Chapter 22

# Integrated Discussion of Potential Municipal and Domestic Water Supply Management Options

## 22.1 Introduction

This chapter provides an integrated discussion of potential municipal and domestic water supply management options in response to implementation of the Lower San Joaquin River (LSJR) alternatives. Southern Delta water quality (SDWQ) alternatives are not discussed in this chapter, because a substantial degradation of water quality affecting service providers diverting drinking water from the southern Delta would not occur. This chapter incorporates information from Chapter 9, *Groundwater Resources*, and Chapter 13, *Service Providers*, in order to illustrate how potential impacts from LSJR alternatives would affect water supply to urban and rural populations in the San Joaquin Valley under current regulatory conditions. Current regulatory conditions include the Sustainable Groundwater Management Act (SGMA) (Wat. Code, § 10720 et seq.), which took effect January 1, 2015, and requires the formation of local agencies to protect and manage groundwater resources. SGMA is discussed in more detail below. This chapter also references project overview information from Chapter 1, *Introduction*; water resources and management descriptions from Chapter 2, *Water Resources*; project alternative descriptions from Chapter 3, *Alternatives Description*; and, cost information from Chapter 16, *Evaluation of Other Indirect and Additional Actions*.

This chapter summarizes: water use; the regulatory background for current and future groundwater management; potential impacts on public water supplies and domestic (i.e., private) wells; costs of potential management responses by municipal and domestic users; and the availability of financial and technical assistance programs to help address potential impacts. This chapter also discusses public health, with a special emphasis on disadvantaged communities (DACs)[1] and schools.

This chapter relies on the analyses in Chapters 9 and 13. Chapter 9 analyzes the potential impacts on groundwater as a resource as determined by reductions in groundwater levels and the risk of subsidence. Chapter 13 includes an examination of whether implementation of the LSJR alternatives could potentially require or result in: (1) construction of new water supply facilities or wastewater treatment facilities, or the expansion of existing facilities; or (2) violation of any drinking water quality standards. The study area as used in this chapter is the primary area likely to experience groundwater effects associated with the LSJR alternatives (i.e., the four main groundwater subbasins—the Eastern San Joaquin, Modesto, Turlock, and the "Extended" Merced Subbasin[2]), as defined in Chapter 9 (Figure 9-1).

[1] *Disadvantaged communities* are defined as those communities with an annual median household income (MHI) that is less than 80 percent of the statewide annual MHI. (Public Resources Code, § 75005 subd. (g).)

[2] As described in Chapter 9, *Groundwater Resources*, the Merced Subbasin was extended for the analysis to include a part of the Chowchilla Subbasin.

The impacts of the LSJR alternatives on groundwater resources cannot be determined with certainty because groundwater conditions vary within each aquifer subbasin and water users would have varied responses to reduced surface water deliveries and any decrease in groundwater elevations. In addition SGMA, mentioned above, will improve groundwater management as it places a mandatory duty upon local agencies in high and medium priority groundwater basins, including those in the study area, to form groundwater sustainability agencies (GSAs) by June 30, 2017 and adopt and implement groundwater sustainability plans (GSPs) to sustainably manage groundwater resources.[3] Upon GSP adoption, SGMA grants the local GSA specific authorities to manage and protect its groundwater basin including, but not limited to, the ability to require reporting of groundwater withdrawals and to control groundwater extractions by regulating, limiting, or suspending extractions from wells. (Wat. Code, § 10726.4.) If a local agency is unwilling or unable to manage its groundwater resources to prevent undesirable results as defined under SGMA, which include but are not limited to chronic lowering of groundwater levels or migration of contamination, then SGMA empowers the state to provide interim management until local agencies are able to assume management. SGMA is discussed in more detail in Section 22.3, *Regulatory Background.*

# 22.2 Water Supply

This section summarizes the two major uses of water in the study area (Figure 9-1): irrigation and drinking water. This section focuses on drinking water supply from both surface water and groundwater, but also describes agricultural water use, mainly in the form of irrigation, to put competing water demands in the study area in context.

## 22.2.1 Water Use

Irrigation districts and water districts (collectively referred to as irrigation districts hereafter) supply water for multiple uses (i.e., agricultural, municipal and industrial) within the study area. They obtain water by either diverting surface water from the three eastside tributaries (Stanislaus, Tuolumne, and Merced Rivers), pumping groundwater from aquifers, or both. Irrigation districts primarily deliver water to a distribution system for crop irrigation. Although these districts serve primarily agricultural supplies, in some cases they also supply local municipalities through existing agreements. Additionally, these districts may also provide hydropower to their service areas. There are also individuals and entities in the study area that use domestic wells to meet their water needs, and riparian diverters that directly deliver water for crop irrigation. A summary of the irrigation district and riparian diversions from the LSJR tributaries is presented in Table 2-3.

A significant portion of California's water supply needs is met by groundwater. Typically, groundwater supplies about 30 percent of California's urban and agricultural uses. In dry years, groundwater use increases to about 40 percent statewide and 60 percent or more in some regions (DWR 2003a). In the San Joaquin River Hydrologic Region, groundwater contributed approximately 38 percent (3.2 million acre-feet [MAF]) to the 2005–2010 average annual total water supply.

[3] The Modesto and Turlock Subbasins are listed as high-priority basins, and the Eastern San Joaquin, Merced, and Chowchilla Subbasins are listed as high-priority and critically overdrafted basins. Plans for critically overdrafted basins subject to SGMA must be adopted by January 31, 2020. The deadline to adopt plans for all other basins subject to SGMA is January 31, 2022. See the Sustainable Groundwater Management Act discussion in Section 22.3, *Regulatory Background.*

Groundwater supplies, based on average annual estimates for 2005–2010, contribute 36 percent of the total agricultural water supply, 58 percent of the total urban water supply, and 38 percent of the total managed wetlands supply in the San Joaquin River Hydrologic Region (DWR 2015a).

Irrigation districts pump groundwater to supplement their water supply when surface water is in shortage. Many private growers who are not served by an irrigation district also pump groundwater to irrigate their crops. More than half of all land within the subbasins is irrigated agriculture, which is the largest user of groundwater. Many cities and towns in the study area also rely on groundwater either wholly or partially to for their drinking water supply.

While surface water is the major source of irrigation and provides significant contribution to groundwater recharge, groundwater levels in the San Joaquin Valley Groundwater Basin have generally declined as a result of extensive pumping. As discussed in Chapter 9, *Groundwater Resources*, the Modesto, Turlock, and Merced Subbasins have experienced varying degrees of overdraft and recharge conditions between 1970 and 2000. Each subbasin experienced a net overdraft condition between 1970 and 2000, as indicated by average declines in groundwater elevation of approximately 15, 7, and 30 feet (ft), respectively, with the eastern portion of the subbasins experiencing more severe overdraft (DWR 2003c, 2003d, 2003e). It is estimated that the groundwater storage in the Turlock Subbasin decreased by an average of 21.5 thousand acre-feet per year (TAF/y) during the period of 1997–2006 (TGBA 2008). The Eastern San Joaquin Subbasin has been in a consistent overdraft condition (approximately 1.7 ft/yr) for the same time period. It is estimated that the overdraft has reduced storage in the Eastern San Joaquin Subbasin by 2 MAF over a 40-year period (DWR 2003b), 50 TAF/y on average. According to a recent California Department of Water Resources (DWR) review, two of the four groundwater subbasins underlying the study area (Eastern San Joaquin and Merced) are critically overdrafted (DWR 2016). Groundwater pumping in the region continues to increase in response to growing demand and reduced surface water deliveries. Additional pumping in any of these subbasins could reduce the average groundwater level (i.e., drawdown), with a noticeable effect on groundwater levels over a number of years.

## 22.2.2 Water Quality

As discussed in Chapter 5, *Surface Hydrology and Water Quality*, surface water quality is very good in the three eastside tributaries,[4] with an average salinity (as measured by electrical conductivity [EC][5]) value of less than 0.1 deciSiemens per meter (dS/m) near the confluence with the San Joaquin River. The water quality of the Stanislaus, Tuolumne, and Merced Rivers is primarily affected by reservoir operations and agricultural return flow. EC generally increases as water moves downstream in all three rivers due to the relatively high EC in agricultural drainage and groundwater discharges to the river. Chloride, bromide, sulfate, and boron are specific ions that contribute to overall salinity and are constituents of concern. However, of these constituents of concern, in the plan area only boron is included on California's statewide list of impaired

[4] In this document, the term *three eastside tributaries* refers to the Stanislaus, Tuolumne, and Merced Rivers.

[5] In this document, EC is *electrical conductivity*, which is generally expressed in deciSiemens per meter (dS/m). Measurement of EC is a widely accepted indirect method to determine the salinity of water, which is the concentration of dissolved salts (often expressed in parts per thousand or parts per million). EC and salinity are therefore used interchangeably in this document.

waterbodies (303(d) list).[6] Boron and salinity can affect multiple beneficial uses, including the yield of crops that are sensitive to these constituents. Additionally, high EC values in source water may limit the ability to utilize recycled water. The presence of bromide in municipal water sources is also a concern because bromide is the precursor to the formation of harmful byproducts of the water disinfection process. However, there are no 303(d) listings for bromide. In addition, the Stanislaus, Tuolumne, and Merced Rivers are identified on the 303(d) list for constituents associated with agricultural uses, including pesticides (e.g., chlorpyrifos and diazinon), and temperature (State Water Board 2011).

As discussed in Chapter 9, *Groundwater Resources*, groundwater quality can be affected by many factors, both natural (e.g., substrate material) and anthropogenic (e.g., land use). Therefore, groundwater quality varies substantially throughout the San Joaquin Valley Groundwater Basin. In general, groundwater in the San Joaquin River Hydrologic Region is suitable for most urban and agricultural uses. Groundwater in shallower aquifers generally contains higher concentrations of anthropogenic contaminants, such as nitrates and pesticides, than in deeper aquifers (DWR 2015a). In addition to agricultural and industrial sources, trace elements (such as arsenic, manganese, vanadium and uranium) that naturally occur in rocks and soils can come in contact with the water and present water quality problems. See Chapter 13, *Service Providers*, for further information on quality of groundwater used as a drinking water source.

In general, municipal drinking water wells do not exceed federal and state maximum contaminant levels (MCLs). This is because municipal wells are generally deep, and water quality tends to be better in deeper aquifers. Furthermore, water quality is managed such that if drinking water standards are violated at a public well, the well will be brought offline and corrective actions will be taken to ensure the water will meet the MCL requirement before it is delivered the consumers. For example, dibromochloropropane (DBCP) was detected over the MCL at two of the City of Atwater's wells. Granular activated carbon filtering systems were installed on these water sources to remove the contaminant prior to introduction of water into the City's water system (City of Atwater 2015). The City of Livingston, located in the Merced Subbasin, recently improved filtration in order to reduce arsenic concentrations that were above the state MCL (Giwargis 2014).

Water quality in community water systems is frequently monitored by the State Water Board and the service providers pursuant to various regulatory requirements (discussed in Chapter 13, Section 13.3, *Regulatory Background*). Community water systems must provide annual drinking water quality reports, known as consumer confidence reports (CCRs), to their customers. Table 13-5 of Chapter 13 provides information from CCRs of select municipalities in the groundwater subbasins during representative non-drought and drought years.

Private drinking water wells may have more significant water quality issues than municipal wells because they are often shallower than municipal wells and, therefore, are more susceptible to surface contaminants. However, the State does not regulate the water quality of private drinking water wells, and does not require private drinking water well owners to test for water quality. As such, there is a lack of water quality data for private drinking water wells in the study area.

[6] Clean Water Act section 303(d) requires states, territories, and authorized tribes to develop a ranked list of water quality limited segments of rivers that do not meet water quality standards.

# 22.2.3 Municipal Water Use and the Current Drought

There are approximately 1.2 million people living in the four groundwater subbasins (U.S. Census Bureau 2010). Of this population, approximately 1.1 million people, or 89 percent, receive some portion of their water supply from a public water supplier (California Environmental Health Tracking Program 2016). The remaining 11 percent, equivalent to approximately 133,000 people, rely solely on domestic wells for their water supply. However, due to a lack of records, it is difficult to determine the actual number of people currently relying on domestic wells. Using 635,000 scanned well-completion reports provided by DWR in 2011, and based on a spatially distributed and randomized survey, Johnson and Belitz (2015) estimated that there are 37,386 domestic wells in the six counties that are within or intersect the study area (Table 22-1).

Ninety-three public water suppliers were identified within the four groundwater subbasins (California Environmental Health Tracking Program 2016; State Water Board 2016). Table 13-3a, in Chapter 13, *Service Providers*, lists those public water suppliers, the population served in 2014, and the reliance on groundwater supply (as a percentage of total water supply) in 2014. Many of these water suppliers rely solely or partially on groundwater for their water supply. In 2014, groundwater supplied 52 percent of the 91 public water suppliers' total water production; the remaining 48 percent of the total water production came from surface water or recycled water. California's current drought (2012–present) has left many public water suppliers struggling to deliver water to their customers and caused many domestic wells to go dry. The following are examples of public water supplier responses to ensure adequate water supplies during the drought.

## Stockton East Water District (SEWD)

SEWD, a water wholesaler, used surface water solely between 2010 and 2014. During this time, SEWD had two inactive drinking water wells intended only for use as emergency or dry year supplies. In February, 2015, the U.S. Bureau of Reclamation (USBR) announced its zero initial water allocation for many agricultural users north and south of the Delta, including SEWD, which received zero percent of their contract quantity due to a lack of available Central Valley Project (CVP) supplies out of New Melones Reservoir (Martineau 2015). In response, SEWD reactivated the two wells, built a new well, and converted two old irrigation wells into drinking water wells in 2015. The changes were permitted by the State Water Board. SEWD now has five active wells, and uses both surface water and groundwater as its sources of water supply (Sahota pers. comm.).

## Le Grand Community Service District

Le Grand Community Service District, which serves 1,700 people in Merced County, has three wells. In 2014, one well, which was drilled in 1966, collapsed due to its age, and another well had a valve failure With financial assistance from the State's Drought Emergency Fund, the district rehabilitated the two wells and was able to extract groundwater again. Repairing the wells alleviated the emergency situation; however, water shortages are still a problem. The third well capacity has dropped to 200 gallons per minute and requires new equipment to achieve its maximum production of 1,000 gallons per minute (Giwargis 2014; Chauhan pers. comm.). Furthermore, the District Superintendent, Richard Kilgore II, stated that the local water table (in the Merced Subbasin) was dropping fast (Giwargis 2014).

### Plainsburg Elementary School

Plainsburg Elementary School, located near Le Grand, has one well. In 2014, the well went dry and was abandoned. With financial assistance from the State's Drought Emergency Fund, the school constructed a new, deeper well near the old well. The old well was approximately 250 ft deep and the new well is 600 ft deep (Chauhan pers. comm.).

## 22.2.4 Domestic Wells and Household Water Shortages

In general, public wells are deeper than domestic wells, because private entities do not have the resources to drill deep into the ground. Due to their shallower depth, under drought conditions, domestic wells tend to go dry before public wells. In California, water systems with fewer than 15 household connections, including individual household wells or water supplies, are regulated at the county level. Counties vary in their practices, but rarely do counties collect data regularly from these very small and individual household water supplies. Even where data is collected it is entirely voluntary. As the drought developed, local and state agencies began receiving anecdotal reports of household water shortages. In 2014, DWR led an effort to put these reports in a centralized database. Table 22-1 shows the cumulative numbers of well outages[7] reported to DWR between January 2014 and April 5, 2016 (DWR 2016), and the percentage of outages for each county that intersects the study area. Most reported outages are for wells that serve 1-2 households (Fencl pers. comm.).

**Table 22-1. Number of Domestics Wells and Number of Well Outage Reported**

| County | Number of Domestic Wells | Number of Well Outage Reported[a] | % of Outage |
|---|---|---|---|
| Calaveras | 4,873 | 1 | 0.02 |
| Mariposa | 5,276 | 172 | 3.3 |
| Merced | 6,209 | 160 | 2.6 |
| San Joaquin | 7,666 | 25 | 0.3 |
| Stanislaus | 8,980 | 227 | 2.5 |
| Tuolumne | 4,382 | 234 | 5.3 |
| Total | 37,386 | 819 | 2.2 |

Source: Johnson and Belitz 2015; State of California 2016

[a] Cumulative report of household water shortages by county reported to the State, January 2014–April 5, 2016.

# 22.3 Regulatory Background

This section discusses current and future regional or local program, policies, and regulations related to managing current and future water supplies. Regulations related to managing groundwater resources are in Chapter 9, *Groundwater Resources*; regulations related to service providers are in Chapter 13, *Service Providers*. Select regulations from these chapters are presented below.

[7] Outage means the well has gone completely dry, is experiencing very low flow, or has pump issues such that no water can be pumped out of the well.

## 22.3.1 Current Planning Efforts

It is the state's policy that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes. (Wat. Code, § 106.3.) In addition, it is the state's policy that "groundwater resources be managed sustainably for long-term reliability and multiple economic, social, and environmental benefits for current and future beneficial uses" and that sustainable groundwater management "is best achieved locally through the development, implementation, and updating of plans and programs based on the best available science." (Wat. Code, § 113.) Referenced below are relevant state and regional policies and plans related to current planning efforts to ensure a reliable water supply in the future.

### Sustainable Groundwater Management Act

As discussed in Section 22.1, *Introduction,* and Chapter 9, *Groundwater Resources*, SGMA provides the framework to implement the state's sustainable groundwater management policy by requiring that local agencies in high- and medium-priority basins[8] form GSAs by June 30, 2017 that will develop and implement GSPs that achieve sustainable groundwater management within 20 years. The four main groundwater basins in the plan area—the Eastern San Joaquin, Modesto, Turlock, and Merced subbasins—are all high-priority subbasins, as is the Chowchilla Subbasin. Basins in a critical condition of overdraft, including the Eastern San Joaquin, Merced, and Chowchilla Subbasins, must achieve sustainability by 2040; all other high- and medium-priority basins must achieve sustainability by 2042. Importantly, SGMA does not require GSP approval at the state level before a GSA can implement measures to protect groundwater resources. SGMA's management and enforcement powers attach upon adoption of a GSP by the local GSA.

SGMA is intended to promote coordinated management of a groundwater basin through GSA formation and requires GSAs to consider the interests of all beneficial uses and users of groundwater, including domestic well owners, municipal well operators, public water systems, disadvantaged communities, and tribes in developing and implementing a GSP. SGMA requires a GSP to provide for "the management and use of groundwater in a manner that can be maintained during the [50-year] planning and implementation horizon without causing 'undesirable results.'" (Wat. Code, § 10721 subd. (v).) *Undesirable results* include, but are not limited to:

- Chronic lowering of groundwater levels (not including overdraft during a drought if a basin is otherwise managed).
- Significant and unreasonable reduction of groundwater storage.
- Significant and unreasonable seawater intrusion.
- Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.

[8] One hundred twenty-seven of California's 515 alluvial groundwater basins, which account for 96 percent of California's annual groundwater pumping, were identified as high- or medium-priority (DWR 2014). Prioritization factors include, but are not limited to, the level of population overlying the basin or subbasin, the projected rate of population growth for the basin or subbasin, the number of public supply wells dependent on the basin or subbasin, the irrigated acreage overlying the basin or subbasin, and the degree of reliance on groundwater (Wat. Code, § 10933, subd. (b).)

- Significant and unreasonable land subsidence that substantially interferes with surface land uses.
- Depletions of interconnected surface water that have significant and unreasonable adverse effects on beneficial uses of the surface water.

If local agencies are unwilling or unable to manage their groundwater resources, SGMA authorizes the State Water Board to step in to protect a groundwater basin in limited circumstances: (1) if no agency has opted by June 30, 2017 to serve as a GSA for a basin, (2) when a GSA does not complete a GSP by the relevant deadline (2020 or 2022), or (3) when the GSP is inadequate or the GSP is not being implemented in a manner that is likely to achieve the plan's sustainability goal(s), and the basin is either in a condition of long-term overdraft or, after January 31, 2025, the State Water Board determines that the basin is in a condition where groundwater extractions result in significant depletions of interconnected surface waters.

## Integrated Regional Water Management Planning

Integrated Regional Water Management (IRWM) Planning is a collaborative stakeholder process that promotes sustainable water use. IRWM Planning identifies and implements water management efforts on a regional scale to ensure sustainable water uses, reliable water supplies, better water quality, efficient urban development, protection of agriculture, environmental stewardship, and a strong economy. IRWM plans (IRWMPs) acknowledge that regions have distinct identities and hydrologic and ecologic conditions, and that water supply reliability should be a primary water management objective to be considered in these integrated plans.

## Urban Water Management Plans

The California Urban Water Management Planning Act (UWMPA) requires California's urban water suppliers[9] to initiate planning strategies to ensure the appropriate level of reliability in their water service to meet the needs of the various categories of customers during normal, dry, and multiple dry years. To do this, urban water suppliers must prepare an UWMP every 5 years. UWMPs serve as a resource for planners and policy makers over a 25-year planning time fame, and include information about groundwater and surface water supplies, historic and projected water use, recycled water, water use efficiency programs in a contracting water district's service area, and contingency planning for the possibility of water shortages.

2015 UWMPs (due to DWR by July 1, 2016) do not reflect new requirements for groundwater management under SGMA. However, DWR recommended that 2015 UWMPs include a discussion of current or planned activities to meet anticipated SGMA requirements (DWR 2016). 2010 UWMPs that are relevant to the irrigation districts and four subbasins are summarized in Table 9-11; 2010 UWMPs that are relevant to the urban water suppliers are summarized in Chapter 13, *Service Providers*. UWMPs vary in terms of water shortage management responses and implementation methods included.

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[9] Urban water suppliers are defined as suppliers that have 3,000 or more water connections or provide over 3,000 acre-feet of water annually.

### Water Shortage Contingency Plan

A reliable water supply is essential and its importance highlights the necessity to prepare for the possibility of drought. Contingency planning before a water shortage allows for a selection of appropriate responses consistent with the varying severity of shortages. To prepare for the possibility of water shortages, UWMPs include a Water Shortage Contingency Plan (WSCP). The WSCP enables the urban water supplier to provide water for public health and safety and minimize impacts on economic activity, environmental resources, and the region's economic health. Examples of priorities for use of available water include the following.

- Health and Safety – interior residential and firefighting.
- Commercial, Industrial, and Institutional – maintain economic base, protect jobs.
- Permanent Crops – takes 5 to 10 years to replace.
- Annual Crops – protect jobs.
- Landscaping – direct water to trees and shrubs.
- New Demand – typically, 2 years of construction projects that are already approved.

Several WSCPs have been developed in the counties that intersect the plan area. While WSCPs vary in terms of water shortage management responses and implementation methods included, all WSCPs include: (1) a description of the stages of action an agency will take in response to water shortages; (2) an estimate of supply for three consecutive years; (3) a plan for dealing with a catastrophic supply interruption; (4) a list of the prohibitions, penalties, and consumption reduction methods to be used; (5) an analysis of expected revenue effects of reduced sales during shortages and proposed measures to overcome those effects; and (6) how the supplier will monitor and document cutbacks.

### Water Conservation Act of 2009 (Senate Bill X7-7)

SBX7-7, the water conservation bill passed as part of the 2009 Comprehensive Water Package, requires urban and agricultural water suppliers to increase water use efficiency. SBX7-7 requires urban water suppliers to achieve an interim goal of achieving at least a 10 percent reduction in per capita water usage by 2015 and a 20 percent reduction in per capita water usage by 2020. Additionally, all suppliers were required to determine baseline water use and set reduction targets according to specified requirements.

Several urban and agricultural water suppliers in the counties that intersect the plan area are required to report on progress towards the savings goal. Implementation methods and the level of savings achieved varies by supplier.

## 22.3.2 Managing Water Supplies under Reduced Water Availability Conditions

### Emergency Urban Water Conservation

In April 2015, Governor Edmund G. Brown Jr issued Executive Order (EO) B-29-15, which called for a statewide 25 percent mandatory conservation by urban water suppliers in preparation for the possible continuation of the drought. In response to EO B-29-15, the State Water Board adopted

Resolution 2015-0032, which assigned each of the state's urban water suppliers a conservation standard that ranged between four percent and 36 percent, based on the supplier's residential gallons per capita per day (R-GPCD). The tiered conservation standards accounts for water conservation already achieved by communities based on relative per capita water usage. The compliance period for achieving the statewide mandatory 25 percent savings goal and supplier-specific conservation standards was June 2015 through February 2016. Water use for the same months during 2013 acted as the baseline for calculating water savings. In response to EO B-37-16, issued in May 2016, the State Water Board adopted a modified version of the emergency urban water conservation regulations, extending revised conservation standards through January 2017.

There are 15 urban water suppliers in the study area that were required to achieve water conservation standards for the compliance period. In response to reporting associated with mandatory statewide water conservation regulations, detailed per capita residential water use information is available for 15 water suppliers in the counties that intersect the study area. The residential water use reported by these 15 water suppliers accounted for, on average, approximately 68 percent of their total water production (172 thousand acre-feet [TAF] out of their total production of 253 TAF in 2013). During the compliance period (June 2015-February 2016), the 15 suppliers reported an average cumulative savings of 26 percent, as compared to the total water use for the same months in 2013, with individual supplier savings ranging from 8 to 42 percent (Table 22-2). While supplier success towards achieving their conservation standard varied, all 15 urban water suppliers reported reduced residential water use between 2013 and 2015/16. Average residential water use declined from 148 R-GPCD in 2013, to 106 R-GPCD during the 2015/16 compliance period. This decline represents an overall annual reduction of 47 TAF/y for these 15 water suppliers. If applied to all residential use in the plan area, this represents a potential reduction of 61 TAF/y.

## 22.3.3 Planning for Future Water Needs

Water is critical to future population and economic growth, and can also be the major limiting factor to growth. Planning for future water needs requires examining current demand and supply pressures, looking at trends within each, and promoting and implementing sustainable and efficient water management practices. However, water management does not happen in isolation. A coordinated, integrated approach is essential to ensure adequate water supplies for future needs. This is accomplished through urban planning (including city and county general plans, water master plans, recycled water master plans, integrated resources plans, IRWMPs, UWMPs, and groundwater management plans). New planning efforts are greatly enhanced when they rely upon the information found in all planning documents within their service area and neighboring service areas.

Meeting future water needs includes ensuring adequate supplies for projected urban population growth, current and future projects, and preparing for climate change impacts on water supplies and possible water shortages. As highlighted by the recent drought, the unreliable nature of municipal water supplies emphasizes the need for communities to develop and manage local resources through strategies such as water use efficiency and conservation, recycled water, and groundwater recharge.

**Table 22-2. Urban Water Conservation and Residential Water Use**

| Urban Water Supplier | Principal County Served | Groundwater Subbasin | Groundwater Reliance in 2014 (%) | Population Served | % Cumulative Water Savings (Jun-15–Feb-16, compared to 2013) | Conservation Standard (Jun-15 – Feb-16; %) | Average R-GPCD (Jun-15 – Feb-16) | Average R-GPCD (Jan-Feb 2013)[a] |
|---|---|---|---|---|---|---|---|---|
| Atwater | Merced | Merced[b] | 100 | 29,167 | 42.1[c] | 36 | 171 [c] | 201 |
| Cal Water, Stockton | San Joaquin | Eastern San Joaquin | 26 | 169,682 | 21.8 | 20 | 64 | 83 |
| Ceres | Stanislaus | Turlock | 100 | 45,884 | 24.0 | 28 | 85 | 116 |
| Lathrop | San Joaquin | Eastern San Joaquin | 88 | 19,831 | 28.3 | 20 | 84 | 117 |
| Livingston | Merced | Merced | 100 | 14,894 | 16.8 | 32 | 97 | 117 |
| Lodi | San Joaquin | Eastern San Joaquin | 73 | 63,651 | 26.5 | 32 | 107 | 145 |
| Manteca | San Joaquin | Eastern San Joaquin | 42 | 73,808 | 29.6 | 32 | 98 | 143 |
| Merced | Merced | Merced | 100 | 83,400 | 37.1 | 36 | 137 | 217 |
| Modesto | Stanislaus | Modesto | 61 | 217,269 | 27.8 | 36 | 129 | 182 |
| Oakdale | Stanislaus | Modesto | 100 | 21,772 | 39.0 | 32 | 112 | 185 |
| Ripon | San Joaquin | Eastern San Joaquin | 100 | 14,915 | 27.4 | 36 | 161 | 223 |
| Riverbank | Stanislaus | Modesto | 100 | 23,024 | 7.9 | 32 | 127 | 58 [d] |
| Stockton | San Joaquin | Eastern San Joaquin | 23 | 173,893 | 26.7 | 28 | 89 | 25 |
| Turlock | Stanislaus | Turlock | 100 | 71,064 | 25.7 | 32 | 113 | 153 |
| Winton WSD | Merced | Merced | 100 | 8,500 | 21.7 | 36 | 121 | 155 |
| Total for All Populations Served | | | | 1,030,755 | 27.8 | NA | 106 | 148 |

Sources: State Water Board 2014; State Water Board 2016.

R-GPCD = Residential Gallons Per Capita Per Day

NA = Not Applicable

WSD = Water Service District

[a] 2013 R-GPCD is calculated using residential gallons and population from Jun-14 through Feb-15 reports.

[b] As described in Chapter 9, *Groundwater Resources*, the Extended Merced Subbasin includes a portion of the Chowchilla Subbasin.

[c] Based on Jun-15—Nov-15 monthly water conservation reports.

[d] Missing Aug-14 monthly water conservation report.

UWMPs provide a framework for long-term water planning and ensuring adequate water supplies for existing and future demands. These plans require urban water suppliers to coordinate with local planning agencies to assess future growth and related water demand growth. Planning for future water demands may be based on projected development, population growth, and expected future projects and programs during average, single-dry, and multi-dry years. Plans also need to include, to the extent practicable, a description of any constraints on the agency's water supply, such as inconsistent availability or water quality issues, that the water agency has identified, as well as the management strategies that have been, or will be, employed to address the constraint (DWR 2015b).

# 22.4 Impact Analysis

This section describes the potential impact the LSJR alternatives may have on drinking water supply.

## 22.4.1 Potential Impacts of LSJR Alternatives

Implementation of the LSJR alternatives would reduce surface water available for diversion. Table 22-3 shows the average annual surface water diversion in baseline and the expected reduction in each LSJR alternative relative to baseline. See Appendix F.1, *Hydrologic and Water Quality Modeling*, for a detailed description of the hydrologic modeling that produces this result.

**Table 22-3. Average Annual Change in Surface Water Diversion Compared to Baseline in the Plan Area**

| | | Change in SW Diversion Relative to Baseline (TAF/y) | | |
|---|---|---|---|---|
| River | Average Baseline SW Diversion (TAF/y) | LSJR Alt 2 | LSJR Alt 3 | LSJR Alt 4 |
| Stanislaus | 637 | -12 | -79 | -206 |
| Tuolumne | 851 | -20 | -119 | -298 |
| Merced | 580 | -33 | -95 | -185 |
| Total | 2,068 | -65 | -293 | -689 |

SW = surface water
TAF/y = thousand acre-feet per year

As discussed in Chapter 9, *Groundwater Resources*, LSJR Alternative 2 would have a less-than-significant impact on groundwater as a resource, while LSJR Alternatives 3 and 4 would have significant and unavoidable impacts on groundwater as a resource. That is, under LSJR Alternatives 3 and 4, the average annual groundwater balance is expected to be reduced by more than the equivalent of 1 inch in three subbasins (Modesto, Turlock, and Extended Merced) and all four subbasins, respectively. Exceeding the 1-inch threshold would eventually result in a measurable decrease in groundwater elevations in the basins. Therefore, it is expected that LSJR Alternatives 3 and 4 would result in a substantial depletion of groundwater supplies or substantial interference with groundwater recharge.

As discussed in Chapter 13, *Service Providers*, under LSJR Alternative 2, there would not be a substantial reduction of surface water or a substantial depletion of groundwater supplies. Therefore, LSJR Alternative 2 would have a less-than-significant impact on service providers.

However, under other LSJR alternatives (Alternative 2 with adaptive implementation, and LSJR Alternatives 3 and 4 with and without adaptive implementation), there would be substantial reductions of surface water and depletion in groundwater supplies. For details of which subbasin and service providers would be impacted under each alternative, see Chapter 13. These LSJR alternatives would potentially require service providers to construct new water supply facilities or wastewater treatment facilities or expand existing facilities, the construction of which could cause significant environmental effects. In this regard, these alternatives would have a significant and unavoidable impact on the environment related to the construction of new or expanded facilities.

Furthermore, due to increased groundwater pumping as a result of implementation of LSJR Alternative 2 with adaptive implementation, and LSJR Alternatives 3 and 4 with and without adaptive implementation, the quality of groundwater as a source of drinking water in the study area could potentially be degraded. However, a substantial increase in groundwater pumping would not necessarily result in an increase in violations of drinking water quality standards. During the recent drought, the amount of groundwater pumped for drinking purposes and the service providers' reliance on groundwater greatly increased and yet there was not a greater number of MCL violations as compared to a wet year based on CCRs prepared by the service providers (Table 13-5). In addition, public water systems are regulated by the state; if a drinking water quality problem is detected, the service provider would have to take corrective actions to ensure that the water is in compliance with relevant drinking water standards before it is served to the public. Therefore, under these alternatives, it is not expected that the quality of groundwater used for public water systems would be affected such that violations of water quality standards would occur. Accordingly, impacts would be less than significant.

In contrast to drinking water served by public water systems, LSJR Alternative 2 with adaptive implementation, and LSJR Alternatives 3 and 4 with and without adaptive implementation may result in the use of contaminated groundwater for drinking water by domestic wells. While it is true that pumping greatly increased during the drought and yet there was not a greater number of MCL violations as compared to a wet year based on CCRs provided by service providers, there is a lack of information to support that this was also the case for private domestic wells. In addition, domestic well users are largely unregulated and are under no state requirements to monitor, test, and treat their water to meet the state and federal Safe Drinking Water Act (discussed in Chapter 13, Section 13.3, *Regulatory Background*). Therefore, there is no required mechanism to prevent private domestic wells from using groundwater that exceeds MCLs. Thus, under these alternatives, there is a potential for the quality of groundwater used in private domestic wells to be affected such that violations of water quality standards would occur. Accordingly, impacts would be significant.

## Groundwater Pumping

Pumping within each irrigation district typically increases in dry years when surface water availability is reduced. Therefore, it is expected that, if surface water availability is reduced due to the LSJR alternatives, irrigation districts will respond by increasing groundwater pumping to compensate for a portion of the reduced surface water diversions. In the short-term, the amount of pumping would be limited by the existing capacity of the pumping facilities. However, in the long-term, irrigation districts might respond by deepening their wells or building more wells.

Public water suppliers are also expected to turn to groundwater to compensate for the loss of surface water available to them before additional water treatment or water recycle facilities are commissioned. The cities and communities that currently rely partially on groundwater would have to rely more heavily on groundwater. Such an increase in groundwater reliance will exacerbate the problem of declining groundwater level. The cities and communities that currently solely rely on groundwater might find their groundwater levels reduced and face the increased risk of wells going dry. They might have to deepen their wells or construct new wells to obtain the same groundwater production they currently have.

Dry well issues would affect both domestic and public supply wells. However, domestic wells, which are usually shallower than public wells, would be more likely to be affected by declining groundwater level than public wells. Additionally, because private well owners typically have fewer resources to deepen or construct new wells than public water suppliers, private well owners are likely to be more severely impacted by LSJR alternatives than public water suppliers. There could be more cases of dry wells or more well outages reported, as mentioned in Section 22.2, *Water Supply*.

Table 22-4 shows the expected annual increase of groundwater pumping relative to baseline in each of the LSJR alternatives assuming maximum groundwater pumping based on 2009 infrastructure. Average annual groundwater pumping for agricultural and residential uses by all entities (in and out of districts) in the study area is 2,038 TAF/y in baseline, and it is expected to increase by 23 TAF/y, 109 TAF/y and 224 TAF/y under LSJR Alternatives 2, 3, and 4 respectively.

**Table 22-4. Estimated Effect of LSJR Alternatives on Average Annual Groundwater Pumping in the Study Area (Assuming Maximum Groundwater Pumping Based on 2009 Infrastructure)**

| GW Subbasin | Average Baseline GW Pumping (TAF/y)[a] | Average Change in GW Pumping Relative to Baseline (TAF/y)[b] | | |
|---|---|---|---|---|
| | | LSJR Alt 2 | LSJR Alt 3 | LSJR Alt 4 |
| Eastern San Joaquin | 705 | -4 | 23 | 69 |
| Modesto | 191 | 1 | 8 | 15 |
| Turlock | 507 | 2 | 16 | 30 |
| Merced | 635 | 23 | 61 | 110 |
| Total | 2,038 | 23 | 109 | 224 |

GW = groundwater

TAF/y = thousand acre-feet per year

[a] The average baseline pumping numbers are larger than those presented in Table G.3-3 because the numbers here are estimated for both in-district and out-of-district irrigation, but the numbers in Table G.3-3 are for in-district irrigation only.

A reduction in surface water supply would also affect the groundwater aquifer by simultaneously causing a reduction in groundwater recharge (due to a reduction in conveyance losses from the distribution system and in deep percolation from irrigated fields). Table 22-5 shows the expected annual net change in groundwater balance due to the surface water reduction under the LSJR alternatives. The groundwater balance for each subbasin is calculated as the sum of off-stream reservoir seepage, conveyance losses, and deep percolation from irrigation, minus total groundwater pumping. These components are not all of the inflows and outflows in a groundwater balance model. They are the only inflows and outflows that would be changed under the LSJR alternatives. Other inflows and outflows (such as infiltration from precipitation, recharge from out-of-district irrigated land, and net flux from/to the stream channels) are not included because they are assumed to remain unchanged in the alternatives. The total groundwater balance for the four subbasins in baseline is -994 TAF/y (positive means net recharge and negative means net pumping).

However, this is an over estimate and should not be used as an estimate of the overdraft in the four subbasins, because this groundwater balance does not take into account all components needed for a complete groundwater balance model. The key information is the difference in the groundwater balance between the baseline and the LSJR alternatives as shown in Table 22-5. The groundwater balance is expected to increase by 41, 186 and 411 TAF/y under LSRJ Alternatives 2, 3 and 4 respectively. As previously discussed in Section 22.2, the four groundwater subbasins underlying the study area have experienced varying degrees of overdraft. Increases in pumping due to the LSJR alternatives would exacerbate this problem.

**Table 22-5. Estimated Effect of LSJR Alternatives on Average Annual Groundwater Pumping in the Study Area**

| | Average Change in GW Balance Relative to Baseline (TAF/y) | | |
|---|---|---|---|
| GW Subbasin | LSJR Alt 2 | LSJR Alt 3 | LSJR Alt 4 |
| Eastern San Joaquin | 2 | -36 | -101 |
| Modesto | -6 | -25 | -57 |
| Turlock | -7 | -43 | -100 |
| Merced | -30 | -82 | -152 |
| Total | -41 | -186 | -411 |

Note: Positive values mean increase in net recharge; negative values mean increase in net pumping.

GW = groundwater

TAF/y = thousand acre-feet per year

As previously discussed in Section 22.2, groundwater overdraft in the Eastern San Joaquin Subbasin has been estimated to be 50 TAF/y (DWR 2003a) and groundwater storage in the Turlock Subbasin decreased by an average of 21.5 TAF/y (TGBA 2008). These numbers suggest a mean annual rate of groundwater overdraft of approximately 72 TAF/y for the combined Eastern San Joaquin and Turlock Subbasins. The current rate of overdraft in the Merced and Modesto Subbasins is not known, but if a similar combined rate of overdraft is assumed, the current rate of groundwater overdraft is approximately 144 TAF/y (2 x 72) in the subbasins. The 186 TAF/y increase in overdraft under LSJR Alternative 3 would slightly more than double this rate of overdraft to 330 TAF/y (144+186).

It is extremely difficult to provide perspective on the implications of these groundwater overdraft. The numbers beg the question of how long such levels of overdraft can be sustained. Estimates of groundwater storage made in the 1960s suggest that total aquifer storage in the four subbasins is on the order of 125 MAF (Williamson et al. 1989). This suggests that the current assumed rate of overdraft of 144 TAF/y represents approximately 0.12 percent of the total storage. The rate of overdraft under LSJR Alternative 3, 330 TAF/y, represents 0.26 percent of the total storage. These low percentages of total storage should not be taken to mean that these rates of groundwater overdraft do not pose a long-term problem with regard to sustainability. A number of other factors should be considered to make estimates and determinations of sustainability, including:

- It is difficult to quantify groundwater storage for a particular basin and essential data to make an accurate estimate are lacking (Faunt 2009). Even in basins where many studies have been completed, there are still many unknowns and conflicting findings.

- The estimates of storage in Williamson et al. (1989) are based on data collected in the 1960s and may not reflect current storage. No comprehensive estimate of groundwater storage for the four groundwater subbasins has been undertaken since 1961.
- These numbers assume that there is no groundwater movement between adjacent subbasins, and no changes in groundwater-surface water interactions.
- It is impossible to remove all water from storage by pumping. The deeper the well, the more difficult and expensive is it to drill and extract groundwater. At some point, it becomes economically infeasible to drill deeper.
- There will be very large associated effects, including subsidence and loss of recharge capacity, that occur long before all water in an aquifer could be removed.

This means that actions are needed now to address groundwater overdraft in this area, with or without the LSJR alternatives. This highlights the importance of implementing SGMA in areas in which there is already significant groundwater overdraft. This analysis also suggests that the timelines provided under SGMA afford sufficient time for water users in the plan area to develop and implement groundwater sustainability plans.

## Groundwater Quality

As discussed in Chapter 9, *Groundwater Resources*, substantial additional groundwater pumping and reduction in groundwater level could occur in the subbasins under LSJR Alternative 2 with adaptive implementation, and LSJR Alternatives 3 and 4 with and without adaptive implementation. Lowering the groundwater table could alter the direction and rate of the groundwater flow and create a hydraulic gradient between the well and surrounding saturated zone. This could potentially accelerate migration of surface contaminants to the well, cause saline water intrusion to the aquifer, mobilize naturally-occurring trace elements in the substrate, and elevate their concentrations in the aquifer (see Chapter 13, *Service Providers*, for a discussion of these processes).

However, the impact of groundwater pumping on groundwater quality depends on a number of different variables including, but not limited to, location and depth of the well, the amount of groundwater pumped and the frequency at which pumping occurs, number and proximity of nearby wells, hydrogeological characteristics of the aquifer, distance between the well and the contaminant(s), contaminant characteristics (e.g., highly mobile in water or adhering primarily to soil), and land use near the well. In addition, it is not possible to predict how the affected parties would respond to the reduction of surface water due to the LSJR alternatives. They may deepen existing wells or build new wells. If they build new wells, it is impossible to determine the number of new wells and their location. Thus while groundwater pumping can affect groundwater flow and quality, for all of the foregoing reasons, it is speculative to determine what that change in groundwater flow and its impact on groundwater quality would be from increased groundwater pumping.

The reduction in surface water supply would therefore affect entities that rely upon groundwater as their principal source of drinking water by: (1) increasing the need to deepen their wells or construct more wells to continue to access groundwater, (2) increasing groundwater pumping costs, (3) degrading groundwater quality, and (4) making groundwater unavailable in some areas in the long term as the groundwater level drops to a level that makes groundwater no longer accessible economically.

If LSJR Alternative 2 with adaptive implementation is implemented in a long term, or LSJR Alternatives 3 or 4 with and without adaptive implementation is implemented, it is expected that service providers relying on surface water supplies may need to find alternative supplies (e.g., groundwater). This could result in a potential degradation in groundwater quality and could impact those service providers (see Tables 13-3a and 13-3b in Chapter 13) and domestic well users relying on groundwater as source of drinking water.

However, a substantial increase in groundwater pumping would not necessarily result in contamination of groundwater used for drinking water for several reasons as described below.

1. During the recent drought, the amount of groundwater pumped for drinking purposes and the service providers' reliance on groundwater greatly increased and yet there was not a greater number of MCL violations as compared to a wet year based on the CCRs prepared by the service providers (Table 13-5 in Chapter 13).
2. While drinking water quality standard exceedances have been detected at the wellhead in different locations in the area of potential effects, these exceedances reflect raw, untreated groundwater quality. Service providers would have to take actions to ensure that the water is in compliance with relevant drinking water standards before it is served to the public. Such actions include monitoring groundwater quality regularly, and if any exceedances are detected, bringing the well offline until the problem is rectified (Chapter 13, Section 13.3, *Regulatory Background*). Treatment options include blending, large-scale treatment systems, wellhead treatment systems, or Point-of-Use/Point-of-Entry water treatment systems used in homes or residences.
3. While increased groundwater pumping may expedite the migration of contaminants introduced at the land surface into the water table and flow towards the well, the effect would be localized, i.e., at the well (see Chapter 13, Section 13.2, *Environmental Setting*). Hence, it would be unlikely that such contamination would spread to other parts of the aquifer.

Therefore, under LSJR Alternative 2 with adaptive implementation, and LSJR Alternative 3 and 4 with and without adaptive implementation, it is not expected that the quality of groundwater used for public water systems would be affected such that violations of water quality standards would occur. Accordingly, impacts would be less than significant.

An additional factor that would keep this impact less than significant is that SGMA would provide controls on the degradation of groundwater quality. As discussed in Section 22.3.1, *Current Planning Efforts*, under SGMA, local agencies in high- and medium-priority basins are required to form groundwater sustainability agencies by June 30, 2017, that will develop and implement GSPs that achieve sustainable groundwater management within 20 years. Sustainable groundwater management includes not causing chronic lowering of groundwater levels and significant and unreasonable degradation of water quality, including the migration of contaminant plumes that impair water supplies. GSPs must be adopted by January 31, 2020, for Eastern San Joaquin and Merced Subbasins. GSPs for Modest and Turlock Subbasins must be adopted by January 31, 2022. Upon GSP adoption, SGMA grants the local GSA specific authorities to manage and protect its groundwater basin including, but not limited to, the ability to require reporting of groundwater withdrawals and to control groundwater extractions by regulating, limiting, or suspending extractions from wells. If a local agency is unwilling or unable to manage its groundwater resources to prevent undesirable results as defined under the SGMA, which include but are not limited to chronic lowering of groundwater levels or migration of contamination, then SGMA empowers the state to provide interim management until local agencies are able to assume management.

Thus, under SGMA, groundwater subbasins will be managed both in terms of over-pumping and groundwater quality degradation from migrating contaminant plumes.

In contrast to drinking water served by public water systems, a substantial increase in groundwater pumping and decrease in groundwater levels may result in contamination of groundwater used for drinking water by private domestic wells under LJSR Alternative 2 with adaptive implementation, and LSJR Alternatives 3 and 4 with and without adaptive implementation. While it is true that pumping greatly increased during the drought and yet there was not a greater number of MCL violations as compared to a wet year as reported by service providers, there is a lack of information to support that this was also the case for private domestic wells. Importantly, private domestic well users are largely unregulated and are under no state requirements to monitor, test, and treat their water to meet the state and federal Safe Drinking Water Act. Therefore, there is no required mechanism to prevent private domestic wells from using groundwaters that may exceed MCLs.

Therefore, under LSJR Alternative 2 with adaptive implementation, and LSJR Alternatives 3 and 4 with and without adaptive implementation, there is a potential for the quality of groundwater used in private domestic wells to be affected such that violations of water quality standards would occur. Accordingly, impacts would be significant.

The State Water Board does not have authority to require implementation of mitigation that could reduce this impact to a less-than-significant level, because it does not regulate private domestic wells. It can and does assist in identifying water quality threats through the Groundwater Ambient Monitoring and Assessment (GAMA) Program, the Board's comprehensive groundwater quality monitoring program for California, and GeoTracker GAMA, which provides water quality data in California via the internet. For example, using the publicly available data collected in GAMA since 2000, State Water Board provides an online, map-based, tool, called "Is My Property Near a Nitrate-Impacted Water Well?," which domestic owners can use to evaluate the risk of nitrate contamination to their well. The tool can be accessed at http://www.waterboards.ca.gov/water_issues/programs/nitrate_project/nitrate_tool/.

Possible mitigation measures owners and operators of private domestic wells should undertake to avoid or reduce potential drinking water impacts at private domestic wells include the following.

- Having a licensed contractor construct wells in accordance with well construction standards.
- Choosing a location for a well to make sure it is free of potential sources of contamination.
- Testing well water at certified drinking water laboratories to ensure its quality.
- Installing, if necessary, a water treatment system tailored to the overall water chemistry and constituents that need to be removed. Example systems include activated alumina filters, activated charcoal filters, air stripping, anion exchange, and ultraviolet radiation.
- Drilling, if necessary, a new well that taps into a cleaner aquifer or finding an alternative water source.
- Destroying properly of unused and abandoned wells to prevent contamination.

In addition, local agencies can and should exercise their police powers and groundwater management authority under SGMA, described above, to address groundwater contamination so as to prevent and/or mitigate drinking water impacts on private domestic wells. Specifically, under SGMA, local agencies in high- and medium-priority basins must form GSAs by June 30, 2017, that will develop and implement GSPs that achieve sustainable groundwater management within

20 years. Each GSP must also include measureable objectives as well as milestones in increments of 5 years, to achieve the sustainability goal in the basin within 20 years of the implementation of the plan. (Wat. Code, § 10727.2.) If local agencies are unwilling or unable to manage their groundwater resources, SGMA authorizes the State Water Board to step in to protect a groundwater basin, as discussed above.

Thus, at this time, local agencies are vested with the mandatory duty to achieve sustainable groundwater management, which includes preventing significant and unreasonable degradation to water quality. These agencies, therefore, can and should exercise their full authorities to address degradation of groundwater quality, both under SGMA and their police powers. Doing so would prevent and/or mitigate private domestic well drinking water supply impacts. Due to inherent uncertainty in the degree to which this mitigation and those listed above may be implemented by local agencies and owners and operators of private domestic wells, drinking water impacts on private domestic wells under LSJR Alternative 2 with adaptive implementation, and LJSR Alternatives 3 and 4 with and without adaptive implementation would remain significant and unavoidable.

## 22.4.2 Potential Impacts on Public Health

All Californians have a right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes. Safe water is necessary for public health and community prosperity. The reduction in surface water supply could affect all entities that rely upon groundwater as a partial or primary source of drinking water, including end-users of municipal and public water systems, DACs, domestic well owners, and schools. The public health impacts associated with the LSJR alternatives on groundwater resources cannot be determined with certainty because groundwater conditions vary within each groundwater subbasin, and water users would have varied responses to reduced water deliveries. Communities and individuals will be affected differently by reduced water supply conditions, depending on several variables, including the following.

- Structure and capacity of existing water system.
- Economic development.
- At-risk populations living within the affected area.
- Local governance of water use.
- Other societal factors, such as the presence of local social networks.

Reduction in potable water supplies could results in directly observable and measurable health effects, such as compromised quality or quantity of potable water, diminished living conditions pertaining to sanitation and hygiene in the short term. Other, long-term chronic impacts, such as increased risk of mental or behavioral health issues, such as anxiety and other conditions and disorders (especially among persons who rely on water for their economic survival), increased risk to vulnerable people (e.g., persons suffering from chronic health conditions or immune disorders), and increased disease incidence for infections, chronic, and vector borne or zoonotic diseases are not always easy to anticipate or monitor (CDC et al. 2010).

The analysis of the plan amendment's[10] potentially significant impacts on service providers is in Chapter 13, *Service Providers*. That analysis includes an examination of whether implementation of the LSJR alternatives would lead to drinking water that exceeds standards and the potential for service providers to have to construct new or expanded facilities due to water quality or issues associated with reduced surface water diversions (i.e., reduced water supply). This section moves beyond the Chapter 13 analysis of impacts on service providers and to the environment, and discusses the potential public health impacts on various water users. Implementation of the LSJR alternatives may have some public health impact, with potential public health impacts increasing as the percent unimpaired flow[11] increases. Thus, as LSJR Alterative 2 would have the lowest percentage of unimpaired flow (at 20 percent), it would have the lowest impact on municipal and domestic water supplies, and therefore the least potential impact on public health. The risk of potential public health impacts would increase with LSJR Alternatives 3 and 4. However, because water supply conditions vary by service providers, and because service providers and end users would have varied responses to reduced surface water deliveries, the impacts of the LSJR alternatives on public health cannot be determined with certainty.

The following sections discuss potential public health impacts that specific water users could experience under the LSJR alternatives.

## Municipalities and Public Water Systems

Under reduced surface water supply conditions, such as those associated with the LSJR alternatives, California's reliance on groundwater increases, which in turn increases groundwater pumping and lowers groundwater levels. In addition to potentially resulting in reduced groundwater levels, increasing pumping also raises the risk of groundwater contaminant transport and public supply wells going dry, both of which impact water supplies and pose a potential public health threat to public water systems. Contaminated groundwater requires additional treatment and could pose a threat for water systems that could not afford additional treatment to remove contaminants from groundwater prior to serving it to customers. Additionally, lowering groundwater levels may require suppliers to deepen existing wells or construct new wells to ensure adequate groundwater supplies, which could result in higher costs for ratepayers and consumers. As mentioned above, impacts on public health would vary by public water supplier, based on local groundwater contaminants, the system's reliance on groundwater, and groundwater resource management. However, while the LSJR alternatives could have public health impacts, public water systems are required to prepare for reduced water supply scenarios, including reducing or preventing public health impacts.

## Disadvantaged Communities

Potential public health impacts associated with the LSJR alternatives are similar to those discussed under Municipalities and Public Water Systems. However, as highlighted during the recent drought, the effects of reduced surface water supplies are not felt by communities equally. In California,

[10] These plan amendments are the *project* as defined in State CEQA Guidelines, Section 15378.

[11] *Unimpaired flow* represents the water production of a river basin, unaltered by upstream diversions, storage, or by export or import of water to or from other watersheds. It differs from natural flow because unimpaired flow is the flow that occurs at a specific location under the current configuration of channels, levees, floodplain, wetlands, deforestation and urbanization.

communities of color and low-income people living in tribal, rural, and farming communities often disproportionately experience impacts on drinking water supplies. While the public water systems serving DACs are still required to maintain essential public health and resources, public water systems serving DACs are less likely to have the resources to adequately respond to water supply or water quality emergencies.

As discussed above, responding to contaminated or reduced groundwater resources is expensive. The systems serving DACs are more likely to have a difficult time responding to impacts on their water supply because they lack the infrastructure and financing that exists for the water systems serving more affluent communities, which may make them unable to afford treating or finding alternative supplies for a contaminated drinking water source. As a result, DACs may be more vulnerable than other municipalities and cities to impacts associated with the LSJR alternatives.

#### Domestic Well Users

As discussed earlier in this chapter and in Chapter 9, *Groundwater Resources*, due to their shallower depths, domestic wells are more susceptible to the impacts associated with the LSJR alternatives—such as groundwater contaminant transfer and dry wells—than public water systems wells. Additionally, domestic well owners lack the resources of public water systems to respond to reduced drinking water supplies. Domestic well users represent a small percentage of water users within the four groundwater subbasins, which means that potential public health impacts are more likely to occur as isolated cases. However, given their limited resources, it is possible that individual users would experience more significant impacts than would be experienced by a public water system under the same supply reductions. Given the lack of data regarding both the exact number of domestic well users and the groundwater quality of domestic wells, it is not possible to assess the potential public health impacts on domestic well users.

#### Schools

With students typically spending at least six hours at school each day, ensuring safe, clean drinking water at schools is an important factor in contributing to overall good health. Like the other water users discussed above, public health impacts associated with the LSJR alternatives will vary by school. However, because schools receive water from either a public water system or a private well, the potential public health impacts would be similar to those impacts discussed in the sections above.

## 22.4.3 Costs of Potential Management Options

As discussed previously, service providers could respond to reduced surface water supplies associated with LSJR alternatives by deepening their wells and constructing more wells. Additionally, service providers could reduce overall water use by implementing water efficiency and conservation programs, create alternative water supplies through groundwater recharge programs and recycled water programs, or purchase water from other agencies. Domestic well owners might deepen their wells or construct new wells. This section describes potential actions affected entities could take to replace surface water that may be reduced due to implementing the LSJR alternatives. Such actions include the following.

- Substitute groundwater for surface water by deepening wells and constructing more wells – The costs of well projects can vary substantially depending on the geology of the well location, well depth and diameter, well type, pump efficiency, level of water treatment required, size of the distribution system, and cost of electricity and staff needed to maintain equipment and facilities. Table 22-6 shows the two well projects that were funded by the State Water Board. As shown in the table, the cost ranged widely among the projects. One of the dominant cost categories in the operations and maintenance budget for groundwater wells is the cost for electricity. Based on information presented in Chapter 16, *Evaluation of Other Indirect and Additional Actions,* it can reasonably be estimated that groundwater pumping electrical costs in the plan area are between $57.36 and $76.48/AF. According to Flex Your Power (2012), energy costs may represent 50–75 percent of a water utility's budget. Using the upper end electricity cost calculated above ($76.48/AF), it can reasonably be estimated that annual total operations and maintenance cost of a groundwater project would be between $101.97–$152.96/AF.

- Purchase water from parties that have extra water through contracts or transfers – The duration and cost for purchasing water are subject to many factors. A short-term transfer is a transfer of 1 year or less; a long-term transfer is a transfer longer than 1 year. A water transfer may change the place of use, the point(s) of diversion, or the purpose of use. A water transfer cannot increase the amount of water a diverter is permitted to use, nor can it change the season when water is diverted. According to USBR (2006), average costs for a short-term water transfer is $1,716/AF and $310/AF for a long-term water transfer.
- Recharge groundwater basins – Recharging groundwater basins by storing "extra" available surface water in the aquifer allows it to be extracted for use later, when the water would otherwise be unavailable. This process is known as aquifer storage and recovery (ASR), which typically includes: (1) gravity recharge basins or injection wells that move water under pressure from the surface to an underground aquifer, and (2) wells that pump groundwater from the aquifer and send the water to an existing treatment plant or directly into a distribution system for use. The costs of ASR projects are highly variable and depend on many factors. Table 16-8 identifies recently funded groundwater recharge projects. Annual costs are typically between $158 and $238/AF; this includes planning, design, permitting, land acquisition/rights of way, construction, and administrative costs, in 2010 dollars (DWR 2012).
- Use recycled water – Recycled water is wastewater that has been treated to a desired water quality standard, and then distributed and used for another purpose. Typically, recycled water costs less than potable water because it does not need to meet the same water quality standards. For example, cities and municipalities could offset potable water by using recycled water to irrigate parks, golf courses, gardens and other landscaping areas, and agricultural fields. Thus more potable water could be made available for municipal uses. The complexity and cost of a recycled water project depends on many factors, such as the level of treatment needed, the desired water quality for the secondary beneficial use, and the distance between the treatment location and the use location. Recycling wastewater for landscape and agricultural irrigation typically costs between $400-$2,100/AF, including capital, treatment, operations, and maintenance costs (WRF 2011). With advanced treatment technology, recycled water could also be used to replace potable water for domestic use. Direct potable reuse is practiced in areas where supply water is extremely scarce, such as Singapore and Namibia (WRF 2011). Direct potable reuse of recycled water typically costs $700–$1,200/AF, including capital, treatment, operations, and maintenance (WRF 2011). Recycled water can be used by the commercial, institutional, or industrial sector as process water. For example, cooling towers at power plants could use recycled water to offset the need for potable water. Water quality required for process

water is similar to that for potable water. Process water recycling projects typically cost the same as direct potable reuse projects due to the need for higher water quality.

The cost of each of these options is summarized in Table 22-7. See Chapter 16, *Evaluation of Other Indirect and Additional Actions,* for more information on these potential substitution options.

**Table 22-6. Example New Groundwater Well Projects Funded by the State**

| Applicant | Project | Construction Cost ($) | Production Capability (AFY) | Depth (ft) | Cost per foot of depth ($) |
|---|---|---|---|---|---|
| City of Ceres | Replacement of well due to uranium and nitrate contamination | 155,598 [a] | 1,936 | 324 | 480 |
| Plainsburg Elementary School | New water supply well | 165,000 [b] | 242 | 600 | 275 |

Source: Orellana pers. comm.

[a] Well is equipped with a 100 horsepower submersible pump. It is unclear whether the cost of distribution pipelines is included.

[b] This cost includes the cost of the labor and equipment to drill and install well casing to 600 feet, installation of a submersible pump, pressure tank and electrical system, E-log, potholing for existing utilities, water for drilling, access to the job site as well as a survey.

**Table 22-7. Costs of Potential Management Options**

| Option | Cost ($) |
|---|---|
| Deepen existing wells | Variable, range between $15–$50/foot |
| Construct new wells | Highly variable (Table 22-6)<br>Operations and maintenance (O&M) annual costs range between $101.97–$152.96/AF |
| Purchase water from another party (short-term water transfer) | $1,716/AF on average |
| Purchase water from another party (long-term water transfer) | $310/AF on average |
| Treat recycled water | $400–$2,100/AF for irrigation including capital and O&M costs (WRF 2011)<br>$700–$1,200/AF for direct portable reuse and process water, including capital and O&M costs (WRF 2011) |
| Aquifer storage and recovery (ASR) projects | Highly variable (see Table 16-8), depends on the scale of the project and the level of O&M required |

Source: Chapter 16, *Evaluation of Other Indirect and Additional Actions*

# 22.5 Assistance Programs

Sustainable water supply solutions must strike a balance between the need to provide for public health and safety (e.g., safe drinking water, clean rivers and beaches, flood protection), protect the environment, and ensure a stable California economy. There are many state, county, and local assistance programs available that may be leveraged to support and improve water supplier planning and supply efforts. This section highlights select State Water Board programs that provide financial and technical assistance to agencies for implementing water supply and quality projects.

## 22.5.1 Financial Assistance

There are many state and federal financial assistance programs designed to assist public water systems. Over the last 15 years, four major state public funding sources have been made available for public drinking water or water quality improvement projects: Proposition 50, Proposition 84, the Drinking Water State Revolving Fund (DWSRF), and Proposition 1. Often, these funding programs leverage each other to make a project more feasible. A brief description of some applicable funding programs is included in Chapter 16, Section 16.5, *Sources of Funding*.

The State Water Board works with local, state, and federal partners to provide financial assistance to at-risk drinking water systems. This includes a broad range of funding sources for new wells, interties, and emergency drinking water supplies. Through propositions 50 and 84, the State Water Board has provided funding for projects intended to improve water security, as well as infrastructure improvement and groundwater quality projects, and emergency and urgent funding for projects that ensure safe drinking water supplies. The DWSRF continues to provide funding assistance to public water systems for infrastructure improvements to correct public water system deficiencies that pose public health risks and improve drinking water quality, or both.

The passing of Proposition 1 expanded upon existing funding programs, making an additional $260 million available for the DWSRF projects. Proposition 1 also provided $260 million to the Small Community Grant Fund to provide financial assistance to small communities (i.e., population of 20,000 persons, or less) for the planning, design, and construction of publicly owned wastewater treatment and collection facilities. Proposition 1 provided $800 million for projects intended to prevent and clean-up contamination of groundwater that serves (or has served) as a source of drinking water. Additionally, Proposition 1 provided $625 million for water recycling projects and $200 million for storm water projects that will improve regional water supply resiliency.

During the recent drought emergency, the State Water Board made $19 million in funding available to meet interim emergency drinking water needs for those communities, including DACs, with a contaminated water supply or that suffered drought-related water outages or threatened outages (State Water Board 2016). The State Water Board's Drought Response Outreach Program for Schools (DROPS) made $30.2 million in funding available to schools to encourage water conservation education and projects. DROPS provides grants to school districts to create opportunities for storm water retention and reuse, and to raise awareness of sustainability. All DROPS-funded projects include an educational and outreach element to increase student and public awareness of water conservation.

Many financial assistance programs include additional assistance for eligible DACs. During the recent drought, many county and non-profit programs have provided financial assistance to communities with impacted drinking water supplies.

## 22.5.2 Technical Assistance

Complying with state and federal drinking water regulations is essential for protecting public health and ensuring safe drinking water. There are many technical assistance programs designed to assist agencies implementing water supply and water quality projects. These programs are designed to ensure access to a safe, clean, and affordable water supplies and maintain compliance with all applicable water laws and regulation. The State is committed to identifying and monitoring the status of drought-vulnerable public water systems to help prevent or mitigate any anticipated shortfalls in supply and to secure alternative sources of water for the communities when needed. In 2013, the State Water Board released a report that identified communities relying on a contaminated groundwater source for drinking water (State Water Board 2013). The state also works with local governments and agencies to identify drought-vulnerable areas served by domestic wells and collaborate to prevent or mitigate any anticipated shortfalls.

The State Water Board provides technical assistance to DACs and at-risk drinking water systems and works with the water systems to identify potential solutions. State technical assistance programs provide help with: preparing financial assistance applications; performing compliance audits; reviewing proposed projects alternatives; planning and preparing budgets; and performing community outreach, awareness, and education. DWSRF and Proposition 1 eligible projects can assist publicly owned water systems (e.g., counties, cities, districts), privately owned community water systems (e.g., for-profit water utilities, non-profit mutual water companies), and non-profit or publicly owned non-community water systems (e.g., public school districts) with the planning/design and construction of drinking water infrastructure projects that will improve the community's water efficiency and ensure a drought-resilient water supply. Potential solutions include, but are not limited to, stringent conservation measures, interconnections with other water systems (i.e., consolidation), development of new water sources, expansion of existing sources (e.g., deepen wells, extend reservoir intakes), and treatment of sources that produce water that does not meeting drinking water quality standards. Locally-implemented cost-effective and technically feasible strategies such as urban and agricultural water conservation and efficiency, water reuse and recycling, and storm water capture. Triggers and responses are developed and implemented at the local level.

Sometimes, the best solution for ensuring a safe drinking water supply is for a small, failing water system to join a larger public water system. Senate Bill (SB) 88 authorizes the State Water Board to require public water systems that consistently fail to meet standards to consolidate with, or obtain service from, a public water system. Consolidating public water systems and extending service from existing public water systems to communities and areas which currently rely on under-performing or small, failing water systems, as well as domestic wells, reduces costs and improves reliability (State Water Board 2015).

During the recent drought, many county and non-profit programs have provided technical assistance to communities and private well owners with impacted drinking water supplies, including providing free water quality testing for domestic wells.

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