Master Response 3.4
Groundwater and the Sustainable Groundwater Management Act

Overview

This master response addresses comments raised regarding the groundwater impact analysis and approach to incorporating the Sustainable Groundwater Management Act (SGMA) in the substitute environmental document (SED) recirculated in September 2016 (Recirculated SED).

The Lower San Joaquin River (LSJR) flow objectives and program of implementation propose higher levels of unimpaired flows in the Stanislaus, Tuolumne, and Merced Rivers to reasonably protect fish and wildlife beneficial uses. Multiple commenters were concerned that if less surface water were available for diversion, then water users in the plan area would pump more groundwater to maintain water use at current levels, which could reduce groundwater levels and cause other impacts. Some commenters voiced concern that by analyzing potential reductions in groundwater levels from increased groundwater pumping, the State Water Resources Control Board (State Water Board) is directing more groundwater pumping. Commenters were also concerned that if water users pump additional groundwater, local public agencies would be unable to develop and implement plans to manage groundwater sustainably as required by SGMA. Finally, some commenters asserted that because SGMA could eventually restrict groundwater pumping, the SED baseline analysis should have projected less future groundwater pumping instead of using the historical 2009 levels of pumping that occurred when the Notice of Preparation was issued.

The Recirculated SED analyzes potential local responses to reductions in surface water based on historical 2009 levels of substitute pumping (SED baseline) and 2014 levels of substitute pumping (Chapter 9, *Groundwater Resources,* Section 9.4.2, *Methods and Approach*). The plan amendments do not encourage or mandate an increase in groundwater pumping, and nothing in the Recirculated SED requires water users to increase groundwater pumping in response to implementation of the plan amendments. The precise actions local public agencies decide to take in response to implementation of the plan amendments will depend on many individual and collective decisions, including the discrete actions of local water users in response to reductions in surface water, crop choices in response to markets and other factors, use of conservation measures, and implementation of SGMA.

Groundwater accounts for approximately 38 percent of the total water supply in the San Joaquin River Hydrologic Region, and the majority of groundwater (81 percent) is used for agriculture (DWR 2013). Groundwater levels in the San Joaquin Valley have generally declined because of extensive groundwater pumping to sustain agriculture (Chapter 9), and as a result, many groundwater basins in the region have experienced some level of overdraft and its attendant impacts, including land subsidence and dry wells. Two of the four subbasins underlying the plan area (Eastern San Joaquin and Merced Subbasins) are on the California Department of Water Resources (DWR) list of critically overdrafted basins (Section 9.2.1, *San Joaquin Valley Groundwater Basin and Subbasins*). This overdraft problem was a primary reason the California Legislature passed SGMA in 2014 (Section 9.3.2, *State*).

SGMA requires local public groundwater sustainability agencies (GSAs) develop groundwater sustainability plans (GSPs) that achieve sustainable groundwater management within 20 years of GSP implementation. SGMA applies to California groundwater basins designated high- or medium-priority by DWR. The State Water Board is required to intervene, within designated timeframes, if local public agencies fail to form GSAs, fail to adopt GSPs, or submit GSPs that are determined to be inadequate or are not being implemented in a way that is likely to achieve sustainable groundwater management.

The State Water Board released the SED Notice of Preparation in February 2009 and the first public draft of the SED in December 2012 before SGMA passed in September 2014. The Recirculated SED was released in September 2016, before local public agencies in the plan area formed GSAs. As of June 2017, most public agencies were in the process of GSA formation (a prerequisite to GSP planning) and no GSPs had been developed. Therefore, no existing GSPs could be affected by implementation of the LSJR flow objectives. Stated another way, GSPs are in the early development phase and still being written. For those GSPs to be sufficient, GSAs will have to incorporate accurate water supply projections that include the LSJR flow objectives in their technical assumptions.

Consistent with California law, SGMA compliance cannot occur at the expense of reasonably protecting surface water beneficial uses (Wat. Code, § § 113, 10721 (x) (6), 10726.8 (c)). It is unreasonable to use extremely limited surface water resources to address impacts of overdrafted groundwater for SGMA compliance, because diversion of surface water in the plan area has already resulted in adverse impacts on fish and wildlife (*Executive Summary*, Section ES-4, *Purpose, Needs, and Goals*, and Chapter 19, *Analyses of Benefits to Native Fish Populations*). The State Water Board has a legal mandate to reasonably protect fish and wildlife beneficial uses in the LSJR Watershed, which the State Water Board is proposing to do with the plan amendments.

The State Water Board reviewed all comments related to groundwater resources and SGMA and developed this master response to address recurring comments and common themes. This master response references related master responses, as appropriate, where recurring comments and common themes overlap with other subject matter areas. For ease of reference, a table of contents is included after this overview to help guide readers to specific subject areas. In particular, this master response addresses, but is not limited to, the following topics.

- Historical groundwater use and overdraft in the plan area.
- SED consideration of SGMA.
- Approach used to evaluate impacts on groundwater resources.
- Groundwater-dependent ecosystems.

For responses to comments regarding groundwater resources and disadvantaged communities, please see Master Response 2.7, *Disadvantaged Communities*. For an explanation of the groundwater assumptions in the hydrologic modeling, please see Master Response 3.2, *Surface Water Analyses and Modeling*. For responses to comments regarding groundwater resources and service providers, please see Master Response 3.6, *Service Providers.* For an explanation of the groundwater assumptions in the agricultural economics modeling, please see Master Response 8.1, *Local Agricultural Economic Effects and the SWAP Model.*

Table of Contents

Historical Groundwater Use and Overpumping

It is important to understand the current status of the four groundwater subbasins underlying the plan area (Eastern San Joaquin, Modesto, Turlock, and extended Merced, which includes a part of the Chowchilla) to distinguish between potential groundwater impacts that are attributable to the plan amendments and impacts that are attributable to, or potentially exacerbated by, existing legacy issues. The California Water Plan Update (DWR 2013) estimates the 2005 to 2010 average annual total water supply (municipal, agricultural, and managed wetlands) in the San Joaquin River Hydrologic Region was 8.3 million acre-feet (MAF) of which 3.2 MAF (38 percent) came from groundwater. The majority of groundwater in the region (81 percent) is used for agriculture, while municipal use accounts for 13 percent, and managed wetlands account for the remainder (6 percent) (DWR 2013).

Groundwater levels in the San Joaquin Valley Groundwater Basin have generally declined as a result of extensive groundwater pumping to sustain agriculture (Chapter 9). Figure 3.4-1 shows the number of new irrigation wells and public wells reported in California from 1980 through 2015. During that time, irrigation well construction increased in critically dry years when surface water was less available and agricultural production continued to grow. Conversely, the installation of public wells remained relatively constant.

All four subbasins in the plan area are designated as high priority and are experiencing some level of overdraft. DWR identified the Eastern San Joaquin and Merced Subbasins as critically overdrafted (DWR 2016). Over the last 40 years, groundwater levels in the Eastern San Joaquin Subbasin declined an average of 1.7 feet per year (ft/y) (USACE 2001), and overdraft reduced storage by approximately 2 MAF (DWR 2003a). Overdraft in the Merced Subbasin is estimated between 20 and 44 thousand acre-feet per year (TAF/Y) (DWR 2003c). Groundwater storage in the Turlock Subbasin decreased by an average of 21.5 TAF/Y from 1997 to 2006 (TGBA 2008). Groundwater levels in the Modesto Subbasin decreased by about 0.5 ft/y between 1970 and 2000 (DWR 2003b). Despite these declines, groundwater pumping in the region continued to increase in response to growing demands.

In 2014, the California Assembly acknowledged the overdrafted conditions of San Joaquin Valley groundwater basins in an oversight hearing on management of California's groundwater resources (prior to enacting SGMA). At the hearing, researchers from the NASA Gravity Recovery and Climate Experiment (GRACE) demonstrated that between October 2003 and March 2009, the Central Valley had lost enough water to nearly fill Lake Mead (26 MAF), the largest reservoir in the United States. According to GRACE, 64 percent of that loss occurred in the San Joaquin Valley—the primary cause (75 percent) was groundwater pumping to irrigate crops (California Assembly 2014). Thereafter, the Legislature passed SGMA as a way to address groundwater overdraft and promote sustainable management in California's groundwater basins (Section 9.3.2, *State*; Chapter 13, *Service Providers*, Section 13.3.2, *State*).

Despite conditions of overdraft, local agencies (e.g., San Joaquin, Stanislaus, and Merced Counties) typically approved the drilling and pumping of groundwater wells through ministerial actions without discretionary review that would require environmental analysis. Local ordinances could restrict the installation of new wells, but in 2015 alone, 2,500 new wells were installed in the San Joaquin Valley (304 in Merced County and 160 in Stanislaus County)—five times the annual average for the previous 30 years (Sacramento Bee 2016). Not all of these wells are located in the plan area, but the high number gives some perspective to the current problem. For example, in Merced County, new well permit requests spiked during the 2 months before the county adopted Ordinance No. 1930 on March 17, 2015. That ordinance prohibits the exportation of groundwater out of the basin but exempts existing exports that are not "in excess of extraction patterns, established between 1995 and 2013, in place as of the date of adoption of this ordinance" (Merced County Code, § 9.27.040). Merced County received 512 requests for well permits and gave priority to domestic wells that had gone dry (Merced Sun Star 2015).

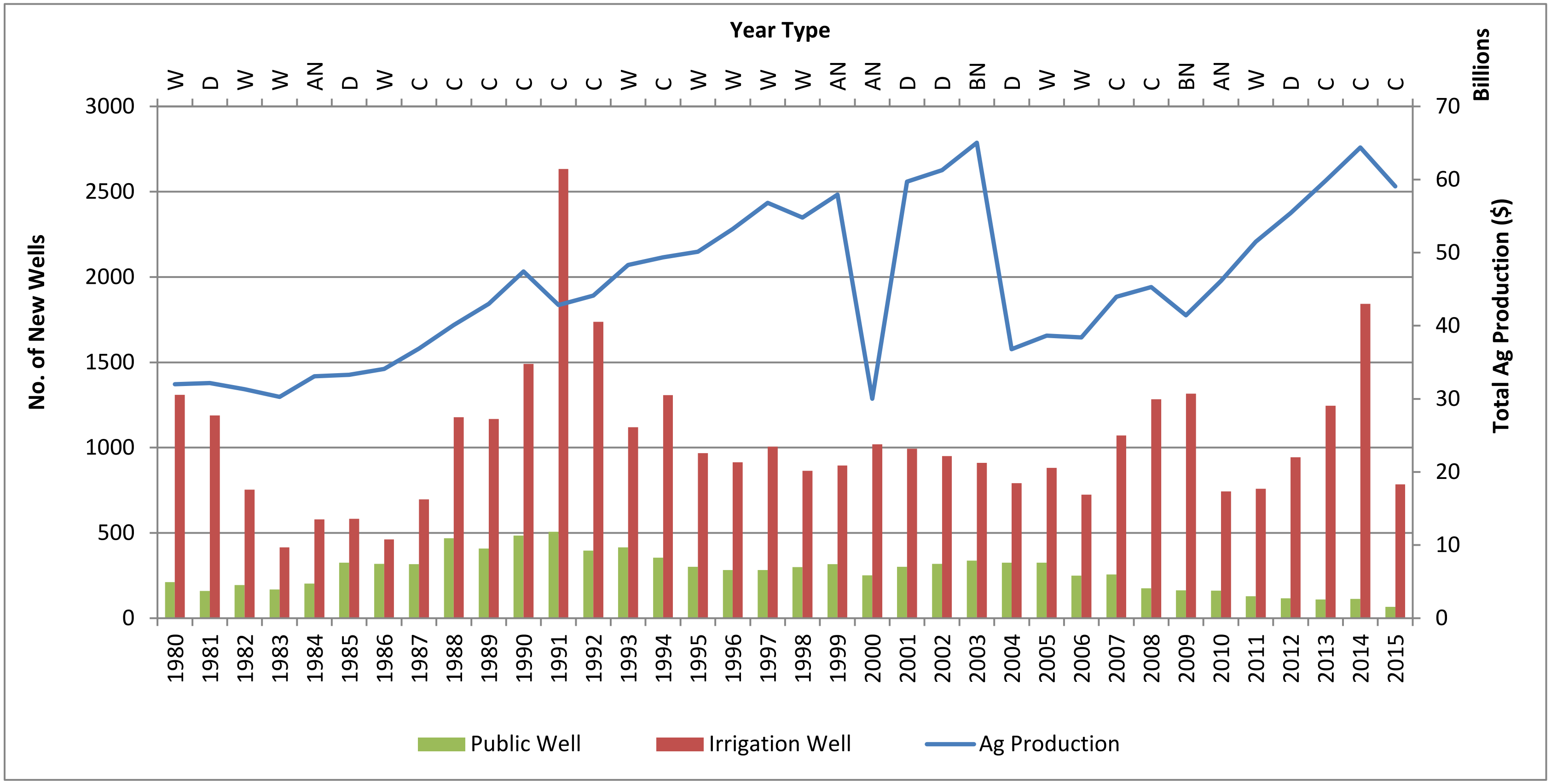

Figure 3.4-1. Reported New Irrigation Wells and Total Agricultural Production in California (1980 to 2015)

Sources: USDA 2017; DWR 2017y

Water Year (starting on October 1 of the previous calendar year) Type:
W = Wet
AN = Above Normal
N = Normal
BN = Below Normal
D = Dry
C = Critically Dry

Sustainable Groundwater Management Act

In 2014, the Legislature passed SGMA to address ongoing unsustainable groundwater use in California's groundwater basins. SGMA is not a moratorium on groundwater pumping or a remedial statute that requires basins to be returned to a pre-SGMA level. Instead, sustainable groundwater management is defined under SGMA as the "management and use of groundwater in a manner that can be maintained during the [50-year SGMA] planning and implementation horizon without causing undesirable results" (Wat. Code § 10721 (v)). Under SGMA, undesirable results occur when one of the following effects become "significant and unreasonable:" chronic lowering of groundwater levels, reduction of groundwater storage, seawater intrusion, degraded water quality, land subsidence, and depletions of interconnected surface waters that impact beneficial uses of surface waters (Wat. Code § 10721 (x)). As noted by Governor Brown, a central feature of SGMA is "the recognition that groundwater management in California is best accomplished locally" (OG 2014). Thus, SGMA only authorizes the State Water Board to assert authority and protect groundwater resource if local agencies are unable or unwilling to manage their groundwater in a sustainable manner (Wat. Code §§ 10735–10736.6).

SGMA required formation of GSAs in the state's high- or medium-priority basins by June 30, 2017; all four subbasins in the plan area are now fully covered by one or more GSAs (State Water Board 2017a). GSAs are legally required to prepare technical, basin-specific GSPs, based on local geology, historical data, groundwater levels, groundwater quality, subsidence, groundwater-surface water interactions, historical and projected water demands, groundwater elevations, groundwater extractions, surface water supplies, and other elements. From this technical, locally specific information, each GSA will determine the basin's sustainable yield and develop a water budget. GSAs must determine the best approach to manage their groundwater and surface water resources sustainably in order to ensure their basin is operated within its sustainable yield. GSAs will do this by developing and implementing GSPs that outline projects, programs, and enforcement actions. SGMA authorizes GSAs to regulate, limit, and suspend groundwater extractions in order to achieve basin-wide sustainability. GSAs have until 2020 (in critically overdrafted basins) and 2022 (in all other high- or medium-priority basins) to develop and commence implementation of GSPs; GSAs have until 2040 or 2042, respectively, to reach sustainability.

SGMA requires GSAs to consider the interests of all beneficial uses and users of groundwater in their basin, including, but not limited to, agricultural users, domestic well owners, municipal well operators, environmental users, and disadvantaged communities (Wat. Code § 10723.2). GSAs must explain how they will consider those interests in the development and implementation of their GSP (Wat. Code § 10723.8 (a) (4)). Table 3.4-1 lists the GSAs within the plan area, their members, and the interested parties identified by the GSAs.

Table 3.4-1. Groundwater Sustainability Agency (GSA) and Selected Interested Parties Identified in the GSA Formation Notification Submittals by June 30, 2017

Subbasin	Name of GSA (Formation Notice Date)	GSA Member	Listed Interested Parties within the GSA boundary		
			Municipal Well Operators (MWO)	Public Water Systems (PWS)	Disadvantaged Communities (DAC)
Eastern San Joaquin	City of Manteca (1/4/17; modified 2/16/17)	City of Manteca	City is MWO; no other MWO present	District is PWS; no other PWSs present	To be identified
	Linden County WD (9/29/16; modified 2/16/17)	Linden County WD	District is MWO; no other MWO present	District is PWS; no other PWSs present	Part of district
	Stockton East WD (10/22/15; modified 6/22/17)	Stockton East WD	District is MWO; no other MWO present	Not identified	Presence identified but not listed
	City of Stockton (12/29/15; modified 6/22/17)	City of Stockton	City of Stockton Cal Water, Stockton	San Joaquin County	Presence identified but not listed
	Lockeford CSD (12/29/15; modified 2/16/17)	Lockeford CSD	District is MWO; no other MWO present	District is PWS; no other PWSs present	Part of district
	San Joaquin County, ESJ (1/5/16; modified 7/20/17)	San Joaquin County, ESJ	City of Stockton City of Lodi City of Lathrop City of Manteca City of Ripon City of Escalon	California Water Service Company Lockeford CSD Linden County WD Farmington Water Company	Presence identified but not listed
	Woodbridge ID (1/13/17; modified 6/22/17)	Woodbridge ID	Not present	Not present	Presence identified but not listed
	City of Lodi (2/9/16; modified 6/22/17)	City of Lodi	City is MWO; no other MWO present	City is PWS; no other PWSs present	Presence identified but not listed

Subbasin	Name of GSA (Formation Notice Date)	GSA Member	Listed Interested Parties within the GSA boundary		
			Municipal Well Operators (MWO)	Public Water Systems (PWS)	Disadvantaged Communities (DAC)
Eastern San Joaquin Cont.	North San Joaquin Water Conservation District (3/1/16; modified 6/22/17)	North San Joaquin Water Conservation District	City of Lodi Lockeford CSD San Joaquin County	City of Lodi Lockeford CSD San Joaquin County	Presence identified but not listed
	City of Lathrop (2/24/17; modified 6/23/17)	City of Lathrop	City is MWO; no other MWO present	City is PWS; no other PWS present	Part of city
	Central San Joaquin Water Conservation District (3/14/17; modified 6/23/17)	Central San Joaquin Water Conservation District	Not present	Farmington Water Company	Presence identified but not listed
	Central Delta WA (3/2/17; modified 6/22/17)	Central Delta WA	Not present	Limited number of marina-related PWSs	Presence identified but not listed
	South Delta WA (3/14/17; modified 6/22/17)	South Delta WA	Not present	Limited number of marina-related PWSs	Presence identified but not listed
	Oakdale ID Eastern San Joaquin Subbasin GSA (3/22/17; modified 6/23/17)	Oakdale ID	Not present	Not present	Presence identified but not listed
	South San Joaquin GSA (4/18/17; modified 6/22/17)	South San Joaquin ID City of Ripon City of Escalon	City of Ripon City of Escalon	City of Ripon City of Escalon	Presence identified but not listed
	Eastside San Joaquin GSA (5/10/17; modified 7/6/17)	Calaveras County WD Rock Creek WD Stanislaus County	Not present	**CWS:** Valley Springs Public Utility District Calaveras County WD Knights Ferry CSD 4N Mobile Home Park **Non-Transient, Non-CWS:**	DWR DAC Mapping Tool shows no DACs within GSA boundary. GSA believes DACs exist within GSA boundary; given the rural nature of the GSA, DACs may not be accurately

Subbasin	Name of GSA (Formation Notice Date)	GSA Member	Listed Interested Parties within the GSA boundary		
			Municipal Well Operators (MWO)	Public Water Systems (PWS)	Disadvantaged Communities (DAC)
				U.S. Army Corps of Engineers (New Hogan Reservoir) East Bay Municipal Utility District (Lake Camanche) Valley Home School (Texas Ave) Valley Home School (Pioneer St) Pioneer Equine Hospital WS **Transient, Non-CWS:** Orange Blossom Recreation Area Knights Ferry Recreation Area Whiskey River Saloon Woodward Reservoir WS Shivley's Bar & Grill	reflected in census data.
	San Joaquin County No. 2 (1/5/16; modified 7/20/17)	San Joaquin County California Water Service Company[1]	Notice includes spreadsheet of interested parties, but does not specify interested party by type. Same spreadsheet is included in the San Joaquin County ESJ notice. It is unclear which parties are associated with each GSA.		
Merced	Merced Irrigation–Urban GSA (5/31/17; modified 6/1/17)	City of Atwater City of Livingston City of Merced Le Grand CSD Merced ID Planada CSD Winton Water and Sanitary District	City of Atwater City of Livingston City of Merced Le Grand CSD Planada CSD Winton Water and Sanitary District	To be identified	Presence identified but not listed

Subbasin	Name of GSA (Formation Notice Date)	GSA Member	Listed Interested Parties within the GSA boundary		
			Municipal Well Operators (MWO)	Public Water Systems (PWS)	Disadvantaged Communities (DAC)
Merced Cont.	Merced Subbasin GSA (3/28/17)	County of Merced County of Mariposa Le Grand-Athlone WD Merquin County WD Plainsburg ID Stevinson WD	To be identified	To be identified	Many identified; only listed Le Grand, Planada, and El Nido
	Turner Island WD 1 (3/22/17; modified 4/7/17)	Turner Island WD	Not present	Not present	Not present
Modesto	Stanislaus and Tuolumne Rivers Groundwater Basin Association (2/28/17; modified 5/30/17)	City of Modesto City of Oakdale City of Riverbank City of Waterford Modesto ID Oakdale ID Stanislaus County	City of Modesto City of Oakdale City of Riverbank City of Waterford	City of Modesto City of Oakdale City of Riverbank City of Waterford	Presence identified but not listed
	Tuolumne Groundwater Sustainability Agency (5/22/17)	Tuolumne County	Not present	Not present	Not present
Turlock	East Turlock Subbasin GSA (4/3/20; modified 7/7/20)	**Members:** Ballico-Cortez WD Eastside WD Merced County Merced ID Stanislaus County **Proposed Associate Member:** City of Turlock	City of Turlock	To be identified	Presence identified but not listed

Subbasin	Name of GSA (Formation Notice Date)	GSA Member	Listed Interested Parties within the GSA boundary		
			Municipal Well Operators (MWO)	Public Water Systems (PWS)	Disadvantaged Communities (DAC)
Turlock Cont.	West Turlock Subbasin GSA (3/27/17; modified 5/1/17)	**Members:** City of Ceres City of Hughson City of Modesto City of Turlock Delhi County WD Denair CSD Hilmar County WD Merced County Stanislaus County Turlock ID **Associate Members:** Keyes CSD Stevinson WD City of Waterford (for Hickman)	City of Ceres City of Hughson City of Modesto City of Turlock Delhi County WD Hilmar County WD Denair CSD Keyes CSD City of Waterford (for Hickman)	To be identified	Presence identified but not listed

Source: DWR 2017a through DWR 2017x.

[1] Notice says San Joaquin County is the only member, but a supporting document states that county and California Water Company have entered into an agreement to form the “Cal Water-County GSA”; as such, California Water Company is included.

GSA = groundwater sustainability agency; MWO = municipal well operator; PWS = public water system; DAC = disadvantaged community; WD = water district; CSD = community service(s) district; ESJ = Eastern San Joaquin; ID = irrigation district; WA = water agency; WS = water system; DWR = California Department of Water Resources;

SGMA Compliance

Some commenters asserted that implementation of the plan amendments would violate or conflict with SGMA. The plan amendments do not violate or conflict with SGMA for multiple reasons. First, compliance with SGMA is based on a future evaluation *by the state* as to whether *local public agencies* have met certain requirements for managing the local groundwater basin sustainably. The state is not a local public agency, and, more importantly, groundwater pumping is not part of the plan amendments and program of implementation. As discussed further, the SED was required to evaluate a potential increase in groundwater pumping because an increase in groundwater pumping is a foreseeable local reaction to a reduction in surface water. Second, SGMA empowers local public agencies (i.e., GSAs) to regulate their groundwater basins. Even in situations where the state is directly pumping groundwater, which is not the case here, the state cannot violate SGMA because it is a sovereign entity and not subject to local regulation. SGMA provides that if a state entity were pumping groundwater in contravention of a SGMA plan, then the remedy is that a GSA can file a notice with the State Water Board requesting the board direct the state entity to cooperate (Wat. Code § 10732.2). Third, there are no existing SGMA plans with which to conflict. GSAs have not yet written any GSPs, so there are no GSPs in the plan area. For all of these reasons, there is no violation of or conflict with SGMA.

Commenters expressed concerns that increasing instream flows to reasonably protect fish and wildlife would, on average, reduce the amount of surface water available for diversion. The SED acknowledges that this could lead to more groundwater pumping because, historically, the local response to reductions in surface water in the plan area was to pump more groundwater.[1] The SED was required to acknowledge the potential for groundwater impacts, because in the past, increased groundwater pumping was the response to reduced surface water availability. Some commenters misstated that by acknowledging the potential impacts, the State Water Board was declaring (1) groundwater should be pumped or (2) groundwater impacts are inevitable. Both are incorrect. During the public hearing on the plan amendment and SED, State Water Board staff stated, "the project itself is certainly not requiring or advocating increased groundwater pumping, it's just observing what has happened when there has been water shortage" (State Water Board 2017b). To the extent that some commenters anticipated that existing or increased levels of surface water diversions could be used for future SGMA compliance, such conjecture is unreasonable, because local public agencies have been on notice since 2009 that additional instream flow would be needed for fish and wildlife beneficial uses in the plan area. The 2009 Notice of Preparation notified local agencies that, since adoption of the 1995 flow objectives for the San Joaquin River, "concerns related to protection of the beneficial uses of the Bay-Delta have escalated" and adequate San Joaquin River flows were "an emerging issue requiring additional consideration" in an update to the Delta Water Quality Control Plan (State Water Board 2009). Furthermore, the widely publicized public trust flows criteria report issued by the State Water Board in 2010, as required by the Delta Reform Act, concluded that "60% of 14-day average unimpaired flow" from February through June, as measured

[1] See Section 9.2.1, *San Joaquin Valley Groundwater Basin and Subbasins*, Section 9.2.2, *Subbasin Groundwater Use,* Section 9.4.2, *Methods and Approach*, and Table 9-8, *Irrigation District Methods for Dealing with Surface Water Shortages*; Section 13.2.1, *Lower San Joaquin River and Tributaries*, Section 13.2.1, *Lower San Joaquin River and Tributaries*, and footnote of Table 13-3b, *Groundwater Reliance and Summary of Well Information for Selected Public Water Suppliers in the Eastern San Joaquin, Modesto, Turlock, and Extended Merced Subbasins*; Chapter 22, *Integrated Discussion of Potential Municipal and Domestic Water Supply Management Options*, Section 22.4.1, *Potential Impacts of LSJR Alternatives*.

on the San Joaquin River at Vernalis, would be required if fishery protection were the sole purpose for which the waters were put to beneficial use (Wat. Code § 85086(c)) (State Water Board 2010).

Implementation of the flow objectives does not prevent SGMA compliance; sustainably managing surface water and groundwater resources together is the only way to ensure the protection of both resources. In addition, comprehensively addressing both resources allows for synergistic and creative opportunities that facilitate adaptation and other responses to change. SGMA is designed to protect the beneficial uses of groundwater; the LSJR flow objectives are designed to "support and maintain the natural production of viable native San Joaquin River Watershed fish populations migrating through the Delta." A sustained natural production of viable native fish population is an indicator of a healthy river and its watershed. A healthy river will benefit all users of the river, including agricultural, municipal, and environmental users. In this way, SGMA and the LSJR flow objectives are not threats or limiting factors to each other—SGMA and the LSJR flow objectives are two powerful, integrated tools that must be used together if Californian is to manage both groundwater and surface water resources efficiently and holistically.

Restoring flows for the reasonable protection of fish and wildlife in the LSJR and its tributaries will reduce surface water supply for users who have relied on that water in the past. Reducing groundwater overdraft and bringing groundwater basins into balanced levels of pumping and recharge under SGMA may reduce groundwater as a source for water supply. Many water users have relied on both surface water and groundwater to meet their water supply needs. Surface water and groundwater have both been over extracted for a long time. Overreliance on surface water and groundwater for consumptive purposes in the region has degraded commercial, recreational, and native fish populations, increased river temperatures, depleted groundwater basins, and caused land subsidence. LSJR flow objectives and SGMA are responses to the overreliance on surface water and groundwater and are intended to achieve a balanced and sustainable level of water use. LSJR flow objectives and SGMA are establishing complementary paths toward sustainable surface water and groundwater use. The State Water Board recognizes that adjusting to reductions in water supplies will be challenging for water users as these actions progress.

Groundwater Recharge

Groundwater recharge is the replenishment of groundwater, by natural or artificial means, in lieu or direct, with surface water or recycled water. The effects of the LSJR flow objectives on groundwater recharge in the plan area are discussed in Appendix G, *Agricultural Economic Effects of the Lower San Joaquin River Flow Alternatives: Methodology and Modeling Results*, Section G.3, *Estimation of Groundwater Balance*.

Some commenters asserted that lack of surface water due to the LSJR flow objectives would limit the ability to recharge groundwater resources contrary to the requirements of SGMA, citing Water Code section 10720.1(g). Water Code section 10720.1(g) is not a requirement but a finding by the Legislature that one of the Legislature's intentions in enacting SGMA was to increase groundwater storage and remove impediments to recharge. That is because, until SGMA was passed, groundwater was unregulated in much of California (LAO 2010). Limited information about the condition of many groundwater basins, the number of users, or the amount of pumping made storage and recharge programs challenging. Even in areas where groundwater rights are quantified through an adjudication and captured in a court-issued decree, the determination of who "owned" the space in a basin for the purpose of recharge and storage was unclear enough to generate basin-specific legislation (Senate Bill 1386 [Lowenthal], Statutes of 2012).

SGMA does require GSAs to include in their GSPs a description of the surface water supply used or available for use for groundwater recharge or in lieu use as applicable to the basin (Water Code §10727.2(d)(5). This means the sustainable yield values required by SGMA will need to reflect an accurate calculation of recharge that accounts for the projected availability of surface water in accordance with relevant water regulations, including the plan amendments.

Groundwater recharge is not, in and of itself, a beneficial use of water. Capturing surface water to recharge groundwater aquifers artificially is a method of diversion to storage and generally requires an appropriative water right that identifies how the stored water will be beneficially used in a timely manner. Some commenters claimed that irrigating crops with a volume of water that far exceeds what the plant can consumptively use (e.g., flood irrigating) is a large source of groundwater recharge; therefore, reducing the surface water that would be available for flood irrigation would exacerbate the unstainable conditions of groundwater in the plan area. In other words, commenters claimed that SGMA would be violated if they were not able to continue to recharge the groundwater incidentally through an inefficient use of water. This comment conflates cause and effect. The condition of the groundwater basin is unstable because of excessive groundwater pumping, primarily for agricultural irrigation, not a lack of incidental recharge from excessive agricultural irrigation.

Flood irrigation accounted for 43 percent of all irrigated acres in 2010 and continues to be the predominant irrigation method in California (DWR 2013). However, new irrigation techniques have made it possible to increase yields with less water than growers once thought they needed. California growers have been making progress in switching from flood irrigation to more efficient irrigation methods. Between 1991 and 2010, adoption of drip and microsprinkler irrigation systems more than doubled and accounted for 39 percent of all irrigated acres in 2010 (DWR 2013).

While some surplus water from flood irrigation percolates back into groundwater aquifers, it is limited. Appendix G (Table G.2-3, *Field Losses to Deep Percolation as a Percent of Consumptive Use and Applied Water*) shows that supply-side deep percolation factors (which represent the deep percolation[2] as a percent of total applied water) range between 9 and 32 percent in the plan area. That means, on average, for every 100 gallons of irrigated water applied to crops in the plan area, 9 to 32 gallons would recharge aquifers underlying the plan area. The remaining water is either consumed by crops (the purpose of the irrigation), evaporated, or becomes runoff to rivers. Increased agricultural efficiency is a better way to achieve compliance with SGMA, because for every 1 gallon of water saved by more efficient agricultural methods, 1 less gallon of groundwater needs to be pumped, leaving 1 more gallon of groundwater in the aquifer, which would be equivalent to 100 percent of recharge. Furthermore, agricultural runoff is a source of pollution that can carry fertilizers and pesticides that are applied to farmland. Decreasing runoff reduces the mobility of fertilizers and pesticides.

The emphasis by some commenters on flood irrigation as a good way to recharge groundwater highlights the need for integrated management; pumping and recharge of groundwater cannot be separated. GSAs will consider the best methods of recharging their basins, potential sources of recharge water (e.g., capturing flood flows), quality of the groundwater and recharge water, and the need for artificial recharge, as part of the analysis, planning, and implementation of SGMA.

[2] Deep percolation represents the portion of applied water that is not consumptively used and seeps into the groundwater aquifer.

SGMA as a Mitigation Measure

The State Water Board's obligations under the California Environmental Quality Act (CEQA) are to identify significant environmental impacts of the plan amendments and mitigate those impacts through feasible mitigation measures and alternatives. In formulating mitigation measures, the lead agency must be cognizant of any limitations on their own regulatory powers or those of other agencies with potential mitigation responsibilities. The SED includes mitigation measures in accordance with the State Water Board's certified regulatory program regulation (Cal. Code Regs., tit. 23, § 3777, subds. (b)(3), (b)(4)(D)); however, in many cases, the identified mitigation measures are within the responsibility and jurisdiction of public agencies other than the State Water Board. For general information regarding mitigation measures, please see Master Response 1.1, *General Comments*.

The State Water Board acknowledges that potentially adverse environmental impacts on groundwater resources may indirectly occur as a result of water users choosing to increase groundwater pumping to replace surface water supplies reduced by implementation of the plan amendments. The SED appropriately considers SGMA as mitigation to reduce potential significant impacts on groundwater resources (Section 9.4.3, *Impacts and Mitigation Measures*), because CEQA requires a discussion of mitigation measures that are not included in the proposed project but that the lead agency determines could reasonably be expected to reduce adverse impacts if required as conditions of approving a project (Cal. Code Regs., tit. 14, § 15126.4, subdv. (a)(1)(A)). This can include mitigation measures based on, or related to, regulatory requirements. For example, compliance with local noise ordinances or implementation of stormwater pollution prevention plans may be identified as mitigation to reduce potentially significant impacts from projects that require construction.

Similarly, the SED identifies SGMA as having regulatory requirements that could reduce potentially significant impacts on groundwater resources. Potential impacts would come from local groundwater users pumping groundwater as a substitute for surface water supplies. SGMA empowers GSAs to regulate groundwater extractions and prevent overpumping. However, State Water Board mitigation under SGMA authorities is infeasible at this time, because State Water Board intervention is only triggered by failure of a GSA to meet SGMA deadlines. Local agencies in the plan area met the first SGMA deadline (GSA formation by June 30, 2017), and the next SGMA deadlines for State Water Board intervention are still prospective (GSP adoption in 2020 and 2022). Furthermore, the actions the State Water Board will take in a basin depend on the local conditions that led to the need for intervention. In contrast, the authority for GSAs to mitigate the potential groundwater impacts disclosed in Chapter 9 using SGMA authorities is feasible, as described in the following sections.

Some commenters asserted that SGMA cannot be used as a mitigation measure to reduce the potential indirect impact of the plan amendments on groundwater resources, because SGMA will require reductions in groundwater pumping. SGMA provides a "toolbox" of authorities for GSAs to sustainably manage groundwater basins, including the power to limit groundwater extractions, measure groundwater extraction volumes, acquire water rights, construct facilities, and import surface water (Wat. Code §§ 10726.2, 10726.4). Limiting groundwater extractions is one tool, but SGMA does not require or mandate the use of any particular tool. Instead, SGMA requires GSAs manage groundwater sustainably, for long-term reliability and multiple benefits, through the development and implementation of GSPs (Wat. Code § 113).

The State Water Board could not evaluate the project-specific impacts of implementing a particular GSP as a mitigation measure, because GSPs have not been developed and the specific actions GSAs decide to take to achieve sustainability under SGMA are currently unknown (as described previously). Therefore, evaluating a hypothetical project-specific GSP is speculative. However, the State Water Board acknowledges in Chapter 17, *Cumulative Impacts, Growth-Inducing Effects, and Irreversible Commitment of Resources*, that cumulative impacts on agricultural resources are potentially significant and unavoidable, because SGMA implementation could change irrigation water availability. If GSAs reduce the amount of groundwater available for irrigation to Important Farmland, this may increase the likelihood that Important Farmland could be converted to nonagricultural uses. It is important to note that it is not possible to have both maximum potential impacts on groundwater resources (maximum pumping for irrigation) and maximum potential impacts on agricultural resources (maximum reductions in the availability of water for agricultural irrigation), because most groundwater in the plan area is being pumped for agricultural irrigation. This is discussed in the next section.

Agricultural Economic Effects, Groundwater Pumping, and SGMA

Some commenters mischaracterized and conflated potential effects related to groundwater resources and agricultural economies by suggesting that implementation of the plan amendments would “devastate” both groundwater resources and local agricultural economies. However, these two things cannot occur simultaneously or under SGMA. If more groundwater is pumped during drier years (which is occurring now and could continue to occur under SGMA), there would be little to no effect on local agricultural economies because they would receive the amount of water needed (Master Response 8.1, *Local Agricultural Economic Effects and the SWAP Model*), but there would be some effect on local groundwater basins. Conversely, if groundwater were not pumped during drier years, there would be little to no effect on local groundwater basins because groundwater would not be removed from the aquifer, but there would be some effect on local agricultural economies. These interconnected effects are complex and hinge on the independent decisions and actions made by growers and other local entities that have the ability to pump groundwater. However, it is inappropriate to characterize the interdependence of groundwater basins and local agricultural economies as mutual mass destruction of both groundwater resources and local agricultural economies.

The State Water Board conservatively analyzed effects on groundwater resources and local agricultural economies by making reasonable assumptions regarding past behavior and the existing baseline. This information was used to compare the baseline to conditions under the LSJR alternatives and identify potential effects of the alternatives. The groundwater impacts analyzed in Chapter 9 account for baseline groundwater pumping and a certain amount of additional pumping, up to existing infrastructure capacity, under the LSJR alternatives (see section entitled *Baseline Groundwater Pumping and Consideration of SGMA*). This allows for disclosure of potential effects on groundwater resources if growers and others decide to pump groundwater in response to implementation of the LSJR alternatives. The analyses evaluating agricultural economic effects and use of the Statewide Agricultural Production (SWAP) model also incorporate baseline groundwater pumping and a certain amount of pumping up to existing infrastructure capacities (Master Response 8.1). This is reasonable because conjunctive use is a past practice and, if implemented sustainably, can continue under SGMA (e.g., reducing pumping and/or increasing recharge in wetter years, and increasing pumping in drier years to maintain permanent crops) (see section entitled *Baseline Groundwater Pumping and Consideration of SGMA* and Master Response 8.1).

Method and Approach of the Groundwater Resource Impact Analysis

Detailed descriptions of the approach and results of the groundwater resource impact analysis are provided in Chapter 9 (Section 9.4.2) and Appendix G (Section G.2, *Total Applied Water for Agricultural Production*, and Section G.3, *Estimation of Groundwater Balance*).

The State Water Board's Environmental Checklist identifies the LSJR alternatives as having a "potentially significant impact" on groundwater resources (Appendix B, *State Water Board's Environmental Checklist*). The purpose of the checklist is to help the lead agency identify potentially a project's significant adverse impacts on the physical environment. As such, Chapter 9 addresses whether implementation of the LSJR alternatives could result in the following checklist items:

- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge.
- Potentially cause subsidence as a result of groundwater depletion.

The groundwater analysis uses results from the Water Supply Effects (WSE) model to determine if the LSJR alternatives would result in impacts on groundwater resources by increasing groundwater pumping and reducing groundwater recharge relative to the baseline water budget for each of the subbasins. The groundwater analysis does not present a detailed water budget for each subbasin. Rather, the analysis focuses on the two components of the water budget most likely to change in response to the LSJR alternatives: (1) groundwater pumping and (2) groundwater recharge associated with surface water supply. This approach is appropriate for a program-level environmental review that informs decision-makers and the public about the potential environmental consequences of the programmatic action.

As discussed in Master Response 1.1 *General Comments*, the State Water Board is not conducting, and is not required to conduct, a project-specific or site-specific evaluation. Given the programmatic nature of the action, as well as the unknown variables that could shape groundwater demand and local responses (including SGMA), it is not reasonable or possible to identify future potential effects at specific well locations. A groundwater assessment for a project-specific action might be based on an investigation of all known pumpers in the area, historical patterns of groundwater use, groundwater modeling of the hydrogeology of the defined area based on well completion reports and other investigations, and an assessment of current and future potential for recharge depending on water sources and soil types. Currently, much is unknown about the specifics of California groundwater basins, which have been mostly unregulated since the state entered the Union (LAO 2010). This is why SGMA, which took effect in 2015, provides GSAs until 2020 and 2022 to perform these types of technical analyses and develop GSPs.

In contrast, the groundwater analysis for the plan amendments is, by necessity, broad and programmatic because of the following uncertainties and unknowable factors (Chapter 9):

- Specific location of current and future wells that could be used for increased pumping.
- Potential future volumes of increased pumping at each potential well.
- Depth of current and future wells that could be used for increased pumping.

- Specific locations and volumes of reduced recharge, depending on current and future crops and irrigation methods, as well as current and future priorities, contracts, and agreements to receive surface water.
- The nature of groundwater recharge projects that could be implemented in response to the LSJR alternatives and/or under SGMA.

Additional information regarding specific aspects of the method relevant to common concerns raised by commenters, including use of 2009 levels of groundwater pumping as baseline, criteria used for the impact evaluation (i.e., 1-inch equivalent as the criterion), area of analysis, and modeling and use of groundwater data in the impact analysis is provided below.

Baseline Groundwater Pumping and Consideration of SGMA

The SED baseline analyses use historical 2009 levels of groundwater pumping. This is reasonable and appropriate because, as discussed in Master Response 2.5, *Baseline and No Project*, the SED baseline generally reflects the physical environmental conditions at the time of the 2009 Notice of Preparation. This is also consistent with other SED analyses, which use best available information in or near the 2009 period for baseline. Furthermore, using 2009 levels of groundwater pumping provides a more reasonable comparison in the baseline analysis for two related impact determinations—groundwater resources and agricultural resources (see section entitled *Agricultural Economic Effects, Groundwater Pumping, and SGMA*).

Some commenters stated that the SED baseline analyses should have used higher levels of groundwater pumping, because growers installed more wells during the recent drought. The SED evaluated the increased use of substitute groundwater pumping during the recent drought (2012–2015) by analyzing 2014 levels of groundwater pumping (Section 9.4.2 and Section 9.4.3). Nearly all 2014 maximum groundwater pumping estimates were greater than 2009 estimates. However, given the overdraft conditions of the four subbasins in the plan area, continuous groundwater pumping at 2014 levels is likely unsustainable with or without implementation of the plan amendments. On the other hand, temporary use of existing infrastructure to increase groundwater pumping (up to 2014 capacities) to avoid serious agricultural economic effects during extreme surface water shortages (e.g., to preserve permanent crops during droughts) is both likely and acceptable under SGMA as part of an overall management plan, as discussed further.

While the use of higher levels of groundwater pumping in the baseline would equate to increased impacts on groundwater resources, it would also artificially inflate the water supply available for agriculture and reduce determinations for potential land fallowing. Increasing the levels of groundwater pumping in the baseline could mask potential impacts on agricultural resources, because the SED equates potential fallowing of Important Farmland to an increased risk of conversion to nonagricultural use. Furthermore, local public agencies in the plan area are now required by statute (i.e., SGMA) to manage their groundwater basins sustainably, so it would be unreasonable to assume a higher level of groundwater pumping in the baseline and a concomitant lower level of impacts on agricultural resources (see section entitled *Agricultural Economic Effects, Groundwater Pumping, and SGMA*).

Also, CEQA requires the SED to analyze a reasonable range of alternatives. Within this range, the State Water Board chose to err on the side of conservative environmental impact estimates (i.e., to overestimate impacts) for groundwater resources. That is because, while 2009 levels of groundwater pumping were lower than 2014 levels, 2009 was still a drought year with greater than average levels of substitute groundwater pumping. Stated another way, the use of 2009 levels of groundwater pumping provides a more conservative estimate of impacts on groundwater resources than use of an average level of groundwater pumping based on multiple years up to and including the 2009 baseline year.

Some commenters asserted that the SED baseline analysis for groundwater should have been projected "with SGMA" based on the sustainable yield of each subbasin. As discussed in the section entitled *Sustainable Groundwater Management Act*, determining sustainable yield is a highly technical analysis that requires detailed location-specific information such as geology, hydrology, and local water use (Wat. Code § 10727.2). SGMA requires local GSAs analyze sustainable yield as part of GSP development. The analysis is so complex that SGMA gives GSAs until 2020/2022 to complete GSPs, and DWR adopted extensive (42-page) emergency regulations to guide GSAs in developing GSPs (Cal. Code of Regs., tit. 23, § 350 et seq.). Those regulations acknowledge the need for each GSP to include a hydrogeological conceptual model "based on technical studies and qualified maps that characterizes the physical components and interaction of the surface water and groundwater systems in the basin" (Id., § 354.14) and historical "groundwater elevation data demonstrating flow directions, lateral and vertical gradients, and regional pumping patterns" (Id. § 354.16). Such analyses are beyond the programmatic scope of the SED.

In suggesting a baseline "with SGMA," some commenters also appear to be treating SGMA as a moratorium on pumping, which it is not. SGMA requires "sustainable groundwater management," which is defined as the "management and use of groundwater in a manner that can be maintained during the [50-year SGMA] planning and implementation horizon without causing undesirable results" (Wat. Code § 10721(v)). SGMA defines undesirable results to include chronic lowering of groundwater levels, but states "[o]verdraft during a period of drought is not sufficient to establish chronic lowering of groundwater levels if extractions and recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods" (Wat. Code § 10721(x)(1)). In other words, SGMA envisions that increased levels of groundwater pumping could, and would likely, occur from time to time if offset with increased periods of recharge; this is known as conjunctive use (PPIC 2016). However, SGMA is neither a bar to groundwater pumping nor a guarantee that projects such as conjunctive use will be implemented. Furthermore, SGMA (which is designed to achieve sustainability within a 20-year period through GSPs) is in its early stages and (as discussed previously) no GSPs have been developed. Therefore, a hypothetical future baseline of groundwater pumping "with SGMA" is not used for the purposes of the impact analyses because it would be speculative conjecture.

Some commenters also stated that SGMA should be included in the modeling of all LSJR alternatives to evaluate the combined effect of SGMA and the plan amendments. It is not appropriate or possible to include SGMA in the alternative analysis because (as discussed previously) GSPs have yet to be developed, and any level of groundwater pumping or recharge resulting from implementation of a hypothetical GSP would be speculative conjecture at this point. However, SGMA was properly included in the analyses and acknowledged as an existing legal requirement to prevent further degradation of the groundwater basins and a potential cumulative limit on future irrigation supplies (Section 9.4.3 and Section 22.4.1, *Potential Impacts of LSJR Alternatives*). For further discussion on the inclusion of SGMA in the cumulative effects analysis, please see Master Response 6.1, *Cumulative Analysis*.

Criteria for Evaluation

The method and analysis in Chapter 9 considers the following primary elements:

- Estimate of average annual net change in groundwater balance (net recharge) in the irrigation districts within the plan area, based on the potential reductions in surface water supplies simulated by the WSE model.
- Conversion of the average annual net change in groundwater balance from units of volume to units of equivalent length by diving the potential net change in groundwater balance by the subbasin area (volume / area = length).

The average annual volumetric change in irrigation district groundwater balance is presented in Appendix G (Table G.3-5). The resulting length-equivalent (expressed in inches) is presented in Chapter 9 (Table 9-12) and represents the depth of the volume of water if it were spread evenly over the subbasin. For example, if a 100,000-acre-foot reduction in the average annual groundwater balance were spread evenly over a subbasin with an area of 100,000 acres, the depth of the water (length-equivalent) would be 12 inches.

The length-equivalent is used as an indicator of the potential significant impact to "substantially deplete groundwater supplies or interfere substantially with groundwater recharge," using 1 inch as the impact significance threshold (i.e., the impact is determined to be significant if the reduction in net recharge in a subbasin is greater than the 1-inch equivalent). This criterion is not arbitrary or capricious; the criterion is based on substantial evidence taking into consideration the unique characteristics of the plan amendments and the conditions (e.g., overdraft) of the potentially affected subbasins, which is suitable to the programmatic scope of the SED. Multiple commenters expressed concerns regarding the length-equivalent approach, asserting that the actual volumetric value of the reduction in net recharge should be used to determine the impact. The use of a length-equivalent indicator instead of a volumetric indicator is reasonable because it standardizes the volumetric reduction by subbasin area in order to make meaningful comparisons that take into account difference in subbasin size. In other words, a certain volumetric value in reduction of net recharge (e.g., 5 TAF) could indicate different impacts in a small subbasin as compared to a large subbasin. Expressing the reduction in volume per unit area (i.e., length) addresses this problem.

Some commenters suggested that the 1-inch threshold was arbitrarily chosen and questioned the adequacy of this threshold without proposing a different value. No formal scientific study has investigated the limit of reduction in net recharge beyond which there would be significant environmental impacts. As discussed previously, CEQA requires the SED to analyze a reasonable range of alternatives and err on the side of conservative environmental impact estimates (i.e., overestimating impacts). The 1-inch value was carefully chosen by experts who analyzed the impacts on groundwater resources and used their best professional judgement after reviewing relevant data and considering CEQA requirements, the scope of the SED, and the need for a reasonably understandable and meaningful indicator.

Some commenters pointed out that the reduction in net recharge would not be uniform across the subbasins. This is generally true of groundwater basins because reductions in net recharge from human activities are as varied as the individual and collective decisions that are being made in a specific location regarding pumping groundwater as well as the local hydrogeology of a region, which affects the availability of the resource. This is acknowledged in Section 9.4.3, which identifies that location-specific effects, such as cones of depression, would vary depending on the amount of groundwater pumped, the frequency of pumping, individual well construction, well depth, groundwater levels, and other localized conditions, all of which are currently unknowable due to uncertainty in predicting the decisions individuals may make in response to implementation of the LSJR alternatives.

The implication of "significant" in CEQA is different from that in SGMA. The SED (a CEQA document) adopted the 1-inch impact significance threshold to help the State Water Board determine if the LSJR alternatives would have significant environmental impacts on groundwater resources. This threshold does not imply that the State Water Board believes a 10-inch annual average decline of groundwater levels should be the threshold for determining the status of an aquifer (e.g., chronic lowering of the groundwater levels indicating a significant and unreasonable depletion of supply) for complying with SGMA. GSAs in the plan area would determine the significance and unreasonable conditions (i.e., undesirable results) within their subbasin after detailed technical assessment and stakeholder consultations required by SGMA.

Area of Analysis

Agricultural land outside of the irrigation districts is irrigated almost entirely with groundwater (Appendix G, Section G.3, *Estimation of Groundwater Balance*, and Master Response 8.1, *Local Agricultural Economic Effects and the SWAP Model*). The groundwater pumping in these areas remains relatively constant during droughts because crop demands are generally met with groundwater regardless of how much surface water is available. Since the plan amendments would only affect the availability of surface water in the LSJR Watershed, groundwater pumping and recharge for areas outside of the districts would not change in any of the LSJR alternatives.

However, agricultural groundwater pumping outside of the irrigation districts, but within the subbasins, is estimated in order to provide perspective on the full groundwater effect of irrigation district pumping. The estimates of irrigated acres and applied water associated with the irrigated acres outside of the irrigation districts are provided in Chapter 9 (Table 9-5 and Table 9-6). The estimates of total groundwater pumping for each subbasin and estimates of net input to each subbasin including the areas outside of irrigation districts are presented in Chapter 22, *Integrated Discussion of Potential Municipal and Domestic Water Supply Management Options* (Table 22-4 and Table 22-5).

Modeling and Use of Groundwater Data

Multiple commenters suggested the use of numerical groundwater models, such as C2VSIM and other models developed by the U.S. Geological Survey, DWR, and other agencies to analyze impacts of the plan amendments on groundwater resources and storage. The usefulness of a groundwater model is contingent on model assumptions and the quality of the information (i.e., data) that is input. In this case, a numerical groundwater model would require site-specific data, such as locations of increased pumping, volumes of increased pumping, characteristics of individual wells, locations of reduced recharge, and influences of potential recharge projects. As discussed previously, the State Water Board cannot know the specific actions individual water users might take in response to the flow objectives or the location where such actions would occur. Therefore, it is speculative to assume how pumpers in each site-specific area would respond to implementation of the plan amendments, and such analysis is beyond the programmatic scope the SED.

Some commenters expressed concern regarding the assumptions and data used in the analysis and asserted that existing local information was not referenced or used. The State Water Board used reports and plans prepared by local agencies in the plan area, such as agricultural water management plans prepared by irrigation districts and urban water management plans prepared by service providers, throughout the SED. Those documents are important sources of information and the basis for assumptions in the SED analyses. For example, the 2009 values are the maximum annual district and private groundwater pumping estimates presented in each district's agricultural water management plans (Appendix G, Section G.2.2.3, *Additional Groundwater Pumping*). The 2014 estimates are primarily sourced from irrigation district responses to September 2015 information request letters (Rietkerk pers. comm.; Knell pers. comm.; Hashimoto pers. comm.; Salyer pers. comm.). For further discussion of groundwater pumping estimates, please see Appendix G and Master Response 8.1. For discussion of State Water Board efforts to obtain local information and incorporation of stakeholder-provided materials, please see Master Response 3.2*, Surface Water Analyses and Modeling*.

Groundwater-Dependent Ecosystems

Several commenters stated that the SED failed to evaluate potential adverse effects from the LSJR alternatives on groundwater-dependent ecosystems (GDEs). Chapter 8, *Terrestrial Biological Resources*, addresses effects on riparian corridors (BIO-1) and wetlands (BIO-2), which are essentially GDEs but are not referred to as such in the chapter. CEQA documents commonly use land cover classifications to characterize and determine impacts, because this approach allows a thorough discussion and evaluation of how land cover classifications support different sensitive natural communities and sensitive species. The natural communities that are typically GDEs are tracked in the California Natural Diversity Database (CNDDB); therefore, the RareFind searches conducted in the CNDDB to prepare Chapter 8 identified and addressed those communities (i.e., GDEs) that have been previously mapped within the plan area and extended plan area.

GDEs are generally described as ecosystems that rely on groundwater to maintain ecological structure and function (Murray et al. 2006; Howard and Merrifield 2010). In California, GDEs consist of three ecosystem types: 1) seeps and springs, 2) groundwater-dependent wetlands, and 3) groundwater-dependent streams (Howard and Merrifield 2010). Seeps and springs generally do not occur on the valley floor and, if present, would occur in the upper elevations of the plan area (Howard and Merrifield 2010: Figure 3). Groundwater-dependent wetlands and streams, which include riparian corridors, occur in the plan area according to Howard and Merrifield (2010)—the first study to comprehensively identify and map GDEs in California. It should be noted that the Howard and Merrifield GDE map does not represent specifically mapped GDEs; the mapping was conducted at a watershed scale (National Watershed Boundary Dataset 12-digit hydrologic unit scale) and involved scoring each watershed based on the density of each type of GDE. SGMA requires GSAs identify local GDEs at the basin scale as part of GSP development (Cal. Code Reg. tit. 23, § 354.16 (g)).

Howard and Merrifield (2010) identified groundwater dependent wetlands based on available vegetation datasets, including the U.S. Fish and Wildlife Service National Wetland Inventory, which maps wetlands based on high-altitude aerial imagery (USFWS 2017). The most recent version of this data (July 13, 2017) shows that wetlands in the valley portion of the plan area consist of freshwater emergent wetlands, freshwater ponds, lakes, freshwater forested/shrub wetland, and riverine corridors. These features are associated with surface waters (primarily rivers, streams, reservoirs, irrigation canals, agricultural ponds, and other human-made features) that contribute to surrounding groundwater. In fact, most of these wetlands, including riparian woodlands, occur along the Lower San Joaquin, Lower Merced, Lower Stanislaus, and Lower Tuolumne Rivers, where groundwater is from 10 to 30 feet deep (Chapter 9 and Figure 9-5, *Spring 2010 Depth to Groundwater Contours for the San Joaquin Valley Portion of the San Joaquin River Hydrologic Region*). Wetlands further from streams and rivers, in areas of potential indirect effect, are largely associated with agricultural areas (e.g., canals, drainage, and stock ponds) and state and federal wildlife areas or refuges.

On the eastern edge of the valley and into the foothills, wetlands and riparian corridors are similar to those described previously. In areas of potential indirect effects, seasonal wetlands and vernal pools are found in areas used as rangeland (i.e., grassland). These wetlands depend on seasonal surface water, seasonally saturated soils, and water perched above hardpans, not deeper groundwater. Groundwater in these areas ranges from 100 to 250 feet deep and would not influence ponding in seasonal wetlands (Figure 9-5). Streams and associated riparian corridors in these areas depend on direct runoff and groundwater contributions to the streams during different seasons, but mostly in the upper soil horizon and closer to the streams. These wetlands, streams, and riparian areas would not likely be adversely affected by implementation of the LSJR alternatives.

As noted previously, Impacts BI0-1 and BIO-2 address impacts on wetlands and riparian habitats that meet the definition of GDE. Impacts BIO-1 and BIO-2 conclude that impacts on riparian habitats along rivers and associated with reservoirs and wetlands associated with riverine habitats and reservoirs would be less than significant and that adaptive implementation measures would ensure that flows would be beneficial to both fish and wildlife, including the habitat that supports them. Moreover, wetlands and riparian habitats would largely benefit from the greater stream flows provided by the LSJR alternatives.

Some commenters stated that the SED did not address GDEs away from streams, including groundwater-dependent oak woodlands. Chapter 8 generally acknowledges potential indirect effects on biological resources away from streams in undeveloped and agricultural areas due to changes in agricultural use as a result of reduced irrigation water supply. Oak woodlands (not specifically identified in Chapter 8) in the plan area, aside from riparian oak woodlands (which would benefit from greater stream flows), are largely limited to blue oak woodlands in the foothills and a few small stands of valley oak woodlands in upland areas on the valley floor.

Blue oak woodlands in the foothill portion of the plan area occur in upland areas where the groundwater table is 100 to 250 feet deep (Figure 9-5). Blue oak roots can grow through fractured and jointed rock to a depth of 80 feet or more to tap groundwater reserves, but root depths are largely dependent on soils (Fryer 2007). The foothill portion of the plan area is almost entirely used as rangeland and is not subject to existing extensive groundwater pumping; therefore, blue oak woodlands are not expected to be affected by implementation of the LSJR alternatives.

Most valley oak woodlands in the Central Valley have been removed because of agricultural conversion. There are remnant stands in isolated spots in the valley, including two documented locations (California Natural Diversity Database 2017), as well as those individual trees that may be associated with rural residences or along fence lines. Valley oaks take up water through deep taproots and extensive horizontal roots; vertical root depths have been reported as deep as 80 feet (Howard 1992). Groundwater beneath the valley where valley oak woodlands can occur ranges from 20 to 60 feet deep (Figure 9.5); however, groundwater is known to exist at or well below 80 feet across the valley. Valley oaks are resistant to short-term drought and mature trees primarily suffer drought damage when a series of dry seasons lowers water tables to extreme depths (Howard 1992). As stated in Chapter 9, under LSJR alternatives 2 through 4, groundwater levels away from rivers and streams could measurably decrease over time; however, the changes disclosed in Chapter 9 are broad and do not account for site-specific circumstances. Valley oak woodlands could be affected if, over time, groundwater levels exceed the rooting depth of the trees (80 feet), particularly during periods of drought when seasonal soil moisture in the upper soil horizon is limited. Overall, the adverse effects on small stands and individual valley oaks in the plan area would not rise to a level of significance because of their ability to tolerate periods of drought (e.g., deep rooting depths, extensive horizontal roots).

As discussed in Impacts BIO-1 and BIO-2, some vegetation may be adversely or beneficially affected depending on site-specific changes, but any existing groundwater-dependent vegetation would continue to have access to water and is not expected to be substantially affected by fluctuations in water surface elevations due to changes in water releases or effects on the groundwater aquifer. Furthermore, none of the information presented in this response changes information in Chapter 8 or Chapter 9, nor does it change the less-than-significant impact determinations in Chapter 8 with respect to adversely affecting sensitive species or habitats that are present in GDEs.

References Cited

Printed References

California Assembly. 2014. Water, Parks and Wildlife Committee Assembly, Budget Subcommittee No. 3 (California Assembly). *Joint Oversight Hearing: Management of California's Groundwater Resources*. Sacramento, CA.

California Department of Water Resources (DWR). 2003a. *California's Groundwater Bulletin 118, Update 2003*. *San Joaquin River Hydrologic Region, San Joaquin Valley Groundwater Basin, Eastern San Joaquin Subbasin*. Last revised: 2006. Sacramento, CA.

———. 2003b. *California's Groundwater Bulletin 118, Update 2003. San Joaquin River Hydrologic Region, San Joaquin Valley Groundwater Basin, Modesto Subbasin*. Last revised: 2006. Sacramento, CA.

———. 2003c. *California's Groundwater Bulletin 118, Update 2003. San Joaquin River Hydrologic Region, San Joaquin Valley Groundwater Basin, Merced Subbasin*. Last revised: 2006. Sacramento, CA.

———. 2013. *California Water Plan Update 2013*. Volume 3, Agricultural Water Use Efficiency.

———. 2016. *Critically Overdrafted Basins.* Final List of Critically Overdrafted Basins. January. Available: http://www.water.ca.gov/groundwater/sgm/cod.cfm. Accessed: March 2017.

———. 2017a. SGMA Portal, All Posted GSA Notices, City of Manteca. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: November 2017.

———. 2017b. SGMA Portal, All Posted GSA Notices, Linden County Water District. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: November 2017.

———. 2017c. SGMA Portal, All Posted GSA Notices, Stockton East Water District. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: November 2017.

———. 2017d. SGMA Portal, All Posted GSA Notices, City of Stockton. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: November 2017.

———. 2017e. SGMA Portal, All Posted GSA Notices, Lockeford Community Service District. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: November 2017.

———. 2017f. SGMA Portal, All Posted GSA Notices, San Joaquin County - ESJ. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: November 2017.

———. 2017g. SGMA Portal, All Posted GSA Notices, Woodbridge Irrigation District. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: November 2017.

———. 2017h. SGMA Portal, All Posted GSA Notices, City of Lodi. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: November 2017.

———. 2017i. SGMA Portal, All Posted GSA Notices, North San Joaquin Water Conservation District. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: November 2017.

———. 2017j. SGMA Portal, All Posted GSA Notices, City of Lathrop. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: November 2017.

———. 2017k. SGMA Portal, All Posted GSA Notices, Central San Joaquin Water Conservation District. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: November 2017.

———. 2017l. SGMA Portal, All Posted GSA Notices, Central Delta Water Agency. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: November 2017.

———. 2017m. SGMA Portal, All Posted GSA Notices, South Delta Water Agency. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: November 2017.

———. 2017n. SGMA Portal, All Posted GSA Notices, Oakdale Irrigation District Eastern San Joaquin Sub-basin Groundwater Sustainability Agency. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: November 2017.

———. 2017o. SGMA Portal, All Posted GSA Notices, South San Joaquin Groundwater Sustainability Agency. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: November 2017.

———. 2017p. SGMA Portal, All Posted GSA Notices, Eastside San Joaquin Groundwater Sustainability Agency. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: November 2017.

———. 2017q. SGMA Portal, All Posted GSA Notices, San Joaquin County No. 2. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: November 2017.

———. 2017r. SGMA Portal, All Posted GSA Notices, Merced Irrigation-Urban Groundwater Sustainability Agency (MIUSGA). Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: October 2017.

———. 2017s. SGMA Portal, All Posted GSA Notices, Merced Subbasin GSA. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: October 2017.

———. 2017t. SGMA Portal, All Posted GSA Notices, East Turlock Subbasin GSA. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: October 2017.

———. 2017u. SGMA Portal, All Posted GSA Notices, Stanislaus and Tuolumne Rivers Groundwater Basin Association. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: October 2017.

———. 2017v. SGMA Portal, All Posted GSA Notices, Tuolumne Groundwater Sustainability Agency. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: October 2017.

———. 2017w. SGMA Portal, All Posted GSA Notices, Turner Island Water District - 1. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: October 2017.

———. 2017x. SGMA Portal, All Posted GSA Notices, West Turlock Subbasin Groundwater Sustainability Agency. Available: http://sgma.water.ca.gov/portal/gsa/all. Accessed: October 2017.

———. 2017y. Online System for Well Completion Reports Database Export. Available: https://gis.water.ca.gov/app/wcr. Accessed: September 1, 2017.

California Natural Diversity Database. 2017. GIS data query. Last revised: 2018. Available: https://www.wildlife.ca.gov/Data/CNDDB. Accessed: December 5, 2017.

California Office of the Governor (OG). 2014. Governor Edmund G. Brown Jr.'s SGMA Signing Message. Sacramento, CA.

Fryer, J. L. 2007. Quercus douglasii. In*: Fire Effects Information System, [Online]*. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/. January 2018.

Howard, J. L. 1992. Quercus lobata. *In: Fire Effects Information System, [Online]*. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/. January 2018.

Howard, J., and M. Merrifield. 2010. Mapping Groundwater Dependent Ecosystems in California. *PLoS ONE* 5(6): e11249. doi:10.1371/journal.pone.0011249.

Legislative Analyst's Office (LAO). 2010. *Liquid Assets: Improving Management of the State's Groundwater Resources*. Sacramento, CA.

Merced Sun Star. June 2015. *Long Lines for New Wells in Merced County*. Available: http://www.mercedsunstar.com/news/local/environment/article25624903.html. Accessed: January 2016.

Murray, B. R., G. C. Hose, D. Eamus, and Damian Licari. 2006. Valuation of Groundwater-Dependent Ecosystems: A Functional Methodology Incorporating Ecosystem Services. *Australian Journal of Botany* 54(2) 221–229.

Public Policy Institute of California. (PPIC). 2016. *California's Water*. Available: http: //www.ppic.org/content/pubs/report/R_1016WPCBKR.pdf. Accessed: January 2018.

Sacramento Bee. 2016. *Farmers Say No Apologies as Well Drilling hits Record Levels in San Joaquin County*. Available: http://www.sacbee.com/news/state/california/water-and-drought/article103987631.html. Accessed: February 2017.

State Water Resources Control Board (State Water Board). 2009. *Notice of Preparation and of Scoping Meeting for Environmental Documentation for the Update and Implementation of the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary: Southern Delta Salinity and San Joaquin River Flows.* Last revised: July 27, 2017. Available: https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/environmental_review/docs/nop2009feb13.pdf.

———. 2010. *Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem.* Available: https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/docs/final_rpt080310.pdf.

———. 2017a. *State Intervention Compliance Map*. Last revised: July 27, 2017. Available: http://www.waterboards.ca.gov/water_issues/programs/gmp/index.shtml. Accessed: October 2017.

———. 2017b. *Amendment to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary: San Joaquin River Flows and Southern Delta Water Quality and on the Adequacy of the Supporting Recirculated Draft Substitute Environmental Document (SED) Public Hearing, January 3, 2017*. Available: https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/2016_sed/docs/transcript_day5_01032017.pdf.

Turlock Groundwater Basin Association (TGBA). 2008. *Assessment of Future Groundwater Impacts Due to Assumed Water-use Changes, Turlock Groundwater Basin, California*. September 11. Prepared by Timothy J. Durbin, Inc., Carmichael, CA.

U.S. Army Corps of Engineers, Sacramento District (USACE). 2001. *Farmington Groundwater Recharge/Seasonal Habitat Study.* Final Report. Prepared by M. W. Harza.

U.S. Department of Agriculture. 2017. *USDA's National Agricultural Statistics Service, California Field Office.* Last revised: May 2018. Available: https://www.nass.usda.gov/Statistics_by_State/California/Publications/AgComm/Detail. Accessed on June 30, 2017.

U.S. Fish and Wildlife Services. 2017. National Wetland Inventory Wetlands Mapper. Available: https://www.fws.gov/wetlands/data/Mapper.html. Accessed: July 13, 2017.

Personal Communications

Knell, Steve, P. E. Oakdale Irrigation District General Manager. October 28, 2015—Memorandum regarding responses to State Water Resources Control Board request dated September 4, 2015.

Hashimoto, Casey, P. E. Turlock Irrigation District General Manager. October 6, 2015—Letter submitted via email regarding information request related to preparing the substitute environmental document for the update to the water quality control plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary."

Rietkerk, Peter, P. E. South San Joaquin Irrigation District General Manager. October 3, 2015—Letter regarding information requests related to preparing the substitute environmental documentation for the update to the water quality control plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary.

Salyer, Greg. Modesto Irrigation District Interim General Manager. October 2, 2015—Letter regarding Modesto Irrigation District response to information request related to preparing the substitute environmental document for the update to the water quality control plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary.