clean renewable power for the building.

Table 3.4 New Construction Exceeding Title 24 by 15%

Buildings Exceeding Title 24 by 15%	Number of Buildings	Floor Area (ft^2)
Completed Since July 2012	1	24,000
Under Design or Construction	0	0
Proposed Before 2025	0	0

For future new construction and renovations, DWR's strategy is to ensure that all buildings and facilities are zero net energy and will exceed Title 24 by at least 15 percent. For example, DWR will be a major occupant of the newly constructed

Natural Resources Headquarters building, which is zero net energy and LEED Platinum certified.

Reduce Grid-Based Energy Purchased by 20% by 2018

Executive Order B-18-12 requires State agencies to reduce grid-based energy purchased by 20 percent by 2018, compared with a 2003 baseline.

DWR has conducted energy audits at select SWP facilities and implemented several energy-efficiency upgrade projects, including lighting and control upgrades. These projects helped DWR reduce its grid-based energy purchases by 20 percent by the EO B-18-12's 2018 target date as measured against a 2003 baseline; however, those reductions were offset by reconstruction and emergency work at Oroville Field Division (OFD) that occurred from 2017 to 2019.

Reconstruction work at both the Thermalito facility and emergency construction work related to the Oroville Dam Spillway increased levels of activities at the OFD O&M Center. This work has significantly increased the retail electricity consumption at that facility. In addition, the OFD O&M Center is planning to add another building at the site, increasing the energy consumption of that facility. However, since the completion of the Thermalito reconstruction in early 2020, DWR expects to meet EO B-18-12's requirement of reducing grid-based electricity purchase by 20 percent by the end of 2021.

Per Management Memo 14-09, DWR has enlisted the DWR/CNRA Data Center, which services DWR and 30 other Natural Resources Agency organizations via the Government Technology Agency. The Natural Resources Data Center, located at 1416 Ninth Street in Sacramento, is approximately 6,000 square feet with temperature control maintained between 76–84 degrees and operating under the Class A1–A4 guidelines. All installed network switches meet current energy efficiency standards. The DWR/CNRA Data Center is 97 percent virtualized and 3 percent physical.

DWR has taken the following measures to reduce its power use effectiveness (PUE) at its data centers to below the current PUE threshold of 1.46 or lower:

- Consolidated storage racks and devices.
- Replaced and decommissioned an older supervisory control and data acquisition (SCADA) system backup environment that ran on energy inefficient hardware.

- Replaced two heating, ventilation, and air conditioning (HVAC) systems with highly efficient, thermal hybrid management systems.
- Added louvers under the chillers to direct cold air to desired locations.
- Implemented various airflow improvement actions, which allow the Computer Room Air Conditioner (CRAC) and the Computer Room Air Handler (CRAH) to slow down and use less electricity to operate.
- Decommissioned and removed unused cabling under floors to improve cold airflow.

DWR continues to evaluate and take necessary measures to reduce energy usage at its data centers.

Management Memo 14-07, "Standard Operating Procedures for Energy Management in State Buildings," is self-explanatory. All State agencies shall follow the Standard Operating Efficiency Procedures for managing energy usage in State-owned buildings and, as practical, in State-leased buildings. These standards clarify roles and responsibilities; require energy saving features on computers, copiers, and printers; require State agencies to purchase ENERGY STAR-rated equipment; require some form of daylight controls near windows and under skylights under specified conditions; include Demand Response guidelines; and include policies and procedures on plug load. All these requirements affect the EUI of a building. DWR has incorporated many of the operating procedures detailed throughout this report. Some of these operating procedures are not practical in DWR facilities because of the nature and/or age of the facility; however, where possible and practical, DWR continues to implement these operating procedures.

Table 3.5 shows the Department-wide source energy trend over the past six years and compares it against the 2018 target mandated in EO B-18-12. The source energy use intensity (EUI) score classifies facilities as either energy intensive or energy efficient by comparing them to a State target score of similar facility (building) types. Generally, a low EUI signifies good energy performance. The 2018 building area remained the same as the 2003 baseline year at nearly 563,244 square feet. Overall, the total source energy and source EUI have both increased compared with the baseline year.

Until 2015, DWR's sustainability initiatives maintained an EUI score at or below 90 kBTU per square foot while continuing regular use of energy intensive activities at O&M yards necessary to maintain the SWP. In 2016, reconstruction work at the

Thermalito Power Plant and support from the Oroville O&M yard required significant retail energy consumption from the PG&E power utility company. This resulted in an annual increase of 10 kBTU per square foot that will continue until reconstruction work ends in 2020. However, the reconstruction work has made it difficult to achieve the 2020 target of 56 kBTU per square foot despite the completion of several energy efficiency projects at O&M yards. DWR energy reduction efforts will not reflect until after the 2020 completion date.

With 26 facilities to monitor, DWR can classify them into three general building EUI categories to compare their efficiency against other State buildings of similar function. DWR's four laboratories have an average EUI score of 157 kBTU per square foot compared with the State's average target of 261. These facilities are used to treat and test water quality along the SWP and are among the top performers because of their small building area and minimal staff needed. DWR visitor centers have an average EUI score of 63 kBTU per square foot compared with the State's average target of 62 for public entertainment building types. DWR's visitor centers are learning centers for the public and utilize interactive exhibits and theater rooms for explaining how the SWP works. When omitting Thermalito as an outlier, DWR's remaining 13 O&M yards have an average EUI score of 128 kBTU per square foot compared to the State's average target of 45 for maintenance yards. DWR O&M yards are a mixture of offices, shops, and warehouses that make temperature control difficult and require energy intensive infrastructure for industrial lighting and industrial power use. Table 3.5 summarizes the source energy consumption and EUI score.

Table 3.5 Department-Wide Energy Trends (if available)

Year	Floor Area (ft^2)	Total kBTU Consumption	Department Average EUI
Baseline Year 2003	563,244	42,233,682	75
2013	563,244	42,389,944	75
2014	563,244	44,007,584	78
2015	563,244	43,461,429	77
2016	563,244	50,686,962	90
2017	563,244	50,914,646	90
2018	563,244	49,502,477	88
2019	563,244	37,847,536	67
2020	563,244	39,147,745	70
% Change 2003-2020	0%	-7%	-7%

As shown in Table 3.5, the retail energy consumption went down in 2015 when compared with the 2003 baseline. This reduction is from lighting and controls upgrades implemented in 2010 and 2014. Additional energy efficiency projects implemented during 2016 to 2018, as shown in Table 3.6, further reduced the retail energy consumption. However, the Thermalito reconstruction work started during that time and energy consumption went up significantly because of the reconstruction activities. Starting from 2018, the Thermalito reconstruction work has been winding down. The reduction of Department-wide annual energy consumption, shown in Table 3.5, reflects this reduction.

Since 2010, DWR has completed lighting and control upgrades at many of its field division facilities. As shown in Table 3.6, on an overall building square footage basis, 40 percent of DWR facilities have undergone some level of energy efficiency upgrades.

Table 3.6 Summary of Energy Projects Completed or In Progress

Year Funded	Estimated Energy Savings (kBTU/yr.)	Floor Area Retrofit (sq. ft.)	Percent of Department Floor Area
2015	948,140	102,713	22%
2016	108,505	800	0.2%
2017	277,127	32,100	7%
2018	21,692	22,446	5%
2019	0	0	0
2020	0	0	0
2021	0	0	0

DWR is now taking the next steps toward meeting EO targets, which include working with electric utilities to perform preliminary assessments of buildings and facilities, incorporating the effectiveness of equipment upgrades or replacement toward meeting EO mandates and targets. In particular, the preliminary assessments will identify which facilities will require new investment grade audits, which will lead to recommendations of energy conservation measures across all DWR facilities. DWR will next develop a comprehensive upgrade or replacement plan and budget that will allow DWR to reach EO mandates, including the new, higher standard of EUI targets recently set by DGS.

During the past six years, DWR has worked with electric utilities to perform energy audits of many of its buildings and facilities following the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) standards.

Table 3.7 shows the square footage of DWR building area that has undergone ASHRAE Level 1 and Level 2 energy audits. DWR continues the process in working with electric utilities to complete comprehensive energy audits of its facilities to help identify equipment replacement or upgrades to reduce energy consumption.

Table 3.7 Energy Surveys

Year	Total Department Floor Area (sq. ft.)	Energy Surveys Under Way (sq. ft.) Level 1	Energy Surveys Under Way (sq. ft.) Level 2	Percent of Department Floor Area Level 1	Percent of Department Floor Area Level 2
2015	563,244	89,013	89,013	18%	18%
2016	563,244	78,389	89,669	16%	18%
2017	563,244	32,900	800	7%	0.2%
2018	563,244	22,446	0	5%	0%
2019	563,244	0	0	0%	0%
2020	563,244	0	0	0%	0%

Demand Response (DR)

Executive Order B-18-12 directed that all State Departments are to participate in available demand response programs and to obtain financial incentives for reducing peak electrical loads when called upon, to the maximum extent cost-effective.

DWR verified the DR program eligibility requirements for many of its buildings served by retail energy and participated in three programs. These are SCE's "Summer Discount Plan" (SDP), which offers up to 3 kW of potential peak load reduction among three DWR facilities. The second is PG&E's "Peak Day Pricing," which offers up to 13 kW of potential peak load reduction among six DWR facilities. The third is PG&E's "Manage Your Own Power" programs, which offers up to 5 kW of potential peak load reduction for one DWR facility.

In addition, PG&E annually monitors customer savings for their participation in its DR programs and automatically delists customers who are not realizing savings.

To date, no DWR facilities are delisted. PG&E found other DR programs eligible for participation, such as the Capacity Bidding Program and FlexAlert, but further analysis determined that DWR would not benefit financially without disturbing SWP functions.

DWR has also investigated programs available from other small power utilities such as the Power Partners Program, California Independent System Operator (CAISO) FlexAlert, Summer Shift, Time of Use Plus, and more, but elected not to participate because of a negative impact on energy and cost savings. Additional participation is challenging because of DWR's lack of modern equipment and data communication devices, which are necessary to provide fast response to an electric utility's request to adjust loads.

Table 3.8 summarizes DWR's participation in DR programs.

Table 3.8 Demand Response Programs

Demand Response Participation	Number of Buildings	Estimated Available Energy Reduction (kW)
Number of Buildings Participating in 2020	10	21
Number of Buildings That Will Participate in 2021	10	21
All Department Buildings (Totals)	20	21
All Department Buildings (Percent)	38%	N/A

Renewable Energy

New or majorly renovated State buildings over 10,000 square feet must use clean, on-site power generation and clean back-up power supplies, if economically feasible. Facilities with available open land must consider large-scale distributed generation through various financing methods, including, but not limited to, third party power purchase agreements (PPAs).

Although there are no specific kW goals for renewable energy, renewable energy does count towards meeting: (1) Zero Net Energy goal for 2025 and (2) 20 percent grid-based energy use reduction by 2018.

At the retail level, DWR installed a 30-kilowatt solar photovoltaic (PV) system to provide renewable power for the Pearblossom LEED building described in the "Construction Exceeds Title 24 by 15 percent" section of this document. DWR also continues to assess the feasibility of installing solar PV at its facilities. In 2018, DWR participated in a competitive request for proposals (RFP) process, managed by DGS, to solicit proposals for the design, installation, operations, and maintenance of a canopy mount solar generation installation to be interconnected behind the meter at its Lost Hills O&M Center, under a 20-year PPA; however, the winning bidder was subsequently disqualified. DWR is now considering bundling multiple projects to promote economy of scale and re-advertising the RFP.

On a wholesale level, Table 3.9 includes the Pearblossom Solar Facility, which is in operation and is part of DWR's wholesale power portfolio. DWR is conducting studies to determine the feasibility and cost effectiveness of integrating additional utility scale solar generation, including energy storage, at its pumping facilities.

Table 3.9 On-Site Renewable Energy

Status	Number of Sites	Capacity (kW)	Estimated Annual Power Generation (kWh)	Percent of Total Annual Department Power Use
Current On-Site Renewables in Operation or Construction	1	10,000	15,770,000	433.0%
On-Site Renewables Proposed	8	1,531	2,414,387	66.3%
On-Site Renewables Operational or Proposed Totals	9	11,531	18,184,387	499.2%
Total Department-Wide ZNE-Targeted Facilities & Energy Current & Proposed On-Site Totals	9	11,531	3,642,396	—
Current Combined On-Site and Off-Site Renewable Energy	1	10,000	15,770,000	433.0%
Additional Planned On-Site and Off-Site Renewable	8	1,531	2,414,387	66.3%

Monitoring Based Commissioning (MBCx)

New and existing State buildings must incorporate Monitoring Based Commissioning (MBCx) to support cost effective and energy efficient building operations, using an Energy Management Control System (EMCS). State agencies managing State-owned buildings must pursue MBCx for all facilities over 5,000 square feet with EUIs exceeding thresholds described in Management Memo 15-04.

DWR does not have any new buildings or current renovation projects underway larger than 5,000 square feet with EUIs exceeding thresholds as described in Management Memo 15-04. Therefore, DWR has deleted Table 3.10.

Financing

State agencies are required to pursue all available financing and project delivery mechanisms to achieve these goals including, but not limited to, State revolving loan funds, utility On-Bill Financing (OBF), Power Purchase Agreements (PPAs), GS $Mart, Energy Service Contractors (ESCOs), or other available programs.

DWR is pursuing all available financing and project delivery mechanisms to achieve the Governor's sustainability goals including, but not limited to, State revolving loan funds, utility On-Bill Financing (OBF), Power Purchase Agreements (PPAs), GS $Mart, Energy Service Contractors (ESCOs), or other available programs.

CHAPTER 4 — WATER EFFICIENCY AND CONSERVATION

This chapter demonstrates the progress that the California Department of Water Resources (DWR) is making toward meeting Executive Order (EO) B-18-12, EO B-29-15, and EO N-10-21 goals. This chapter identifies accomplishments, ongoing efforts, and outstanding challenges in water efficiency and conservation.

DWR's biggest challenge is adapting to California's extreme variability in annual precipitation. For example, from 2012 to 2015, California had the four driest consecutive years of statewide precipitation on record. By 2015, California had a record low statewide mountain snowpack average of five percent. The following water year (October 1, 2016–September 30, 2017) surpassed the wettest year on record (1982–1983) in the Sacramento River and San Joaquin River watersheds and fell short of setting a record in the Tulare Basin (set in 1968–1969). Uncertainty in annual precipitation from one year to the next demonstrates the need for DWR to be prepared for a flood or drought year.

As a result, DWR made water efficiency and conservation the key tenants of its Sustainability Policy. EO B-29-15, EO N-10-21, the SAM, and DWR's Administrative Manual Section 8001 emphasize the importance of surface water and the connection between the water-energy nexus, climate change, and ecosystem services.

DWR goes beyond the scope of current legislative policies to address the long-term effects of water runoff, water pollution, water infiltration, soil health, and nutrient recycling. By implementing a holistic water plan, DWR intends to meet State mandates and address the other effects that affect the environment while adding value and benefits to the State Water Project (SWP) and surrounding communities.

DWR's water plan has two major components necessary to define and prioritize water conservation initiatives. The first component consists of a quantitative inventory of indoor water use by fixtures, boilers, and cooling systems. The second component focuses on outdoor water use and includes a measurement of landscape areas, types, and irrigation equipment. Each water plan component includes a mandatory set of Best Management Practices (BMPs) for ongoing water

use efficiency for monitoring and reporting for annual compliance. Additionally, there are further requirements for large landscape water-use tracking if an agency has a total landscape area greater than 20,000 square feet at a facility. Both components of water use include monitoring, reporting, oversight, and compliance. DWR is currently working on a plan to install meters and submeters at its SWP facilities to more accurately measure and monitor indoor and outdoor water use.

Department Mission and Built Infrastructure

DWR's mission is to manage sustainably the water resources of California, in cooperation with other agencies, to benefit the state's people and to protect, restore, and enhance the natural and human environments.

To accomplish part of its mission, DWR owns, operates, and maintains the California State Water Project (SWP), a utility-scale water conveyance system that provides raw water to 29 water contractors (municipalities and irrigation districts) throughout the state. The SWP infrastructure includes 34 water storage facilities (reservoirs and lakes), 20 hydroelectric pumping plants, 4 hydroelectric pumping-generating plants, 5 hydroelectric power generating plants, and approximately 700 miles of aqueducts, canals, and pipelines.

The SWP consists geographically of five field divisions (FD) throughout the state with its headquarters located in Sacramento. Each SWP field division includes an administrative center, an operations area control center, and several operations and maintenance (O&M) offices, shops, warehouses, and buildings, which are used to manage, operate, and maintain the field division and the hydroelectric equipment and infrastructure within its boundaries. Currently, the energy needed to operate DWR's SWP facilities (26 facilities including 96 structures totaling 563,244 sq. ft.) comes from retail sources, such as PG&E, whereas the energy needed to operate the SWP's hydroelectric pumping facilities comes from wholesale energy market.

Although the EOs require monitoring both owned and leased buildings, to date, DWR has not been successful in collecting data related to its leased buildings. DWR plans to become more assertive in collecting water and energy usage data from the owners of leased buildings.

DWR currently monitors and reports water use on 22 of its 26 State-owned facilities in compliance with the water section of EO B-18-12. Of these 22 facilities,

seven are located along the SWP's open canals and reservoirs and rely on water from the aqueduct. Additionally, four facilities are in remote locations without municipal water deliveries, and they rely on ground water to operate and maintain daily functions. The water use estimate within these facilities uses factors such as individual buildings within a site, function type, and the number of occupants. EO B-18-12 policies target potable water use, but DWR facilities, as yet, do not have submeters to separate potable, irrigation, and process water use. A monetary cost is not available for estimated water consumption.

Table 4.1 summarizes the total amount of water used by the SWP facilities, but the cost value reflects only 11 facilities that receive a utility bill. In 2020, DWR consumed about 15.7 million gallons of potable water and paid approximately $53,000 to municipal water utilities. DWR has reviewed the potential of using recycled water for outdoor use. However, the expense of integrating recycled water systems is cost prohibitive at this time. DWR will continue to study the issue.

Table 4.1 2020 Total Purchased Water

Purchased Water	Quantity (Gallons)	Cost ($)
Potable	15,706,300	$ 53,572
Recycled Water	0	0
Totals	15,706,300	$ 53,572

Typically, DWR's three visitor centers account for the largest amounts of water consumption because they are popular with the public, even though each visitor center employs only two staff. But because of the pandemic, the number of visitors at the visitor centers has been below normal for 2020.

Table 4.2 summarizes five DWR-owned facilities that consumed the most amount of water during 2020, which are SWP's O&M Centers. DWR's Field Division O&M Centers are large consumers of water because of the amount of work required to properly maintain equipment and grounds, in addition to construction projects that are performed on site at various times. These facilities range from 13,000 to 67,000 square feet of building area with a fixed number of employees on site

during a workday and dozens of utility craftworkers working on and off site (intermittent) maintaining the SWP infrastructure, with outside contractors occasionally working on DWR projects. DWR defines one intermittent staff as one quarter of a full-time staff at the facility for determining occupancy numbers.

Additionally, without submeters to separate the different uses of water, the total water consumption amount of a given facility includes the process, potable, and landscape water, resulting in an inflated per-capita number.

Table 4.2 Five Properties with Largest Water Use in 2020

Property Name	Area (Sq. ft)	# of Building Occupants	2020 Total Water Use (Gallons)	2020 Total Irrigation Water Use[1]	Per Capita Water Use (Gallons/ person/ day)
Oroville Operations & Maintenance Center	55,820	55	2,953,500	See Note 1	147
Pearblossom Operations & Maintenance Subcenter - new	24,000	50	2,385,600	—	131
Pearblossom Operations & Maintenance Subcenter - old	36,800	50	1,856,600	—	102
Lost Hills Operations & Maintenance Subcenter	37,600	37	1,849,000	—	138
Southern California Operations & Maintenance Center	45,100	11	1,743,400	—	434
Total for Buildings in this table	199,320	203	10,788,100	—	146

Property Name	Area (Sq. ft)	# of Building Occupants	2020 Total Water Use (Gallons)	2020 Total Irrigation Water Use[1]	Per Capita Water Use (Gallons/ person/ day)
Total for all Department buildings	563,244	461	15,706,300	—	93
% of Total	35%	44%	69%	—	—

Note: Irrigation water use is not known due to lack of submetering for separate measurements.

While not measurable, DWR believes that potable water constitutes a fraction of DWR's total water consumption, with process water and landscape irrigation systems having a bigger impact on annual water usage. As mentioned, although there are no devices to separate potable, process, and landscape water, DWR has conducted landscape surveys to determine landscape size, type, and efficiency. In total, DWR facilities have nearly 570,000 square feet of landscaping surface area, 84 percent of which is located at its five Field Division O&M centers, and nearly 50 percent of this landscaping surface area is turf grass.

Table 4.3 summarizes the top five facilities with the largest landscape area, which include four of the Field Division O&M centers and the Sacramento Maintenance Yard, which is also a maintenance facility for DWR's Flood Division. As shown, the San Joaquin Field Division (SJFD) O&M Center has the largest landscaped area, with 133,800 square feet of total landscaping. As previously stated, DWR does not, to date, have data for leased facilities.

Table 4.3 Five Properties with Largest Landscape Area

Property Name	Landscape Area (Sq.ft)
San Joaquin Operations & Maintenance Center	133,800
Delta Operations & Maintenance Center	116,619
Oroville Operations & Maintenance Center	113,115
Sacramento Maintenance Yard	83,805
Lost Hills Operations & Maintenance Subcenter	44,600
Total Landscape area for Properties in this Table	491,939

Property Name	Landscape Area (Sq.ft)
Total Landscape area for All Department Properties	565,999
% of Total that is Large Landscape	87%

The Oroville Field Division (OFD) O&M Center has more turf area than any other facility, with approximately 73 percent of its landscaping being turf that covers 82,635 square feet; however, OFD has a more climate appropriate landscape when compared with the San Joaquin Field Division (SJFD) O&M Center.

DWR's biggest challenge is integrating landscape and irrigation improvement projects into its capital improvement plan and scheduling the personnel to implement those projects. In the interim, DWR has been applying for various available funding programs, including State-sponsored programs; however, funding for most programs were exhausted or DWR was determined "Not Eligible." DWR also attempted to collaborate with the Department of General Services (DGS) on a demonstration project related to water conservation; however, DWR & DGS were unable to implement the projects because of a lack of human resources and funding.

In terms of demonstration projects, DWR used the Model Water Efficient Landscape Ordinance and the "Save Our Water" campaign to demonstrate low water-use plantings. The most successful demonstration is the annual outdoor exhibit that DWR has held at the California State Fair since 2014. The Water-Wise landscaping exhibit presents ways to reduce outdoor water use through water-wise landscaping. The exhibit contains garden beds with California native species and low water use plants, displays a systematic guide to replacing lawns with water-efficient landscaping, and gives information on lawn- replacement rebate programs. Public education ensures DWR serves as a leader in important water conservation legislation, regulations, and EO directives.

In 2012, Executive Order B-18-12 mandated a statewide reduction of water consumption of at least 20 percent by 2020, compared to a 2010 baseline. In 2013, EO B-29-15 declared a more stringent target, a 25 percent reduction of water use, in response to Governor Brown's Emergency Drought Declaration.

Table 4.4 compares the 2020 annual water consumed and the 2010 and 2013 baseline years mandated in each EO. During the 2013 California drought, DWR

responded by ceasing all landscape irrigation. DWR subsequently has taken steps to reduce landscape water usage by implementing best management practices for landscape. In 2013, DWR met the 25 percent goal for the emergency declaration but was unable to sustain this level of conservation on an ongoing basis. Nevertheless, DWR achieved the 20 percent target of the EO B-18-12 in 2020. DWR continues to search for ways to reduce water consumption to meet the 15% reduction target of EO N-10-21.

Table 4.4 Department Wide Water Use Trends

Year	Total Occupancy /year	Total Amount Used (Gallons/year)	Per capita Use (Gallons per person per day)
Baseline Year 2010	Not Available	19,719,700	Not Available
2013	Not Available	14,579,400	Not Available
2018	Not Available	14,814,100	Not Available
2020	461	15,706,300	93

Table 4.5 summarizes the number of facilities that complied with the EO's 2010 water reduction goals. Eight facilities met the 20 percent goal while 13 facilities fell short of that goal; however, overall, DWR met the 20 percent reduction goal. The new Pearblossom O&M facility construction took place after 2010, so its water consumption does not match with the baseline year. DWR continues to find ways to reduce annual water consumption through long-term sustainable methods and water projects.

Table 4.5 Total Water Reductions Achieved in 2020

Total Water Use Compared to Baseline	Total Amount Used (Gallons per year)	Annual Gallons Per Capita
20% Reduction Achieved	15,706,300	93
Less than 20% Reduction	Not Applicable	N/A
Total	15,706,300	93
Department-wide Reduction	4,013,400	24

As summarized in Table 4.6 and Table 4.7, DWR has not started or completed any indoor water efficiency or heating and cooling system projects within the last seven years. However, whenever a water fixture needs repair or replacement, then upgrading to water efficient fixtures takes place. For example, recently at its Lost Hills O&M Subcenter, three urinals were replaced with waterless urinals to conserve water use.

Table 4.6 Summary of Indoor Water Efficiency Projects Completed 2014–2020 or In Progress

Year Completed	Water Saved (Gallons/yr.)	Number of Indoor Water Efficiency Projects Completed	Cost Savings per Year ($)
2014	0	0	0
2015	0	0	0
2016	0	0	0
2017	0	0	0
2018	0	0	0
2019	0	0	0
2020	0	0	0

Table 4.7 Summary of Boilers and Cooling Systems Projects Completed or In Progress

Year Completed	Water Saved (Gallons/yr.)	Number of Systems with Water Efficiency Projects
2014	0	0
2015	0	0
2016	0	0
2017	0	0
2018	0	0
2019	0	0
2020	0	0

Table 4.8 summarizes completed landscape projects that required irrigation hardware installation. The San Luis Field Division (SLFD) O&M Center installed a drip system in 2014, saving over 17,000 gallons of water annually. Twenty-thousand square feet of landscaping was replaced in compliance with the Model Water Efficient Landscape Ordinance (MWELO) and another 1,100 square feet were replaced with climate-appropriate plantings. The estimated cost savings is relatively low because the SLFD O&M Yard does not pay for water as it receives water directly from the California aqueduct. In 2019, part of the landscape irrigation-control system at Lost Hills O&M Subcenter was upgraded and sprinkler heads were replaced with high efficiency components.

As previously noted, DWR's SJFD O&M Center has the largest landscaped area. DWR estimated it needs approximately 280,000 drip emitters to complete a transition to drip irrigation. Water savings numbers are not available, but savings will be significant. Monitoring and tracking irrigation water separately from domestic and process water use will require additional analysis on submeter projects.

Table 4.8 Summary of Landscaping Hardware Water Efficiency Projects Completed or In Progress

Year Funded	Water Saved (Gallons/yr.)	Estimated Annual Cost Savings	Total Number of Projects per Year
2014	17,054	$29	1
2015	0	0	0
2016	0	0	0

Year Funded	Water Saved (Gallons/yr.)	Estimated Annual Cost Savings	Total Number of Projects per Year
2017	0	0	0
2018	0	0	0
2019	0	0	0
2020	0	0	0

Table 4.9 summarizes living landscape projects implemented in 2014. Two projects at the Delta Field Division O&M Center and San Luis Field Division O&M Center had high water-use shrubs and turf grass replaced with low maintenance plants and drip irrigation systems. These two projects helped DWR conserve over 346,000 gallons of water annually.

Table 4.9 Summary of Living Landscaping Water Efficiency Projects Completed or In Progress

Year Funded	Water Saved (Gallons/yr.)	Landscape Area MWELO (sq. ft.)	Climate Appropriate Landscape Area (sq. ft.)
2014	346,330	20,240	20,240
2015	0	0	0
2016	0	0	0
2017	0	0	0
2018	0	0	0
2019	0	0	0
2020	0	0	0
Totals	346,330	20,240	20,240

Water Shortage Contingency Plans and Critical Groundwater Basins

Urban water suppliers are required to maintain Water Shortage Contingency Plans customized to local conditions. These plans include a staged response to water shortages and droughts lasting up to three years. When implementing the stages of the Water Shortage Contingency Plan, the water supplier will require increasingly stringent reductions in water use.

EO 37-16 required DWR to strengthen the requirements for these plans, including, among other proposed changes, the creation of common standards for each stage in the plan, and extending the drought planning from three to five years. For smaller water suppliers and rural communities not required to maintain a Water

Shortage Contingency Plan, DWR works with counties to facilitate improved drought planning.

DWR has finalized these requirements in a Primer found at: Making Conservation a CA-Way-of-Life-Primer.

State agencies are to be aware of their water suppliers' Water Shortage Contingency Plan and the potential impact each stage may have on their water use. State agencies are to have their own contingency plans in place for their building and landscaping water use in order to respond to any stage implemented by the water supplier.

The Sustainable Groundwater Management Act (SGMA) established a new structure for managing California's groundwater resources at a local level by local agencies. SGMA required, by June 30, 2017, the formation of locally controlled groundwater sustainability agencies (GSAs) in the state's high- and medium-priority groundwater basins and subbasins (basins). A GSA is responsible for developing and implementing a groundwater sustainability plan (GSP) to meet the sustainability goal of the basin to ensure that it is operated within its sustainable yield, without causing undesirable results. For those facilities located in critical groundwater basins, State agencies are to work with the local GSA plan.

Table 4.10 summarizes the number of facilities with urban water shortage contingency plan and in critical groundwater basins. Four DWR facilities are within the San Joaquin Valley basin and DWR has implemented contingency plans for two of the facilities.

Table 4.10 Number of Buildings with Urban Water Shortage Contingency Plans and in Critical Groundwater Basins

Number of Buildings with Urban Water Shortage Contingency Plans	Number of Buildings in Critical Groundwater Basins	Total Amount of Water Used by Buildings in Critical Groundwater Basins (Gallons)
2	4	1,496,800

Building Inventories Summary

In 2010, DWR received federal funding under the American Recovery and Reinvestment Act (ARRA) to implement energy and water efficiency projects in four DWR SWP facilities. These projects primarily focused on energy efficiency upgrades involving lighting and HVAC units. No water-efficiency retrofit projects were undertaken at that time; however, DWR completed building walkthroughs and identified those water-related areas that need upgrades or retrofits. The results are in Table 4.11. DWR's Division of O&M will plan for potential upgrades utilizing existing maintenance funds. DWR is currently working on a plan to conduct water audits at all of its SWP Facilities to identify water efficiency and conservation improvement opportunities.

Table 4.11 Summary of Building Inventory that Needs Upgrade

Number of toilets to be replaced	90
Number of urinals to be replaced	5
Number of faucet aerators to be replaced	77
Number of showerheads to be replaced with 1.8 gallons	15
Number of clothes washers to be replaced	N/A
Number of garbage disposals to be replaced.	N/A
Number of pre-rinse valves to be replaced	N/A

Heating and Cooling Systems Inventories Summary

DWR has identified heating and cooling system documentation and maintenance procedures that are required, but not thoroughly practiced. Although DWR has trained staff and service contracts for third-party maintenance, the inventory information that was supposed to be in Table 4.12 is not centrally located or well documented. DWR plans to conduct on-site inspections to obtain detailed information on boiler and chiller inventory, personnel training, maintenance, and inspection criteria. At many sites, the current heating and cooling units are insufficient and at the end of their useful life. Upgrades and replacement of outdated equipment will be coordinated with the O&M Division, using existing maintenance funds or through additional funding programs.

Table 4.12 Summary of Boilers and Cooling Systems Inventory

Amount of Water Used for make-up (Gallons)	Number of flash tanks to purchase and install	Number of meters to purchase and install	Amount currently reused (Gallons)	Remaining additional water suitable for other purposes (Gallons)
Unknown	Unknown	Unknown	Unknown	Unknown

Irrigation Hardware Inventories Summary

Landscaping typically uses 50 percent or more of a site's total water use. If irrigation hardware is not properly installed and maintained, water waste will counteract DWR's landscape water-wise initiatives.

DWR conducted landscaping surveys and analyzed blueprints to determine landscape size, meter location, and watering zones. DWR also purchased a portable water meter to analyze and prioritize sub-meter locations at O&M facilities. DWR planned to implement the use of water sub-metering systems to monitor and assist in the development of water conservation efforts to achieve water savings and landscape usage reductions. However, through general water-use reduction efforts throughout its facilities, DWR already met the EO reduction goals and therefore has not yet followed through with irrigation hardware inventories or submetering installation projects. Currently DWR has prepared a roadmap for installing meters and submeters as necessary for measuring, monitoring, and reporting water use by occupants, irrigation, and process activities at the SWP O&M Facilities.

MWELO standards require flow sensing for landscapes greater than 5000 square feet. Flow sensors monitor the flow through an irrigation system and can alert a user to low- or high-flow conditions. To date, the number of flow sensors required for DWR landscapes is unknown. Table 4.13 summarizes irrigation hardware required at the San Joaquin Field Division O&M Center to comply with MWELO standards. To track irrigation water, DWR will need to install 45 submeters and over 280,000 drip emitters.

Replacing current landscaping with climate-appropriate landscaping is an ongoing task with budget, staff, and COVID constraints. The first step is to establish a water budget for the San Joaquin facility and ensure appropriate staff become EPA

WaterSense (or other equivalent) certified. To date, DWR has not conducted a comprehensive site survey at other facilities to document irrigation inventory but is developing a plan to do so.

Table 4.13 Summary of Irrigation Hardware Inventory

Number of separate meters or sub-meters needed	45
Number of irrigation controllers required with weather or soil moisture adjustment and flow sensing capabilities needed.	0
Number of backflow prevention devices needed.	0
Number of flow sensors to be purchased and installed	0
Number of automatic rain shut-off devices needed	0
Number of new pressure regulators needed.	0
Number of new hydrozones needed.	0
Number of new valves needed.	0
Number of filter assemblies needed.	0
Amount of drip irrigation needed (area covered)	283,419
Number of booster pumps needed	0
Number of rotary nozzles or other high efficiency nozzles needed	0

Living Landscape Inventory

Landscaping plays a critical role for public buildings and facilities by providing safety and security, reducing local heat islands, suppressing dust, reducing water runoff, maintaining soil health, aiding in water filtration, and recycling nutrients. Landscaping in public areas frequently surrounds historic places and public memorials as well as providing public gathering spaces. The health and proper maintenance of these landscapes is vital to the physical wellbeing of California's people as well as its social, cultural, political, and historical life.

Urban forests are vital to improving site conditions for occupants and visitors to the community. Large shade trees should be considered valuable infrastructure

and given priority over other plants. A voluntary urban forest plan is encouraged to assess individual trees and plan for additional tree plantings.

Table 4.14 details MWELO-compliant landscape and memorial sites maintained by DWR. There are eight facilities with landscape areas over 5,000 square feet. DWR converted a section of the Coalinga Operations and Maintenance Yard landscape into a memorial area following the fatalities of two DWR divers. As previously mentioned, the Delta and San Luis Maintenance yards completed a living landscape water efficiency project for MWELO compliance in 2014.

Table 4.14 Summary of Living Landscape Inventory

Landscape >500 Sq. Ft. (sq. ft.)	Turf (sq. ft.)	Number of historical sites or memorials	MWELO landscape area (sq. ft.)	Climate appropriate landscape area (sq. ft.)
559,029	261,830	1	20,240	20,240

Large landscape Water Use

Large landscape water use represents a significant percentage of a facility's water use, and water savings are achieved through better irrigation scheduling or inexpensive improvements in irrigation hardware. As part of DWR's Water Use Guidelines and Criteria, the water used for landscape areas over 20,000 square feet will be tracked through a water budget program. Landscape water budget is calculated based on landscape area, local climate factors, specific plant requirements, and irrigation system performance. The water budget establishes an efficient standard for the landscape area. Landscape water budget management services in California are available by landscape associations and private vendors. Large landscapes also require EPA WaterSense or Irrigation Association certified staff.

Table 4.15 summarizes DWR's large landscape facilities and their associated total water budget. DWR has six facilities with large landscapes totaling nearly 535,000 square feet. Water budgets for these facilities have not been calculated nor do these facilities have any personnel who are EPA WaterSense (or equivalent) certified. DWR plans to establish a water budget and certify staff as part of its efforts to conserve landscape water use.

Table 4.15 Summary of Large Landscape Inventory and Water Budget

Number of Sites with > 20,000 sq. ft. of Landscaping	Total Landscape Area all Facilities (sq. ft.)	Total Water Budget all Facilities	Total EPA WaterSense or Irrigation Association Certified Staff
6	534,899	Not Calculated	0

Table 4.16 summarizes living landscape projects completed by DWR with associated annual water and cost savings of 365,182 gallons and $615, respectively. The square footage of MWELO landscaping is 20,240 square feet and climate-appropriate landscape projects are 21,350 square feet.

Table 4.16 Summary of Completed Living Landscaping Water Efficiency Projects

Total of all Facilities	Estimated Annual Water Savings (Gallons)	Estimated Annual Cost Savings ($)	Sum of MWELO Landscape Installed (sq. ft.)	Sum of Climate Appropriate Landscape Installed (sq. ft.)
3	365,182	$615	20,240	21,350

Best Management Practices

Building Best Management Practices (BMP) are ongoing actions that establish and maintain building water-use efficiency. DGS, through Management Memo 14-02, requires State agencies to implement the following building BMPs.

Building Water Management BMPs

General Water Management

- Track monthly water use in Energy Star Portfolio Manager (ESPM), a federal database.
- Check leak indicator on water meter when water is not in use.

Leak Detection and Repair

- Perform monthly visual leak detection survey on all water fixtures:
  - Toilets.
  - Urinals.

- Faucets and aerators (install aerators or laminar flow devices if necessary).
- Showers.

DWR does not have facilities that include commercial kitchens or laundry amenities. DWR field personnel perform monthly visual leak detection surveys on all water use fixtures.

Building Heating and Cooling Systems BMPs

The BMPs in this section not only save water and energy but they also perform an important safety role. The meters, leak detection processes, and routine maintenance (following manufacturers' instructions) required by BMPs assure that costly repairs and accidents are avoided. As previously discussed, this is an area that needs improvement as documentation is scarce.

Landscaping Hardware Maintenance BMPs

Landscaping hardware BMPs include:

- Install check valves and swing joints and replace nozzles as needed.
- Install faucet timers for hose or hand irrigation.
- Install shut-off nozzles or quick-couplers for all hoses.

DWR Field Division personnel routinely inspect and maintain, as necessary, landscape hardware systems for leaks and proper function. Whenever a repair or replacement is required, it is done with energy efficient components.

Living Landscape BMPs

Landscaping is usually a function of building design and age and is designed to complement a building's appearance. Landscaping is also installed to build safety and security. DWR does not alter landscaping except when diseased plantings are removed. Typically, plants are replaced with the same species, regardless of climate appropriateness. This makes implementing drought protocols and water efficiency measures difficult.

Most DWR buildings are over 50 years old and reflect the landscaping practices of the time they were constructed. DWR's challenge is to transition these landscapes to newer water efficiency norms in a cost-effective manner. DWR plans to accomplish the following BMPs:

- Prioritize and assign value to plants within a landscape.
- During drought or other water shortages, give trees and large shrubs the highest priority for survival.
- Water trees and shrubs as needed.
- Refresh mulch as needed. All bare soil must be covered with a minimum of 3 inches of mulch.
- Adjust irrigation schedules for seasonal changes.
- Test irrigation systems monthly to check for leaks, misalignments, and other malfunctions. Repair faulty fixtures immediately with correct parts.
- Water early in the morning or in the evening when wind and evaporation are lowest.
- Prevent runoff. Ensure sprinklers are directing water to only landscape areas, avoiding hardscapes such as parking lots, sidewalks, or other paved areas.
- Utilize Water Use Classifications of Landscape Species (WUCOLS) to find plant water use requirements and only water landscapes according to the plant water needs.
- Install plant species native to the climate zone.
- Recycle and reuse water onsite.
- Incorporate plantings for pollinators.
- When planting new areas or replacing existing plants, add compost to the soil (entire planting areas, not just planting holes) at a rate of 4 cubic yards per 1000 square feet to a depth of 6 inches unless contradicted by a soil test.
- Fix leaks immediately.

Applying these BMPs and transitioning to water efficient landscaping requires expertise, time, and realistic budgets. DWR has the resources for training staff, but funding is an ongoing challenge. Implementing a master landscaping plan for

each facility will help DWR make better progress in complying with current and future legislation.

Monitoring, Reporting, and Compliance

DWR is responsible for monitoring water use and reporting baseline and annual water use for compliance with the water-use reduction targets. Water use is estimated at facilities that do not have water meters. All estimates and assumptions of water use are well documented. DWR is working on a plan to install water meters and submeters at its SWP facilities to accurately measure, monitor, and report water consumption by building occupants, process activities, and landscape irrigation.

CHAPTER 5 — GREEN OPERATIONS

Greenhouse Gas Emissions

State agencies are directed take actions to reduce entity-wide greenhouse gas (GHG) emissions by at least 10 percent by 2015 and 20 percent by 2020, as measured against a 2010 baseline. For many State agencies, this goal is achievable by maximizing building energy efficiency and reducing mobile sources such as fleet vehicles.

For DWR, the challenge is greater, as DWR owns and operates the SWP. The SWP delivers water to 29 water contractors in the state. These water contractors, in turn, sell water to their customers. The SWP supplies water to almost 27 million Californians and about a million acres of farmland. As described in this chapter, DWR uses the following strategies to meet the State's 20 percent reduction goal and the more aggressive goals of DWR's Climate Action Plan:

- Energy Efficiency.
- On-Site Renewable Energy.
- Purchased Renewable Energy.
- Fuel Efficient Vehicles.
- Zero Emission Vehicles.
- Biofuels.

Table 5.1a and Graph 5.1 detail DWR's GHG emissions beginning in 2010, the mandated baseline year to the latest verified reporting in 2018. In addition to emissions associated with retail energy use described in Chapter 3, Table 5.1 includes GHG emissions associated with wholesale energy that DWR purchased to operate the SWP, including energy from the Reid Gardner Power Station (RG4). Consequently, DWR's emissions related to purchased electricity and miscellaneous decrease after the RG4 contract expired in 2013. Note that DWR's emissions also fluctuate for various reasons, such as water demand and hydrology. To address this fluctuation, DWR's Climate Action Plan monitors DWR's emissions based on a five-year average.

The following are additional description of Table 5.1a:

- Natural gas includes Scope 1 natural gas for DWR and RG4.

- Vehicles include Scope 1 mobile diesel, mobile gasoline, mobile bulk gasoline, mobile combustion-CNG, and renewable diesel.
- Purchased Electricity includes Scope 2 retail and pump load.
- Miscellaneous emission includes Scope 1 emission from CO2 cylinders, propane, stationary diesel, SF6, acetylene, RG4 coal burned, RG4 fugitive emission, RG4 diesel, RG4 fire pump, and RG4 emergency generator.

Table 5.1a GHG Emissions since 2010

Vehicle Types	2010 Baseline	2015	2016	2017	2018	Percent Change since Baseline
Natural Gas	604	348	397	412	309	-49%
Vehicles	11,701	11,804	8,517	13,183	11,485	-2%
Purchased Electricity	1,626,730	437,681	575,589	838,669	510,597	-69%
Misc.	40,707	2,017	1,145	4,055	1,944	-95%
Total	1,679,742	451,850	585,648	856,319	524,335	-69%

Notes: *Purchased Electricity includes all the emission from RG4. **Miscellaneous includes SF6, welding gas, compressed natural gas, refrigerant, propane, and fire-protection system emissions.

The measures listed in DWR's Climate Action Plan will reduce annual GHG emissions in 2020 by over 1 million metric tons and by over 2.5 million metric tons in 2050. Table 5.1b lists DWR's Emission Reduction goals.

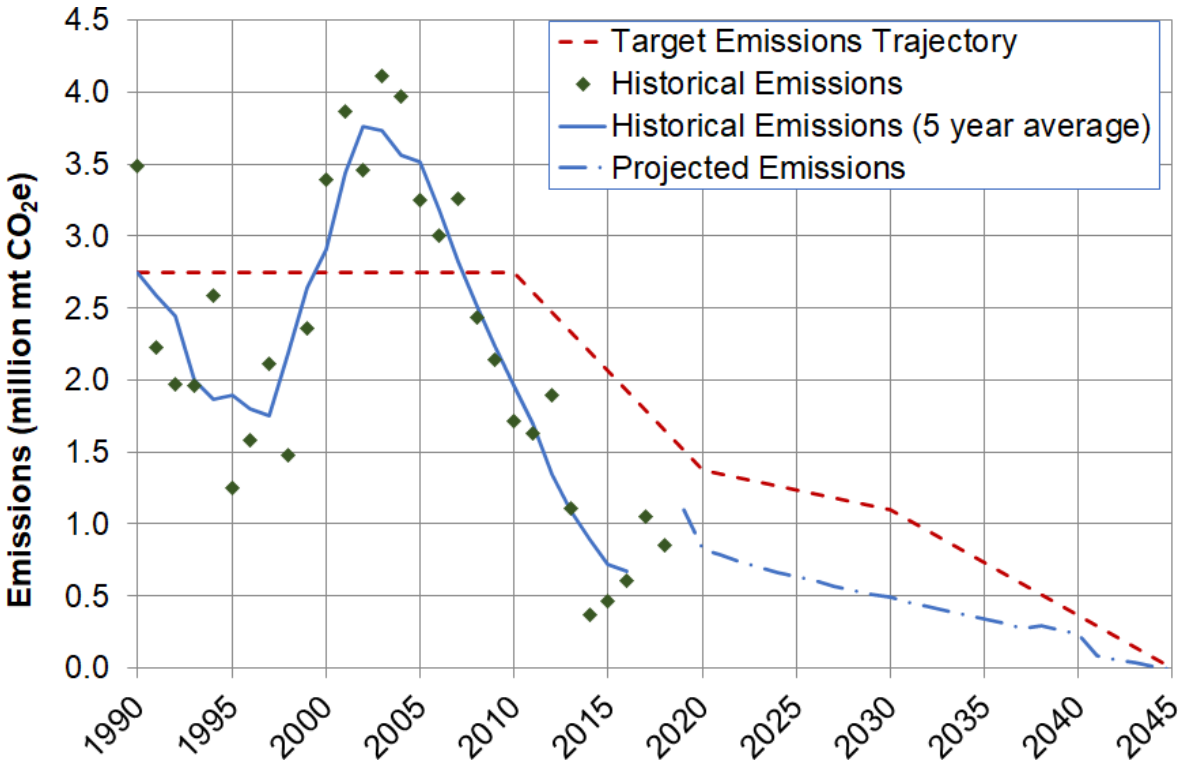
Table 5.1b DWR GHG Emissions Reduction Goals (mtCO2e)

Emission Source	1990 Baseline*	2014–2018 Average	2030	2045
Operations	2,692,000	536,508	461,500	0
Construction	28,200	115,751**	13,110	0
Maintenance & Business Practices	52,700	16,498	14,383	0
Total	2,746,000	668,758	488,993	0
% Reduction from 1990 Level	N/A	76%	82%	100%

Notes: * The 1990 baseline emission is the average of 1988–1992 emissions.

** Emission increased because of the Oroville Dam spillway repair in 2017 and 2018.

Figure 9 Historical & Projected Annual GHG Emissions (mtCO2e)



Strategy 1. Energy Efficiencies

SWP Energy Efficiency

DWR continues to implement a comprehensive plan to increase the energy efficiency of pumping and generating units throughout the SWP system, which can reduce energy use per unit of water delivered and increase clean energy generation per unit of water flow through turbines. This includes evaluating the performance of SWP pumps and electricity generating turbines to identify opportunities for increasing the efficiency of each individual unit.

Through state-of-the-art design, construction, and refurbishment methods, DWR strives to maintain and improve the first-in-class energy efficiency of each hydroelectric and pumping unit in the SWP system. As the rotating and stationary components of both pumps and generators wear during operation, clearances increase and result in a reduction in efficiency. Both annual maintenance and systematic refurbishment efforts help maintain energy efficiency at maximum levels throughout the lifetime of the equipment.

DWR completed energy efficiency improvements on six generating units at the Edward Hyatt Powerplant and four pump units at the A.D. Edmonston Pumping Plant in 2011. This effort increased the efficiency in each unit by as much as 6.5 percent, with several units reaching the 95 percent efficiency level. The combined energy savings of these improvements resulted in a reduction of 33,710 Metric tons of carbon dioxide equivalent (mtCO2e) per year (California Department of Water Resources 2010).

Edward Hyatt Powerplant Unit #1 is currently being refurbished, for the second time, adding a new turbine runner and thrust bearing that will increase efficiency, reliability, and operational availability, thus providing increased levels of energy generation. This unit previously experienced significant turbine blade cracking and downthrust issues that led to operational restrictions. The combined energy savings of these improvements will result in a reduction of 2,719 mtCO2e per year by 2021.

Restoration of the Thermalito Pumping-Generating Plant following fire damage has been underway since 2013, with the first unit coming online in August 2019. The project included a runner replacement for one Kaplan turbine unit and the refurbishment of three Francis turbine units. The new Kaplan runner has a guaranteed efficiency of 93 percent, an increase of 6.12 percent over the original unit, which will result in energy savings and a corresponding reduction of 971 mtCO2e per year by 2021. The three refurbished units will have their efficiency return to original equipment manufacturer levels; however, the GHG reduction associated with this refurbishment is not included in Table 5 based on the assumption that the cycle of performance degradation and return to original condition will continue in the future.

DWR also expects to implement several additional energy efficiency projects prior to 2030, including replacement of up to seven additional pumps at the A.D. Edmonston Pumping Plant has proposed new pumps that would reduce energy use of pumping operations by 71,414 MWh per year, resulting in an emissions reduction of around 11,349 mtCO2e per year by 2030.

The GHG emissions reduction includes only energy efficiency improvements to which DWR has already committed. Thus, this is a conservative estimate of the efficiency improvements planned between now and 2045.

Retail Energy Efficiency

As described in Chapter 3, DWR has completed 12 major energy efficiency projects at 10 facilities since 2010. These projects helped DWR reduce approximately 93 mtCO2e of GHG emissions annually. Note that this does not account for ongoing, extraordinary reconstruction work at Thermalito Pumping-Generating Plant, which added approximately 43 mtCO2e annually, but is now completed.

Strategy 2. On-Site Renewable Energy

Wholesale On-Site Renewable Energy

Over the past several years, DWR has conducted several surveys of its property, including land and waterways, to determine a given property's suitability to support the development of renewable energy generation. In 2015, DWR executed a contract to annually purchase approximately 28,000 MWh of solar energy from SunPower to construct, operate, and maintain a 9.5 MW solar facility on 70 acres of DWR-owned land adjacent to the Pearblossom Pumping Plant. This facility provides DWR with 28,000 MWh per year of solar energy through a 20-year power purchase agreement.

Figure 10 Solar panels producing renewable energy at the Pearblossom solar facility 2018

Retail On-Site Renewable Energy

DWR has been investigating on-site solar projects that interconnect with DWR's energy loads at facilities such as administration buildings, flood maintenance yards, O&M shops, and visitor centers. For example, DWR incorporated solar carports in its Southern Field Division's O&M center using Leadership in Energy and Environmental Design (LEED) standards. DWR has also identified several other locations described in Chapter 3.

Strategy 3. Purchased Renewable Energy

Most of DWR's GHG emissions are associated with energy purchased to operate the SWP. Consequently, DWR has created a Renewable Energy Procurement Plan (REPP) to replace energy from thermal and unspecified sources with renewable energy.

DWR structured the REPP to be more than adequate to meet the mid-term goal for 2030 while incrementally increasing procurement as the renewable energy market matures so that total operations emission is zero by 2045. Based on the average loads and resources from 2000 to 2018 and on forecasted power requirements, Table 5.2a shows progressively increasing renewable energy purchases. Thus, the energy purchased each year adds to the previous year's total, i.e., Year 1 = 36 GWh, Year 2 = 36 GWh + 36GWh from Year 1 = 72 GWh, Year 3 = 36 GWh + 72 GWh from Year 2 = 108 GWh, etc.

Actual procurement may occur in larger or smaller tranches and may not exactly follow the timing indicated in Table 6 because of market availability and the level of resources needed to meet GHG emissions reduction goals. Further, long-range projections indicate that DWR may not need to procure all 3,960 GWh of electricity per year to meet its long-term goal in 2045.

DWR will monitor emissions trends and modify the schedule for procurement of renewable energy as necessary to meet its mid-term and long-term goals.

Table 5.1c DWR Renewable Energy Procurement Plan

Period	Renewable Energy Annual Incremental Procurement Rate	End of Period Procurement Target Rate	End of Period Estimated Emissions Reduction Rate
2011–2020	36 GWh/Year	360 GWh/Year	83,999 mtCO2e /Year
2021–2025	72 GWh/Year	720 GWh/Year	141,211 mtCO2e /Year
2026–2030	72 GWh/Year	1,080 GWh/Year	171,633 mtCO2e /Year
2031–2035	108 GWh/Year	1,620 GWh/Year	197,176 mtCO2e /Year
2036–2040	180 GWh/Year	2,520 GWh/Year	212,958 mtCO2e /Year
2041–2045	288 GWh/Year	3,960 GWh/Year	187,313 mtCO2e /Year

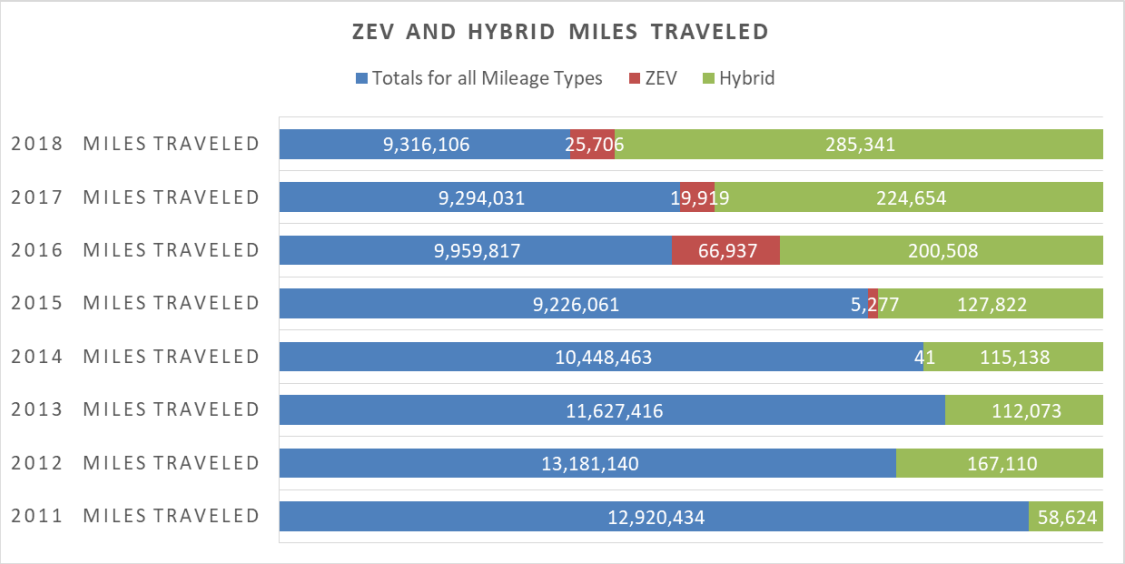
Note: GHG reduction rate increases as renewable procurements increasingly replace market resources. However, because market resources are projected to be cleaner in the future, the difference between renewable resources and market resources becomes smaller, and the REPP's emission reduction rate eventually decreases.

Since implementation of its REPP, DWR has executed contracts to procure renewable energy from multiple sources, including solar, hydroelectric, geothermal, and landfill gas. By the end of 2018, DWR has already met its 2020 REPP target, which was set in the 2012 Plan. Consistent with the REPP, Figure 3 shows the estimated average annual renewable energy from contracts that DWR has executed as well as pending and future contracts that DWR plans to execute. Note that the timing and amount of pending and future procurements are estimates.

Strategy 4. Fuel Efficient Vehicles

In 2017 and 2018, DWR employees averaged 9.5 million miles per year on work-related tasks. Most of these miles are in standard fuel vehicles rather than fuel-efficient vehicles. As discussed in Chapter 2, DWR has challenges in its use of fuel-efficient vehicles. However, since 2011, DWR has begun to purchase hybrid engine vehicles. In 2015, DWR also purchased its first all-electric vehicle or ZEV. Table 11 below details the number of miles traveled by both hybrids and ZEVs in comparison to all fossil-fuel miles traveled. Table 5.8 shows DWR's purchase strategy from 2017 to 2022, when DWR will have 30 ZEVS.

Figure 11 DWR's ZEV and Hybrid Vehicle Miles 2011-2018



Strategy 5. Zero Emission Vehicles

Despite DWR's challenges, Table 5.8 below shows that DWR is meeting the requirement for ZEV purchases. Of note is the fact that in 2016, when DWR had three ZEVs, the total miles traveled by ZEVs was 66,937 miles. Since then, mileage by ZEVs has dropped by nearly 50 percent. It is difficult to know what caused this reduction in usage, but employees need more education in the use of ZEVs.

Table 5.1d ZEV Additions to the Department Fleet by Fiscal Year

Vehicle Type	**17/18**	**18/19**	**19/20**	**20/21**	**21/22**
Battery Electric Vehicle	3	1	3	6	5
Plug-in Hybrid Vehicle	11	1	0	4	4
Fuel Cell Vehicle	0	0	0	0	0
Percent of total purchases	15%	20%	25%	30%	35%
Required ZEV Percentage	15%	20%	25%	30%	35%
Total number of ZEVs in Fleet	**14**	**16**	**19**	**25**	**30**

Strategy 6. Biofuels

As Table 5.1e reveals, the energy content, nitrogen oxide (NOx) content, cold flow properties, and lubricity of renewable diesel are equal to or better than diesel derived from fossil fuel. Table 5.1f shows that nearly 83 percent of DWR's diesel fuel in 2020 was renewable diesel, a 23 percent increase from the 50 percent purchased in the 2018 Roadmap.

Table 5.1e Comparison of Properties between Various Types of Diesel Fuel

Properties	Petrodiesel	Biodiesel	Renewable Diesel
Cetane #	40–55	50–65	75–90
Energy Density, MJ/kg	43	38	44
Density, g/ml	0.83–0.85	0.88	0.78
Energy Content, BTU/gal	129,000	118,000	123,000
Sulfur	< 10 ppm	< 5 ppm	< 10 ppm
NOx Emission	Baseline	+10	-10 to 0
Cloud Point, C	-5	20	-10
Oxidative Stability	Baseline	Poor	Excellent
Cold Flow Properties	Baseline	Poor	Excellent
Lubricity	Baseline	Excellent	Similar

Note: MJ/kg = megajoules per kilogram, g/ml = grams per milliliter, BTU/gal = British Thermal Units per gallon, ppm = parts per million, NOx = nitrous oxide, C = degrees Celsius.

Table 5.1f Total of all Types of Purchased Fuel and Cost 2020

Purchased Fuel Type	Quantity in Gallons	Cost ($)
Gasoline	766,561	$2,591,287
Diesel	40,533	$158,001
Renewable Diesel	199,288	$747,333
Total Gallons/Total Cost Gasoline gallon equivalent (GGE)	1,006,383	$3,496,622

Building Design and Construction

Executive Order B-18-12 requires that all new buildings, major renovation projects, and build-to-suit leases over 10,000 square feet shall obtain LEED Silver certification or higher. All new buildings under 10,000 square feet shall meet applicable CALGreen Tier 1 Measures. New buildings and major renovations greater than 5,000 square feet are also required certification after construction.

Table 5.2a New Constructions since July 1, 2012

Facility Name	LEED Certification Type & Level Achieved	Commissioning Performed (Yes/No)
Southern Field division Headquarters	LEED Platinum	Yes

State agencies shall implement mandatory measures and relevant and feasible voluntary measures of the California Green Building Standards Code (CALGreen), Part 11, related to indoor environmental quality (IEQ), that are in effect at the time of new construction or alteration and shall use adhesives, sealants, caulks, paints, coatings, and aerosol paints and coatings that meet the volatile organic compound (VOC) content limits specified in CALGreen.

DWR uses a very structured approach for planning new construction, consisting of pre-planning, budgeting, design, construction, and final acceptance. DWR incorporates the IEQ provisions outlined in the CALGreen Code in the building engineering design and contract specifications. As a result, these provisions are included as inspection acceptance criteria during each phase of the project, including design review, construction, and commissioning, helping to ensure the compliance of the outlined requirements.

LEED for Existing Buildings Operations and Maintenance

All State buildings over 50,000 square feet were required to complete LEED-Engineering Bill of Materials (EBOM) certification by December 31, 2015, and meet an Energy Star rating of 75 to the maximum cost-effective extent.

DWR does not have any buildings that meet these criteria.

Table 5.2b LEED for Existing Buildings and Operations

Number of Buildings over 50,000 sq. ft. and eligible for LEED EBOM	Number of Building over 50,000 sq. ft. that have achieved LEED EBOM	Percentage of buildings over 50,000 sq. ft. required to achieve LEED EBOM that have achieved it
0	0	0

Indoor Environmental Quality

When accomplishing alterations, modifications, and maintenance repairs and when relevant and feasible, State agencies shall implement the mandatory and voluntary measures of CALGreen, Part 11, related to indoor environmental quality.

Indoor environmental quality must be maintained using low emission furniture, cleaning products, and cleaning procedures.

New Construction and Renovation

DWR has developed purchasing requirements that use the IEQ-related voluntary measures from CALGreen in all building projects. Currently paints, coatings, carpet systems, flooring systems, and other building finishing materials are chosen using third-party certifications as well as understanding the planned utilization considering several criteria.

For instance, the product is reviewed to ensure VOC content is limited and the product is certified for intended application and safe for personnel. The requirements outlined in the CALGreen guidelines mirror many of the same requirements utilized by DWR; however, a more formal system can be incorporated by the Department's Division of Engineering (DOE) to comply with all CALGreen guidelines. CALGreen guidelines stipulate suggested products for meeting such requirements unless more stringent local limits on products can be applied, such as those presented by the South Coast Air Quality Management District regulations on air pollutants. The type of documentation utilized for the verification process for meeting standards includes methods already utilized by DWR. This includes manufacturers' product data sheets or on-site visits and could also be addressed in the engineering specifications.

Typically, DWR divisions work with DOE to verify that new design and construction projects meet CALGreen requirements. DOE does not review other smaller renovation projects such as replacing carpeting and windows. DOE relies on DWR employees to know the CALGreen requirements. A review of current projects revealed that DWR complies with CALGreen requirements. For example, the roofing materials and the sealants used for the 2017 roof replacements at the San Luis O&M Center comply with CALGreen specifications where applicable. DOE prepared and administered the roof replacement contract.

In 2018, both DOE and DWR's purchasing section developed and implemented training and procedures that met CALGreen standards and added this training to DWR's annual buyer training.

One of DWR's challenges is ensuring that all new construction and renovation projects include commissioning of all building systems, including those delivering the required amount of outside air. Since DWR is doing far more renovating and maintenance, HVAC maintenance and operation consists of keeping older systems running. Contracted services or field division staff perform the actual maintenance, depending on each field division's circumstances. However, DWR's existing designs

generally incorporate ventilation requirements, which include improvement of indoor air quality. One option for DWR is to include outdoor airflow monitoring systems in the design of a building. In addition, under DWR's GHG reduction plan, HVAC, refrigerant, and fire suppression equipment that do not contain Chlorofluorocarbons or Halons are utilized. As to the Minimum Efficiency Reporting Values (MERV) for air quality, utilizing the recommended air filters and providing proper maintenance assure compliance with these values. This requirement will be part of DWR's HVAC contract specifications.

For new construction, the construction inspector can determine compliance by simply checking the installed filters to verify the MERV rating. Indoor environmental quality is assured by such measures as removing absorbent materials from moisture, storing odorous materials off-site, and cleaning ducting on a regular basis. Testing for contaminants or indoor air quality is available to ensure levels do not exceed maximum allowable values. DWR will implement these measures through staff training and follow-up inspections and testing. DWR addressed these issues in 2018. DWR will develop a master contract for HVAC system operation and maintenance that incorporates an IEQ Construction Management Plan that meets CALGreen Sections A5.501.1–A5.504.2.

The last building constructed by DWR was its Southern Field Division Headquarters, which earned a LEED Platinum rating. As part of the LEED certification, DWR pursued Daylighting Credit 8.1, which maximized daylighting in the facility.

Figure 12 Daylighting in the Southern Field Division Headquarters Lobby

Furnishings

DWR purchases all furnishings from CALPIA through its purchasing contracts. There are occasions where DGS grants an exemption when the item is not available through CALPIA.

Cleaning Products

Cleaning products purchased through DWR's Business Services Office specify Green Seal products. However, not all DWR locations purchase cleaning supplies through the Business Services Office. In some locations, procurement of janitorial services and cleaning products occurs through janitorial services contracts. A review of those contracts revealed that a number of contracts did not specify Green Seal products. In the future, when a contract is renewed, DWR will include Green Seal products as part of the contract. In 2018, DWR instituted both a policy and a purchasing procedure for its Division of Operations and Maintenance headquarters that Green Seal products are used at all DWR locations. DWR's annual buyers' training now includes this requirement as well.

Cleaning Procedures

There is no data available for San Joaquin Field Division nor San Luis Field Division.

Oroville Field Division

Cleaning procedures in the field divisions vary. At the Oroville Field Division, a preliminary inspection of vacuum cleaners found that approximately half of the cleaners surveyed have the Green Seal. Currently, all of the surveyed vacuums are fully functional. Entryway maintenance meets CALGreen Section A5.504.5.1. A contract is in place with G&K Services (Contract # 4600011717), and on a weekly basis entryway mats are removed and replaced with clean/washed mats. The Oroville Field Division currently has two contracts with the Work Training Center (Contract #4600012011 and Contract #4600012012) which cover janitorial services at the O&M Yard (460 Glen Drive) and the other facilities throughout the Field Division. These contracts specify the frequency of cleaning, which most often is daily, and at a minimum occurs five times per week.

Southern Field Division

The Southern Field Division currently has a contract for janitorial services. The current contract does not specify Green Seal compliant procedures. The next time this contract is renewed, Green Seal cleaning procedures will be included as part of the requirements. At this time, the cleaning procedures meet Title 8 Section 3362.

Delta Field Division

For cleaning, Delta Field Division has two contracts, Arc San Joaquin and JLK Enterprises Inc. Both cleaning contracts require the use of cleaning products and equipment that meet all State, federal, County, and municipality requirements.

Division of Flood Maintenance

The current vacuum cleaners at the Division of Flood Maintenance do not have the Carpet and Rug Institute Seal of Approval. The Division will specify that future vacuum cleaners have the Seal of Approval. Most entryways are maintained per CALGreen Section A5.504.5.1. The Division will survey entryways and install CALGreen compliant entryways.

HVAC Operation

One of DWR's challenges is ensuring that all new construction and renovation projects include commissioning of all building systems, including delivering the required amount of outside air. Since DWR is doing far more renovating and maintenance than new construction, HVAC maintenance and operation consists of keeping older systems running. The actual maintenance work is done by contracted services or by field division staff, depending on each field division's circumstances. However, DWR's existing designs generally incorporate ventilation requirements that include improvement of indoor air quality. One option for DWR is to include outdoor airflow monitoring systems in the design of a building. In addition, under DWR's GHG reduction plan, HVAC, refrigerant, and fire suppression equipment that do not contain chlorofluorocarbons or halons are utilized. Further, by replacing HVAC systems with modern efficient systems that have time of use programming will also create an additional carbon and cost savings. DWR achieves compliance with the Minimum Efficiency Reporting Values (MERV) for air-quality by utilizing the recommended air filters and providing proper maintenance. This requirement will be part of DWR's HVAC contract specifications.

For new construction, the construction inspector determines if the proper filter is in place by simply checking the installed filters to verify the MERV rating. Measures such as removing absorbent materials from moisture, storing odorous materials off site, and cleaning ducting on a regular basis assure indoor environmental quality. Testing for contaminants or indoor air quality is available to ensure levels do not exceed maximum allowable values. DWR will implement these measures through staff training and follow-up inspections and testing. DWR addressed these issues in 2018. DWR will develop a master contract for HVAC system operation and maintenance that incorporates an IEQ Construction Management Plan that meets CALGreen Sections A5.501.1–A5.504.2.

Delta Field Division

HVAC — A maintenance Plan is in DWR's enterprise data system generates automatically each year and triggers HVAC Preventive Maintenance and Service to all Units and all services performed in accordance with manufacture recommendations. Other actions taken by the Delta Field Division to maintain HVAC are as follows:

- 2019 — Contractor cleans all buildings' duct work,
- 2019 — South Bay Pumping Plant Stage 2 HVAC upgrade/replacement.

- 2020 — Finished a contract to upgrade/replace five 25-ton HVAC units in Harvey O Banks Pumping Plant.
- 2020/2021 — Planner Scheduler Building HVAC unit underwent an upgrade/replacement, alleviating old cooling tower system.

Further HVAC units to be upgraded/replaced are planned for 2022, including the Plant Maintenance Building, the Warehouse Building and the Engineering Building. All of the above upgrades/replacements follow the latest California requirements for engineering and procurement.

Integrated Pest Management

Department staff and contracted pest management (CPM) companies will follow an integrated pest management (IPM) strategy that focuses on long-term prevention of pest problems through monitoring for pest presence, improving sanitation, and using physical barriers and other nonchemical practices. If nonchemical practices are ineffective, then Tier 3 pesticides are used, progressing to Tier 2 and then Tier 1 if necessary.

With the exception of the Delta Field Division, DWR does not contract for pest management at its facilities. Instead, pest-control management efforts occur at the field division level. DWR does not a have a formal IPM plan in place and the efforts vary among facilities. Some practices fall under structural pest control methods involving buildings. Some of the structural practices include:

- Conducting a check of the exterior and interior of buildings to de-web and clean approximately once a month or as needed.
- Sealing any obvious holes, cracks, or openings where pests could enter with mesh or wire screen.
- Performing regular cleanings of facilities to provide a sanitary environment to discourage pests.
- When absolutely needed mouse/rat bait (Talon G — rodenticide bait pack, mini pellets) and sticky board traps are placed in facilities and checked regularly by CPM staff.

For other DWR projects, restoration projects, and levee maintenance, DWR’s Field Divisions design, train staff, and utilize a written herbicide/pesticide program based on the Department’s pesticide regulation and best management practices. Field divisions utilize approved IPM practices before applying pesticide. Ninety-five

percent of all chemicals used at Department field divisions have a caution label, which is the lowest hazard rating available.

Prior to utilizing the pesticide program, DWR uses different IPM methods such as mowing, weed eating, livestock grazing, and burning where applicable.

The Delta Field Division's pest control contract is with Take Care Termite, a certified IPM company. All future pest-control contracts will include the IPM requirement.

Table 5.4 Pest Control Contracts

Pest Control Contractor	IPM Specified (Y/N)
Take Care Termite	Yes

Waste and Recycling Programs

California's Department of Resources Recycling and Recovery (Cal Recycle) brings together the State's recycling and waste management programs. State agencies must report their waste and recycling efforts by May 1 of each year, delineating the activities conducted during the prior calendar year.

Table 5.5a State Agency Reporting Center (SARC) Report on Total Waste per Capita

Per Capita Baseline	2019	2020	Total Waste 2019	Total Waste 2020	% Change from 2019/2020
8.30 lbs./capita	22.63 lbs./capita	0.50 lbs./capita	17,296.46 lbs.	674.16 lbs.	-96% lbs./capita

DWR, in DWR-owned facilities, did very well in its waste and recycling efforts for 2019/2020, exceeding the requirements with a 96 percent reduction in 2020. Part of this achievement can be attributed to DWR's "dumpster" award given annually to a Division of DWR that has the highest waste reduction percentage, along with other forms of recognition that help keep employees interested and engaged in waste reduction efforts. However, a significant reduction was a result of the Covid-19 pandemic and lower occupancy rates at DWR facilities.

In buildings owned by DGS or a private lessor, DWR staff work closely with the lessor and/or building managers to obtain internal receptacles and signage for the

disposal of food, paper, and trash, and to coordinate the collection of data for annual reporting. DWR continues to seek out methods to increase awareness in waste reduction by educating employees to use the proper receptacles and consider placing gently used items in the "Green Pastures" room for re-use. Staff requesting the purchase of furniture must check the DGS and DWR surplus storage. DWR is required to check with State surplus prior to any new purchases.

Recycling

Recycling is the practice of collecting and diverting materials from the waste stream for remanufacturing into new products, such as recycled-content paper. Other recycling efforts include such things as beverage containers, glass, plastics (#3–7), carpet, etc.

DWR's facilities management has supported efforts to have Information Technology (IT) and non-IT equipment recycled or repurposed rather than thrown away. They continue to seek out opportunities to reduce waste by donating materials to local schools and sending usable items to the DGS warehouse for repurposing or sale. They also take advantage of the recycling contract maintained by DGS for IT equipment so that it does not end up in a landfill.

Organics Recycling

State agencies must abide by AB1826, which requires that State agencies arrange for recycling services for the following types of organic material:

- Food waste.
- Green waste.
- Landscape and pruning waste.
- Nonhazardous wood waste.
- Food-soiled paper.

This new law requires that each State agency recycle organic material on or by the following dates, based on the amount of materials generated:

- Eight or more cubic yards of organic material per week — April 1, 2016.
- Four or more cubic yards of organic material per week — January 1, 2017.
- Four or more cubic yards of solid waste per week — January 1, 2019.

- Two or more cubic yards of solid waste per week if statewide disposal of organic waste is not decreased by half — January 1, 2020.

In all DWR service contracts which include waste removal or generation, it is required that the contractor report the method of waste removal and the weight of materials being removed. DWR places waste bins with signage identifying types of waste (food, paper, trash) to be disposed of throughout DWR buildings. Specifically, food waste bins are included in break rooms and cafeterias. In addition, DWR provides separate recycling and trash receptacles in all DWR facilities. Employees know to separate waste (ex: food waste vs. recycling vs. trash) by the signage included with all receptacles. Additionally, when available, language in the "Tenant Handbook" or building-wide guidance describes the recycling efforts available and describes each employee contribution to the recycling effort.

Currently, waste removal and janitorial service contracts for DWR-owned facilities (or DWR-leased facilities where the lessor does not regulate waste removal) adhere to DGS contracting and local government or county regulations. DWR aims to increase the recycled organic material goals stated above by looking for opportunities where janitorial and waste removal services can incorporate separate receptacles and disposal of organic waste. DWR does not provide janitorial or waste removal services for DGS-owned facilities and for some leased facilities where these services are included in the lease agreement.

Hazardous Waste Materials

The Division of Business Services, Facilities and Property Branch, uses a DGS-approved recycler for surplus IT equipment. DWR has created service contracts for items such as antifreeze, oil, batteries, biowaste, asbestos, and others that require the contractor to:

> "Assume ownership and responsibility of all materials collected and waste generated by their operation and be held responsible to ensure that all services will be performed in accordance with all applicable State, federal, and local regulations to include proper identification, handling, storage, and disposition of all solid and hazardous wastes."

Contractors are also required to provide routine reports on the amount of hazardous waste removed.

Material Exchange

These programs promote the exchange and reuse of unwanted or surplus materials from an agency. The exchange of surplus materials reduces the cost of materials/products for the receiving agency and results in the conservation of energy, raw resources, landfill space, and the reduction of greenhouse gas emissions, purchasing costs, and disposal costs.

The Division of Business Services supported efforts to have IT and non-IT equipment recycled or repurposed rather than thrown away. The DWR Green Pastures Re-Use Room is an office materials re-use program managed by BSO and is open to all DWR employees. The re-use room offers free gently used or surplus materials. The room reduces Departmental costs for new supplies and expands the opportunity for increased use of our used office supplies. For the 2019/2020 Fiscal Year, DWR put an estimated $7,400.00 in office supplies back into circulation. For the 2020/2021 Fiscal Year, an estimated $9,700.00 of supplies was put back into circulation. Furthermore, at the start of Fiscal year 2021/2022, as part of the move from the California Natural Resource Agency (CNRA) Headquarters at 1416 9th Street in Sacramento to the new CNRA HQ Building at 715 P Street in Sacramento, DWR coordinated a complete collection of office supplies for re-use, recycle, or donation. Here are the figures from that effort:

- Approximately 22 carts of office supplies moved to the Central Warehouse for reuse by the Department (approximate value of $55,000.00).
- Approximately 900 unused toners and copy machine parts moved to the Central Warehouse for reuse by the Department (approximate value of $65,000.00).
- Approximately 200 cubic yards of obsolete office supplies recycled, including 30 percent metal items, 25 percent plastic items, 30 percent binders, and 15 percent mixed use (primarily wood and plastic).
- DWR donated approximately 95 boxes of reusable office supplies to schools and donation stores.

Figure 13 DWR's Office Supply Re-Use Room

Waste Prevention/Reuse

Programs in this section support (a) waste prevention: actions or choices that reduce potential waste and prevent the generation of waste in the first place; and (b) reuse, using an object or material again, either for its original purpose or for a similar purpose, without significantly altering the physical form of the object or material.

The Division of Business Services, Facilities and Property Branch, has supported efforts to have IT and non-IT equipment recycled or repurposed rather than thrown away. DWR has established a process to redistribute used items internally, rather than disposing of them. Providing an easily accessible and well-organized storage location allows staff to obtain used items rather than buy new. DWR continues to seek out opportunities to reduce waste by donating used materials to local schools and sending usable items to the DGS warehouse for repurposing or sale. DWR also takes advantage of DGS's recycling contract for IT equipment, diverting these materials from the landfill.

Training and Education

Compliance with the State's goals for purchasing recycled content is an established ongoing priority. Policies in support of Recycled Content Products and Environmentally Preferred Purchasing (EPP) are both included in the Department Administrative Manual. DWR developed a guidance manual for DWR's Buy

Recycled Program. All training for DWR's buyers includes how to find EPP products and how to determine Post-Consumer Recycled Content (PCRC) of the products purchased as well as how to record that information in the Department's purchase order. DWR reviews and updates all Purchasing Services guidelines and materials to ensure that they are current. DWR regularly distributes "Going Green" articles to procurement staff to heighten awareness and to share best practices.

Environmentally Preferable Purchasing (EPP)

State agencies are required to purchase and use environmentally preferable products that have a reduced effect on human health and the environment when compared with competing goods that serve the same purpose. DGS tracks all State agencies' "EPP spend," which is the percentage of dollars spent on products that meet EPP requirements compared to the number of products available (Services 2019). Public Contract Code (PCC) (12153-12320) mandates the EPP goals for buying recycled-content products (RCPs). The goal of this effort is to increase purchases of RCPs. However, the EPP spend percentage is not available for 2020.

Reducing Impacts

The environmental impact of the goods we buy is often larger than the impact of our own Department's operations. DWR is committed to reducing the environmental impact of the goods and services it purchases.

Compliance with the State's goals for purchasing recycled content goods, reducing waste, recycling, and moving toward a more sustainable existence is an established ongoing priority for the Department. Policies in support of these initiatives are included in the Department Administrative Manual, and DWR provides a training manual for the Buy Recycled Program to all buyers. Periodic reviews of all Purchasing Services guidelines and materials ensure that they are current.

Fundamental challenges with achieving the 50 percent mandate in each reportable category persist. Category ratios continue to fluctuate because of the Department's ever-changing needs, and PCRC products with data available for reporting are difficult to identify because suppliers and manufacturers often indicate "unknown" when asked for certification status.

DGS' Buying Green website and EPP Purchasing Standards are under review for increased use in identifying vendor and product options in support of Cal Recycle's State Agency Buy Recycle Campaign (SABRC).

DWR is committed to buying goods and services that lessen impacts to public health, natural resources, economy, and environment.

DWR includes Exhibit C — General Terms and Conditions (GTC 04/2017) in all service contracts. Paragraph 9 of GTC 04/2017 reads as follows "9. RECYCLING CERTIFICATION: The Contractor shall certify in writing under penalty of perjury, the minimum, if not exact, percentage of post-consumer material as defined in the Public Contract Code Section 12200, in products, materials, goods, or supplies offered or sold to the State regardless of whether the product meets the requirements of Public Contract Code Section 12209. With respect to printer or duplication cartridges that comply with the requirements of Section 12156(e), the certification required by this subdivision shall specify that the cartridges so comply" (Pub. Contract Code Section12205).

Additionally, DWR includes Exhibit D — Special Terms and Conditions for Department of Water Resources (Exhibit D) in service contracts, when applicable. Paragraph 8 of Exhibit D reads as follows:

"8. REPORT OF RECYCLED CONTENT CERTIFICATION: In Accordance with Public Contract Code Sections12200-122217, et seq. and 12153-12156, et seq., the contractor must complete and return the form DWR 9557 Recycled Content Certification, for each required product to the Department at the conclusion of services specified in this contract. Form DWR 9557 is attached to this Exhibit and made part of this contract by this reference."

As referenced in Exhibit D, DWR also includes DWR 9557, Recycled Content Certification form in service contracts as Exhibit D, Attachment 1. Per Paragraph 8, contractors are required to submit a completed DWR 9557 directly to the appropriate DWR contract manager.

DWR is working to ensure goods and services bought meet the current DGS purchasing standards and specifications available from the Department of General Services Buying Green website. The Department will continue to follow the requirements listed above. Additionally, DWR will revise its contract provisions to ensure compliance with all elements of SCM Volume 1, sections 3.34 and 7.70.

DWR is committed to educating and ensuring purchases are EPP. Each product category below describes steps DWR has taken to ensure purchases are EPP.

Paint (i.e., master painters institute certified paint and recycled paint):

Requestor has specifications typically listed in the requisition long text or uses a material master. Edward Dunn is DWR's vendor for paint in a couple of field divisions. Their product conformance table and information for paint is available on the main website for Dunn-Edwards paint (https://www.dunnedwards.com/wp-content/uploads/2021/04/DE-product-conformance-table.pdf).

IT goods (energy star rated computers, monitors, and televisions meet DGS-52161505 Purchasing Standard or meet current specifications of statewide contracts):

- DWR uses DGS LPA's when purchasing IT goods. DGS obtains the Certification for EPP compliance. Equipment purchased outside of contracts require a DGS exemption.
- Mandatory contracts account for nearly all (80-90%) of DWR's IT items. As a result, those devices are EPEAT and Energy Star compliant.
- For items not acquired from statewide contracts, new solicitations include the EPP requirement.

Janitorial supplies, paper products (i.e., SABRC compliant and DGS_141117A Purchasing Standard Compliant):

- DWR leases the majority of its properties from DGS and private property management entities required to meet DGS property lease standards. Lessors are responsible for providing janitorial services and supplies used to service the facilities and meet this standard for service.
- Janitorial Supplies, paper products — Tissue purchased is 39 percent PCRC, paper towels are 100 percent PCRC, and toilet tissue jumbo roll are 40 percent PCRC.
- Janitorial Products and Cleaners — Whenever possible, DWR purchases janitorial products with the "Green" filter from Grainger, etc.

Desk Lamps (DGS-391115-A Purchasing Standard compliant):

- DWR has received rebates from Grainger/PG&E for buying energy reducing light bulbs. Most lighting purchased is LED which is energy star green certified.

Office equipment (i.e., EPEAT compliant and EnergyStar rated printers and copiers, and DGS_432121A Purchasing Standard compliant for high-end multifunctional devices):

- DWR uses DGS LPA's when purchasing office equipment. DGS obtains the Certification for EPP compliance. Equipment purchased outside of contracts requires a DGS exemption.
- Mandatory contracts account for nearly all (90 percent) of DWR's IT office equipment. As a result, those devices are EPEAT and Energy Star compliant. For items not acquired from statewide contracts, new solicitations include the EPP requirement.

Paper products (i.e., Sustainable Forestry Initiative certified, SABRC compliant copy paper, DGS-441200-A Purchasing Standard compliant):

- Copy paper is purchased through the DGS contract and all copy paper is 30 percent post-consumer recyclable. For all other paper not purchased via the contract, it is 30 percent PCRC.

Remanufactured toner cartridges (available from PIA, statewide contract ID/Number: 1-19-75-60):

- Toner cartridges use mandatory contract 1-19-75-60.

Measure and Report Progress

DWR plans to improve its procurement of recycled content goods. Plans include re-educating buyers in DWR's Division of Operations and Maintenance (O&M) because they function independently when purchasing goods and services. Many of their experienced buyers retired within the last two years, and the new buyers need time to develop the skills that ensure accurate reporting. This is significant because O&M purchases are a large component of the Department's total expenditure. A workshop on this topic will be conducted at the next annual DWR Buyers Conference.

Examples of strategies and plans that DWR has taken or will take to increase EPP are:

- Measure percent EPP spend in comparison to non-EPP spend.
- Incorporate EPP criteria in the goods and services the State buys.
- Embed sustainability roles and responsibilities into purchasing procedures.
- Because more than one Recycled Content Certification form has been in use, DWR hopes to achieve standardized documentation by using only the Cal Recycle report form.
- DWR is strengthening its efforts to gather certification for commodity purchases by ensuring that the certification form is included with all solicitations for price quotes. Additionally, DWR will consider how DWR can better address situations in which the vendor does not provide certification or certifies "unknown" content.
- Train buyers in the benefits of buying EPP products, how to apply EPP best practices, the importance of accuracy in recording buys within SCPRS and reporting labor separate from goods in service contracts, and listing EPP goods by line item.
- Continuously update DWR training materials used in the DWR Fundamentals of Commodity Procurement course to place greater emphasis on this topic.
- Engage and educate suppliers to offer EPP products when selling to the State.
- Continue to participate in the Sustainable Purchasing Leadership Council (SPLC) SPLC BENCHMARK Cohort Program benchmarks.

DWR's efforts to measure, monitor, report, and oversee progress to increase EPP include the following:

- DWR recently implemented a new data analytics system that can analyze purchasing data to identify areas where improvement may be possible.
- Strengthen efforts to gather certification information for commodity purchases. In addition to the certification form being included with all solicitations for price quotes, buyers are encouraged to search the manufacturer's website and seek out information from other buyers to address situations in which the vendor does not provide certification or certifies "unknown" content.

- Contractors are required to submit a completed DWR 9557 for each required product at the conclusion of services. Contractors return this form directly to the DWR Recycling Coordinator. DWR is evaluating these forms to redefine existing processes.

Table 5.5b State Agency Buy Recycled Campaign 2019/20 Performance

Product Category	Total SABRC Reportable Dollars	Total SABRC Compliant Dollars	% SABRC Compliant [(Column 3 / Column 2) * 100]
Antifreeze	19,176.27	2,512.48	13.10 %
Compost, Co-compost & Mulch	13,536.78	7,086.59	52.35 %
Glass Products	219,527.58	113,318.23	51.62 %
Lubricating Oils	478,246.26	181,189.87	37.89 %
Paint	236,692.92	12,954.79	5.47 %
Paper Products	467,855.42	296,418.82	63.36 %
Plastic Products	2,762,967.46	1,797,513.39	65.06 %
Printing and Writing Paper	181,575.34	144,667.94	79.67 %
Metal Products	23,108,514.57	21,211,558.61	91.79 %
Tire-derived Products	76,824.50	71,629.78	93.24 %
Tires	359590.90	0.00	0%
Total	$27,924,508.00	$23,838,850.50	85%

DWR is committed to reducing the environmental impact of the goods and services it purchases.

Compliance with the State's goals for purchasing recycled content goods, reducing waste, recycling, and moving toward a more sustainable existence is an established ongoing priority for the Department. Policies in support of these initiatives are included in the Department Administrative Manual, and DWR provides a training manual for DWR's Buy Recycled Program to all buyers. Periodic review of all Purchasing Services guidelines and materials ensures that they are current with all requirements.

DWR is working to ensure that purchased goods and services meet or exceed the current DGS purchasing standards and specifications available from the

Department of General Services Buying Green website. The Department will continue to follow the requirements listed above. Additionally, DWR will revise its purchasing practices to ensure all elements of the State Contracting Manual (SCM), volumes 1,2, 3, & F, are kept current.

Each product category below describes steps DWR has taken to ensure purchases are EPP.

Paint (i.e., master painters institute certified paint and recycled paint):

- DWR continues to use Edward Dunn as a vendor for recycled paint. DWR has made a significant increase of 15 percent in recycled paint purchases.

Paper products (i.e., Sustainable Forestry Initiative certified, SABRC compliant copy paper, DGS-441200-A Purchasing Standard compliant):

- Copier paper uses the DGS contract and all copier paper is 30 percent post-consumer recyclable. For all other paper not purchased via the contract, it is 30 percent PCRC.

IT goods (energy star rated computers, monitors, and televisions that meet the DGS-52161505 Purchasing Standard or the current specifications of Statewide contracts):

- DWR uses DGS limited partnership agreements (LPAs) when purchasing IT goods. DGS obtains the Certification for EPP compliance. Equipment purchased outside of contracts require a DGS exemption.
- Mandatory contracts account for nearly all (80–90 percent) IT items. As a result, those devices have been vetted under DGS Purchasing Department (PD) EPP purchasing guidelines and are Electronic Product Environmental Assessment Tool (EPEAT) and Energy Star compliant. For items not acquired from statewide contracts, all solicitations include the EPP requirement.

Janitorial supplies, paper products (i.e., SABRC compliant and DGS_141117A Purchasing Standard compliant):

- DWR leases the majority of properties from DGS and private property management entities that are required to meet DGS property lease standards. Lessors are responsible for providing the janitorial services and supplies used to service the facilities and meet this standard for service.

- Tissue purchased is 39 percent PCRC, paper towels are 100 percent PCRC, and toilet tissue jumbo rolls are 40 percent PCRC.

Janitorial supplies and cleaners (Eco Logo, Green Seal certified cleaners, DGS_471318A Purchasing Standard compliant):

- Janitorial Products and Cleaners — Whenever possible, janitorial products are purchased using the "Green" filter from Grainger, etc.

Additional EPP Purchases:

- Desk Lamps (DGS-391115-A Purchasing Standard compliant):
- DWR has received rebates from Grainger/PG&E for buying energy reducing light bulbs. Most lighting purchased is light-emitting diode (LED), which is Energy Star or Green certified.

Office equipment (i.e., EPEAT compliant and Energy Star rated for printers, copiers, and DGS_432121A Purchasing Standard compliant for high-end multifunctional devices):

- DWR uses DGS LPAs when purchasing office equipment. DGS obtains certification for EPP compliance. Equipment purchased outside of contracts requires a DGS exemption.
- Mandatory contracts account for nearly all (90 percent) IT office equipment (printers and copiers) items. As a result, those devices are EPEAT and Energy Star compliant devices. For items not acquired from statewide contracts, solicitations add the EPP requirement.

Remanufactured toner cartridges (available from Rasix, using the statewide contract ID/Number: 1-15-75-61):

- Toner cartridges use mandatory contract 1-19-75-60.

Table 5.6 Commodities categories with the Greatest Potential to Green

Commodity	2020 Total Spend ($)	2020 Percent EPP Spend (%)	EPP Target (%)
Paper Products	467,855.42	63%	75%
Plastic Products	276,2967.46	65%	75%

Sustainability Development and Education

DWR is strengthening its efforts to gather certification for commodity purchases to ensure that the certification form is included with all solicitations for price quotes. DWR is considering how to address situations in which the vendor does not provide certification or certifies "unknown" content. Additionally, because more than one Recycled Content Certification form has been in use, documentation standardizing is an issue. Standardization will improve with use of only the Cal Recycle report form. Future workshops and updated training materials will place greater emphasis on EPP to ensure improved compliance. Updated training materials used in the DWR's Fundamentals of Commodity Procurement course place greater emphasis on this topic.

DWR's efforts to promote the understanding and advancement of sustainable procurement internally and with external suppliers are as follows:

- DWR notifies bidders of EPP requirements within the following areas: construction contracts, service and transportation agreements, commodity purchases, grants, interagency agreements, and Architecture and Engineering (A&E) contracts.
- DWR is working to ensure contractors provide EPP goods and meet SABRC requirements in service contracts. Collaboration with Contracts Services to incorporate the Recycled Content Certification form with every services contract will improve these requirements. This will include working on a system to better capture that data for incorporation into the annual SABRC report.

DWR is researching ways to include more specialty staff dedicated to EPP. One outcome was to update duty statements for IT procurement staff to include compliance with EPP. The total number of employees assigned as buyers now equals 47.

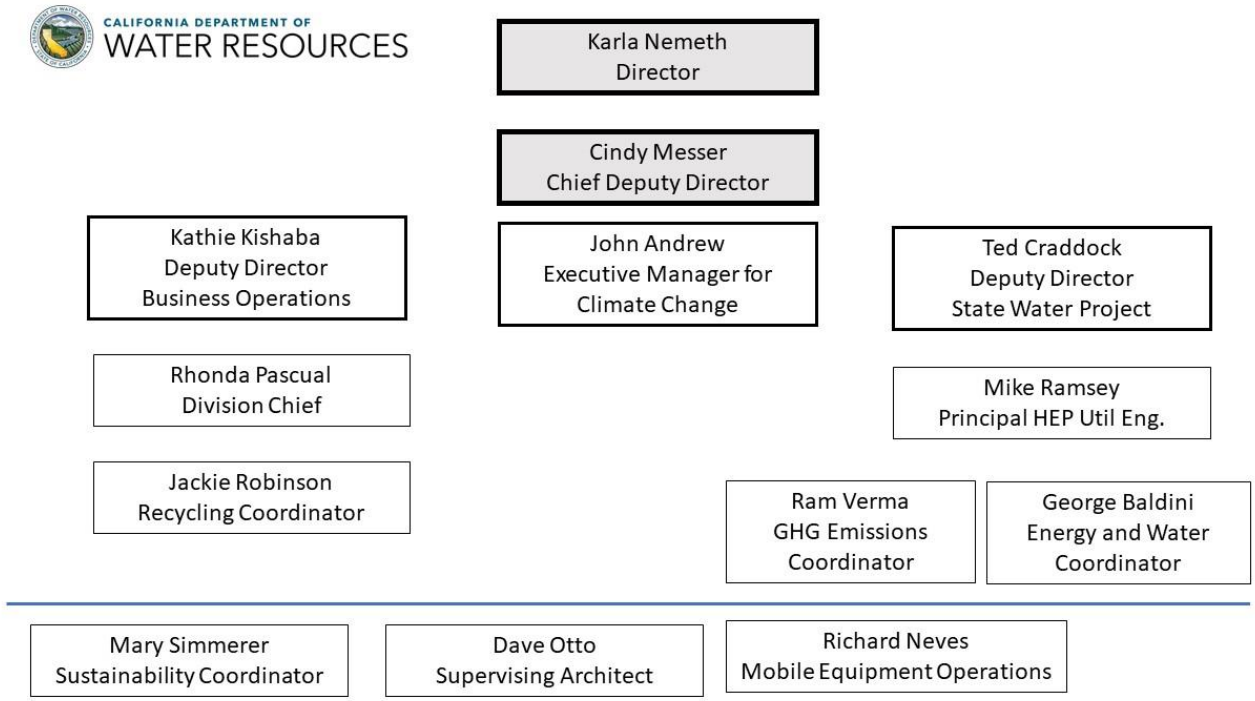
Table 5.7 Buyer Categories that have completed EPP Training

Position Classification	Total Number of Buyers	Percent Completing EPP Training	Commitment to have buyers complete EPP training
Associate Governmental Program Analyst	16	100%	100%
Associate Business Management Analyst	1	100%	100%

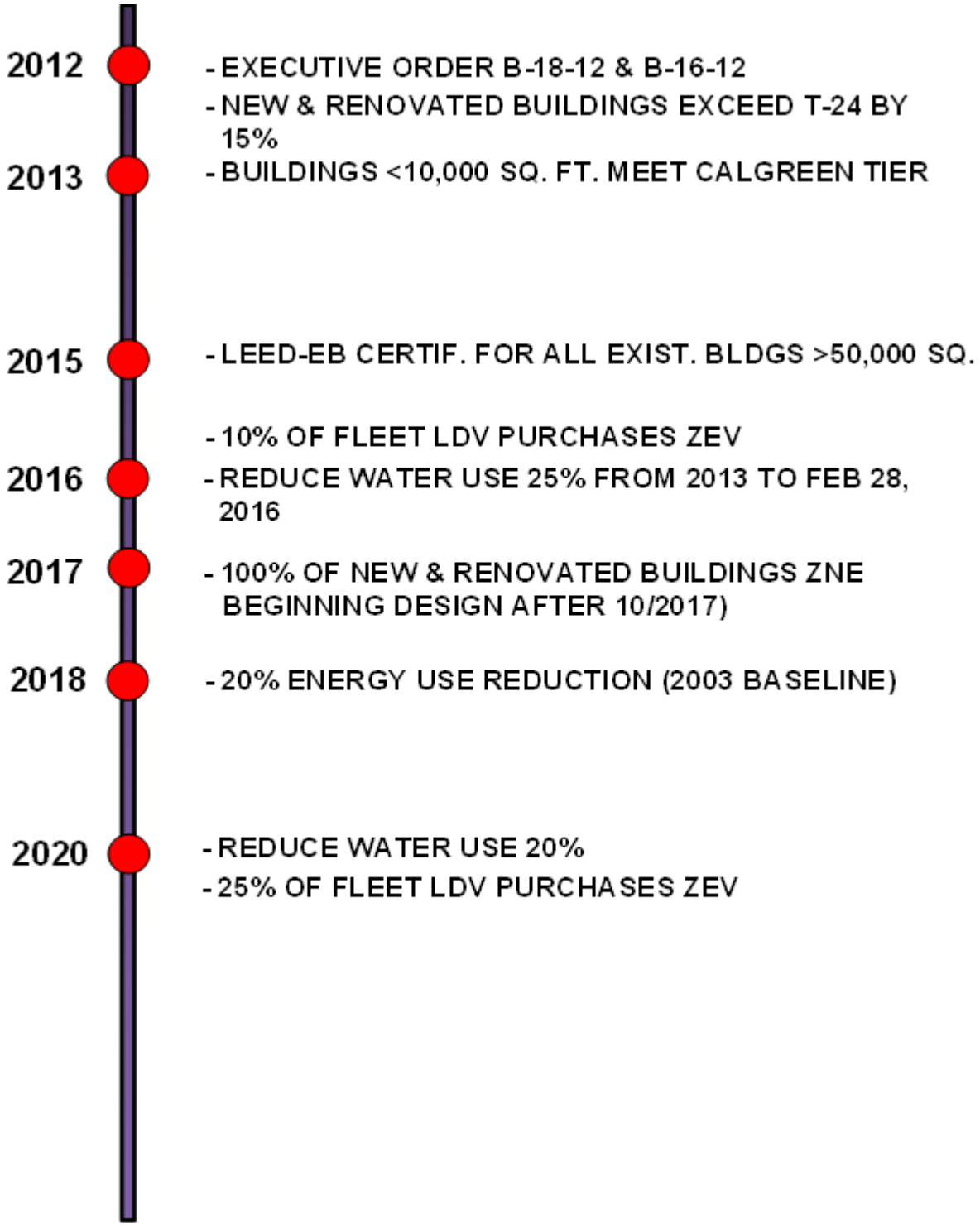
Position Classification	Total Number of Buyers	Percent Completing EPP Training	Commitment to have buyers complete EPP training
Associate Information Systems Analyst (Specialist)	2	100%	100%
Business Service Officer I (Specialist)	10	100%	100%
Business Services Assistant (Specialist)	2	100%	100%
Senior Information Systems Analyst (Supervisor)	1	100%	100%
Senior Engineer WR	1	100%	100%
Staff Information Systems Analyst (Specialist)	2	100%	100%
Staff Services Analyst (General)	9	100%	100%
Staff Services Manager I	1	100%	100%
Staff Services Manager II (Manager)	1	100%	100%
Water Resources Technician II	1	100%	100%
Total	47	100%	100%

Future workshops and updated training materials will place greater emphasis on EPP to ensure improved compliance. Updated training materials used in DWR's Fundamentals of Commodity Procurement course place greater emphasis on this topic.

Appendix A — Sustainability Leadership



Appendix B — Sustainability Milestones &Timeline



Appendix C – Roadmap Checklists

1 Climate Adaptation Roadmap Checklist

Policy References: Executive Order B-30-15

Executive Summary:

☐ Summary of status and actions underway to meet sustainability objectives related to climate adaptation.

☐ Include summary of changes from previous roadmap.

(This executive summary can be a paragraph in a single, comprehensive executive summary including all roadmap chapters if combined into one document.)

Past Performance:

☐ Describe how screening process will integrate facility operations and planning processes.

☐ Describe approach and steps taken to integrate climate considerations in planning and investment, and how this will address changes.

☐ Use Cal-Adapt to collect data and characterize anticipated climate change.

☐ Report Top 5 facilities most affected by changing temperature in Table 1.2a.

☐ Discuss how temperature and extreme heat events affect your facilities and operations, and what facilities and regions are most affected.

☐ Describe strategies to reduce impacts of changing temperatures.

☐ Describe ways you could employ natural infrastructure to reduce risks of climate change.

☐ Report facilities located in disadvantaged communities in Table 1.5 and discuss how these facilities can interact with the community or serve as a resource.

☐ Report facilities located in urban heat islands in Table 1.4.

☐ Describe whether these facilities have large parking lots or impervious surface.

☐ Describe actions that can be or are being taken to reduce urban heat island affect at these facilities.

Future Planning:

☒ Report five facilities that will experience the largest increase in extreme heat events in Table 1.1.

☐ List facilities most impacted by projected changes in precipitation in Table 1.5, and describe strategies to reduce these impacts.

☐ Identify facilities at risk from rising sea levels in Table 1.6.

☐ Discuss actions that can be taken to minimize risks of sea-level rise.

☐ List facility climate risks in Table 1.10.

☐ Identify new facilities anticipating future extreme heat events in Table 1.10.

☐ Discuss how new facilities siting, design, construction, and operation are accounting for these changing conditions.

☐ Report new facilities and disadvantaged communities and urban heat islands in Table 1.11.

☐ Describe how climate change will affect the useful life of each planned facility.

☐ Verify the integration of a Climate Change Plan into department planning in Table 1.12.

☐ Verify the engagement and planning processes in Table 1.13.

☐ Report if climate change is integrated into funding programs in Table 1.14.

☐ Describe what climate impacts are of most concern to your facilities and plans, and how the Department will track how they are changing.

☐ Describe which office or branch will develop a policy to integrate climate change into infrastructure, how it will prioritize, and when the policy will be completed.

Appendix D: 2020 (Mega) Wildfire Season

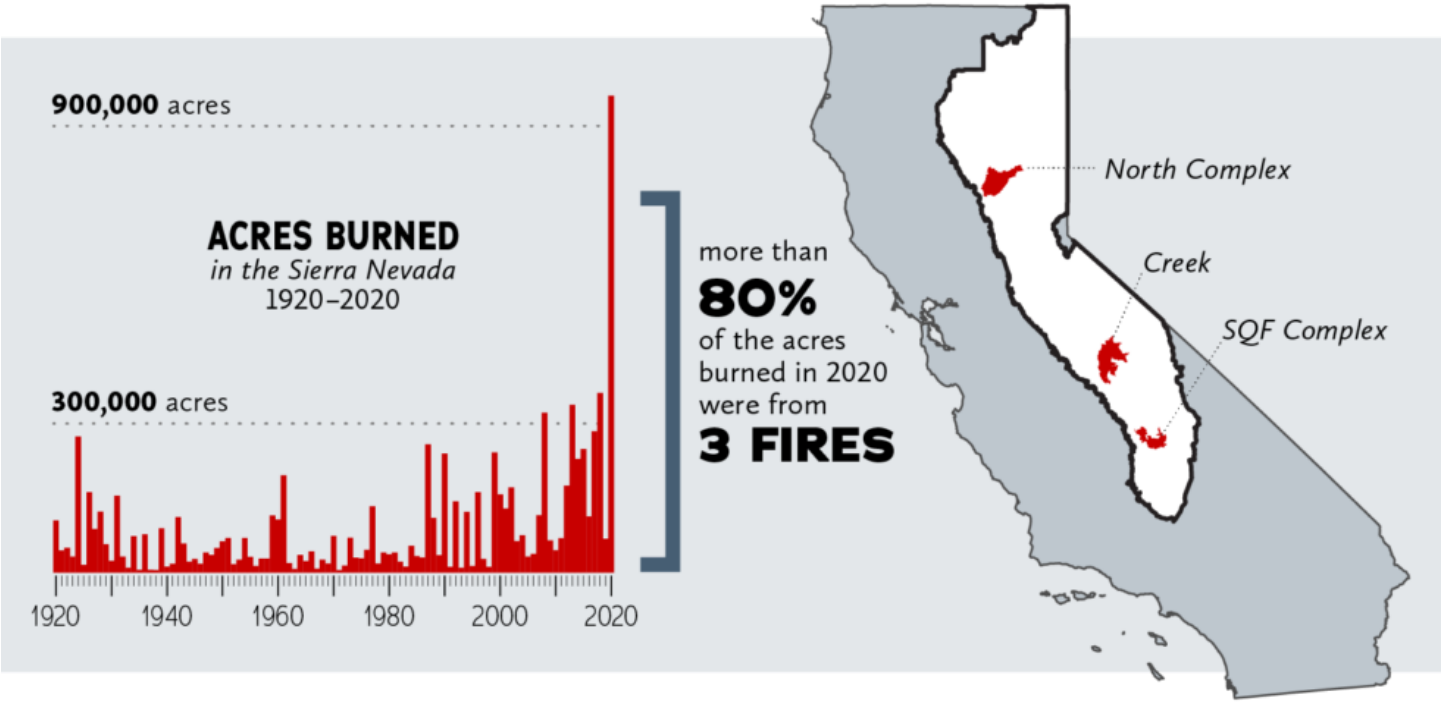
Mar 24, 2021 | SIERRA NEVADA UPDATES

Nearly half of the 2020 Creek Fire, the largest in the modern history of the Sierra Nevada, burned at high severity. The amount, size, and arrangement of high-severity fire in 2020 appears to be unlike anything the region has experienced in the past.

A record-breaking year in 3 fires

Almost one million acres burned in the Sierra Nevada in 2020, which is more than double the previous record set in 2018. Although the amount of fire grabs headlines, more concerning is the type and distribution of these fires. The Creek, North Complex, and SQF fires were three of the five largest Sierra Nevada fires in the last 100 years, and each fire left behind large areas where all, or nearly all, vegetation was killed.

Historically, hundreds of thousands of acres burned in the Sierra Nevada in a normal year, but they were spread across the landscape in many smaller fires, not concentrated in a few megafires like in 2020.



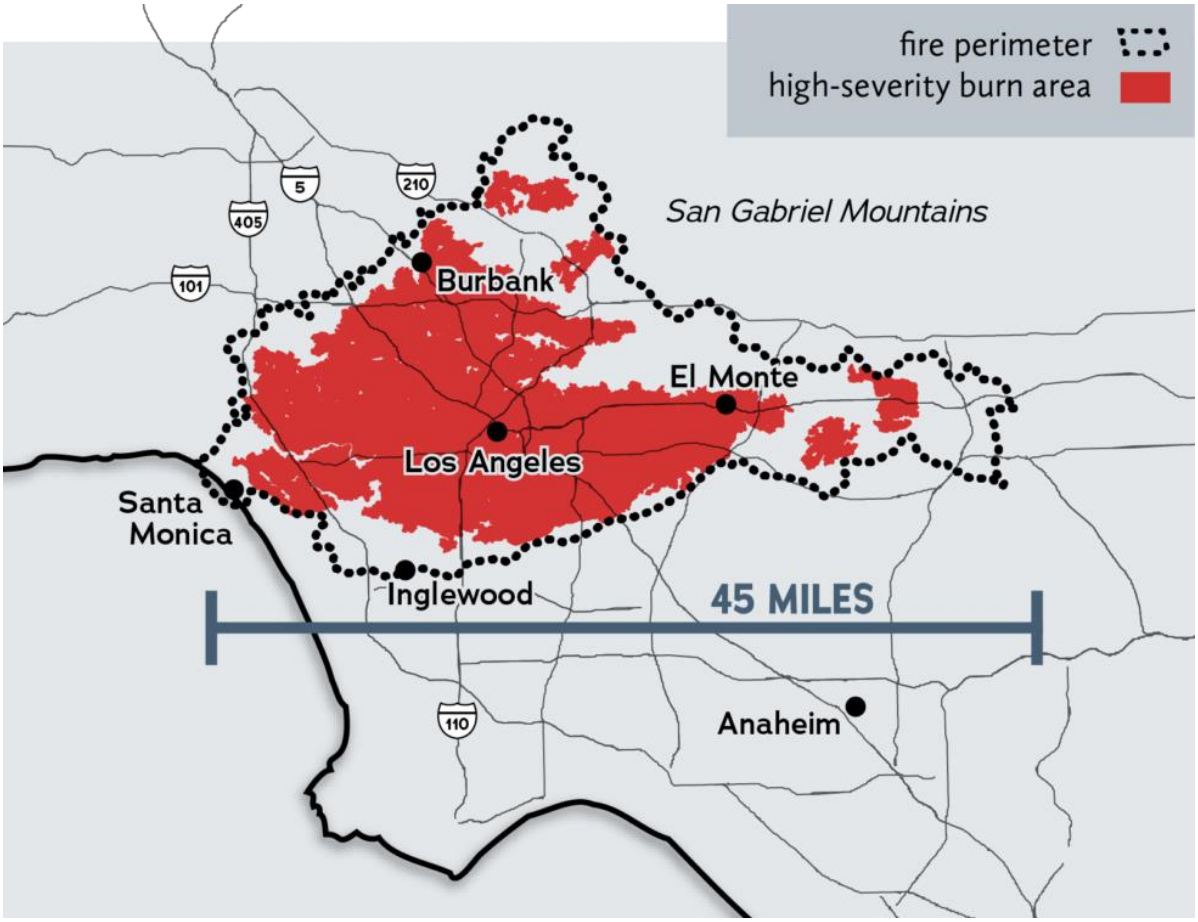
The wrong kind of high-severity fire

The scientific literature describing fire regimes in the Sierra Nevada's mixed conifer forests refers to high-severity burn ***patches***, relatively small areas within a mosaic of fire effects where all, or nearly all, vegetation is killed.

This vocabulary is inadequate to describe what transpired in 2020. Instead, the intensity with which these large 2020 fires burned created high-severity burn ***landscapes***. The amount, size, and arrangement of high-severity fire in the region appears to be unlike anything the region has experienced in the past.

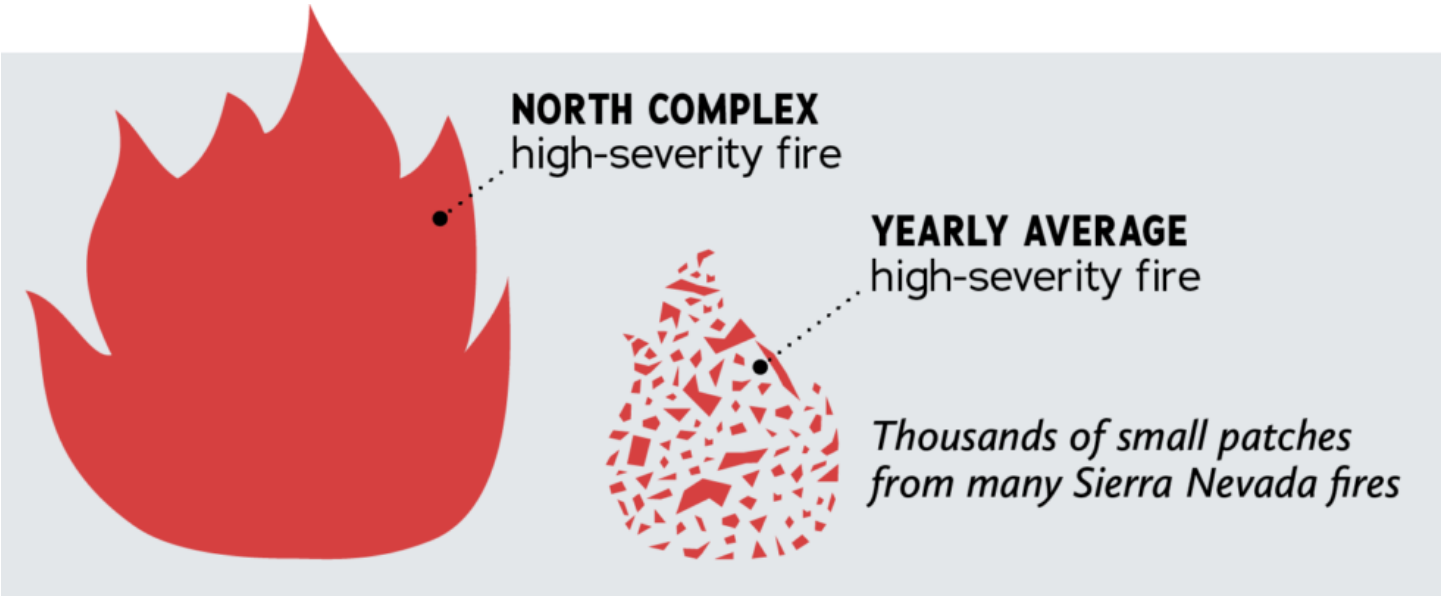
North Complex Fire overlayed on Los Angeles

The 2020 North Complex Fire, near Lake Oroville, burned over 170,000 acres at high severity. This area is bigger than downtown L.A. and neighboring cities.



North Complex Fire *Quadruples* Yearly Historical Average

The North Complex Fire's high-severity burn landscape is unlike anything the Sierra Nevada has experienced. This one fire's high- severity burn area is four times larger than the average area burned at high severity from all Sierra Nevada fires ***during an entire year***. *(Note: the average area burned is based on a healthy, historical fire regime that predated European settlement)*.



Historically, fires burned small areas ("patches") at high-severity that were mixed among other small patches of low and moderate severity. The North Complex Fire did not burn like historical fires — it burned a single high-severity landscape.

Appendix E — Fire Season Impacts

The North Complex Fire was one of three megafires in the Sierra Nevada in 2020. The Creek and SQF Complex Fires also burned large landscapes at high severity in mixed conifer forests.

These megafires affected communities up and down the Sierra Nevada. Sixteen lives were lost, and more than 3,500 homes and businesses were destroyed, including most of the town of Berry Creek.

Berry Creek, California.

The size and severity of these megafires also caused:

- Megasmoke across California.
- California's forest carbon to go up in smoke risks for California's water supply.

A Giant (Sequoia) Loss

The SQF Complex Fire killed hundreds, if not thousands, of old-growth Giant Sequoias that had survived countless smaller, less severe fires. The tragic loss of these ancient trees highlights how fires of this type

degrade, rather than renew, Sierra Nevada forests along with the habitat, carbon storage, and water security benefits they provide.

Photos: Curtis Kvamme, U.S. Forest Service.

The destruction of the 2020 fire season was neither uniform nor completely random. In places where public and private partners had already completed work to improve forest health, fires appeared to burn in less dangerous and destructive ways. Read more about our work through the Sierra Nevada Watershed Improvement Program in our 2020 Annual Report.

2 - Zero-Emission Vehicle Roadmap Checklist

Policy References: EO B-18-12, EO B-16-12, 2016 ZEV Action Plan

Executive Summary:

☐ Summary of status and actions underway to meet sustainability objectives related to fleet operations and Zero Emission Vehicles.

☐ Include summary of changes from previous roadmap.

(This executive summary can be a paragraph in a single, comprehensive executive summary including all roadmap chapters if combined into one document, signed by the department executive director.)

Department Fleet Status:

☐ Describe fleet composition and uses.

☐ Edit Graph 2.1 to reflect Department fleet vehicle composition.

☐ Edit Graph 2.2 to reflect Department light duty vehicle fleet composition.

☐ Edit Graph 2.3 to reflect Department medium and heavy duty vehicle fleet composition.

Past Performance:

☐ Report all prior year Total Purchased Fuel in Table 2.1.

☐ Describe any successes or challenges encountered by your department as it seeks to incorporate ZEVs into its portfolio.

☐ Report on department light duty fleet eligible for replacement in Table 2.2.

☐ Report recent and planned light duty ZEV fleet additions in Table 2.3.

☐ Report on facilities with parking and whether hosting fleet vehicles & modify Graph 2.2 to reflect this.

Future Planning:

☐ Identify facilities with the most urgent need for EV charging in Table 2.4.

☐ Describe Department's engagement with utility and other funding programs for EVSE's and infrastructure.

☐ List any hydrogen fueling stations that could serve as any primary refueling stations for fleet vehicles and any plans to install hydrogen refueling infrastructure at Department facilities.

☐ List site and infrastructure assessment results for ZEV parking in Table 2.5.

☐ Describe plan to design, bid, construct and activate EVSE infrastructure.

☐ Describe department's operation plan for EVSE infrastructure and how it will collect and report EVSE use data and maintain equipment.

☐ Identify department stakeholders for ZEVs and EVSE efforts in Appendix.

3 - Energy Efficiency Roadmap Checklist

Policy References: EO B-18-12, MM 14-07, MM 14-09, MM 15-04, MM 15-06, MM 17-04

Executive Summary:

☐ Summary of status and actions underway to meet sustainability objectives related to energy use and efficiency.

☐ Include summary of changes from previous roadmap.

(This executive summary can be a paragraph in a single, comprehensive executive summary including all roadmap chapters if combined into one document, signed by the department executive director.)

Department Energy Status:

☐ Describe mission of your department.

☐ Describe built infrastructure supporting department mission that consumes energy (electricity, natural gas, propane, etc.). Include number and total square footage of department facilities.

☐ Complete summary of actions and timeframes to meet requirements (can be bullet points).

Past Performance:

☐ Report 2020 Total Purchased Energy in Table 3.1.

☐ List department properties with largest energy consumption in Table 3.2.

☐ Describe any successes or challenges encountered by your department and solutions as it seeks to achieve energy efficiency.

☐ Identify specific challenges to achieving ZNE, T-24+15 percent, reducing grid-based energy, demand response, renewable energy, or monitoring-based commissioning.

☐ Describe department's 5-year capital improvement program.

☐ List department zero net energy buildings in Table 3.3 and department's plans to achieve ZNE at 50% of building portfolio area.

☐ Report department-wide energy trends in Table 3.5.

☐ Report yearly energy surveys in Table 3.7.

☐ Discuss energy survey status and efforts over past 5 years.

Future Planning:

☐ Describe efforts to reduce plug loads and comply with energy standard operating procedures.

☐ List status of new buildings exceeding Title 24 by 15% in Table 3.4, and describe strategy for ensuring this minimum level of efficiency in the future.

☐ Identify department energy projects in Table 3.6.

☐ Identify department demand response in Table 3.8.

☐ Describe demand response programs available, positive or negative experiences or lessons learned, and department benefits for participation.

☐ Discuss steps department is taking to implement DR in more buildings.

☐ Identify department on-site renewable energy in Table 3.9.

☐ Discuss proposed increases in on-site renewable energy.

☐ Report department planned Monitoring-Based Commissioning (MBCx) projects in Table 3.10.

☐ Summarize department's MBCx experience, challenges, successes, and whether MBCx is incorporated as required, or plans to implement.

☐ Discuss how energy efficiency Best Management Practices have been implemented, how they were institutionalized, and quantify repairs and replacements with estimated energy savings, if possible.

☐ Describe department steps to finance energy goals and requirements, and what programs it is using.

4 - Water Efficiency and Conservation Roadmap Checklist

Policy References: Executive Order B-37-16

Executive Summary:

☐ Summary of status and actions underway to meet sustainability objectives related to water efficiency and conversation.

☐ Include summary of changes from previous roadmap.

(This executive summary can be a paragraph in a single, comprehensive executive summary including all roadmap chapters if combined into one document.)

Past Performance:

☐ Describe built infrastructure supporting department mission that consumes purchased water. Include number and total square footage of department facilities.

☐ Report all 2020 Total Purchased Water in Table 4.1.

☐ List department properties with largest water use per capita in Table 4.2.

☐ List facilities with largest landscape areas in Table 4.3.

☐ Describe any successes or challenges encountered by your department, and solutions as it seeks to achieve water efficiency and conservation.

☐ Report department=wide water use trends in Table 4.4.

☐ Report total water reductions achieved in Table 4.5.

☐ Describe major water efficiency project over past five years or underway.

☐ Identify indoor water efficiency projects in Table 4.6.

☐ Identify boilers and cooling systems projects in Table 4.7.

☐ Identify landscaping hardware water efficiency projects in Table 4.8.

☐ Identify living landscaping water efficiency projects in Table 4.9.

Future Planning:

☐ Report the number of buildings with urban water shortage contingency plans and in critical groundwater basins in Table 4.10, and discuss steps to reduce water use in those facilities.

☐ Identify building inventory interior fixture needs in Table 4.11.

☐ Summarize water using boilers and cooling systems inventory in Table 4.12.

☐ Identify irrigation hardware inventory in Table 4.13 and discuss how replacements will occur.

☐ Identify living landscape inventory in Table 4.14 and discuss results.

☐ Identify large landscape inventory and water budget, as well as certified staff in Table 4.15.

☐ Discuss how water conservation Best Management Practices have been implemented, how they were institutionalized, and quantify repairs and replacements with estimated water savings, if possible.

5 - Green Operations Roadmap Checklist

Policy References: Executive Order B-18-12

Executive Summary:

☐ Summary of status and actions underway to meet sustainability objectives related to green operations.

☐ Include summary of changes from previous roadmap.

(This executive summary can be a paragraph in a single, comprehensive executive summary including all roadmap chapters if combined into one document.)

Past Performance:

☐ Report GHG Emissions since 2010 in Table 5.1 and update Graph 5.1 to reflect department emissions trend.

☐ Describe any successes or challenges encountered by your department as it seeks to achieve GHG Emission reductions, and how various strategies contribute.

☐ Explain which actions your department has taken that had the largest impact on GHGe.

☐ Identify newly constructed buildings since July 1, 2012 and LEED level achievement in Table 5.2 and list number of buildings eligible as well as have achieved LEED for Existing Buildings and Operations in Table 5.3.

☐ Report State agency buy recycled campaign 2016 performance in Table 5.5 and describe your department's efforts to increase green commodities.

☐ Report the lowest smart location score leases in Table 5.9 and describe the department's measures to improve location efficiency scores.

Future Commitment:

☐ Discuss how your department implements efficiency measures to meet Energy Star targets and to achieve LEED EBOM for buildings >50,000 sw. ft. Describe steps to achieve these and goal dates.

☐ Discuss the steps taken to ensure new construction incorporates the IEQ provisions of CalGreen, and ensures IEQ is considered and incorporated into products, cleaning, and HVAC operation.

☐ Identify pest control contracts in Table 5.4 and discuss the steps taken to incorporate IPM into all contracts and practices.

☐ Describe department efforts to reduce waste and recycle.

☐ Describe department efforts to reduce environmental impacts through purchases of goods and services.

☐ Identify commodities categories with the greatest potential to green in Table 5.6 and describe your department's efforts to increase green commodities.

☐ List buyers who have completed EPP Training in Table 5.7 and discuss available training and certifications buyers may have beyond the basic training courses.

☐ List new leases and their smart location scores in Table 5.8 and describe the department's measures to improve location efficiency scores.

☐ Describe how you will achieve greener operations and how many GHGe reductions your department will need to achieve its goal.

Appendix F — Acronyms

AB	Assembly Bill
ADR	Automated Demand Response
AMB	Asset Management Branch (at DGS)
BMP	Best management practices
CA	California
CALGREEN	California Green Building Code (Title 24, Part 11)
CEC	California Energy Commission
DGS	Department of General Services
DWR	Department of Water Resources
EHT	Extreme heat threshold
EMS	Energy management system (aka EMCS)
EMCS	Energy management control system (aka EMS)
EO	Executive Order
EPP	Environmentally preferable purchasing
ESCO	Energy service company
ESPM	Energy Star Portfolio Manager
ETS	Enterprise Technology Solutions (a division at DGS)
EUI	Energy use intensity (source kBTU/sq. ft.)

EVSE	Electric vehicle supply equipment (charging equipment)
FMD	Facilities Management Division (a division at DGS)
GCM	Global circulation model
GGE	Gasoline Gallon Equivalent
GHG	Greenhouse gas
GHGe	Greenhouse gas emissions
GSP	Groundwater Sustainability Plan
GVWR	Gross Vehicle Weight Ratio
IEQ	Indoor environmental quality
kBTU	Thousand British thermal units (unit of energy)
LCM	The Landscape Coefficient Method
LEED	Leadership in Energy and Environmental Design
MAWA	Maximum applied water allowance
MM	Management Memo
MWELO	Model Water Efficient Landscape Ordinance
O & M	Operations and Maintenance (a branch inside of SWP at DWR)
OBAS	Office of Business and Acquisition Services (at DGS)
OBF	On-bill financing
OFAM	Office of Fleet and Asset Management (at DGS)

OS	Office of Sustainability (at DGS)
PMDB	Project Management and Development Branch (at DGS)
PPA	Power purchase agreement
PUE	Power usage effectiveness
RCP	Representative Concentration Pathway
SABRC	State Agency Buy Recycled Campaign
SAM	State Administrative Manual
SWP	State Water Project
SB	Senate Bill
SCM	State Contracting Manual
SGA	Sustainable groundwater agency
SGMA	Sustainable Groundwater Management Act
SWP	State Water Project (a division at DWR and an infrastructure project)
UFRW	Upper Feather River Watershed
WMC	Water management coordinator
WUCOLS	Water Use Classifications of Landscape Species
VA	Vulnerability Assessment
ZEV	Zero-emission vehicle
ZNE	Zero net energy

Appendix G — Glossary

Backflow — Is the undesirable reversal of the flow of water or mixtures of water and other undesirable substances from any source (such as used water, industrial fluids, gasses, or any substance other than the intended potable water) into the distribution pipes of the potable water system.

Backflow prevention device — A device that prevents contaminants from entering the potable water system in the event of backpressure or back siphonage.

Blowdown — Is the periodic or continuous removal of water from a boiler to remove accumulated dissolved solids and/or sludge. Proper control of blowdown is critical to boiler operation. Insufficient blowdown may lead to deposits or carryover. Excessive blowdown wastes water, energy, and chemicals.

Compost — Compost is the product resulting from the controlled biological decomposition of organic material from a feedstock into a stable, humus-like product that has many environmental benefits. Composting is a natural process that is managed to optimize the conditions for decomposing microbes to thrive. This generally involves providing air and moisture, and achieving sufficient temperatures to ensure weed seeds, invasive pests, and pathogens are destroyed. A wide range of material (feedstock) may be composted, such as yard trimmings, wood chips, vegetable scraps, paper products, manures and biosolids. Compost may be applied to the top of the soil or incorporated into the soil (tilling).

Critical overdraft — A condition in which significantly more water has been taken out of a groundwater basin than has been put in, either by natural recharge or by recharging basins. Critical overdraft leads to various undesirable conditions such as ground subsidence and saltwater intrusion.

Ecosystem services — Are the direct and indirect contributions of ecosystems to human well-being. They support directly or indirectly our survival and quality of life. Ecosystem services can be categorized in four main types:

1. Provisioning services are the products obtained from ecosystems such as food, fresh water, wood, fiber, genetic resources and medicines.

2. Regulating services are the benefits obtained from the regulation of ecosystem processes such as climate regulation, natural hazard regulation, water purification and waste management, pollination or pest control.
3. Habitat services provide living places for all species and maintain the viability of gene-pools.
4. Cultural services include non-material benefits such as spiritual enrichment, intellectual development, recreation and aesthetic values.

Grass cycling — Refers to an aerobic (requires air) method of handling grass clippings by leaving them on the lawn when mowing. Because grass consists largely of water (80 percent or more), contains little lignin and has high nitrogen content, grass clippings easily break down during an aerobic process. Grass cycling returns the decomposed clippings to the soil within one to two weeks acting primarily as a fertilizer supplement and, to a much smaller degree, mulch. Grass cycling can provide 15 to 20 percent or more of a lawn's yearly nitrogen requirements.

Hydrozone — Is a portion of a landscaped area having plants with similar water needs that are served by one irrigation valve or set of valves with the same schedule.

Landscape Coefficient Method (LCM) — Describes a method of estimating irrigation needs of landscape plantings in California. It is intended as a guide for landscape professionals.

Landscape Water Budget — Is the calculated irrigation requirement of a landscape based on landscape area, local climate factors, specific plant requirements and the irrigation system performance.

Model Water Efficient Landscape Ordinance (MWELO) — The Water Conservation in Landscaping Act was signed into law on September 29, 1990. The premise was that landscape design, installation, and maintenance can and should be water efficient. Some of the provisions specified in the statute included plant selection and groupings of plants based on water needs and climatic, geological, or topographical conditions, efficient irrigation systems, practices that foster long term water conservation and routine repair and maintenance of irrigation systems. DWR adopted the Model Ordinance in June of 1992. One

element of the Model Ordinance was a landscape water budget. In the water budget approach, a Maximum Applied Water Allowance (MAWA) was established based on the landscape area and the climate where the landscape is located. The latest update to MWELO was in 2015. MWELO applies to all state agencies' landscaping.

Mulch — Mulch is a layer of material applied on top of soil. Examples of material that can be used as mulch include wood chips, grass clippings, leaves, straw, cardboard, newspaper, rocks, and even shredded tires. Benefits of applying mulch include reducing erosion and weeds and increasing water retention and soil vitality. Whenever possible, look for mulch that has been through a sanitization process to kill weed seeds and pests.

Trickle flow — A device that allows users to reduce flow to a trickle while using soap and shampoo. When the device is switched off, the flow is reinstated with the temperature and pressure resumes to previous settings.

Sprinkler system backflow prevention devices — Are devices to prevent contaminants from entering water supplies. These devices connect to the sprinkler system and are an important safety feature. They are required by the California Plumbing Code.

Submeter — A metering device installed to measure water use in a specific area or for a specific purpose. Also known as dedicated meters, landscape submeters are effective for separating landscape water use from interior water use, evaluating the landscape water budget and for leak detection within the irrigation system.

Water Budget — A landscape water budget is the calculated irrigation requirement of a landscape based on landscape area, local climate factors, specific plant requirements and the irrigation system performance.

Water-energy nexus — Water and energy are often managed separately despite the important links between the two. 12 percent of California's energy use is related to water use with nearly 10 percent being used at the end water use. Water is used in the production of nearly every major energy source. Likewise, energy is used in multiple ways and at multiple steps in

water delivery and treatment systems as well as wastewater collection and treatment.

Water Shortage Contingency Plans — Each urban water purveyor serving more than 3,000 connections or 3,000 acre-feet of water annually must have an Urban Water Shortage Contingency Plan (Water Shortage Plan) which details how a community would react to a reduction in water supply of up to 50 percent for droughts lasting up to three years.

Appendix H — Department Stakeholders

List individuals, offices, and divisions responsible for leading efforts related to each initiative identified in this report. Include their respective titles, roles, responsibilities.

Climate Change Adaptation

Understanding Climate Risk at Existing Facilities	
Climate Change	Title, role, responsibilities, managers, etc. John Andrew, Executive Manager for Climate Change

Understanding Climate Risk at Planned Facilities	
Climate Change	Title, role, responsibilities, managers, etc. John Andrew, Executive Manager for Climate Change

Integrating Climate Change into Department Planning and Funding Programs	
Climate Change	Title, role, responsibilities, managers, etc. John Andrew, Executive Manager for Climate Change

Measuring and Tracking Progress	
Climate Change	Title, role, responsibilities, managers, etc. John Andrew, Executive Manager for Climate Change

Zero Emission Vehicles

Incorporating ZEVs Into the Department Fleet	
Fleet Management Branch	Title, role, responsibilities, managers, etc. Robert Neves, Manager, Mobil Equipment Operations

Telematics	
Fleet Management Branch	Title, role, responsibilities, managers, etc. Robert Neves, Manager, Mobil Equipment Operations

Public Safety Exemption	
Fleet Management Branch	Title, role, responsibilities, managers, etc. Robert Neves, Manager, Mobil Equipment Operations

Outside Funding Sources for ZEV Infrastructure	
Fleet Management Branch	Title, role, responsibilities, managers, etc. Robert Neves, Manager, Mobil Equipment Operations

Hydrogen Fueling Infrastructure	
Fleet Management Branch	Title, role, responsibilities, managers, etc. Robert Neves, Manager, Mobil Equipment Operations

Comprehensive Facility Site and Infrastructure Assessments	
Fleet Management Branch	Title, role, responsibilities, managers, etc. Robert Neves, Manager, Mobil Equipment Operations

EVSE Construction Plan	
Fleet Management Branch	Title, role, responsibilities, managers, etc. Robert Neves, Manager, Mobil Equipment Operations

EVSE Operation	
Fleet Management Branch	Title, role, responsibilities, managers, etc. Robert Neves, Manager, Mobil Equipment Operations

Energy

Zero Net Energy (ZNE)	
Water and Efficiency Unit	Title, role, responsibilities, managers, etc. George Baldini, Manager, Water and Energy Efficiency Branch

New Construction Exceeds Title 24 by 15%	
Water and Efficiency Unit	Title, role, responsibilities, managers, etc. George Baldini, Manager, Water and Energy Efficiency Unit

Reduce Grid-Based Energy Purchased by 20% by 2018	
Water and Efficiency Unit	Title, role, responsibilities, managers, etc. George Baldini, Manager, Water and Energy Efficiency Unit

Server Room Energy Use	
Division of Technology Services	Title, role, responsibilities, managers, etc. Tim Garza, Chief Information Officer

Demand Response	
Water and Efficiency Unit	Title, role, responsibilities, managers, etc. George Baldini, Manager, Water and Energy Efficiency Unit

Renewable Energy	
Water and Efficiency Unit	Title, role, responsibilities, managers, etc. George Baldini, Manager, Water and Energy Efficiency Unit

Monitoring Based Commissioning (MBCx)	
Capital Outlay and Sustainable Business Practices	Title, role, responsibilities, managers, etc. Dave Otto, Supervising Architect

Financing	
Water and Efficiency Unit	Title, role, responsibilities, managers, etc. George Baldini, Manager, Water and Energy Efficiency Unit

Water Efficiency and Conservation

Indoor Water Efficiency Projects In Progress First initiative	
Water and Efficiency Unit	Title, role, responsibilities, managers, etc. George Baldini, Manager, Water and Energy Efficiency Unit

Boilers and Cooling Systems Projects In Progress	
Water and Efficiency Unit	Title, role, responsibilities, managers, etc. George Baldini, Manager, Water and Energy Efficiency Unit

Landscaping Hardware Water Efficiency Projects In Progress	
Water and Efficiency Unit	Title, role, responsibilities, managers, etc. George Baldini, Manager, Water and Energy Efficiency Unit

Living Landscaping Water Efficiency Projects In Progress	
Water and Efficiency Unit	Title, role, responsibilities, managers, etc. George Baldini, Manager, Water and Energy Efficiency Unit

Buildings with Urban Water Shortage Contingency Plans In Progress	
Water and Efficiency Unit	Title, role, responsibilities, managers, etc. George Baldini, Manager, Water and Energy Efficiency Unit

Green Operations

Greenhouse Gas Emissions	
Climate Change	Title, role, responsibilities, managers, etc. John Andrew, Executive Manager for Climate Change

Building Design and Construction	
Capital Outlay and Sustainable Business Practices	Title, role, responsibilities, managers, etc. Dave Otto, Supervising Architect

LEED for Existing Buildings Operations and Maintenance	
Capital Outlay and Sustainable Business Practices	Title, role, responsibilities, managers, etc. Dave Otto, Supervising Architect

Indoor Environmental Quality	
Facility and Properties Branch And O&M Field Divisions	Title, role, responsibilities, managers, etc. Susan Lemmon, Branch Manager, Facilities and Property Branch; Mark Hafner, Manager, Oroville Field Division; Pardeep Singh, Delta Field Division; Steven Nichols, Chief, Southern Field Division; Joel Quintero, Manager, San Joaquin Field Division; and, Rob Dunlop, Manager, San Luis Field Division.

Integrated Pest Management	
Facility and Properties Branch And O&M Field Divisions	Title, role, responsibilities, managers, etc. Susan Lemmon, Branch Manager, Facilities and Property Branch; Mark Hafner, Manager, Oroville Field Division; Pardeep Singh, Delta Field Division; Steven Nichols, Chief, Southern Field Division; Joel Quintero, Manager, San Joaquin Field Division; and Rob Dunlop, Manager, San Luis Field Division.

Waste Management and Recycling	
Business Services Office	Title, role, responsibilities, managers, etc. Rhonda Pascual, Manager, Business Services

Environmentally Preferable Purchasing	
Business Services Office	Title, role, responsibilities, managers, etc. Rhonda Pascual, Manager, Business Services

Location Efficiency	
Business Services Office	Title, role, responsibilities, managers, etc. Rhonda Pascual, Manager, Business Services

Appendix I — Sustainability Requirements & Goals

Governor Edmund G. Brown Jr. directed California State agencies to demonstrate sustainable operations and to lead the way by implementing sustainability policies set by the State. Additionally, enacted legislation includes sustainability-related requirements of State facilities and operations. Specific references and background on executive orders, legislation, management memos, and other requirements or actions are included in five general chapters within this roadmap, as follows:

- Climate change adaptation.
- Zero-emission vehicles.
- Energy.
- Water efficiency and conservation.
- Green operations.

These general sustainability initiatives include the following:

- GHG emissions reductions.
- Climate change adaptation.
- Building energy efficiency and conservation.
- Indoor environmental quality (IEQ).
- Water efficiency and conservation.
- Monitoring-based Building Commissioning (MBCx).
- Environmentally preferable purchasing (EPP).
- Financing for sustainability.
- Zero-emission vehicle (ZEV) fleet purchases.
- Electric vehicle charging infrastructure.
- Monitoring and executive oversight.
- Zero Net Energy (ZNE).

Appendix J — Sustainability Background References

The following executive orders, Management Memos, legislative actions, resources and guidance documents provide the sustainability criteria, requirements, and targets tracked and reported herein.

Executive Orders

The governor issued the following executive order relevant to chapters of this roadmap:

Executive Order B-16-12

- EO B-16-12 directs State agencies to integrate zero-emission vehicles (ZEVs) into the State vehicle fleet. It also directs State agencies to develop the infrastructure to support increased public and private sector use of ZEVs. Specifically, it directs State agencies replacing fleet vehicles to replace at least 10 percent with ZEVs, and by 2020 to ensure at least 25 percent of replacement fleet vehicles are ZEVs.

Executive Order B-18-12

- EO B-18-12 and the companion Green Building Action Plan require State agencies to reduce the environmental impacts of State operations by reducing greenhouse gas emissions, managing energy and water use, improving indoor air quality, generating on-site renewable energy when feasible, implementing environmentally preferable purchasing, and developing the infrastructure for electric vehicle charging stations at State facilities. The Green Building Action Plan also established two oversight groups — the staff-level Sustainability Working Group and the executive-level Sustainability Task Force — to ensure these measures are met. Agencies annually report current energy and water use into the Energy Star Portfolio Manager (ESPM).

Executive Order B-29-15

- EO B-29-15 directs State agencies to take actions in response to the ongoing drought and to the state of emergency resulting from severe drought conditions proclaimed on January 17, 2014. Governor Brown

directed numerous State agencies to develop new programs and regulations to mitigate the effects of the drought, and required increased enforcement of water waste statewide. Agencies were instructed to reduce potable urban water use by 25 percent between 2013 and February 28, 2016.

Executive Order B-30-15

- In 2015, the governor issued EO B-30-15, which declared climate change to be a "threat to the well-being, public health, natural resources, economy and environment of California." It established a new interim statewide GHG emission reduction target of 40 percent below 1990 levels by 2030 and reaffirms California's intent to reduce GHG emissions to 80 percent below 1990 levels by 2050. To support these goals, this order requires numerous State agencies to develop plans and programs to reduce emissions. It also directs State agencies to take climate change into account in their planning and investment decisions and employ life-cycle cost accounting to evaluate and compare infrastructure investments and alternatives. State agencies are directed to prioritize investments that both build climate preparedness and reduce GHG emissions, prioritize natural infrastructure, and protect the state's most vulnerable populations.

Executive Order B-37-16

- EO B-37-16 builds on what were formerly temporary statewide emergency water restrictions in order to establish longer-term water conservation measures, including permanent monthly water use reporting; new permanent water use standards in California communities; and bans on clearly wasteful practices such as hosing off sidewalks, driveways and other hardscapes. The EO focuses on using water more wisely and eliminating water waste by taking actions to minimize water system leaks. The California Department of Water Resources (DWR) estimates that leaks in water district distribution systems siphon away more than 700,000 acre-feet of water a year in California — enough to supply 1.4 million homes for a year.
- The EO further strengthens local drought resilience and looks to improve agricultural water use efficiency and drought planning. State agencies are to cooperate with urban water management plans, which include plans for

droughts lasting for at least five years by assuring that the water efficiency and conservation plan has drought contingency actions.

State Administrative Manual & Management Memos

The following section of the State Administrative Manual (SAM), and associated Management Memos (MMs) currently impose sustainability requirements on the department under the governor's executive authority:

- SAM Chapter 1800: Energy and Sustainability.
- MM 14-02: Water Efficiency and Conservation.
- MM 14-05: Indoor Environmental Quality: New, Renovated, and Existing Buildings.
- MM 14-07: Standard Operating Procedures for Energy Management in State Buildings.
- MM 14-09: Energy Efficiency in Data Centers and Server Rooms.
- MM 15-03: Minimum Fuel Economy Standards Policy.
- MM 15-04: Energy Use Reduction for New, Existing, and Leased Buildings.
- MM 15-06: State Buildings and Grounds Maintenance and Operation.
- MM 15-07: Diesel, Biodiesel, and Renewable Hydrocarbon Diesel Bulk Fuel Purchases.
- MM 16-07: Zero-Emission Vehicle Purchasing and EVSE Infrastructure Requirements.
- MM 17-04: Zero Net Energy for New and Existing State Buildings.

Legislative Actions

Several pieces of legislation were signed in 2015–16 that codified several elements of the executive orders, or provided further requirements included in the policies. These include the following:

- Assembly Bill (AB) 1482 (Gordon, 2015): Requires that the California Natural Resources Agency (CNRA) update the State's adaptation strategy safeguarding California every three years. Directs State agencies to promote climate adaptation in planning decisions and ensure that State investments consider climate change impacts, as well as the use of natural systems and natural infrastructure (Public Resources Code Section 71153).

- Senate Bill (SB) 246 (Wieckowski, 2015): Established the Integrated Climate Adaptation and Resiliency Program within the Governor's Office of Planning and Research to coordinate regional and local efforts with State climate adaptation strategies to adapt to the impacts of climate change (Public Resources Code Section 71354).
- AB 2800 (Quirk, 2016): Requires State agencies to take the current and future impacts of climate change into planning, designing, building, operating, maintaining, and investing in State infrastructure. CNRA will establish a Climate-Safe Infrastructure Working Group to determine how to integrate climate change impacts into State infrastructure engineering (Public Resources Code Section 71155).
- Assembly Bill (AB) 4: Passed in 1989. The State Agency Buy Recycled Campaign (SABRC) statutes are in Public Contract Code Section 12153-12217. The intent of SABRC is to stimulate markets for materials diverted by California local government and agencies. It requires State agencies to purchase enough recycled-content products to meet annual targets, report on purchases of recycled and nonrecycled products, and submit plans for meeting the annual goals for purchasing recycled-content products.
- AB 32 Scoping Plan: The scoping plan assumes widespread electrification of the transportation sector as a critical component of every scenario that leads to the mandated 40 percent reduction in GHG by 2030 and 80 percent reduction by 2015.
- AB 2583 (Blumenfield 2012) Public Resources Code §25722.8: Statute requires reducing consumption of petroleum products by the State fleet compared to a 2003 baseline. Mandates a 10 percent reduction or displacement by Jan. 1, 2012, and a 20 percent reduction or displacement by Jan. 1, 2020.
- AB 75: Implement an integrated waste management program and achieve 50 percent disposal reduction target. State agencies report annually on waste management programs.
- SB 1106: Have at least one designated waste management coordinator. Report annually on how your designated waste and recycling coordinator meets the requirement.

- AB 2812: Provide adequate receptacles, signage, education, staffing, and arrange for recycling services. Report annually on how each of these is being implemented.
- AB 341: Implement mandatory commercial recycling program (if meet threshold). Report annually on recycling program.
- AB 1826: Implement mandatory commercial organics recycling program (if meet threshold). Report annually on organics recycling program.
- SB 1383: 50 percent reduction in the level of the statewide disposal of organic waste from the 2014 level by 2020, a 75 percent reduction by 2025, and 20 percent of currently disposed edible food is recovered for human consumption by 2025.

Agencies already in compliance with AB 1826 may need to further expand their organic waste recycling service to comply with the new requirements.

Jan. 1, 2024, Tier 2 Commercial Edible food Generators will be required to donate edible food to a recovery organization.

- SB 1335: Requires food service facilities located in a State-owned facility, a concessionaire on State-owned property, or under contract to dispense prepared food using reusable, recyclable, or compostable food service packaging.

Action Plan

- 2016 Zero-Emission Vehicle Action Plan.

The plan establishes a goal to provide electric vehicle charging to 5 percent of State-owned parking spaces by 2022. It also advances the ZEV procurement target to 50 percent of light-duty vehicles by 2025.

State Resources and Guidance Documents

California has invested significant resources in understanding the risks of climate change, water efficiency, strategic growth, and State actions available to respond to and reduce these risks. These include the following:

- Safeguarding California: The state's climate adaptation strategy organized by sector. Each sector identifies risks from climate change and actions to reduce those risks.

- Safeguarding California Implementation Action Plans: Directed under EO B-30-15, the Implementation Action Plans outline the steps that will be taken in each sector to reduce risks from climate change.
- Planning and Investing for a Resilient California: Prepared under direction of EO B-30-15, this document provides a framework for State agencies to integrate climate change into planning and investment, including guidance on data selection and analytical approach.
- California's Climate Change Assessments: California has completed three comprehensive assessments of climate change impacts on California. Each assessment has included development of projections of climate impacts on a scale that is relevant to State planning (i.e., downscaled climate projections). These data are available through Cal-Adapt, an online data visualization and access tool.
- Water Use Reduction Guidelines and Criteria: Issued by the California Department of Water Resources February 28, 2013, pursuant to Executive Order B-18-12. Each applicable agency was required to take actions to reduce water use in facilities and landscapes that are operated by the State, including owned, funded or leased facilities. State-operated facilities are defined as facilities where the agency has direct control of the buildings' function, maintenance, and repair. For leased facilities, the Green Building Action Plan directed at that time that new and renegotiated leases include provisions for water conservation, reporting water use, and installation of sub-meters to the extent possible and economically feasible.
- Strategic Growth Council (SGC) Resolution on Location Efficiency: Location efficiency refers to the greenhouse gas emissions arising from the transportation choices of employees and visitors to a building as determined by the Smart Location Calculator. Adopted on December 6, 2016, the resolution directs members of the SGC to achieve a 10 percent improvement in the Smart Location Score of new leases compared to the average score of leased facilities in 2016.

Table H-1 (a–e) Background References and Applicable Roadmap Chapters

Executive Orders:	Climate Adaptation	ZEV	Energy	Water	Green Operation
EO B-16-12		X			X
EO B-18-12		X	X	X	X
EO B-29-15				X	
EO B-30-15	X	X	X		X
EO B-37-16				X	

Table H-1b

Management Memos	Climate Adaptation	ZEV	Energy	Water	Green Operation
MM 14-02				X	
MM 14-05			X		X
MM 14-07			X		X
MM 14-09			X		
MM 15-03		X	X		
MM 15-04			X		X
MM 15-06			X	X	X
MM 15-07		X			
MM 16-07		X			
MM 17-04			X		

Table H-1c

Legislative Actions	Climate Adaptation	ZEV	Energy	Water	Green Operation
SB 246	X				
SB 2800	X				
SB 1106					X
SB 1383					X
AB 4					X
AB 32		X			X
AB 75					X
AB 341					X
AB 1826					X

Legislative Actions	Climate Adaptation	ZEV	Energy	Water	Green Operation
AB 2812					X
AB 1482	X				

Table H-1d

Action Plans	Climate Adaptation	ZEV	Energy	Water	Green Operation
2016 ZEV Action Plan		X			

Table H-1e

State Resources and Guidance Documents	Climate Adaptation	ZEV	Energy	Water	Green Operation
Cal-Adapt	X				
California's Climate Change Assessments	X				
Public Resources Code §25722.8		X			
Planning and Investing for a Resilient California	X				
Safeguarding California	X				
Safeguarding CA Implementation Action Plan	X				
Sustainable Groundwater Management Act of 2014				X	

Appendix K — List of Figures, Tables, and Graphs