Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Psilocarphus tenellus	NA			
Ranunculus repens	NA			
Ruppia cirrhosa	Widgeon-grass			
Salix exigua exigua	Narrowleaf Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Schoenoplectus californicus	California Bulrush			
Schoenoplectus pungens pungens	NA			
Sequoia sempervirens				
Sisyrinchium californicum	Golden Blue-eyed-grass			
Stachys albens	White-stem Hedge-nettle			
Symphyotrichum lanceolatum lanceolatum	NA			
Plagiobothrys chorisianus	NA		SSC	CRPR - 1B.2
Equisetum palustre	NA		SSC	CRPR - 3
Stellaria littoralis	Beach Starwort		SSC	CRPR - 4.2
Azolla microphylla	Mexican mosquito fern		SSC	CRPR - 4.3
Juncus lescurii				Not on any status lists
Ludwigia peploides montevidensis	NA			Not on any status lists
Ludwigia peploides peploides	NA			Not on any status lists
Persicaria amphibia				Not on any status lists
Persicaria punctata	NA			Not on any status lists
Potentilla anserina anserina				Not on any status lists
Rumex occidentalis				Not on any status lists

Notes:
ARSSC = At-Risk Species of Special Concern
BCC = Bird of Conservation Concern
BSSC = Bird Species of Special Concern
CRPR = California Rare Plant Rank
CS = Currently Stable
IUCN = International Union for Conservation of Nature
SSC = Species of Special Concern

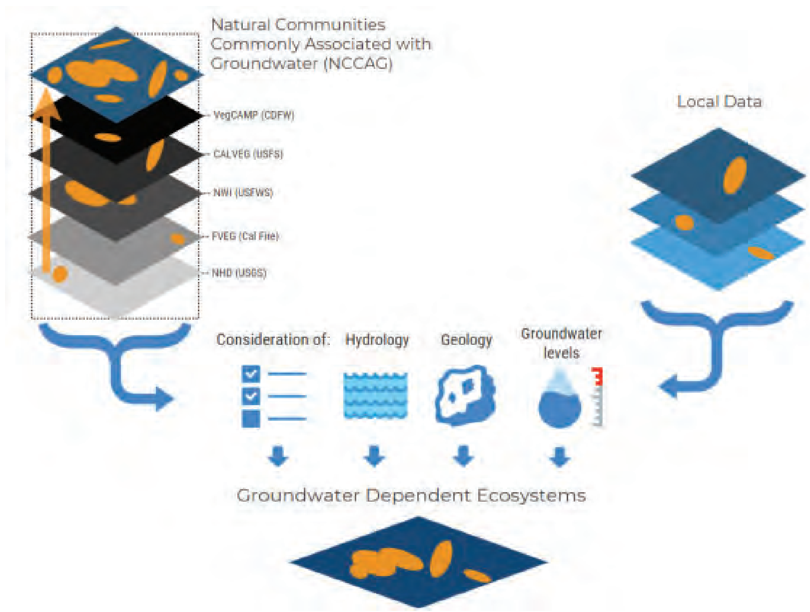
Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[8] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[9]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



[8] *NC Dataset Online Viewer:* *https://gis.water.ca.gov/app/NCDatasetViewer/*

[9] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[10]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[11] on the Groundwater Resource Hub[12], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[10] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[11] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[12] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

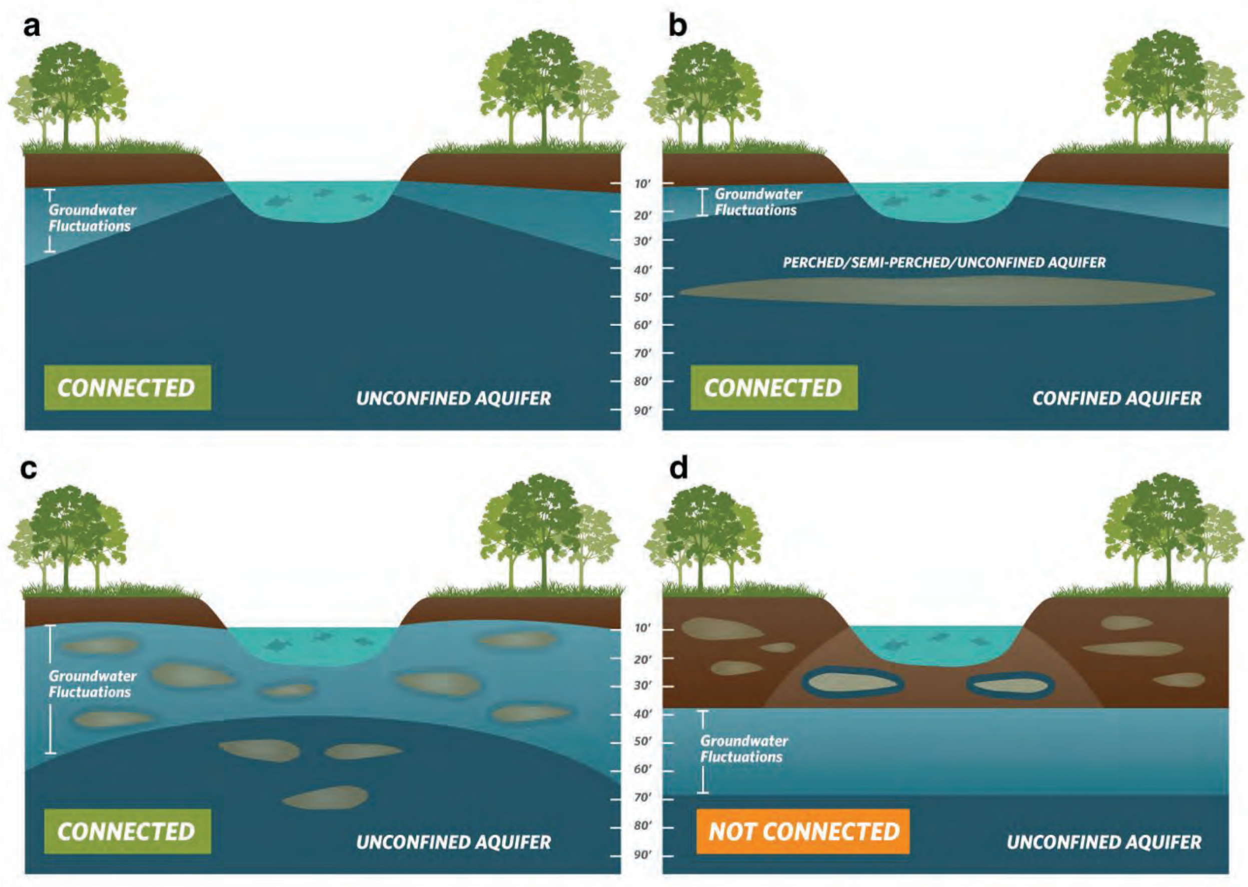

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[13] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[14] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[15] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[16]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

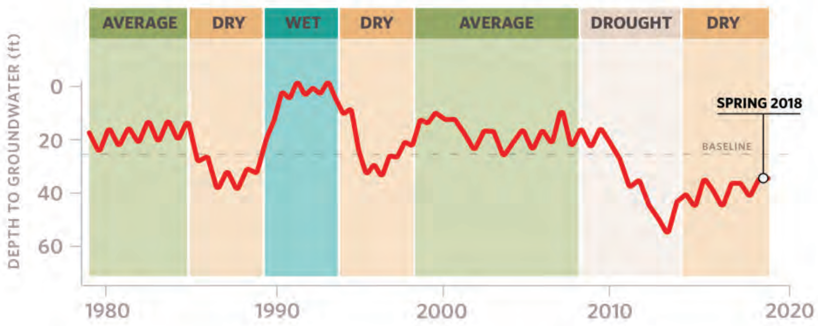

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[13] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[14] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[15] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[16] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[17], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

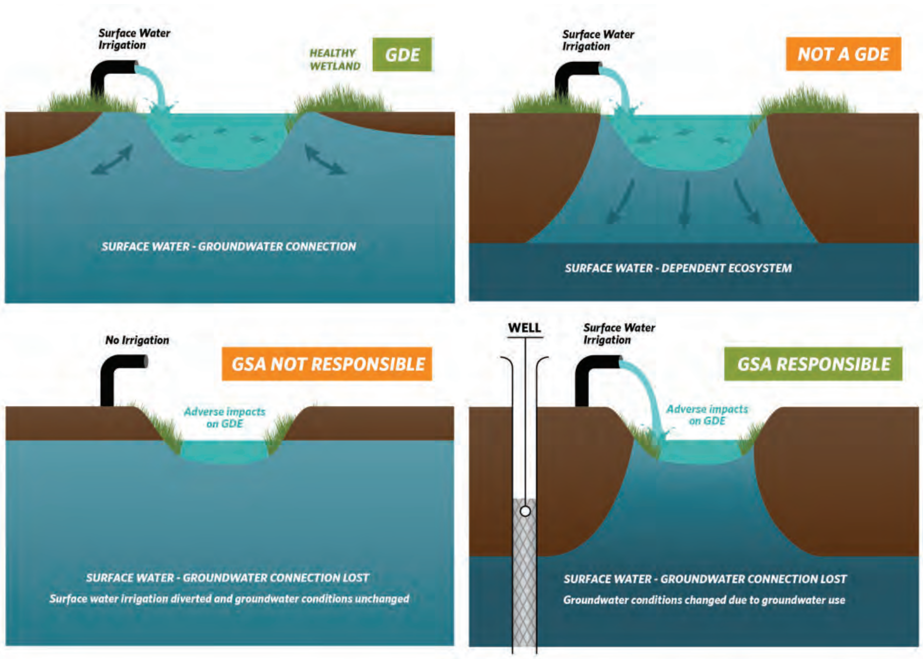


Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[17] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

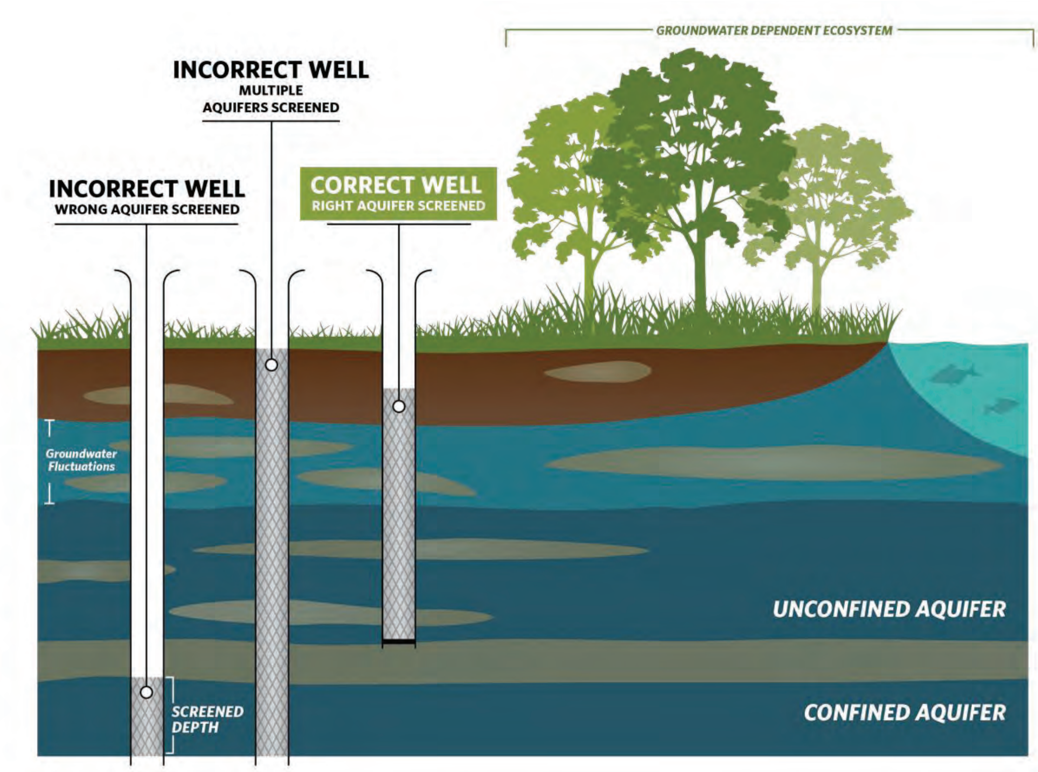


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[18] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

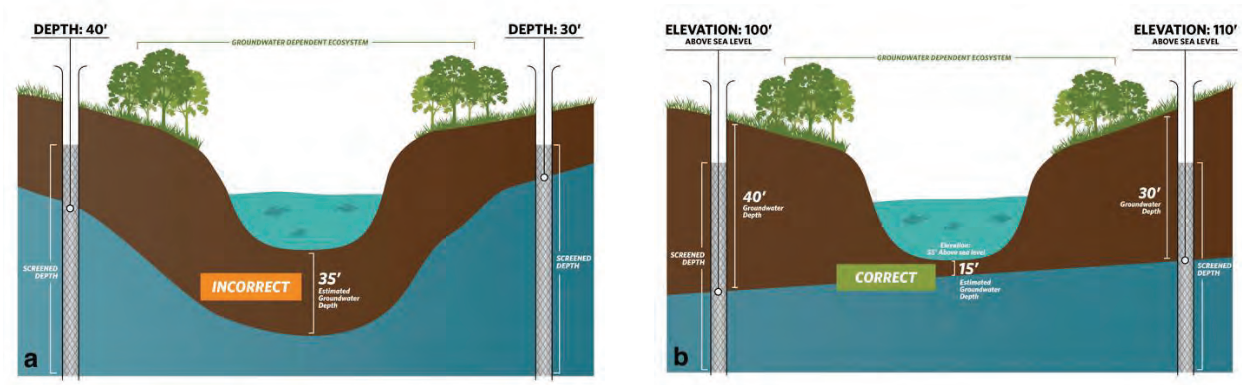


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

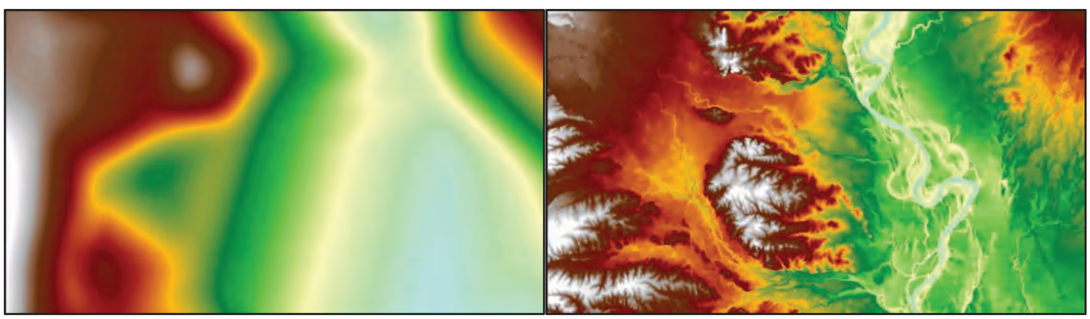


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[18] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

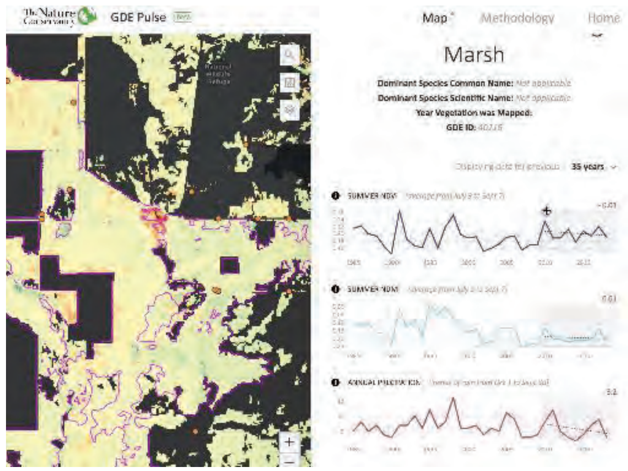
Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

The Nature Conservancy
Protecting nature. Preserving life.

Visit https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[19]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[20]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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[19] The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#

[20] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

WWD DRAFT GSP
Comments and Questions
10/20/19

2-1

Draft GSP Section	Comment	Question
General, Discretion of Board and Staff	Some of the GSP defers to WWD rules and regulations to be developed at a later date. Current rules and regulations do not provide adequate certainty to landowners and often shift discretion to Staff or the Board. This practice of maintaining discretion is not advisable from an investment or financing perspectives nor for showing DWR compliance with SGMA. Many growers are anticipating a gradual transition to sustainability in 2040. Meanwhile, Rules and Regulations are undecided and the GSP seems to paint the picture that the GSA will jump straight into implementation no later than January 31, 2022. Until the Rules and Regulations are drafted and adopted much of the implementation process is unknown. It would be beneficial to growers to get a better understanding of intended phase in. How are SGMA caps handled with land transfers? How will that be tracked? o In my opinion landowners who sell should cure their deficit/negative balance before sale of property, equivalent to lien placed on property by WWD.	GSA Rules and Regulations timing? o Are there any drafts to Rules and Regulations? o When drafted? o When available for review? o When adopted?

		• Transfer water should get return flow credits? Will banked water designated to return be included in this category?	
2-2	General, Subsidence at the Aqueduct	There should be some lessons learned from the subsidence at the Friant Kern Canal. Had they been proactive about the issues would the damage have been so significant?	Is there any project we could partner with DWR on to reduce likelihood of damage to the aqueduct in the subsidence areas? Some steel reinforcements or other modern engineering or technology to be proactive?
2-3	General, Expiration of Credits	WWD should not have expiration dates or increasing leave behind factors on water stored via recharge or credit carryover. It will encourage pumping in an effort not to lose stored water.	
2-4	General, Water Types	All water types should be eligible for recharge and ASR. WWD should encourage these activities in every respect.	
	Section 3, Generally		For water levels, what is the basis for setting the MOs and MTs? Do we need to have more cushion? Is the difference between the MO and MT aligned with the difference in other GSPs?
2-5	Table 3-1	Add private and district groundwater recharge projects as a PMA Add groundwater banking outside of WWD with obligation to return	Is it necessary to impose groundwater allocations from 2022? If politically advisable, do they need to be at the expected eventual sustainable level or can they be phased in?
	Table 3.3.a		This isn’t clear.
2-6	Table 3-12	There should be time to cure any non-compliance so long as the cure is being proactively pursued	How were standards of materially selected? (i.e. 15 percent of wells below minimum threshold for two consecutive fall measurements)

2-7	Section 4.1	Section 4.1.1 and Figure 4-1 conflict – need to clarify that it is 49% with the COA benefit Not clear what the basis is for this sentence: “It is anticipated that the improvement in the availability and reliability of imported surface water will continue to serve as the primary PMA to avoid undesirable results within the Sub basin” Tiered supplemental pricing should be considered as part of this PMA	Why are the long-term limits being imposed in Year 2 of a 20 year glidepath period? Why not start higher and then reduce over time? ed How is this PMA different than what WWD is already doing? The SWP is projecting lower long-term allocations given climate change and expected biop limitations. Aside from COA benefit, what is the basis for WWD projecting substantially higher allocations in the long run? Has any assumption been made regarding there being less sellers of supplemental water and/or less Kings River water as past sellers need to reduce pumping and also develop storage projects?
2-8	Section 4.2	There is a reference to Section 4.6 but the section doesn’t exist. WWD should develop reliable criteria for private banking/recharge rather than deciding each bank on a case by case basis. Confirm that allocations will be on a well by well basis The GSA/District seems to recognize that there will be growers forward pumping their groundwater allocation and growers rolling over credits from year to year. On a grower level it would be ideal to maximize	Are ‘agricultural lands’ the same as assessed acres? Or is there going to be a tie to irrigable lands? What happens to acreage in WWD with non-irrigable purpose? Do they still get a gross allocation? What if forward pumping in the green zone by some growers accelerates the water level decline? Are those that did not pump still subject to restrictions because levels are in the yellow/red zones? Do the two restrictions work in concert?

	groundwater credit rollovers and avoid any carryover losses on credits. o One way of accomplishing could be to offset forward pumping from credit rollovers, to minimize losses for good stewards. (i.e. In any given period, Forward Pumping = 50,000AF/ Period, less Total Credits = 50,000AF/ Period, the total net result for basin = 0AF. Growers with credit remaining shouldn't be penalized by loss of carryover credits when district is in balance.) GSP policies should promote grower conservation and good stewardship in wet years, a similar policy would be beneficial to the basin and district, while not penalizing those who may be forced to forward pump while GSP is in balance.	How will growers know if we are in green, yellow or red zones? Will there be notices such that growers can plan? Why is an annual application needed if allocation is on a gross acre basis? If no application is filed, why doesn't it carry over for the relevant acreage as opposed to being redistributed? Or credited to the sub basin? How are SGMA caps handled with land transfers? How will that be tracked? How does the rolling 5-year period interrelate with the forward pumping in the green zone? What is the leave behind for carryover? Why is there a leave behind if the grower is carrying over? Won't that encourage more pumping. What are the details/criteria to the private groundwater recharge program? Where does the GSP indicate that growers recharging under the pilot program will be grandfathered in? What if a grower exceeds requested allocation in any given year but doesn't exceed 5-year limit or 225% limit?

2-9

		Will Allocation transfers be permitted between gross allocation wells and and/or specific wells? Who will pay for meters and related technology before 2022? Why not mandate metering of all wells rather than estimating 90% compliance? In 4.2.1.2 the provisional initial aquifer specific groundwater pumping allocation is stated as 0.6 acre feet per year, but continues to state groundwater pumped from "Lower Aquifer may not exceed a specified fraction of total groundwater pumped as outlined in the GSA Rules and Regulations." o Is the specified fraction intended to be enforced at the grower level across all owned wells or as an aggregate across the district? ▪ What fraction does the modeling support? o Does Lower Aquifer specific allocation differ?
Section 4.3	Feedback on the ASR program requirements is that they are difficult to comply with. The Ag-ASR program is anticipated to directly contribute to meeting measurable objectives of chronic lowering of groundwater levels, reduction in groundwater storage, and land subsidence through aquifer	Why have a 5-year limitation? That will encourage pumping because of timing out. Why is there no firm commitment on the leave behind? Why suggest a limitation of water type to be stored via ASR (or any other recharge

	replenishment via injected water. The benefits include storage of surplus surface water and ensures protection of the Subbasin via **<u>leave-behind quantities</u>**, which contribute additional water to the groundwater aquifer. • It was discussed that the ASR program would most likely not be subject to leave-behind quantities. If we submit to DWR with above language and then revert to 0% leave-behind, if there is a chance this may create unnecessary scrutiny, we may want to revise	activity)? Shouldn't that be up to the grower to decide based on that grower's water position and economics? Why limit to production wells? If a grower has an unequipped well with a well shaft that is in good condition, grower should be able to use it.
2-10 Section 4.4	This PMA should only be pursued with undersubscribed surface water, water subject to cap loss or rescheduled loss.	Where will WWD get water to deliver to the subsidence areas? Is this PMA at risk of hurting other growers to help others? If surface water is delivered to the subsidence area, then will the subsidence area's SGMA allocation to be delivered to others in WWD? An exchange? If so, how will water quality differences be handled? Is the plan to have a lower allocation to the at-risk areas? Who pays for the cost differential between the surface water delivered and the well water? If Targeted Pumping Restrictions (PMA No. 4) are implemented as soon as January 31, 2020 when will groundwater credits start being accrued for area? (GSA will implement

			the groundwater allocation program no later than January 31, 2022.) o During the potential 2-year gap between PMA No. 4 implementation and GSA implementation, do groundwater users in the Check 16, 17 & 20 areas have the right to turn down the in-lieu water for credit later when needed?
	Section 4.5		What about private recharge programs? What are the details to private recharge? How would growers know that they will receive credits if they bank in 2019-2021? What are the program details?
2-11	Section 4, Additional PMAs	WWD should consider shallow pumping of brackish water, together with treatment and delivery into the WWD system. Other districts are looking at this as SGMA exempt. Returns flows associated with transfer water should be allocated to the party that brought the transfer water to the WWD. Arguably the same should apply for optional purchases of supplemental water.	What about out of district banking and transfer policies related to these activities? What about an in-lieu program – mandatory use of surface water when available? Without this, how does the GSP state: "this PMA encourages water users to utilize imported surface water annually when available, in lieu of groundwater pumping, to provide recharge benefits to the aquifer system and to increase groundwater storage and levels." WWD could charge surcharges on use of wells when Section 215, Kings River or other low-cost water is available.

		What about the fallowing program? If SGMA credits are issued on gross acre basis why aren't surface water rights? WWD should encourage the development of the water options market whereby some growers pay other growers to fallow and transfer water. This is currently be launched by a grower-led group.

Katarina Campbell, WWD GSA Coordinator
Gayle Holman, WWD GSA Coordinator
Don Perracchi, WWD Board President
Daniel Errotabere, WWD Board Vice President
Jim Anderson, WWD Board Member
William Bourdeau, WWD Board Member
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Larry Enos, WWD Board Member
Ryan Ferguson, WWD Board Member
Todd Neves, WWD Board Member
Stan Nunn, WWD Board Member

Sent via Email

October 31, 2019

Re: Comments on Westlands Water District GSA Draft Groundwater Sustainability Plan

Dear Westlands Water District GSA Board of Directors,

Leadership Counsel for Justice and Accountability works alongside low income communities of color in the San Joaquin Valley and the Eastern Coachella Valley. As is most relevant here, we work in partnership with community leaders in the communities of Cantua Creek and El Porvenir to advocate for local, regional and state government entities to address their community's needs for the basic elements that make up a safe and healthy community, including safe and affordable drinking water, affordable housing, effective and safe transportation, efficient and affordable energy, green spaces, and clean air.

We have been engaged in the Sustainable Groundwater Management Act (SGMA) implementation process because most of the communities with which we work are wholly dependent on groundwater for their drinking water supplies, and many have already experienced groundwater quality and supply issues. Communities we work have not been included in decision-making about their precious water resources, and their needs are not at the forefront of such decisions. In 2012, California recognized the Human Right to Water for domestic purposes, and required that state agencies consider this human right in their activities. State law also requires that GSAs avoid disparate impacts on protected classes. SGMA's requirements for a transparent and inclusive process present an opportunity in the context of groundwater management to meaningfully include disadvantaged communities in decision-making, and to create groundwater management plans that understand their unique vulnerabilities, are sensitive to their drinking water needs, and avoid causing disparate negative impacts on low-income communities of color.

We submit these comments to elevate our concerns that the Westlands Water District Groundwater Sustainability Agency's (GSAs) Draft Groundwater Sustainability Plan (Draft GSP) is incomplete, does not adequately analyze drinking water impacts, does not consider drinking water impacts in its policy decisions about groundwater management, lacks basic elements required under SGMA, and does not include projects and management actions to protect protected groups from severe and widespread drinking water impacts. Our review shows that the Draft GSP neither adequately analyzes nor incorporates input from disadvantaged communities and domestic well users, and will create a disparate impact on protected classes unless modified to protect drinking water resources for disadvantaged communities unless significant changes are made. We include herein our comments with respect to deficiencies in the Draft GSP as well as recommendations for improvements.

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The Draft GSP is Incomplete 3-1

As explored below, the Draft GSP omits critical data, including information regarding the water budget, groundwater contamination, and the drinking water impacts of its proposed groundwater management policies. The Draft GSP cannot be effectively reviewed by the public until this information is made available. The GSA must include this information in a new Draft GSP that it publishes for public review.

Westlands GSA must analyze the drinking water impacts of setting sustainable management criteria, follow a concrete methodology for considering those impacts in creating new sustainable management criteria, and include that impacts analysis and methodology in the revised Draft GSP. The GSA must also include complete information regarding existing contamination plumes in the Basin Setting, as well as how many wells could go dry from the proposed groundwater levels sustainable management criteria, how many homes' water could become contaminated from the sustainable management criteria, and how many homes' drinking water infrastructure could be at risk from the proposed criteria for subsidence. Finally, the GSA must show how it took all of these risks and impacts into account in establishing its groundwater management policies.

The GSA must also include critical data missing from the water budget, as well as specify information on groundwater contaminants historically and currently present in the subbasin.

Westlands GSA is responsible for the disproportionate and disparate impacts that its policies and activities will have on domestic well users and disadvantaged communities. 3-2

Westlands GSA must prioritize drinking water as an essential pillar of the proposed groundwater sustainability plan. Under SGMA, the GSA is tasked with managing groundwater in a way that does not cause "significant and unreasonable impacts" to the beneficial uses and users of groundwater in the subbasin. The GSA's activities cannot avoid impacts only on certain types of beneficial users; under SGMA it must "consider the interests of" an enumerated list of all types of beneficial users, including disadvantaged communities on domestic wells and community water systems.[1] Furthermore, state law provides that no person shall, on the basis of race, national origin, ethnic group identification, and other protected classes, be unlawfully denied full and equal access to the benefits of, or be unlawfully subjected to discrimination under, any program or activity that is conducted, operated, or administered by the state.[2] In addition, the state's Fair Employment and Housing Act guarantees all Californians the right to hold and enjoy housing without discrimination based on race, color, or national origin.[3] Lastly, the Department of Water Resources is required to consider the Human Right to Water in its evaluation of the GSA's proposed Groundwater Sustainability Plan, so the drinking water impacts of the GSP are of utmost importance in its approval.[4]

Westlands GSA must consider the drinking water needs of the communities of Cantua Creek and El Porvenir and other disadvantaged communities in the GSA area. It has not done so adequately in this Draft GSP. Our recommendations below show how the GSA could improve its GSP to avoid disparate impacts on protected groups and ensure that it is treating all beneficial users equitably.

Inadequate Transparency, Public Process, Consideration of Public Input and Representation Undermine the Value and Efficacy of the Draft GSP 3-3

SGMA requires that a GSA "shall consider the interests of all beneficial uses and users of groundwater," which expressly includes "[h]olders of overlying rights" and "[d]isadvantaged communities, including, but not limited to, those served by private domestic wells or small

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[1] Water Code § 10723.2.

[2] Gov. Code § 11135 ["No person in the State of California shall, on the basis of sex, race, color, religion, ancestry, national origin, ethnic group identification, age, mental disability, physical disability, medical condition, genetic information, marital status, or sexual orientation, be unlawfully denied full and equal access to the benefits of, or be unlawfully subjected to discrimination under, any program or activity that is conducted, operated, or administered by the state or by any state agency, is funded directly by the state, or receives any financial assistance from the state."]; Gov. Code § 65008 [Any discriminatory action taken "pursuant to this title by any city, county, city and county, or other local governmental agency in this state is null and void if it denies to any individual or group of individuals the enjoyment of residence, land ownership, tenancy, or any other land use in this state…"]; Government Code §§ 12955, subd. (l) [unlawful to discriminate through public or private land use practices, decisions or authorizations].

[3] Gov. Code § 12900 et seq.

[4] Water Code § 106.3.

community water systems."[5] The emergency regulations similarly require that a Draft GSP summarize and identify "opportunities for public engagement and a discussion of how public input and response will be used."[6] The GSA thus must engage "diverse social, cultural, and economic elements of the population within the basin."[7]

Throughout the GSP development process opportunities for public input were often limited to Westland GSA board meetings and workshops that were held during business hours that are not accessible to community members with 9am-5pm jobs. We commend staff for recently coming to a Cantua Creek community meeting to share the draft GSP. However, active community participation should have taken place during the entire GSP creation process, not just towards the end after critical GSP policy decisions had already been made.

To address concerns over public engagement, transparency, and inclusivity, Westlands GSA must:

- For all future GSA activities, plan to obtain and meaningfully consider public input from all beneficial user groups. Westlands GSA should host public workshops and present at meetings with all types of beneficial user groups before decisions are made regarding GSP updates or projects and management actions. To reach disadvantaged groups, Westlands GSA staff and consultants should present relevant information and solicit feedback at meetings in disadvantaged communities regularly. Public workshops must provide interpretation in any languages needed, and should follow robust and effective community outreach to ensure that the most vulnerable drinking water users are informed and included. Public engagement may be funded through SGMA-related fees and/ or state grants if necessary.

- Westlands GSA board meetings and workshops must take place in the evening at a time that is accessible for individuals who work 9am-5pm jobs. We recommend board meetings and workshops to be held at 6pm.

The Water Budget is Inadequate 3-4

GSPs must rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow.[8] The water budget was developed using the groundwater flow model for the subbasin, which was reported to be included in "Appendix I" and made available upon request. This data was requested by our Technical analysis team and to date, Westlands GSA has not provided "Appendix I" to our Team. Therefore, the model's assumptions and model input cannot be evaluated, and the data, methods and assumptions for the groundwater flow model are not available for the public

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[5] Water Code § 10723.2.
[6] 23 CCR 354.10(d).
[7] Guidance Document for Groundwater Sustainability Plan; Stakeholder Communication and Engagement, p. 1.
[8] 23 CCR § 354.18.(e)

review.

The water budget is not fully transparent, impeding the public's ability to access the validity of the historical, current, and proposed water budgets and the water budget has many inconsistencies. Table 2-9 reports the inflows and outflows of the land surface water budget, and includes columns for 'Imported Surface Water' and 'Utilized Surface Water.' A footnote describes the 'Utilized Surface Water" as surface water imports not utilized by the model that are rejected and not included in the water budget. As a result, the total imported surface water volumes shown in Table 2-9, Table 2-10, and discussed in the text are not in agreeance. Additionally, there is no explanation as to why a portion of the surface water imports are rejected and how that impacts the water budget. These issues must be addressed in order to be in compliance with SGMA.

Also, projected water demand must utilize the most recent land use, evapotranspiration, and crop coefficient information as the baseline condition for estimating future water demand, and this projected water demand information must also be applied as the baseline condition used to evaluate future scenarios of water demand uncertainty associated with projected changes in local land use planning, population growth, and climate.[9] The Draft GSP does not include a description of how some municipal and industrial users are accounted for in the projected water budgets. In Section 2.1 of the draft GSP, Westlands GSA states that there are approximately 39 active domestic wells in the subbasin with an estimated pumping rate of 78 AFY, nine public water systems, and eight disadvantaged communities, two of which are in the process of having new wells installed.[10] Additionally, the GSP states that there are solar electricity generation facilities in the Subbasin, which typically require a water supply for solar panel washing or cooling. Without showing how these water users are included in the water budget, the Draft GSP is not in compliance with the requirements of SGMA.

Furthermore, the projected water budget does not show that groundwater sustainability will be achieved by 2040. In Section 2.1.3.4, Westlands GSA reports that there has been a trend of increasing acres of nut trees and fallowed land and trends of land use changes are shown on Figure 2-9. As part of Westlands GSA's settlement in 2015, large portions of agricultural land will be retired. Table 2-3 shows a large increase in fallow/non-agricultural land between 2000 and 2015, suggesting that this may have already happened, although Westlands GSA states that fallowing was due to drought conditions.[11] Furthermore, Westlands GSA states that land use and population, are expected to remain relatively static over the projected water budget period.[12] As it is currently written, it is unclear what land use distribution was used for the projected water budget and how the assumption that land use and population will remain constant in the future is justified. Last, the projected groundwater budget results presented in Figures 2-15, 2-17, and 2-19 show continued declines in groundwater storage for the periods 2020-2040 and 2020-2070.

[9] 23 CCR § 354.18.(c)(3)(B)
[10] Westlands Water District, Westside Subbasin Draft GSP pg. 2-36, dated September 2019
[11] Westlands Water District, Westside Subbasin Draft GSP Section 2.1.3.4, dated September 2019
[12] Westlands Water District, Westside Subbasin Draft GSP pg. 2-47 dated September 2019

The water budget is central to establishing effective policies for sustainable groundwater management in the GSA area. In order to have a valid water budget, Westlands GSA must:

- Make all data relevant to historic, current, and projected water budgets publicly available. Instead of having information available upon request, data must be included in the GSP and be made available online.
- Provide additional details on the imported surface water values used in the water budget and the effect of those surface water imports that were not used in the model. The GSP must also be revised to improve the consistency between total surface water imports shown in Table 2-9, Table 2-10, and discussed in the text.
- Account for non-agricultural groundwater users in the water budget, including increased municipal & industrial groundwater use in the projected water budget. Westlands GSA must quantify impacts to these users from projects and management actions implemented to achieve sustainability.
- The GSP must clarify what land use distribution and population growth patterns were used for the projected water budget and provide supporting information to justify the assumption that land use and population will remain constant in the future.
- The GSP must clarify whether groundwater level and storage sustainability will be achieved by 2040.

The Draft GSP's Sustainable Management Criteria for Groundwater Levels are not Adequate 3-5

The sustainable management criteria for groundwater levels must be made after considering the interests of all beneficial user groups, disadvantaged communities.[13] These policy decisions must also avoid disparate impacts on protected groups pursuant to state and federal law.[14]

The GSA has not shown how it has considered the interests of beneficial users including domestic well owners and disadvantaged communities. The resulting impact from the proposed sustainable management criteria will likely lead to disparate impacts on protected groups pursuant to state and federal law.

Furthermore, the Draft GSP does not show how the sustainable management criteria for groundwater levels will comply with the sustainability goal to "long-term community, financial, and environmental benefits of residents and businesses in the Subbasin."[15]

Undesirable Result

Undesirable results are the point at which "significant and unreasonable" impacts on beneficial users caused by declining groundwater levels. The SGMA regulations require GSAs to justify their undesirable results by including the "[p]otential effects on the beneficial uses and users of

[13] Water Code § 10723.2.
[14] Gov. Code § 11135; Gov. Code § 65008; Government Code §§ 12955, subd. (l).
[15] Westlands Water District, Westside Subbasin Draft GSP pg. 3-4, dated September 2019

groundwater."[16] GSAs must also describe the "processes and criteria relied upon to define undesirable results."[17]

The Draft GSP's definition of undesirable results for groundwater levels is inadequate because it would allow significant and unreasonable impacts to beneficial users to occur without triggering an undesirable result. The Draft GSP states that an undesirable result for groundwater levels will only be triggered when 15% of the groundwater elevations measured in the SGMA monitoring network are below their MTs for two consecutive fall measurements (i.e., two consecutive years).[18] It is not clear what impact this could have on beneficial users in the area, and Westlands has not done this analysis. According to our technical analysis, up to 43% of wells around the representative monitoring wells could go dry from the water levels reaching the minimum threshold alone, and all of these would be drinking water wells.[19] It is unclear how many more would go dry before the undesirable result would be triggered, or what the impact would be on the new wells being drilled in Cantua Creek and El Porvenir, which serve hundreds of residents living in the two disadvantaged communities. In order to avoid these disparate impacts, and ensure that it has considered the interests of all beneficial users, the GSA must evaluate the impact of the undesirable result on drinking water users and change the undesirable result to prevent widespread drinking water impacts to protected groups living on domestic wells and in disadvantaged communities in the GSA area.

In order to avoid a violation of state civil rights law and ensure that the GSA has considered the interests of all beneficial users as required by the SGMA, the GSA must:

- Complete an analysis of the impact of reaching the undesirable result on all beneficial users, including disadvantaged communities on domestic wells and community water systems, who are most vulnerable to groundwater supply issues and least financially able to address issues

- Establish a public process to allow all beneficial users to provide feedback on the undesirable result. The undesirable result should be taken out to all beneficial user groups for feedback, and shaped using their input about what is a significant and unreasonable impact to their groundwater needs. The GSA must collaborate with local community-based organizations to reach disadvantaged community beneficial users.

- To protect drinking water resources for disadvantaged communities, the undesirable result must be triggered when any drinking water well is at risk of being dewatered.

Measurable Objectives

The SGMA regulations require the GSA to set measurable objectives and interim milestones that "achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation

[16] 23 CCR § 354.26.
[17] 23 CCR § 354.26.
[18] Westlands Water District, Westside Subbasin Draft GSP 3-36 and 3-37, dated September 2019
[19] Focused Technical Report, page 4.

horizon."[20] Measurable objectives must be more ambitious than the minimum thresholds, and must be the point at which the GSA has determined that it will not exceed its sustainable yield, and therefore avoid "significant and unreasonable" impacts on beneficial users.

The Westlands GSP establishes measurable objectives for groundwater levels at each representative monitoring well based on water level changes simulated by the groundwater flow model whereby the simulated difference in water levels between 2016 and 2017 is added to the measured 2016 groundwater elevation.[21]

The GSA has not evaluated how this groundwater elevation will affect domestic well users and disadvantaged communities, whose critical drinking water resources will be impacted by a decline in groundwater levels. The GSA cannot therefore have considered the interests of this beneficial user group in determining its measurable objectives, and is likely to have a disparate impact on a protected group if it pursues this course of action.

In order to show that it has considered impacts on domestic well users and disadvantaged communities, and ensure that it is not causing a disparate impact on groups protected from such impact by state civil rights law, the GSA must conduct a complete analysis of how many wells will be impacted by this measurable objective, in particular domestic wells and small community system wells in disadvantaged communities, including the new wells being drilled for Cantua Creek and El Porvenir. It should measure whether the impacts to wells are "significant and unreasonable" by consulting with the impacted beneficial user groups: domestic well owners and disadvantaged communities. If its current measurable objective will cause a disparate impact or cause significant and unreasonable impacts to these beneficial user groups, it must modify its measurable objective to comply with its legal obligations.

It is also unclear how the measurable objectives will achieve the sustainable yield. The GSA must clarify how achieving the measurable objectives at all representative monitoring wells will cumulatively result in attaining the sustainable yield for the GSA area.

The GSA must include the following in its Draft GSP to bring its measurable objectives into compliance with state law:

- The GSA must clarify how its measurable objectives will achieve the sustainable yield.
- The GSA must analyze how many wells will be fully or partially dewatered at the groundwater elevation of the proposed measurable objective.
- The GSA must show how it has considered the needs of all beneficial users, including drinking water users, in setting its measurable objectives, by publishing the above analysis in the GSP and demonstrating how it consulted with domestic well users and disadvantaged communities to set a measurable objective that avoids significant and unreasonable impacts to their beneficial user groups.

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[20] 23 CCR §354.24
[21] Westlands Water District, Westside Subbasin Draft GSP pg. 3-6, dated September 2019

Minimum Thresholds

The groundwater levels sustainable management criteria set by the GSAs must be the point that, "if exceeded, may cause undesirable results."[22] Therefore it must have the purpose of avoiding "significant and unreasonable" impacts on beneficial users caused by declining groundwater levels.[23] For groundwater levels specifically, GSAs must place minimum thresholds for each monitoring site at the level "that may lead to undesirable results."[24] Under the SGMA regulations, the GSA should provide a description of "the information and criteria relied upon to establish minimum thresholds," an explanation of how the proposed minimum thresholds will "avoid undesirable results," and "how minimum thresholds may affect the interests of beneficial uses and users of groundwater."[25] The GSA must also consider that drinking water use has been recognized as the "highest use of water" by the California legislature, and should consult with stakeholders to ensure that the minimum threshold is set is such a way as to guarantee the human right to drinking water to all individuals in the subbasin.[26]

The Westlands GSA's approach to setting minimum thresholds does not "consider the interests of" disadvantaged communities. Westlands established the minimum thresholds by superimposing the magnitude of the groundwater level declines over the 2020 through 2040 period on historic groundwater level lows. Westlands did not conduct an analysis of what the impacts would be to beneficial users from setting these minimum thresholds. As shown in the attached Focused Technical Review, reaching the minimum thresholds in the North Kings GSA could dewater up to 43% of drinking water wells within a 1.5 radius from indicator wells.[27] It is unclear what the impact of reaching these minimum thresholds could have on the new community water system wells for Cantua Creek and El Porvenir, and Westlands has not included this analysis in the GSP. Since the GSA has not conducted an analysis of how its proposed minimum thresholds would impact disadvantaged communities on domestic wells or community water systems, it cannot have considered the interests of this vulnerable beneficial user group. Furthermore, the majority of these individuals belong to a group protected by state civil rights law, so this policy decision is therefore likely to cause a disparate impact in violation of state civil rights law.

In order to show that it has considered impacts on domestic well users and disadvantaged communities, and ensure that it is not causing a disparate impact on groups protected from such impact by state civil law, the GSA must conduct an analysis of how many wells will be impacted by reaching this minimum threshold, in particular domestic wells and small community system wells in disadvantaged communities. It should also quantify the increased pumping costs associated with the increased lift at the projected water levels. Then, it must measure whether the impacts to wells and household finances are "significant and unreasonable" by consulting with domestic well owners and disadvantaged communities. If its current choice of minimum threshold will cause a disparate impact or cause significant and unreasonable impacts to these

[22] 23 CCR § 354.28.
[23] 23 CCR § 354.26.
[24] 23 CCR § 354.28.
[25] 23 CCR § 354.28.
[26] Water Code § 106.
[27] Focused Technical Report, Figure 3.

beneficial user groups, it must modify its minimum threshold to comply with its legal obligations.

The Westlands GSA must set minimum thresholds that consider the interests of drinking water beneficial users and do not create a disparate impact on protected groups by doing the following:

- Evaluate the number of wells that will be impacted should water levels reach the proposed minimum thresholds, taking into account the well screen depth of all drinking water wells in the GSP area. Determine which domestic wells and community water system wells are at risk of going fully or partially dry, and calculate the increased pumping costs associated with the increased lift for each well at the projected water levels.

- Take drinking water impact analysis out to beneficial users most impacted by the proposed minimum threshold policy, disadvantaged communities and domestic well users, and ask beneficial users what they consider to be a "significant and unreasonable" impact on their drinking water resources. The GSA should then change the minimum threshold policy based on this feedback. To protect all drinking water users, the GSAs should place the minimum threshold at a level above where the shallowest domestic well is *screened* in the GSA area.

- In order to show how it has considered the needs of all beneficial users in setting its minimum thresholds, the GSA must publish the above analysis in the GSP and show how it consulted with domestic well users and disadvantaged communities to set a minimum threshold that avoids significant and unreasonable impacts to their beneficial user groups.

- Ensure that the minimum thresholds will not lead to significant changes in groundwater gradients in the GSA area.

- Implement a Drinking Water Observation Plan to detect potential impacts to drinking water resources and trigger GSA action before drinking water supply problems occur. Please see our comments on the Projects and Management Actions for more description of what this program could look like.

- Implement a Drinking Water Protection Program that would be implemented when the Drinking Water Observation Plan is triggered, to prevent and mitigate drinking water impacts from the GSA's policy decisions and groundwater management activities. Please see our comments on the Projects and Management Actions for more description of what this program could look like.

The Draft GSP Fails to Adequately Address Groundwater Quality 3-6

SGMA requires GSAs to prevent further groundwater quality impacts from groundwater management policies and practices.[28] This Draft GSP fails to incorporate performance measures and management criteria with respect to contaminants that impact human health, including those contaminants with established primary drinking water standards. Since many beneficial users in

[28] Water Code §§ 10727.2(d)(2); 10721(x)(4)

the subbasin could be harmed by increased groundwater contamination due to this policy, the GSA therefore fails to conform with its obligation to ensure that its groundwater management policies and practices do not cause an increase in groundwater contamination that has a "significant and unreasonable" impact on beneficial users in the subbasin. Furthermore, Westlands GSA has not "considered the interests of" disadvantaged communities or domestic well owners in determining this policy.

Westlands GSA has not shown how they have considered the interests of beneficial users including domestic well owners and disadvantaged communities in shaping groundwater quality sustainable management criteria.[29] Instead of fully incorporating protection of all drinking water quality standards into the Draft GSP, the Westlands GSA limits its constituents of concern to Total Dissolved Solids, a constituent far less harmful to human health than many others that the Draft GSP identifies as existing in the area. For example, the GSP acknowledges in the Basin Setting chapter that the subbasin contains plumes of other contaminants such as boron, selenium, arsenic, sulfate, and nitrates, the latter of which the GSA acknowledges is a particular threat to domestic wells in the Upper Aquifer.[30] The GSA therefore will not be able to detect increases or expansion of harmful drinking water contaminants from its groundwater management activities. The resulting impact from the proposed sustainable management criteria will likely lead to disparate impacts on protected groups, in conflict with state and federal law.[31]

Additionally, the undesirable result for salinity will only be triggered after 20 percent of wells test above the minimum threshold for TDS, based on average of most recent three-year period.[32] This is an unreasonably lax contamination threshold. By the time 20 percent of representative wells show increases in salinity for three consecutive years, it is more than likely that a high percentage of vulnerable drinking water users will be experiencing severe, long-term drinking water contamination problems before the undesirable result is triggered. Furthermore, the draft GSP does not identify the potential management actions to be implemented if undesirable results occur.

Lastly, per 23 CCR § 354.16, each plan must provide a description of "[g]roundwater quality issues that may affect the supply and beneficial uses of groundwater, including a description and

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[29] Water Code sec. 10723.2.

[30] Section 2.2.2.2 states "Due to the presence of oxidation and reduction conditions, nitrate is likely not a constituent of concern in both the Upper and Lower Aquifers. However, since the Subbasin predominantly includes agricultural land uses, the potential for nitrate to occur in the Upper Aquifer is possible should oxidation and reduction conditions vary in the Subbasin and near the vicinity of domestic wells. As a result, both nitrate and salinity in the form of TDS are the constituents of interest for the GSP monitoring program."

[31] Gov. Code § 11135 ["No person in the State of California shall, on the basis of sex, race, color, religion, ancestry, national origin, ethnic group identification, age, mental disability, physical disability, medical condition, genetic information, marital status, or sexual orientation, be unlawfully denied full and equal access to the benefits of, or be unlawfully subjected to discrimination under, any program or activity that is conducted, operated, or administered by the state or by any state agency, is funded directly by the state, or receives any financial assistance from the state."]; Gov. Code § 65008 [Any discriminatory action taken "pursuant to this title by any city, county, city and county, or other local governmental agency in this state is null and void if it denies to any individual or group of individuals the enjoyment of residence, land ownership, tenancy, or any other land use in this state…"]; Government Code §§ 12955, subd. (l) [unlawful to discriminate through public or private land use practices, decisions or authorizations].

[32] Westlands Water District, Westside Subbasin Draft GSP pg. 3-36, dated September 2019

a map of the location of known groundwater contamination sites and plumes." The GSP's Basin Setting omits data about a key groundwater contamination site, which also must be taken into account when establishing sustainable management criteria for groundwater quality. The Westlands GSA subbasin contains Lemoore Naval Air Station, which according to the State Water Resources Control Board's website GeoTracker, has cleanup sites associated with fuel and gasoline contamination.[33]

In order to set the minimum threshold, measurable objectives, and undesirable result, that are protective of groundwater quality for all beneficial users in the basin, the GSA must make the following changes to the Draft GSP:

- The GSP must add details to the Basin Setting section regarding groundwater contamination present in the subbasin. This information should include agricultural drainage impacts on land use and water quality within the subbasin; maps of selenium, arsenic, boron, and sulfate concentrations in groundwater; and details and present maps of known groundwater contamination sites as listed on GeoTracker, to the extent data are available. The GSP must detail if nitrate concentrations have historically exceeded drinking water standards, present maps of nitrate concentrations in groundwater, and set sustainable management criteria.

- Ensure that the GSA is monitoring for compliance with all of the following constituents of concern: all established primary drinking water standards, hexavalent chromium, and PFOSs/PFOAs, as well as contaminants that are known to increase with groundwater management activities, such as uranium.[34]

- Ensure that all representative monitoring wells are measuring for concentrations of the contaminants of concern, including all drinking water contaminants, every month.

- Set a minimum threshold, measurable objective, and undesirable result for all constituents of concern that protects drinking water beneficial users, particularly disadvantaged communities. Evaluate how the groundwater quality undesirable results, minimum thresholds, and measurable objectives will result in the protection of groundwater for disadvantaged communities and other drinking water users in the subbasin, and provide a detailed explanation of this in the GSP.

- Ensure that minimum thresholds will be triggered after one test shows a violation of the MCL, and clarify this trigger process in the GSP.

- The draft GSP must clearly identify the potential actions that would be implemented and the funding source(s) that would be utilized if undesirable results occur.

[33] https://geotracker.waterboards.ca.gov/

[34] Smith et al., "Overpumping Leads to California Arsenic Threat," Nature Communications (June 2018) [arsenic discharge from clay correlated with overpumping]; Jurgens et al., "Effects of Groundwater Development on Uranium" (November 2010) [strong correlation between high bicarbonate irrigation and recharge water and leaching of uranium from shallow sediments to groundwater].

- Implement a Drinking Water Observation Plan to trigger GSA action when contamination spikes occur. Please see more information about the types of projects that could be implemented when a Drinking Water Observation Plan is triggered in our comments about Projects and Management Actions.

Land Subsidence Sustainable Management Criteria Must Protect Against Significant and Unreasonable Impacts 3-7

As per Water code sec. 10721.(x)(5), the state defines significant and unreasonable land subsidence as land subsidence that substantially interferes with surface land uses. The GSA must consider the interests of all beneficial user groups, including domestic well users and disadvantaged communities, in determining its undesirable result for land subsidence. The GSA has set undesirable result, measurable objectives, and minimum thresholds for impacts to "critical infrastructure", which appears to only be impacts to the San Luis Canal.[35] This definition does not take into account other critical drinking water infrastructure such as private wells, water system wells, and distribution lines.

We are concerned that the sustainable management criteria for land subsidence in the Draft GSP will allow for significant and unreasonable impacts to beneficial users. As currently written, it is unclear how the sustainable management criteria for land subsidence will protect against disparate impacts on disadvantaged communities or domestic well users. The GSA must set sustainable management criteria that reflect the needs of all the stakeholders in the subbasin and protect all types of beneficial users from impacts from further land subsidence in the area.

To comply with its obligations under state law, the GSA must:

- Analyze the impact of subsidence on all beneficial user groups.
- Define a local undesirable result for subsidence that takes into account the critical infrastructure needs of all beneficial user groups, including domestic well owners and disadvantaged communities.

The Monitoring Network Is Inadequate With Respect to Groundwater Levels and Groundwater Quality 3-8

GSAs must monitor impacts to groundwater for drinking water beneficial users, including domestic well users and disadvantaged communities,[36] and must avoid disparate impacts on protected groups pursuant to state law.[37] The GSA's monitoring network is insufficient with respect to groundwater quality and groundwater levels. The network fails to capture drinking water impacts from groundwater pumping and management, and has therefore not considered the interests of drinking water users and is likely to cause a disparate impact on the protected groups dependent on domestic wells and community water systems in the GSA area.

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[35] Westlands Water District, Westside Subbasin Draft GSP pg. 3-27, dated September 2019
[36] Water Code § 10723.2; 23 CCR § 354.34.
[37] Gov. Code § 11135; Gov. Code § 65008; Government Code §§ 12955, subd. (l).

Groundwater Levels Monitoring Network

The SGMA regulations state that monitoring networks must include a sufficient density of monitoring wells to collect representative measurements through depth-discrete perforated intervals to characterize the groundwater table or potentiometric surface for each principal aquifer.[38] The GSA must also make decisions about the monitoring network in a way that considers the interests of all beneficial users.

The Draft GSP's monitoring network for groundwater levels did not take into account well proximity to beneficial users of groundwater, such as domestic wells, small water systems, or DACs.[39] The GSA therefore did not consider the interests of these beneficial user groups in making its decisions about its monitoring network for groundwater levels. Further, according to the attached Focused Technical Review, the monitoring network does not comply with the density requirement because it contains gaps near Calflax and Huron, in the Upper Aquifer in the northern portion of the subbasin along the northern and western boundary, and in the lower aquifer in the southern portion of the subbasin along the western boundary. Lastly, the groundwater levels monitoring network does not comply with the requirement to "collect representative measurements" of all water table depths. While the GSP states that its monitoring network "has complete well construction information for these [GSP monitoring] wells, which allows the GSA to determine the aquifer being monitored with certainty,"[40] Tables 3-14 and 3-15 are missing both well depth and well screen interval information, so it is impossible for the public or DWR to verify this claim.

In order to ensure that the monitoring network for groundwater levels considers the interests of all beneficial users, and complies with the density and depth representativeness requirements of SGMA, the monitoring network must be modified in the following ways:

- Expand the number of representative monitoring wells to ensure that disadvantaged communities and domestic well users are represented in the monitoring network
- Provide a clear plan for including new monitoring wells in areas where there are data gaps.
- Provide the missing well construction information for these wells in Tables 3-14 and 3-15 and clarify the Section 3.6.1. Statement about well depth information.

Groundwater Quality Monitoring Network

SGMA regulations require that GSPs create a groundwater quality monitoring network that will "collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address

[38] 23 CCR § 354.34(c)(1)(A)
[39] Westlands Water District, Westside Subbasin Draft GSP Section 3.6.2, dated September 2019
[40] Westlands Water District, Westside Subbasin Draft GSP Section 3.6.1, dated September 2019

known water quality issues."[41] The GSA must also make decisions about the monitoring network in a way that considers the interests of all beneficial users.

Currently, the proposed groundwater quality network will only monitor for TDS. This decision was made despite documentation of boron, selenium, arsenic, and sulfate in some locations that may exceed drinking water standards.[42] Only monitoring for TDS, a constituent far less harmful to human health than others identified in the Draft GSP and that has more impact on agricultural production that human health, is a clear prioritization of agricultural water user over drinking water user. The proposed monitoring network for groundwater quality does not fulfill SGMA requirements as it does not collect sufficient data of contaminants of concern in the basin.

The GSA must clarify information on frequency of monitoring. Tables 3-22 and 3-23 indicate that the water quality monitoring network will be sampled bi-annually[43] and Section 3.6.5 states that "[d]ata collection in both spring and fall will allow for the analysis of seasonal trends."[44] This information conflicts with Table 3-25 and Section 3.8.4, which indicate that TDS will be sampled annually.[45]

Either way, sampling water for constituents of concern only once or twice a year is not enough to catch drinking water contamination within a reasonable amount of time. The GSA should instead test for groundwater contamination every month so that drinking water contamination can be detected and addressed by the GSA.

Last, as stated at the October 18th Interested Parties Workshop, the groundwater monitoring network includes private wells. In order to ensure the needs of all basin users are covered within the groundwater quality monitoring network, Westlands GSA should have accurate representation of stakeholders in the basin by also including monitoring of private *domestic* wells.

To ensure that the representative wells within the monitoring network accurately monitor impacts
to groundwater management for all beneficial users, and does not create a disparate impact on protected groups, the GSP monitoring section must be changed in the following ways:

- The GSA must monitor for compliance with all of the following constituents of concern: all established primary drinking water standards, hexavalent chromium, and PFOSs/PFOAs, as well as contaminants that are known to increase with groundwater management activities, such as uranium.[46]

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[41] 23 CCR § 354.34(c)(4)
[42] Westlands Water District, Westside Subbasin Draft GSP pg. 3-58 to 3-59, dated September 2019
[43] Westlands Water District, Westside Subbasin Draft GSP pg. 2-36, dated September 2019
[44] Westlands Water District, Westside Subbasin Draft GSP pg. 3-60, dated September 2019
[45] Westlands Water District, Westside Subbasin Draft GSP pg. 3-66 to 3-67, dated September 2019
[46] Smith et al., "Overpumping Leads to California Arsenic Threat," Nature Communications (June 2018) [arsenic discharge from clay correlated with overpumping]; Jurgens et al., "Effects of Groundwater Development on Uranium" (November 2010) [strong correlation between high bicarbonate irrigation and recharge water and leaching of uranium from shallow sediments to groundwater].

- Westlands GSA must include the groundwater wells of El Porvenir and Cantua Creek in the groundwater quality monitoring network. The community residents of Cantua Creek and El Porvenir have specifically requested that Westlands GSA comply with this suggestion.
- Include private domestic wells in the monitoring network.
- Ensure that all representative monitoring wells are measuring for concentrations of the contaminants of concern, including all drinking water contaminants, every month.
- Immediately plan for, fund and construct new representative monitoring wells or evaluate existing wells to ensure that representative monitoring wells are monitoring for impacts to domestic well users.

Projects and Management Actions 3-9

The GSA must consider the interests of beneficial users including domestic well owners and disadvantaged communities[47] and avoid disparate impacts on protected groups.[48] In light of the impacts on domestic well users and disadvantaged communities from the policy decisions discussed above, the GSP must therefore include Projects and Management Actions that protect domestic well users and disadvantaged communities from the drinking water impacts that will occur from the GSA's policy decisions. As noted above and on the attached Focused Technical Report, the minimum thresholds for groundwater levels put up to 43% of domestic wells around representative monitoring wells at risk of dewatering, and the groundwater quality sustainability goals leave drinking water users unprotected from increased contamination. Furthermore, the GSP may not create a disparate impact on protected groups pursuant to state law.

The Draft GSP's chapter on Projects and Management Actions contains projects and management actions including surface water imports, groundwater extraction allocations, ASR, pumping restrictions near the San Luis Canal, and percolation basins. This section does not include measures to protect or mitigate for the drinking water impacts to disadvantaged communities caused by the GSA's policy decisions. Without proactive policies and projects to mitigate forthcoming disparate impacts, communities and homes belonging to protected groups based on race, national origin and ethnicity will experience a disproportionately negative impact in violation of state civil rights law. Because the GSP as written will cause a disparate impact on protected groups, and does not consider the interests of domestic well users or disadvantaged communities, the GSP must include projects to prevent and mitigate those impacts.[49]

In order to prevent disparate impacts on protected groups, and show that it has considered the interests of all beneficial users including domestic well users and disadvantaged communities, the GSA should consider the following projects and management actions:

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[47] Water Code § 10723.2.
[48] Gov. Code § 11135; Gov. Code § 65008; Government Code §§ 12955, subd. (l).
[49] Gov. Code § 11135; Gov. Code § 65008; Government Code §§ 12955, subd. (l).

Clearly Commit to a Drinking Water Protection Program for the Westlands Subbasin 3-10

The GSP must contain a solid commitment to a Drinking Water Protection Program (DWPP). We recommend some parameters for a potential program below, and are glad to work with the GSA on shaping an effective program for preventing drinking water impacts from declining groundwater levels, increased groundwater contamination, and subsidence:

- Eligible activities: Drilling of new wells or deepening wells if homes' wells go dry due to declining groundwater levels, increased energy costs from pumping from deeper depths,[50] assistance in connecting to larger water systems. Wherever possible, and whenever it is the community's preference, the GSA should strive to assist residents on domestic wells and small community water systems with connecting to larger drinking water systems. If consolidation is not possible, the GSAs should support the deepening of wells, installation of treatment facilities or POE/POU treatment in homes and offset the increased energy costs for pumping water from a lower level. In the interim, the GSA should collaborate with local and state agencies to provide emergency bottled water for consumption and sanitary purposes.

- Leadership by program beneficiaries: Any project funded by the program must be guided by the residents or communities that are recipients of program benefits. Community input into a project will ensure project success, by learning from resident experience and knowledge to shape a project that will best suit their drinking water needs.

- Access to the program: The GSA must ensure that the program is accessible for all residents who may need its assistance. The program should work with local agencies and organizations to spread information about the program, should not require residents to opt in to the program, and the GSA must provide translated materials regarding the program.[51]

- Such a program must be proactive, rather than reactive: We recommend that Westlands GSA implement a ***Drinking Water Observation Plan (DWOP)*** that will serve as a warning system so that the GSA is aware of when wells are going dry, or when wells are going to become contaminated from groundwater management activities, so it can take action to prevent drinking water impacts before they occur. This DWOP should trigger proactive measures wherein the GSA should act before wells lose production capacity or before wells become contaminated, to ensure that community members are not left without access to

[50] Recent research has concluded that "in the Tulare Lake area, with an average well depth of 120 feet, pumping would require 175 kWh per acre-foot of water. In the San Joaquin River and Central Coast areas, with average well depths of 200 feet, pumping would require 292 kWh per acre-foot of water." Wilkinson and Kost, *An Analysis of the Energy Intensity of Water in California: Providing a Basis for Quantification of Energy Savings from Water System Improvements*, 2006, ACEEE Summer Study on Energy Efficiency in Buildings, p. 12-123.

[51] Gov. Code, §§ 7293, 7295

safe and reliable drinking water.

Recharge In or Near Disadvantaged Communities and Domestic Well Clusters 3-11

The Westlands GSA should implement or incentivize recharge basins or other recharge activities throughout the GSA area wherever DACs and clusters of domestic wells exist. The GSA should encourage these kinds of recharge projects with health co-benefits over on-farm recharge, which is likely lead to accelerate groundwater contamination.

Establish Pumping Buffer Zones That Protect Disadvantaged Communities and Clusters of Domestic Wells 3-12

For areas vulnerable to declining water levels and loss of production capacity, Westlands GSA should adopt management actions that establish geographical protection areas (buffer zones) by establishing bans, pumping limitations or community-specific management areas around disadvantaged communities and domestic well clusters. In order to implement this policy, the Westlands GSA can consider expanding its management areas around critical subsidence areas to also include disadvantaged communities and clusters of domestic wells, to protect shallow or vulnerable wells from the impacts of over-pumping and cones of depression. This buffer must be protective enough to ensure that disadvantaged communities and residents reliant on domestic wells do not experience localized impacts from nearby pumping activities. This action should not be used to allow more pumping elsewhere in the subbasin, and needs to be coupled with a strong demand reduction policy across the basin.

Warning Against a Groundwater Market 3-13

We also strongly recommend that the GSA ensure that the proposed groundwater allocations scheme cannot turn into a groundwater market. Groundwater markets raise concerns from the perspective of domestic well users and disadvantaged communities, and residents of Cantua Creek and El Porvenir. Such a scheme will likely negatively impact critical drinking water resources, as more financially powerful groundwater users are able to purchase more groundwater resources and diminish the drinking water supplies of nearby community water systems and domestic well users.

Other Considerations for Projects and Management Actions 3-14

The following elements must be incorporated into the Projects and Management Actions section of the GSP in order to avoid a disparate impact on protected groups in the GSA area:

- ***Multi-Benefit Projects:*** Implement and incentivize multi-benefit projects such as wetlands restoration or stormwater drainage ponds that would eliminate flooding and increase groundwater recharge in disadvantaged communities.

- ***Project Funding:*** Although there are multiple short-term funding sources to leverage for SGMA-related projects, the Westlands GSA operating budget must be a reliable source of funding over the long-term of GSP implementation, and the GSA cannot rely on grant funding for long-term projects and programs that benefit disadvantaged communities. The GSA itself must be responsible for addressing the drinking water issues caused its the GSA's policy decisions and activities. Furthermore, any proposed assessments that will pay for projects may not place a disproportionate financial burden on disadvantaged communities. Westlands GSA staff has stated that communities like Cantua Creek and El Porvenir with be exempt from Prop 218 fees associated with SGMA implementation. Westlands GSA must ensure this exemption fee is adopted.

Draft GSP Does Not Contain Adequate Plans for Community Engagement in Plan Implementation 3-15

GSPs must include a planning and implementation horizon.[52] The proposed plan implementation is insufficient in regards to public engagement/outreach and does not contain adequate information regarding annual reporting or the potential to make amendments to the GSP.

The GSA does not include public outreach in any of the key sections of the annual report outline. [53] Public engagement has been a critical component to the SGMA implementation process and must continue to be an integral part of the GSP implementation process. Additionally, the proposed budget for public outreach is insufficient for meaningful community participation. As it is currently written, Westlands GSA is only proposing to allocate $15,000 to public outreach.[54]

In creating annual operating budgets, GSAs must prioritize funding for these necessary outreach activities, something that is not reflected in the proposed annual implementation costs. While Westlands GSA has had interpretation services at their SGMA related workshops, interpretation services are not available at their board meetings, were SGMA related updates have been agendized. Having translation services available during Westlands GSA board meetings is imperative to meaningful community engagement, a point we have raised several times.

Furthermore, Westlands GSA proposes to establish an "Advisory Committee" in order to support effective collaboration and communication between and among stakeholders.[55] Under qualifications for the committee, Westlands GSA proposes to give minimum seven out its eleven committee seats to agricultural interest.[56] This is an imbalance of interests and will not allow for accurate and meaningful representation of domestic, environmental, and disadvantaged community needs. Instead, the GSA should adhere its obligation to consider the interests of all of the beneficial users listen in section 10723.2 of SGMA, and ensure that the Advisory Committee has equal representation from all types of beneficial users present in the subbasin.

Lastly, as the draft GSP is currently written, it is unclear how or when the GSA will make changes to the GSP between five-year updates. The draft GSP states that updates will be made every fifth year of implementation, but it is unclear if this will be the only time at which amendments can be made and/or proposed.[57] While "periodic evaluations" of the GSP are

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[52] Water Code § 10727.2.(c)
[53] Westlands Water District, Westside Subbasin Draft GSP pg. 5-9, dated September 2019
[54] Westlands Water District, Westside Subbasin Draft GSP pg. 5-3, dated September 2019
[55] Westlands Water District, Westside Subbasin Draft GSP pg. 6-4, dated September 2019
[56] Westlands Water District, Westside Subbasin Draft GSP pg. 6-4, dated September 2019
[57] Westlands Water District, Westside Subbasin Draft GSP pg. 5-4, dated September 2019; Westlands Water District, Westside Subbasin Draft GSP pg. 5-5, dated September 2019

mentioned, it is unclear if those periodic evaluations could lead to GSP amendments.[58]

To ensure that the GSP is implemented properly, Westlands GSA must do the following:

- Include public outreach as part of its annual reporting.
- Clarify in the GSP that the plan may be modified as data becomes available, and that the GSA will seek and accept feedback from the public on an ongoing basis throughout plan implementation.
- Clarify that any modification to the GSP must be in writing, noticed and provide sufficient time for public review and feedback.
- Ensure that the proposed "Advisory Committee" contains equal representation from all beneficial user groups present in the subbasin.
- Westlands GSA must establish a processes by which it will seek and incorporate feedback from the public on an ongoing basis through direct outreach to disadvantaged communities and public workshops that are held at convenient locations and times and accessible in multiple languages. Proposed reconsiderations must be publicly noticed and circulated for public review and comment prior to final adoption.

Other Legal Considerations 3-16

The Draft GSP Threatens to Infringe on Water Rights

In enacting SGMA, the legislature found and declared that "[f]ailure to manage groundwater to prevent long-term overdraft infringes on groundwater rights."[59] The test of SGMA further notes that "[n]othing in this part, or in any groundwater management plan adopted pursuant to this part, determines or alters surface water rights or groundwater rights under common law or any provision of law that determines or grants surface water rights."[60] As discussed in detail above, the Draft GSP allows continued overdraft above the safe yield of the basin, such that drinking water wells (especially domestic wells) will continue to go dry, infringing on the rights of overlying users of groundwater. The GSP must be revised to protect the rights of residents of disadvantaged communities and/or low-income households who hold water rights to groundwater.

The Draft GSP Conflicts with the Reasonable And Beneficial Use Doctrine 3-17

The "reasonable and beneficial use" doctrine, to which SGMA expressly must comply,[61] is codified in the California Constitution. It requires that "the water resources of the State be put to beneficial use to the fullest extent of which they are capable, and that the waste or unreasonable use or unreasonable method of use of water be prevented, and that the conservation of such

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[58]Westside Subbasin Draft GSP pg. 5-10 to 5-11, dated September 2019
[59] AB 1739 (2014).
[60] Water Code § 10720.5(b).
[61] Water Code § 10720.1(a).

waters is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and for the public welfare." (Cal Const, Art. X § 2; *see also United States v. State Water Resources Control Bd.* (1986) 182 Cal.App.3d 82, 105 ["…superimposed on those basic principles defining water rights is the overriding constitutional limitation that the water be used as reasonably required for the beneficial use to be served."].)

The reasonable and beneficial use doctrine applies here given the negative impacts of the Draft GSP on groundwater supply and quality, which are likely to unreasonably interfere with the use of groundwater for drinking water and other domestic uses. As the Draft GSP authorizes waste and unreasonable use, it conflicts with the reasonable and beneficial use doctrine and the California Constitution.

The Draft GSP Conflicts with the Public Trust Doctrine 3-18

The "public trust" doctrine applies to the waters of the State, and establishes that "the state, as trustee, has a duty to preserve this trust property from harmful diversions by water rights holders" and that thus "no one has a vested right to use water in a manner harmful to the state's waters."[62]

The "public trust" doctrine has recently been applied to groundwater where there is a hydrological connection between the groundwater and a navigable surface water body.[63] In *Environmental Law Foundation*, the court held that the public trust doctrine applies to "the extraction of groundwater that adversely impacts a navigable waterway" and that the government has an affirmative duty to take the public trust into account in the planning and allocation of water resources.[64] The court also specifically held that SGMA does not supplant the requirements of the common law public trust doctrine.[65] In contrast to these requirements, the Draft GSP does not consider impacts on public trust resources, or attempt to avoid insofar as feasible harm to the public's interest in those resources.

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The GSP must protect subbasin's most vulnerable drinking water users. We appreciate the Westlands GSA staff's willingness to dialogue about our concerns and recommendations, and we welcome the opportunity to discuss our recommendations to ensure compliance with state law. We are also in communication with the Department of Water Resources about current GSP development activities in the San Joaquin Valley, and hope to successfully work with GSAs, communities and DWR to ensure that groundwater management is equitable and sufficiently protective of vital drinking water resources.

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[62] *United States v. State Water Resources Control Bd.* (1986) 182 Cal.App.3d 82, 106; *see also Nat'l Audubon Soc'y v. Superior Court* (1983) 33 Cal.3d 419, 426 ["before state courts and agencies approve water diversions they should consider the effect of such diversions upon interests protected by the public trust, and attempt, so far as feasible, to avoid or minimize any harm to those interests."].

[63] *Environmental Law Foundation v. State Water Resources Control Bd.* (2018) 26 Cal.App.5th 844, 844.

[64] *Id.* at 856-62.

[65] *Id.* at 862-870.

Sincerely,

/s/

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CC:

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Focused Technical Review:
September 30, 2019 Westside Subbasin Public Review Draft Groundwater Sustainability Plan

4-1 **Water Level Monitoring Network and Sustainable Management Criteria (SMCs)**

The draft Groundwater Sustainability Plan (GSP) developed by the Westlands Water District (WWD) Groundwater Sustainability Agency (GSA) details that the Westside subbasin (subbasin) will be considered sustainable when the subbasin is operating within its sustainable yield, the average annual rate of groundwater storage change is equivalent to the 2015 baseline conditions, and when groundwater levels are maintained at elevations necessary to avoid undesirable results, in addition to other factors.

The draft GSP sets the measurable objectives (MOs) for groundwater levels at each representative monitoring well (RMW) based on water level changes simulated by the groundwater flow model whereby the simulated difference in water levels between 2016 and 2017 is added to the measured 2016 groundwater elevation. The draft GSP details "the magnitude of the groundwater level declines over the 2020 through 2040 period were superimposed on historic groundwater level lows to establish the minimum thresholds. The minimum thresholds for chronic lowering of groundwater levels are based on documented screen intervals of key wells located both in the upper and lower aquifers in the Subbasin" (Section 3.3.1.1). Five-year interim milestones were set to split the difference between MOs and minimum thresholds (MTs).

As described in the comments below, the draft GSP does not include a thorough analysis of impacts to key beneficial users in the subbasin, particularly domestic well users and members of disadvantaged communities (DACs) that are planning on increasing their use of groundwater as a drinking water supply.

- According to the draft GSP, screen intervals were considered in the development of MTs for groundwater levels at each RMW. However, text detailing the development of MTs for groundwater levels in Section 3.3.1.1 of the draft GSP quoted above is not consistent with that stated in Table 3-12: "the lowest of a) projected lowest future groundwater level at end of estimated 10-year drought or b) lowest modeled groundwater level from projected with projects model simulation (2019-2070)." **The GSP should clarify how MTs for groundwater levels were established.**
- The draft GSP states "Domestic users of groundwater are not expected to be impacted by the minimum thresholds since those thresholds have already been experienced historical [sic]" (Section 3.3.9). **The GSP should clarify if the historical lows that were used to establish MTs were measured or simulated with the model; given that the data for the domestic wells is described elsewhere in the draft GSP to be incomplete, it is difficult to understand how the statement regarding the well impacts can be made.**
- The draft GSP defines the undesirable result (UR) for chronic lowering of groundwater levels as when 15% of the groundwater elevations measured in the SGMA monitoring network are below their MTs for two consecutive fall measurements (i.e., two consecutive years). Section 3.4.2 of the draft GSP states "For domestic beneficial users of groundwater, the most significant undesirable results are groundwater levels, groundwater storage, and groundwater quality. Undesirables results for any of these three sustainability indicators could potentially restrict the ability of households to use water for domestic purposes." However, the draft GSP does not clearly and transparently

present the impact of the proposed MOs/MTs on domestic wells, DACs, and small water systems within the subbasin, nor does it present an assessment of how many and which domestic wells are expected to go dry if the MOs/MTs are reached. For example, the draft GSP identifies DACs, three of which (i.e., Cantua Creek, El Porvenir, and Huron) are potential groundwater extractors and currently in process of planning and/or installing new supply wells (Section 2.1.5.1), but does not provide a map of these DAC areas overlain with existing pumping wells or the proposed MOs/MTs. Per 23 CCR § 354.28, these assessments should be included in the GSP in order for the public and DWR to be able to fully evaluate how the MTs may affect the interests of beneficial uses and users. **Therefore, an impact analysis should be performed and presented in the draft GSP that evaluates the potential impacts associated with the MTs/MOs on domestic and public drinking water supply wells. Furthermore, locations of potentially impacted wells should be provided on maps to allow the public to assess the well impacts specific to DACs, small water systems, and other sensitive beneficial users within the subbasin.**

- As shown on **Figure 1**, the subbasin includes approximately 70 domestic wells[1] and six DWR-designated DACs[2] (i.e., Avenal, Huron, Cantua Creek, Lemoore Station, El Porvenir/Three Rocks, and Westside) with a collective population of over 27,900 people. The subbasin also includes 35 small water systems, including one school system, which collectively serve a population of over 25,100 people. It is noted that most of these systems rely on surface water delivered through the California Aqueduct; however, groundwater supply wells are currently being planned and/or developed for several communities including Cantua Creek, El Porvenir/Three Rocks, and Huron (Table 2-4 of draft GSP), in addition to the three public supply wells indicated in Figure 2-5 of the draft GSP. The Sustainable Groundwater Management Act (SGMA) requires the GSA to consider how the MTs "may affect the interests of beneficial uses and users of groundwater or land uses and property interests" (23 CCR § 354.28). The draft GSP states "Domestic users of groundwater are not expected to be impacted by the minimum thresholds since those thresholds have already been experienced historical. Lack of groundwater availability for domestic water uses in the Subbasin during the last drought as a result of declining groundwater levels was not reported." (Section 3.3.9). Beyond this anecdotal evidence, the draft GSP does not provide data to determine if domestic wells were impacted (dewatered) during historical drought conditions. **The GSP should clearly describe how the proposed approach to developing MOs/MTs is protective of the drinking water users in the subbasin.**
- Table 3-7 in the draft GSP tabulates the MOs and MTs for each groundwater elevation Upper Aquifer monitoring well. Most MOs are specified at groundwater elevations greater than the 2015 baseline; however, four wells have MOs set to more than 70 feet below the 2015 baseline conditions (ranging from 71 feet to 129 feet lower than 2015 conditions). **The GSP should describe how MOs of 70 to nearly 130 feet below 2015 baseline conditions are sustainable and reasonable, and consistent with the methodologies and conclusions provided in the draft GSP.**
- The draft GSP indicates that 2016 groundwater levels measured in the RMWs were used for developing MOs and Table 3-14 indicates all RMWs have data for at least 2016. However, Tables 3-

[1] Domestic Well Densities: Research to develop the CWC Vulnerability Tool draft as of May 16, 2019.
[2] Designated at the Census Place levels.

2 and 3-3, which quantitatively present the MOs, lists the 2015 groundwater elevations as a baseline instead of 2016. In addition, Appendix 3.A, according to the draft GSP, shows MOs "for each groundwater level sustainable indicator well" (Section 3.2.1.1); however, the information provided does not include groundwater level hydrographs for all RMWs and some hydrographs do not include water level data in 2016. Based on this, it is unclear what data were actually used for the development of the MOs presented in the draft GSP. **The GSP should therefore clarify what historical groundwater elevation data were used for developing the MOs, and what assumptions were applied for the wells that are missing 2016 groundwater level data.**

- **Figures 2A** and **2B** show the estimated water decline from current conditions that would occur at each RMW if water levels reach the MOs and MTs, respectively. At the MOs, the water levels would drop by an average of approximately 37 feet in the RMWs (**Figure 2A**); and at the MTs, the water levels would drop by an average of approximately 92 feet from current (2017) conditions (**Figure 2B**). **Table 1** below identifies selected RMWs located near DACs in the subbasin, the water level MOs and MTs, and the estimated water level decline from current conditions that is expected at the RMWs. The groundwater level MTs in the vicinity of these communities are an average of approximately 80 feet lower than current conditions. Given that the draft GSP has identified that Fresno County is in the process of installing municipal supply wells for both Cantua Creek and El Porvenir, **the GSAs should clearly communicate to the County the projected water level changes to the MOs and MTs in these areas. The GSP should consider and quantify both the potential dewatering of domestic wells and the increased pumping costs associated with the increased lift at the projected lower water levels, in order to more fully and transparently consider the impacts to beneficial users.**

Table 1
Groundwater Elevation Sustainable Management Criteria
Near Selected Communities

Location	RMW	Current Groundwater Elevation (ft msl)*	MO (ft msl)	MT (ft msl)	Water Level Decline to Reach MO (ft)	Water Level Decline to Reach MT (ft)
Avenal	21S/17E-11N01	-15	-74.8	-98.1	60	83
Huron	20S/17E-09N03	28	62.9	-79.8	-35 (increase)	108
Cantua Creek	16S/15E-32A06	-28	4	-17.4	-32 (increase)	-11 (increase)
Naval Air Station Lemoore (NASL)	19S/19E-29A01	-98	-89.7	-152.1	-8 (increase)	54
Three Rocks (El Porvenir)	16S/14E-36E01	-112	-111.5	-156.1	-1 (increase)	44
Westside	18S/17E-09P01	-15	-178.5	-234	164	219
Average Decline from Current Elevation for all Selected RMWs near DACs (ft)					**25**	**83**
Average Decline from Current Elevation for all 75 RMWs (ft)					**37**	**92**

* ft msl = feet mean sea level; typically 2017 water levels.

- The insets in **Figures 2A** and **2B** also show the estimated water level declines at the RMWs overlaid on the draft GSP spring 2015 groundwater elevation contour map for the Upper Aquifer (draft GSP Figure 2-37). As identified above, water levels at all 75 RMWs would be expected to decline an average of 37 feet below current water levels (2017) if the MOs are reached and 92 feet if the MTs are reached. However, as shown on **Figure 2B**, the amount of decline is not consistent throughout the subbasin. For example, water levels would be expected to decline as much as 164 feet at the MO and 219 feet at the MT at RMW 18S/17E-09P01 near Westside (a DAC), but increase 32 feet at the MO and 10 feet at the MT at RMW 16S/15E-32A06 near Cantua Creek (also a DAC). If groundwater levels are managed to the MOs, this may result in changes to the overall groundwater direction gradients, which could potentially result in changes to water quality.[3] **Therefore, it is recommended that the impacts to groundwater gradients at the proposed MOs and MTs be analyzed and described in the GSP, as well as impacts to drinking water wells.**

- **Figure 3** shows the approximate locations of domestic wells and Upper Aquifer water level RMWs within the subbasin. Since most domestic wells have relatively shallow well depths, they are assumed to primarily be screened within the Upper Aquifer and therefore only compared with MTs assigned for Upper Aquifer RMWs. This is consistent with the draft GSP which states "Based on knowledge of domestic wells located in the Subbasin, most domestic wells are constructed in the Upper Aquifer" (Section 2.2.2.2). For purposes of this evaluation, a 1.5-mile radius is shown around each RMW. Based on available well construction information, the well screens of the domestic wells located within this 1.5-mile radius are compared to the proposed MTs for the RMWs. For purposes of this assessment, a well is identified as fully dewatered if the MT is below or at the bottom of the well screen interval and a well is identified as partially dewatered at if the MT is below or at the midpoint of the well screen interval. Approximately 33% of domestic wells in the subbasin are located within the 1.5-mile radius of RMWs. When water levels reach MTs, approximately 43% of these domestic wells would be expected to be fully dewatered. We acknowledge that, according to the draft GSP (Section 2.1.3), not all of these domestic wells are currently active. However, based on the available information in the draft GSP, we are not able to distinguish the status of these domestic wells in the available dataset. We also acknowledge that this is a "quick and dirty" assessment of domestic well impacts, and therefore **recommend that the GSP present a thorough and robust analysis, supported by maps, that identifies: (1) which active domestic wells are likely to be impacted (including partially dewatered) at the MTs and at the MOs, and (2) the location of the likely impacted wells with respect to DACs and other communities and water systems dependent on groundwater.**

- As shown on **Figure 1**, the water level monitoring network generally provides good coverage across the subbasin, with the exception of the areas near Calflax and Huron. Although the community water systems near Calflax and Huron rely on California Aqueduct water, the draft GSP lists the City of Huron as a potential groundwater extractor (Table 2-4). Therefore, future water level monitoring will be important near Huron as well. Additionally, the draft GSP acknowledges water level monitoring network spatial data gaps in Section 3.8.9.3 "Specifically, in the Upper Aquifer, the northern portion of the Subbasin along the northern and western boundary is lacking in monitoring

[3] Stanford, 2019. *A Guide to Water Quality Requirements Under the Sustainable Groundwater Management Act,* Spring 2019.

wells. This spatial gap exists due to the absence of wells in these regions and associated groundwater extraction. In the Lower Aquifer, a spatial gap exists in the southern portion of the Subbasin, along the western boundary." Section 3.6.2 of the draft GSP details that groundwater elevation monitoring network wells were selected based on their proximity to the center of pre-defined hexagons, their length of record, and/or proximity to subsidence areas of concern. However, the monitoring network selection did not take into account well proximity to beneficial users of groundwater, such as domestic wells, small water systems, or DACs. **It is therefore recommended that the WWD GSA consider including at least one RMW near Huron, in addition to the areas identified in the draft GSP.**

- Section 3.6.1 of the draft GSP states that "The GSA has complete well construction information for these [GSP monitoring] wells, which allows the GSA to determine the aquifer being monitored with certainty." However as detailed in Tables 3-14 and 3-15 of the draft GSP, two wells (i.e., 19S/18E-34N04 and 21S/19E-20D02), assigned to the Upper and Lower Aquifer, respectively, are missing both well depth and well screen interval information. **The GSP should provide the missing well construction information for these wells or clarify the Section 3.6.1. statement.**
- Section 3.3.1.4 of the draft GSP acknowledges two conditions that may lead to undesirable results associated with chronic lowering of groundwater conditions and Section 3.3.1.5 details "the primary detrimental effects to beneficial users from water levels falling below the minimum threshold are a loss of significant well capacity, increased costs due to higher pumping lifts, lack of groundwater extraction due to groundwater levels declining below the pump setting depth or the bottom of the well, or subsidence impacts on well structures and above ground infrastructure, especially if the pumping is concentrated in a small geographic area." However, the draft GSP does not detail potential actions to be implemented if undesirable results occur. **The draft GSP should clearly identify the potential actions that would be implemented and the funding source(s) that would be utilized if undesirable results occur.**

4-2

Water Quality Monitoring Network and SMCs

The draft GSP identifies that concentrations of total dissolved solids (TDS), boron, selenium, arsenic, and sulfate have historically exceeded drinking water standards in the Upper Aquifer. However, the draft GSP only identifies TDS as a primary chemical of concern (COC). Water quality MTs are set as relative TDS concentration changes and were established by "account[ing] for short term increases in TDS concentrations that, if continued for an extended period of time, would not be consistent with regulatory requirements such as the upcoming Basin Plan Amendment for salinity. The minimum threshold was based on an analysis of readily available historical data that shows short term variations of groundwater quality" (Section 3.3.5.1). For the reasons identified below, the draft GSP does not clearly present the water quality MTs for all potential COCs and therefore the potential impacts to key beneficial users cannot be evaluated.

- Section 2.2.2.2 states "Due to the presence of oxidation and reduction conditions, nitrate is likely not a constituent of concern in both the Upper and Lower Aquifers. However, since the Subbasin predominantly includes agricultural land uses, the potential for nitrate to occur in the Upper Aquifer is possible should oxidation and reduction conditions vary in the Subbasin and near the vicinity of domestic wells. As a result, both nitrate and salinity in the form of TDS are the constituents of interest for the GSP monitoring program." **The GSP should detail if nitrate concentrations have historically exceeded drinking water standards, present maps of nitrate concentrations in groundwater, and consider setting MTs and MOs for nitrate or provide further justification as to why sustainability management criteria are not required at this time.**

- As mentioned above, the draft GSP presents maps of TDS concentrations for three time periods (Figures 2-43 through 2-48); however, the GSP does not present maps of any other water quality data including those noted as having exceeded drinking water standards: boron, selenium, arsenic, and sulfate. Selenium is of particular note because historically, WWD agricultural drainage caused increased selenium concentrations to toxic levels for waterfowl.[4] Substantial agricultural land retirement (approximately 100,000 acres) will occur as part of WWD's settlement with the Federal Government in 2015.[5] However, the draft GSP provides no discussion of the land use shifts in which agricultural lands will be retired to either fallow or other industrial uses (such as solar panel farms) in the future, nor does it present maps of historical and current selenium concentrations. Furthermore, the subbasin contains Leemore Naval Air Station, which according to the State Water Resources Control Board's website GeoTracker,[6] has cleanup sites associated with fuel and gasoline contamination. Per 23 CCR § 354.16, each plan shall provide a description of "Groundwater quality issues that may affect the supply and beneficial uses of groundwater, including a description and map of the location of known groundwater contamination sites and plumes." Based on this, the water quality analysis and data presented in the draft GSP are incomplete and do not present a thorough assessment of water quality conditions in the subbasin. **The GSP should therefore: (1) add details regarding agricultural drainage impacts on land use and water quality within the subbasin, (2) present maps of selenium, arsenic, boron, and sulfate concentrations in groundwater, and (3) provide details and present maps of known groundwater contamination sites as listed on GeoTracker, to the extent data are available.**
- As quoted above, the MTs were established by examining increases in TDS concentrations over "an extended period of time," but it is not clear what this extended period of time was. Additionally, it is not clear if the regulatory requirements were set as a hard upper bound. **The GSP should add additional detail on how the water quality MTs were established, including chemographs similar to the hydrographs presented in Appendix 3.A.**
- The draft GSP discusses water quality MTs in Section 3.3.5. The draft GSP details that the availability of historical TDS data at RMWs is lacking, and "relative changes in TDS concentrations are only available for a few GSP monitoring locations." The draft GSP further details a multi-step methodology based on the expected concentration trend relative to measured concentration that will be used to define MTs and MOs for TDS at a given RMW. Qualitative MTs are presented in Tables 3-10 and 3-11. However, the GSP does not identify which of the "few" RMWs were used for establishing the MTs. Furthermore, Section 3.3.5.2 states "Tables 3-10 and 3-11 include each well being monitored in the GSP monitoring program for groundwater quality in the Upper and Lower Aquifers, along with the 2015 baseline TDS concentration (if available), minimum threshold,

[4] https://www.usbr.gov/research/projects/detail.cfm?id=962
[5] https://wwd.ca.gov/wp-content/uploads/2015/09/SettleFactSht.cmp_.pdf
[6] https://geotracker.waterboards.ca.gov/

measurable objective, and interim milestones. Generally, minimum thresholds were set at 2,000 milligrams per liter (mg/L) TDS in the Upper and Lower Aquifers." The baseline TDS concentrations are not included in either table, so one cannot calculate what the actual TDS concentration would be at either the MO or MT. **The GSP should therefore clearly present the presumed baseline TDS concentration for each RMW in tables and maps so that the public and DWR may evaluate the proposed SMCs.**

- Table 3-12 of the draft GSP defines the UR for degraded water quality as when "20 percent of wells above the minimum threshold for the same constituent, based on average of most recent three-year period". However, the text in Section 3.4.1.4 states "Groundwater quality degradation is considered an undesirable result with any exceedance of the minimum threshold in at least 20 percent of the monitoring wells during any one year." **The GSP should clarify the definition of UR for degraded water quality**.
- As stated in Section 2.2.2.2 of the draft GSP, "There is little evidence of groundwater quality degradation in the Subbasin that is a result of agricultural or industrial related activities." The draft GSP presents selected chemographs of TDS concentrations over time (Figures 2-41 and 2-42) along with maps showing the spatial distribution of TDS concentrations for three time periods (Figures 2-43 through 2-48). However, it does not discuss if the limited available data shows any association with groundwater level trends. **It is recommended that this analysis includes an evaluation of the change in water quality constituent concentrations relative to change in water levels, particularly over drought periods, to evaluate the potential relationship between water quality and groundwater management activities.**[7]
- Tables 3-22 and 3-23 indicate that water quality RMWs will be sampled bi-annually and Section 3.6.5 details "Data collection in both spring and fall will allow for the analysis of seasonal trends." However, Table 3-25 and Section 3.8.4 indicate water quality RMWs will be sampled for TDS annually. **The GSP should clarify the monitoring frequency of water quality RMWs for both TDS and other identified constituents.**
- Section 3.3.5.5 details "Urban and domestic beneficial uses are impacted if water of degraded quality is the only source of water for potable use. The impacts include the need to utilize alternative sources of water that may be more expensive than groundwater and potential requirement to treat prior to use." Furthermore, Section 3.4.1.4 states "The degraded water quality is considered significant and unreasonable if the magnitude of degradation at pre-existing groundwater wells is not usable without taking management actions to improve the quality of the water to concentrations less than the minimum threshold." However, the draft GSP does not identify the potential management actions to be implemented if undesirable results occur. **The draft GSP should clearly identify the potential actions that would be implemented and the funding source(s) that would be utilized if undesirable results occur.**

[7] Stanford, 2019. *A Guide to Water Quality Requirements Under the Sustainable Groundwater Management Act,* Spring 2019.

4-3 **Water Budget**

The water budget section of the draft GSP was reviewed to identify approaches and assumptions used in the water budget development that may not be protective of DACs, rural domestic water users, and small community water systems. Water budgets were developed for historical conditions (1989-2015), current conditions (2016), and projected future conditions (2017-2090) derived from the numerical groundwater flow model (i.e., the Westside Groundwater Model) output. For the reasons identified below, the description of the water budget in the draft GSP is not fully transparent.

- The water budgets were developed using the groundwater flow model for the subbasin. Model assumptions and details are reported to be included in Appendix I, which was noted as available upon request. However, we requested Appendix I and were provided a different document. To date, we have not been provided by the GSA with Appendix I. The water budget section of the draft GSP only reports the results of the of the water budget analysis. **Therefore, the model's assumptions and model input could not be evaluated, and even when requested, the data, method and assumptions are not available for the public to review and evaluate.**
- Section 2.1 of the draft GSP notes that there are approximately 39 active domestic wells in the subbasin with an estimated pumping rate of 78 AFY; these users are considered by the draft GSP to be de minimis users. The draft GSP notes that there are nine public water systems and eight DACs. Although the draft GSP acknowledges that most municipal water systems rely on water supplied from the California Aqueduct, Figure 2-5 shows the location of up to three public supply wells. Furthermore, Section 2.2.2.2 states that "Fresno County is the process of installing a new well for Cantua Creek and El Porvenir." There are also solar electricity generation facilities in the Subbasin, which typically require a water supply for solar panel washing or cooling. The draft GSP does not include a description how these municipal and industrial (M&I) users are accounted for in the historical, current, or projected water budgets. **The GSP should include detail on how these non-agricultural water users were accounted for in the water budget, if increased M&I groundwater use was considered and incorporated in the projected water budget, and quantify impacts to these users from projects and management actions implemented to achieve sustainability.**
- Table 2-9 reports the inflows and outflows of the land surface water budget. The table includes columns for 'Imported Surface Water' and 'Utilized Surface Water.' A footnote describes the 'Utilized Surface Water" as surface water imports not utilized by the model that are rejected and not included in the water budget. There is no explanation of why a portion of the surface imports are rejected and how that impacts the water budget. The total imported surface water volumes shown in Table 2-9, Table 2-10, and discussed in the text do not agree. **The GSP should provide additional details on the imported surface water values used in the water budget and the effect of those surface water imports that were not used in the model. The GSP should also be revised to improve the consistency between total surface water imports shown in Table 2-9, Table 2-10, and discussed in the text.**
- The projected water budget incorporates the effects of climate change. Land use and population are assumed to remain constant during the projection period. Per 23 CCR § 354.18 (c)(3)(B) the projected water budget must include "projected changes in local land use planning, population growth, and climate." Section 2.1.3.4 reports that there has been a trend of increasing acres of nut

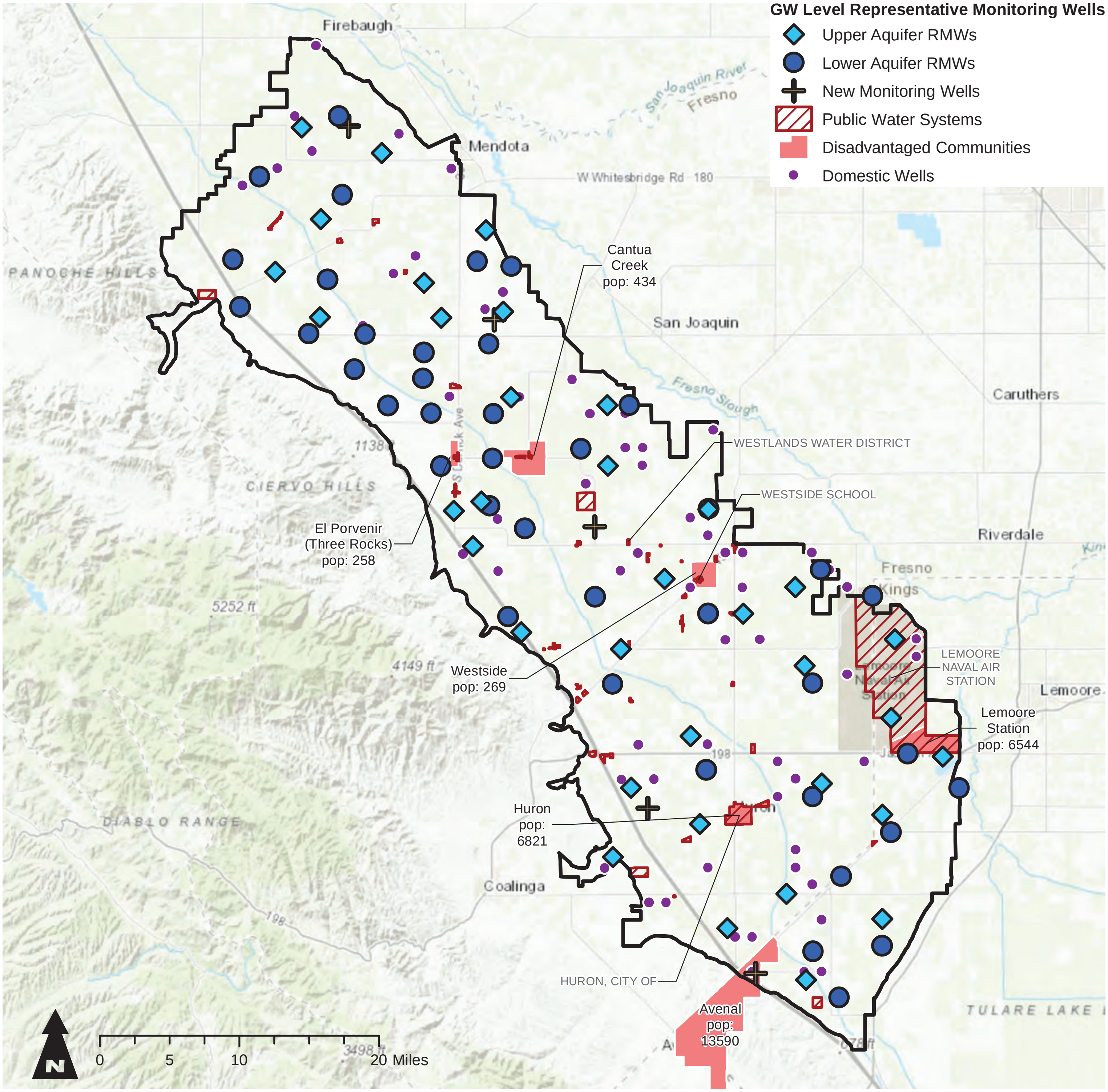
trees and fallowed land and trends of land use changes are shown on Figure 2-9. As mentioned above, as part of WWD's settlement in 2015, large portions of agricultural land will be retired. Table 2-3 shows a large increase in fallow/non-agricultural land between 2000 and 2015, suggesting that this may have already happened, although the text states that fallowing was due to drought conditions (Section 2.1.3.4). **The GSP should clarify what land use distribution was used for the projected water budget and provide supporting information to justify the assumption that land use and population will remain constant in the future.**

- The projected ground water budget results presented in Figures 2-15, 2-17, and 2-19 show continued declines in groundwater storage for the periods 2020-2040 and 2020-2070. The projected water budgets do not show that groundwater sustainability will be achieved by 2040. **The GSP should clarify whether groundwater level and storage sustainability will be achieved by 2040.**

4-4

Figure 1 - Representative Monitoring Network for GW Levels Relative to Domestic Wells, DACs, and Community Water Systems

Westlands Water District GSA



Notes

1. All locations are approximate.

References

1. Domestic Well Densities: Research to develop the CWC Vulnerability Tool draft as of May 16, 2019.
2. Disadvantaged community data (place, tract, and block group): downloaded on August 6, 2019 from the DAC Mapping Tool: https://gis.water.ca.gov/app/dacs/.
3. Public Water System data: downloaded on August 6, 2019 from Tracking California: https://trackingcalifornia.org/water/map-viewer. The dataset also includes "non-community" water systems, such as schools.
4. Groundwater level representative monitoring wells are the wells assigned with MTs and MOs according to the draft Westlands Water District GSA GSP. The representative monitoring well information is from Table 3-7, Table 3-8, Table 3-14, and Table 3-15. The new monitoring well locations are from Figure 3-7 - Public Review Draft dated September 2019.

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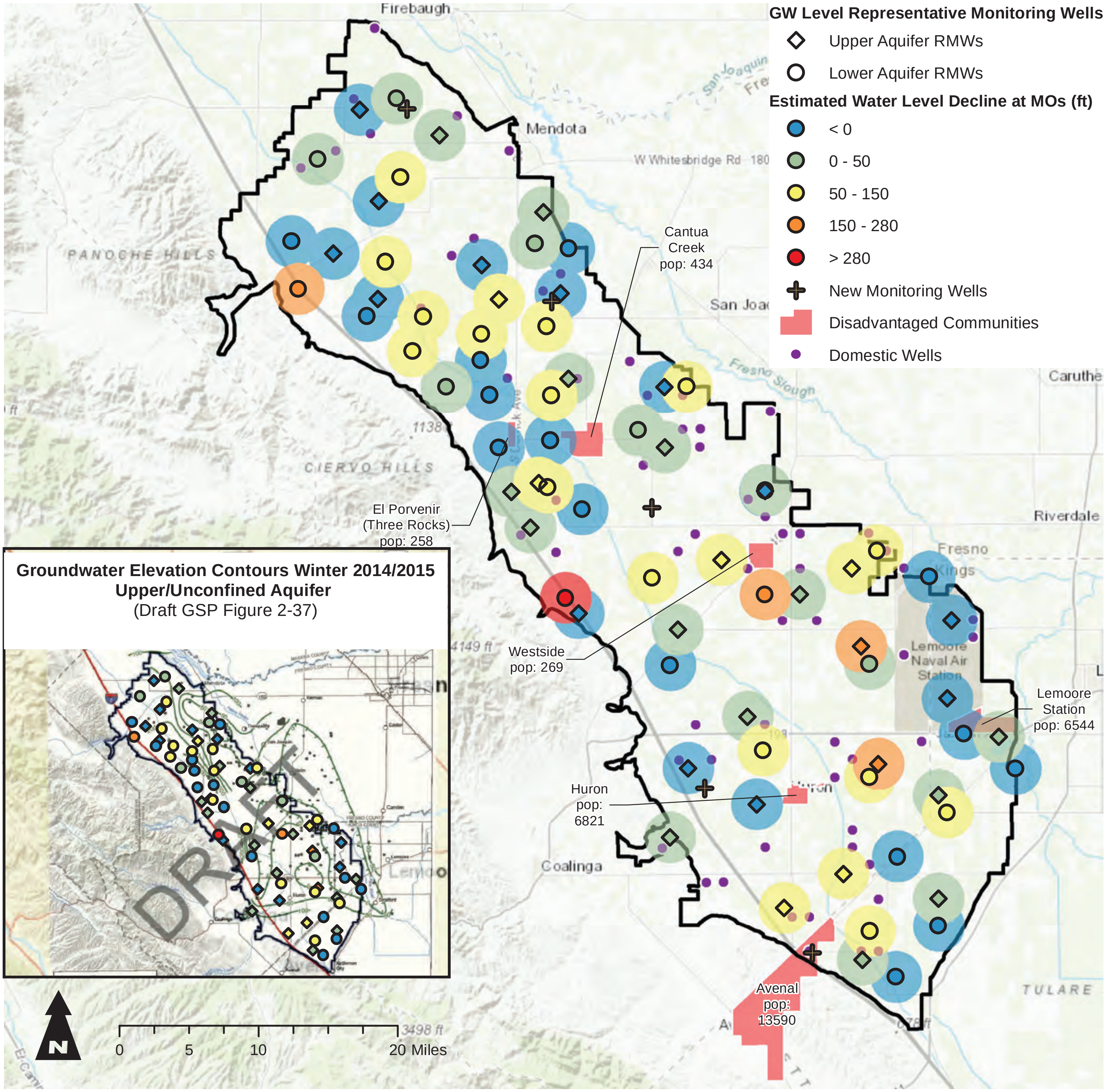
Figure 2A - Estimated Water Level Decline at Measurable Objectives and Domestic Wells

Westlands Water District GSA



Notes

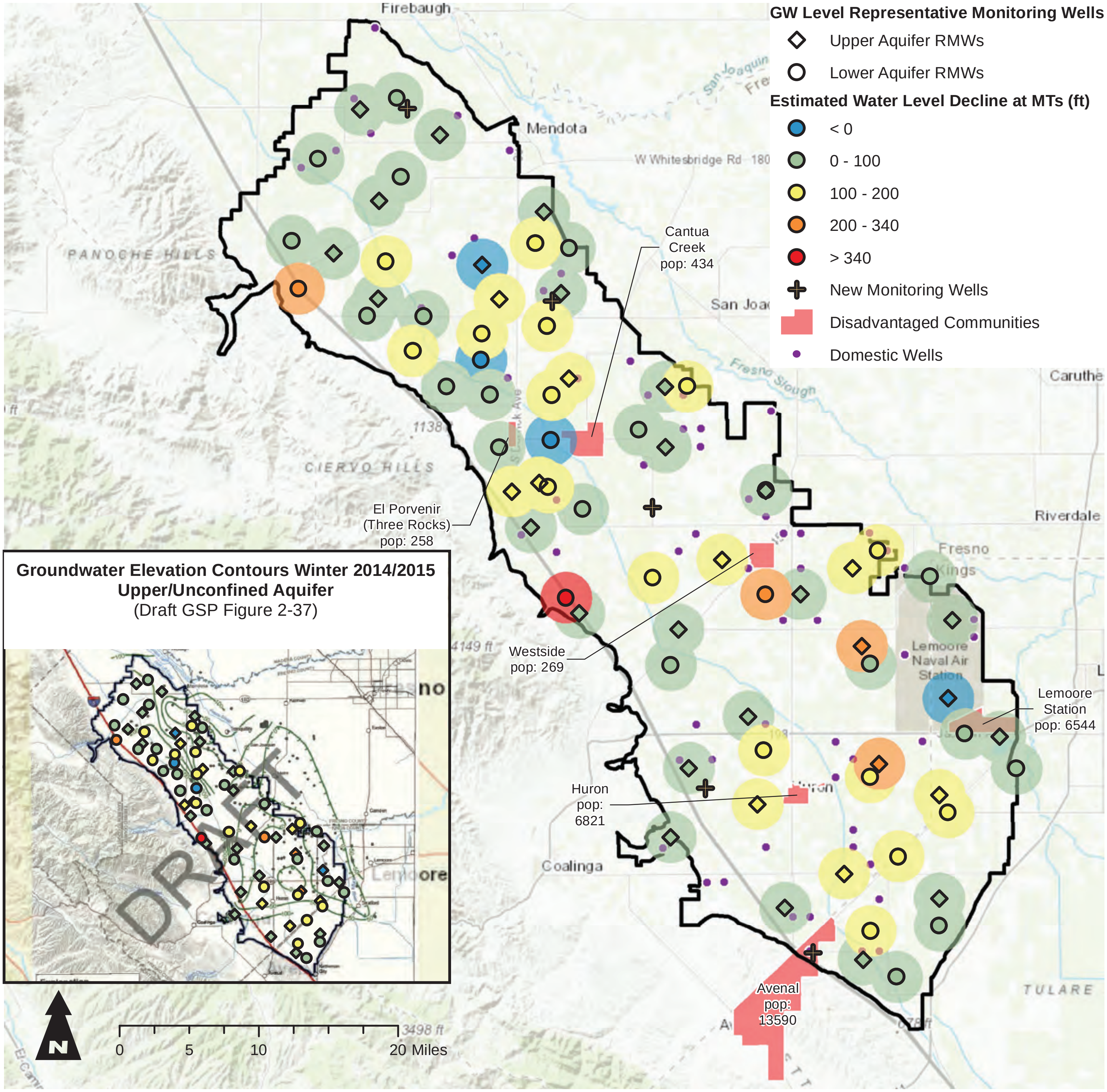
1. All locations are approximate.
2. Water level decline was calculated by comparing the current water level (2017) from Appendix 3-A with the proposed MOs from Table 3-7 and Table 3-8.

References

1. Domestic Well data: Research to develop the CWC Vulnerability Tool draft as of May 16, 2019.
2. Disadvantaged community data: downloaded on August 6, 2019 from the DAC Mapping Tool: https://gis.water.ca.gov/app/dacs/. Last updated in 2016.
3. MO values are from Table 3-7 and Table 3-8 in Westlands Water District GSA GSP - Public Review Draft dated September 2019. Current water level (2017) values are from Appendix 3-A of the draft GSP. For RMWs which cannot be found in Appendix 3-A or do not have 2017 data provided, 2015 water level elevation from Table 3-7 and Table 3-8 are used. Inset contour map is from Figure 2-37 of the draft GSP.

Figure 2B - Estimated Water Level Decline at Minimum Threshold and Domestic Wells

Westlands Water District GSA



Notes

1. All locations are approximate.
2. Water level decline was calculated by comparing the current water level (2017) from Appendix 3-A with the proposed MTs from Table 3-7 and Table 3-8.

References

1. Domestic Well data: Research to develop the CWC Vulnerability Tool draft as of May 16, 2019.
2. Disadvantaged community data: downloaded on August 6, 2019 from the DAC Mapping Tool: https://gis.water.ca.gov/app/dacs/. Last updated in 2016.
3. MT values are from Table 3-7 and Table 3-8 in Westlands Water District GSA GSP - Public Review Draft dated September 2019. Current water level (2017) values are from Appendix 3-A of the draft GSP. For RMWs which cannot be found in Appendix 3-A or do not have 2017 data provided, 2015 water level elevation from Table 3-7 and Table 3-8 are used. Inset contour map is from Figure 2-37 of the draft GSP.

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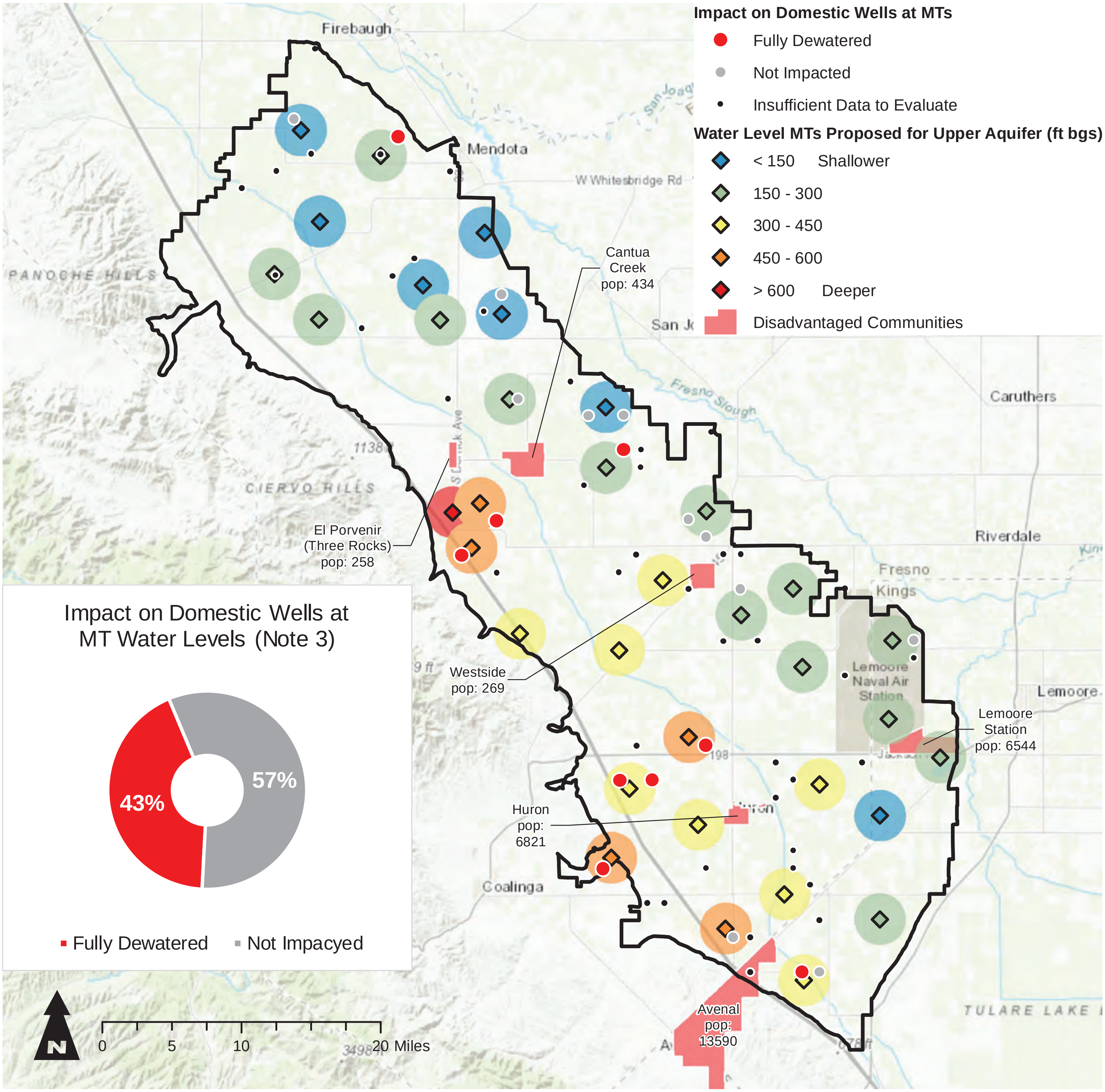
Figure 3 - Water Level Minimum Thresholds and Domestic Wells
Westlands Water District GSA



Notes
1. All locations are approximate.
2. All domestic wells are assumed to be in the upper aquifer based on the relatively shallow screened interval and well depths, therefore are only compared with MTs proposed for the upper aquifer.
3. Where available, bottom of screen interval of a domestic well was used for this assessment, and bottom of well depth was used for the remaining domestic wells. A well is identified as fully dewatered if the MT is below the bottom of the well screen interval; a well is identified as partially dewatered if the MT is below the midpoint of well screen interval. Wells with insufficient data and/or wells outside of the 1.5-mile buffer were not evaluated.
4. Domestic wells shown may not represent the currently active domestic wells based on the Westlands Water District GSA database.

References
1. Domestic Well data: Research to develop the CWC Vulnerability Tool draft as of May 16, 2019.
2. Disadvantaged community data: downloaded on August 6, 2019 from the DAC Mapping Tool: https://gis.water.ca.gov/app/dacs/. Last updated in 2016.
3. MT values are from Table 3-7 and Table 3-8 in Westlands Water District GSA GSP - Public Review Draft dated September 2019.

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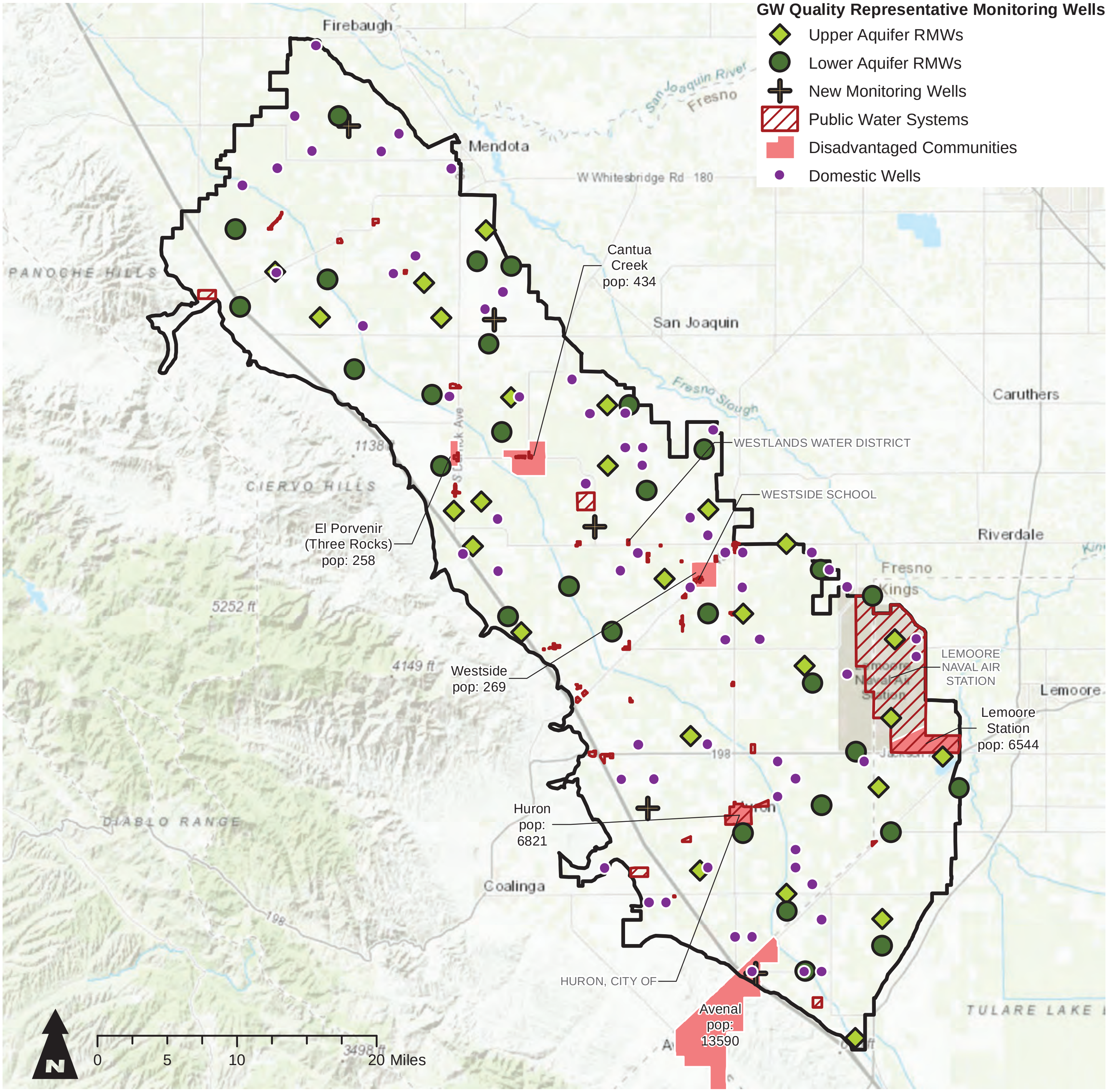
Figure 4 - Representative Monitoring Network for GW Quality Relative to Domestic Wells, DACs, and Community Water Systems

Westlands Water District GSA



Notes
1. All locations are approximate.

References
1. Domestic Well Densities: Research to develop the CWC Vulnerability Tool draft as of May 16, 2019.
2. Disadvantaged community data (place, tract, and block group): downloaded on August 6, 2019 from the DAC Mapping Tool: https://gis.water.ca.gov/app/dacs/.
3. Public Water System data: downloaded on August 6, 2019 from Tracking California: https://trackingcalifornia.org/water/map-viewer. The dataset also includes "non-community" water systems, such as schools.
4. Groundwater quality indicator monitoring wells are the wells assigned with MTs and MOs according to the draft Westlands Water District GSA GSP. The representative monitoring well information is from Table 3-10, Table 3-11, and Table 3-13. The new monitoring well locations are from Figure 3-7 - Public Review Draft dated September 2019.

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KINGS RIVER WATER ASSOCIATION

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October 31, 2019

Board of Directors
Westlands Groundwater Sustainability Agency
3130 N. Fresno Street
P.O. Box 6056
Fresno, CA 93703-6056

VIA EMAIL: sgma@wwd.ca.gov

Re: Comments on Westlands Water District/Westside Subbasin Draft GSP

Dear Board of Directors,

The Kings River Water Association (KRWA) respectively submits the following comments regarding the draft Groundwater Sustainability Plan (GSP) prepared by Westlands Water District (WWD) on behalf of the Westside Subbasin.

Section 4.3.1 identifies the potential sources of injected water for the proposed Aquifer Storage and Recovery (ASR) program as a combination of Section 215 non-storable water, at-risk carryover water from the San Luis Reservoir, and flood flows. The "flood flows" targeted for use in the ASR project are not identified, but the paragraph further states the "total amount of water potentially available from implementation of ASR in 400 wells averages approximately 12,300 acre-feet per year (Figure 4-8). In conjunction with carry over storage in the San Luis Reservoir and Section 215 water contracts, it is anticipated that water stored in the GSA's ASR program could average as much as 28,000 acre-feet annually."

5-1 The 12,300 acre-feet per year referenced in Section 4.3.1 appears to target Kings River floodwater since carry over storage in San Luis Reservoir and Section 215 water contracts are identified as increasing the average up to 28,000 acre-feet annually. Figure 4-8 supports this assumption as it indicates that Kings River floodwater for injection will be available with some frequency in the future that appears to assume that historical floodwater flows will reoccur in the future (although the graph does not accurately reflect the actual frequency of the historical floodwater flows) and that up to 50,000 AF of Kings River water could be captured for injection through the proposed ASR program when floodwater is available. It is not clear in Figure 4-8 how the "annual average" line shown on the graph was calculated and is not marked but appears to be the 12,300 acre-feet per year referenced in Section 4.3.1. It should be noted that although Figure 4-8 appears to assume that historical Kings River floodwater flows will reoccur in the future and be available to WWD, this is an assumption that should not be made as discussed below. In addition, the GSP does not identify where the Kings River floodwater is proposed to be diverted or at what flowrate or duration, which should be identified in the GSP.

WWD has, on occasion, diverted small quantities of available Kings River floodwater in the past from the Mendota Pool after flowing through the North Fork and James Bypass segments of the Kings River. Figure 4-8 assumes that the amount of Kings River floodwater that has historically been discharged through the James Bypass will be available in the future. This assumption is mistaken. The historical annual amount of floodwater will no longer be available even if the hydrology reoccurs. The amount of available floodwater will be significantly less to non-existent because water demands in the Kings River service area have increased during the period when high flow water is typically available, and the Kings River water rights holders have constructed numerous groundwater recharge and other projects over the years that capture floodwater . Indeed, if all the GSAs in the Kings and Tulare Lake subbasins develop projects to utilize Kings River water in the future as proposed, it is highly likely that there will be very little to no high flow water available for use outside the Kings River service area in the future. This fact is not acknowledged in the draft GSP. While the frequency of high flow events on the Kings River might be similar to past years because of the highly variable nature of the Kings River water supply, the Westside GSP and WWD cannot simply assume that this water will be available in the future.

While we support the efforts of WWD to reach groundwater sustainability, planned use of Kings River water is not a long-term solution and we caution you to be realistic in your project development and long-term planning.

If you have any questions or would like to discuss further, please contact me.

Sincerely,

Steve Haugen
Watermaster

cc: Amanda Peisch-Derby, DWR Amanda.Peisch@water.ca.gov

Wonderfulorchards™

October 31, 2019

Westlands Water District
3130 N. Fresno Street
P.O. Box 6056
Fresno, CA93703-6056

"Sent via Email"

Comments on Westlands Water District Draft Groundwater Sustainability Plan

Dear staff and board members:

Thank you for all of the hard work you have put into preparing the draft Groundwater Sustainability Plan (GSP) for the Westside Subbasin, and for the opportunity to provide comments. Below, please find our comments on two specific areas in the GSP.

6-1

Allocation of Groundwater Extraction

Section 4.2 describes a management action to allocate groundwater to private lands in the subbasin. Specifically, 4.2.1.1 provides an "initial groundwater allocation" of 0.45 acre-feet for each acre of agricultural land, with an alternative "aquifer-specific" groundwater allocation described in 4.2.1.2, and the ability to exceed the allocation depending upon groundwater conditions.

We appreciate that the GSP states "the proposed allocation does not determine the common law water rights of any person or entity that pumps groundwater," however, the allocation methodology should be consistent with various legal considerations drawn from applicable case law and consistent with groundwater rights. An equal-per-gross acre approach to allocations is not likely to be consistent with established water rights doctrine, which must recognize many equitable considerations, in addition to acreage owned, to determine a legally defensible allocation. Further information regarding allocation methodology can be found in *Groundwater Pumping Allocations Under California's Sustainable Groundwater Management Act – EDF and NCWL, dated July, 2018*

6-2

Data Management and Groundwater Markets

We appreciate that the GSP indicates parties will be allowed to transfer or bank their allocations, and that a trading program for unused allocation will be established (Section 4.2.1.1). We encourage the GSA to develop a data management system (DMS) that includes, or is capable of interfacing with, a groundwater market platform that allows for individual users to conduct transactions easily. Markets are essential in facilitating the highest and best use of a limited resource and will be most effective if there is trust in the accuracy of measurements and flexibility available to allow for transactions across the basin. We request that the GSA implement a market/transfer system concurrent with groundwater allocations to allow growers as much flexibility as possible to deal with the economic impacts of pumping restrictions.

Thank you for your consideration.

Rob C. Yraceburu
President

North Fork Kings
Groundwater Sustainability Agency

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October 31, 2019

Board of Directors
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VIA EMAIL: sgma@wwd.ca.gov

Re: Comments on Westlands Water District/Westside Subbasin Draft GSP

Dear Board of Directors,

The North Fork Kings Groundwater Sustainability Agency (NFKGSA) appreciates the opportunity to comment on the draft Groundwater Sustainability Plan (GSP). The NFKGSA has reviewed the draft GSP prepared by Westlands Water District (WWD) on behalf of the Westside Subbasin in the limited time available for public review and respectfully submits the following comments.

As a general overall comment, the NFKGSA believes continued coordination between subbasins is necessary as critical information and details are developed that are needed to evaluate the draft plan. It is important that details are available to determine potential impacts on neighboring GSAs and subbasins. In the draft GSP, components that make up the water budgets are summarized and are not clearly identified such as the assumed groundwater flow into and out of the subbasin, which is needed to assess potential impacts. Water budget details such as crop projections, acreage farmed and crop water use need to be provided in the GSP as it is impossible to evaluate the plan and potential impacts without this type of information.

Overall the draft GSP and information provided for public review needs additional detail and is not transparent in a number of areas, making a thorough evaluation impossible.

7-1 Documentation of the data used, and assumptions made in the numerical groundwater model that was used to develop the GSP and establish the Sustainable Management Criteria (SMC) was not provided for public review. Appendix I, the Hydrogeologic Conceptualization Report (HCR), notes that the HCR will be used to support the development and calibration of a numerical flow and solute transport models that will be utilized by WWD for compliance with the Sustainable Groundwater Management Act (SGMA) and the preparation of a Groundwater Sustainability Plan (GSP), however the model information is not provided for review.

7-2 The NFKGSA is concerned that the draft GSP contains idealistic goals for Measurable Objectives (MOs) and Minimum Thresholds (MTs), although details are not available in the draft GSP to sufficiently evaluate how the SMCs were established, other than general comments that MOs were established based on 2017 water levels and MTs were established based on 2015 water levels. However, review of hydrographs provided in the draft GSP indicate that MOs are often higher than historical readings and there is no explanation for how water levels are proposed to occur or why they are set higher than historical levels.

The draft GSP discusses three aquifer zones – shallow (less than 100 feet below ground surface), upper (above the Corcoran clay) and lower (below the Corcoran clay).

7-3 Monitoring networks are proposed for both the upper and lower aquifer, but no information is presented on monitoring the shallow aquifer and potential impacts this shallow water has on neighboring GSAs. Various figures contained in the HCR indicate that groundwater from the shallow zone is moving east out of WWD and into NFKGSA and adjacent areas (Figures 4-8, 4-9 and 4-10) and this water is very poor quality high TDS water (Figure 4-21) that negatively impacts the NFKGSA and adjacent areas. There is no proposed mitigation for this water quality impact contained in the draft plan.

The HCR (Section 4.3.7) states that for the subbasin as a whole, most groundwater pumping has been from the lower aquifer but that recent data "*may suggest a shift towards increasing use of groundwater from the upper aquifer resulting from additional groundwater development within the upper aquifer in areas where groundwater quality is relatively better, such as in areas on the eastern and southeastern margins of the Subbasin*."

7-4 This is concerning to the NFKGSA as groundwater pumping from the upper aquifer within WWD is already significant in the vicinity of NFKGSA as documented in Figure 4-54 in the HCR where less than 20% of pumping in WWD occurred from the lower aquifer, and hence greater than 80% of pumping occurred from the upper aquifer. This could negatively impact the NFKGSA where the majority of pumping occurs in the upper aquifer.

Section 4.8.1 of the HCR under Subsurface Inflows, states "*This variation in groundwater flow directions indicates that on a year to year basis, groundwater flow directions can vary widely into or out of the Subbasin depending on groundwater pumping patterns both within the Subbasin and in adjacent areas. However, on a long-term average annual basis net subsurface flow into or out of the Subbasin may be*
7-5 *small. This element of the water budget will be quantified in greater detail with the development of the numerical groundwater flow model."* Groundwater flows across the Kings/Westside subbasin boundary is especially concerning to the NFKGSA and the entire Kings subbasin as significant documentation exists that indicates groundwater flow out of the Kings subbasin into WWD in many years since groundwater development occurred in WWD. But as noted earlier, the numerical groundwater flow model information and output was not provided for evaluation, so it is impossible at this time to evaluate what potential impacts might be.

Regarding the Westside Subbasin Sustainable Yield, Section 4.1 of the HCR states "*The sustainable yield of the Subbasin as it is currently managed and as estimated over the 1988 to 2015 period is 60,000 to 100,000 afy less than the average groundwater pumping value of approximately 270,000 afy for a ballpark sustainable yield estimate of about 170,000 to 210,000 afy. This value is approximate and will be refined with the use of the numerical groundwater flow model and consideration of stabilizing groundwater level declines in the lower aquifer to minimize impacts to infrastructure from subsidence. This may result in the sustainable yield number being less than the range provided above when addressing undesirable results such as subsidence*." However, the draft GSP provides significantly different estimates of the sustainable yield with no explanation of how these differences were determined. For instance, for the historical water budget the draft GSP states (page 2-50) that "*Given a long-term average pumping of 324,000 AFY and a decline in storage of 19,000 AFY, the approximate sustainable yield for the basin is estimated from the WSGM is 305,000 AFY*". For the projected (2070) water budget, the draft GSP states (page 2-55) "*Based on the methodology presented in Section 2.3.5.4, the projected sustainable yield assuming 2070 climate change factors is 293,000 AFY. This assessment is based on projected groundwater pumping of 466,000 AFY and decline in projected groundwater storage of 114,000 AFY. Simulated average historical net lateral subsurface flow from 1989-2015 were 18,200 AFY out of the Subbasin while projected net lateral subsurface flow from 2020-2070 is 41,000 AFY into the Subbasin resulting in a net difference of -60,000 AFY*." This would indicate that groundwater pumping is projected to increase from a current amount of 270,000 AFY (per the HCR) to 466,000 AFY (projected 2070) with 41,000 AFY of inflow into the subbasin, however no explanation is provided of
7-6 where this water is coming from or potential impacts on neighboring subbasins. With the information provided the NFKGSA cannot determine how these estimates were developed or how they may affect the NFKGSA.

Given the information presented above, the SMCs presented in the draft GSP do not appear to be reasonable, as it is not likely that groundwater pumping could increase and groundwater levels could also increase.

7-7 There are only 5 projects and management actions proposed to achieve sustainability, one of which is an already existing surface water supply that assumes an optimistic average CVP contract supply in the future and continued ability to acquire supplemental water supplies, which may be more difficult to obtain in the future as water supplies tighten.

7-8 An initial allocation of groundwater extraction is a proposed project presented in the draft GSP, which limits the use of the lower aquifer because of subsidence concerns and encourages the use of the upper aquifer, with groundwater pumped from the lower aquifer limited to a specific fraction of the total groundwater pumped. The GSP indicates that aquifer-specific groundwater credits may be banked subject to GSA's rules and regulations. The program details need further explanation. Increased usage of the upper aquifer will have an effect on surrounding subbasins. The monitoring network does not appear to be extensive enough to properly monitor water levels as indicated in contour maps presented in the HCR for the upper aquifer which are incomplete and lack detail, with 50' contour intervals. There is no mention of how the monitoring network will be improved, which is going to be necessary to properly evaluate water levels and potential impacts.

Another project identified is the proposed Aquifer Storage and Recovery (ASR) program (Section 4.3.1) that identifies the potential sources of injected water for the proposed ASR program as a combination of Section 215 non-storable water, at-risk carryover water from the San Luis Reservoir and flood flows. The "flood flows" intended to be used in the ASR project are not identified, but the paragraph further states the "*total amount of water potentially available from implementation of ASR in 400 wells averages approximately 12,300 acre-feet per year (Figure 4-8)*". 7-9 The 12,300 acre-feet per year referenced in Section 4.3.1 appears to be targeted Kings River floodwater when viewing Figure 4-8. The NFKGSA and other GSAs in the Kings and Tulare Lake subbasins are concerned, as well as member units of the Kings River Water Association (KRWA), since all the GSAs in the Kings and Tulare Lake subbasins are planning to develop projects to utilize Kings River floodwater in the future and if the projects are developed as proposed, it is likely that there will be very little to no high flow water available for use outside the Kings River service area in the future. Kings River water should not be considered a long-term water source for WWD for any project.

Coordination meetings held to date between the Westlands GSA and NFKGSA have been helpful and informative, however, we would once again request to have your

7-10 While coordination meetings held to date between the Westlands GSA and NFKGSA have been helpful and informative, we would once again request to have your consultant hydrogeologist attend future meetings to review assumptions used and model output to compare projections and discuss details so any differences can be reconciled.

Thank you for considering these comments, and we look forward to reviewing the final Westside GSP that addresses these issues so the region can achieve groundwater sustainability in the future.

Sincerely,

Mark McKean
President

NORTH KINGS GROUNDWATER *SUSTAINABILITY AGENCY*

October 31, 2019

Member Agencies
Bakman Water Company
Biola Community Services District
City of Clovis
City of Fresno
City of Kerman
County of Fresno
Fresno Irrigation District
Fresno Metropolitan Flood Control District
Garfield Water District
International Water District

Board of Directors
Chairman Jerry Prieto, Jr.
Fresno Irrigation District
Vice-Chairman Brian Pacheco
County of Fresno
Steve Pickens
Bakman Water Company
Jose Flores
City of Clovis
Lee Brand
City of Fresno
Rhonda Armstrong
City of Kerman
Karl Kienow
Garfield Water District

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Gary Serrato

Internet
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North Kings GSA
c/o Fresno Irrigation District
2907 S. Maple Ave.
Fresno, CA 93725

Phone
559-233-7161

Via U.S. Mail and E-Mail (E-mail Address)

Board of Directors
Westside GSA
C/O Westlands Water District
3130 N. Fresno Street
P.O. Box 6056
Fresno, CA 93703-6056

RE: <u>Westside Groundwater Sustainability Agency's Draft Groundwater Sustainability Plan</u>

Dear Board Members:

The North Kings Groundwater Sustainability Agency (NKGSA) consists of member agencies including Fresno Irrigation District, the cities of Fresno, Clovis and Kerman, Fresno County, Bakman Water Company, Biola Community Services District, International Water District, Garfield Water District, and the Fresno Metropolitan Flood Control District. The NKGSA also consists of disadvantaged communities, private well owners, and other landowners. The NKGSA submits this letter to the Westside Groundwater Sustainability Agency (GSA) on their groundwater sustainability plan (GSP) prepared for purposes of the Sustainable Groundwater Management Act (SGMA).

The NKGSA appreciates the opportunity to comment on the Westside GSP. A cursory review of the Westside GSA's draft GSP for public comment showed that the draft GSP is difficult to follow since the document was provided in separate documents for each section rather than in a comprehensive document with all figures and content. It appears that critical information and details are missing and are needed to adequately address the draft GSP.

An additional concern is related to the "flood flows" targeted for use in the the Aquifer Storage and Recovery (ASR) program outlined in the management actions portion of the GSP. The concerns associated with the use of Kings River "flood flows"

8-1

was documented in the comment letter to the Westside GSA from the Kings River Water Association (KRWA). The NKGSA concurs with the comments and expresses the same concerns regarding the availability of "flood waters" for ASR in the Westside GSA boundaries.

The NKGSA appreciates the opportunity to comment on the draft GSP for the Westside GSA. Please contact me at (559) 233-7161 should you have any questions.

Sincerely,

Kassy Chauhan

for Gary R. Serrato
Executive Officer

Enclosure

October 31, 2019

Sent via email to sgma@wwd.ca.gov

Re: Comments on Draft Groundwater Sustainability Plan for Westlands Groundwater Basin

To Whom It May Concern,

On behalf of the above-listed organizations, we would like to offer the attached comments on the draft Groundwater Sustainability Plan for the Westlands Groundwater Basin. Our organizations are deeply engaged in and committed to the successful implementation of the Sustainable Groundwater Management Act (SGMA) because we understand that groundwater is a critical piece of a resilient California water portfolio, particularly in light of our changing climate. Because California's water and economy are interconnected, the sustainable management of each basin is of interest to both local communities and the state as a whole.

Our organizations have significant expertise in the environmental needs of groundwater and the needs of disadvantaged communities.

- The Nature Conservancy, in collaboration with state agencies, has developed several tools[1] for identifying groundwater dependent ecosystems in every SGMA groundwater basin and has made that tool available to each Groundwater Sustainability Agency.
- Local Government Commission supports leadership development, performs community engagement, and provides technical assistance dealing with groundwater management and other resilience-related topics at the local and regional scales; we provide guidance and resources for statewide applicability to the communities and GSAs we are working with directly in multiple groundwater basins.
- Audubon California is an expert in understanding wetlands and their role in groundwater recharge and applying conservation science to develop multiple-benefit solutions for sustainable groundwater management.
- Clean Water Action and Clean Water Fund are sister organizations that have deep expertise in the provision of safe drinking water, particularly in California's small disadvantaged communities, and co-authored a report on public and stakeholder engagement in SGMA[2].

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[1] https://groundwaterresourcehub.org/

[2] https://www.cleanwater.org/publications/collaborating-success-stakeholder-engagement-sustainable-groundwater-management-act

Because of the number of draft plans being released and our interest in reviewing every plan, we have identified key plan elements that are necessary to ensure that each plan adequately addresses essential requirements of SGMA. A summary review of your plan using our evaluation framework is attached to this letter as Appendix A. Our hope is that you can use our feedback to improve your plan before it is submitted in January 2020.

This review does not look at data quality but instead looks at how data was presented and used to identify and address the needs of disadvantaged communities (DACs), drinking water and the environment. In addition to informing individual groundwater sustainability agencies of our analysis, we plan to aggregate the results of our reviews to identify trends in GSP development, compare plans and determine which basins may require greater attention from our organizations.

Key Indicators

Appendix A provides a list of the questions we posed, how the draft plan responds to those questions and an evaluation by element of major issues with the plan. Below is a summary by element of the questions used to evaluate the plan.

1. Identification of Beneficial Users. This element is meant to ascertain whether and how DACs and groundwater-dependent ecosystems (GDEs) were identified, what standards and guidance were used to determine groundwater quality conditions and establish minimum thresholds for groundwater quality, and how environmental beneficial users and stakeholders were engaged through the development of the draft plan.
2. Communications plan. This element looks at the sufficiency of the communications plan in identifying ongoing stakeholder engagement during plan implementation, explicit information about how DACs were engaged in the planning process and how stakeholder input was incorporated into the GSP process and decision-making.
3. Maps related to Key Beneficial Uses. This element looks for maps related to drinking water users, including the density, location and depths of public supply and domestic wells; maps of GDE and interconnected surface waters with gaining and losing reaches; and monitoring networks.
4. Water Budgets. This element looks at how climate change is explicitly incorporated into current and future water budgets; how demands from urban and domestic water users were incorporated; and whether the historic, current and future water demands of native vegetation and wetlands are included in the budget.
5. Management areas and Monitoring Network. This element looks at where, why and how management areas are established, as well what data gaps have been identified and how the plan addresses those gaps.
6. Measurable Objectives and Undesirable Results. This element evaluates whether the plan explicitly considers the impacts on DACs, GDEs and environmental beneficial users in the development of Undesirable Results and Measurable Objectives. In addition, it examines whether stakeholder input was solicited from these beneficial users during the development of those metrics.
7. Management Actions and Costs. This element looks at how identified management actions impact DACs, GDEs and interconnected surface water bodies; whether mitigation for impacts to DACs is discussed or funded; and what efforts will be made to fill identified data gaps in the first five years of the plan. Additionally, this element asks whether any changes to local ordinances or land use plans are included as management actions.

Conclusion

We know that SGMA plan development and implementation is a major undertaking, and we want every basin to be successful. We would be happy to meet with you to discuss our evaluation as you finalize your Plan for submittal to DWR. Feel free to contact Suzannah Sosman at suzannah@aginnovations.org for more information or to schedule a conversation.

Sincerely,

Jennifer Clary
Water Program Manager
Clean Water Action/Clean Water Fund

Danielle V. Dolan
Water Program Director
Local Government Commission

Samantha Arthur
Working Lands Program Director
Audubon California

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Appendix A
Review of Public Draft GSP

Groundwater Basin/Subbasin: Westside Subbasin (DWR 5-022.09)
GSA: Westlands Water District GSA
GSP Date: September 2019 Public Review Draft

1. Identification of Beneficial Users

Were key beneficial users identified and engaged?

9-1

Selected relevant requirements and guidance:
GSP Element 2.1.5, "Notice & Communication" (§354.10):
(a) A description of the beneficial uses and users of groundwater in the basin, including the land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests, and the nature of consultation with those parties.
GSP Element 2.2.2, "Groundwater Conditions" (§354.16):
(d) Groundwater quality issues that may affect the supply and beneficial uses of groundwater, including a description and map of the location of known groundwater contamination sites and plumes.
(f) Identification of interconnected surface water systems within the basin and an estimate of the quantity and timing of depletions of those systems, utilizing data available from the Department, as specified in Section 353.2, or the best available information.
(g) Identification of groundwater dependent ecosystems within the basin, utilizing data available from the Department, as specified in Section 353.2, or the best available information.
GSP Element 3.3, "Minimum Thresholds" (§354.28):
(4) How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.

Review Criteria		Yes	No	N/A	Relevant Info per GSP	Location (Section, Page[1])
1. Do beneficial users (BUs) identified within the GSP area include:	a. Disadvantaged Communities (DACs)	X			"There are eight disadvantaged communities overlying the Subbasin, including, Avenal, Huron, Three Rocks, Cantua Creek, NASL, Calflax, and Turk."	2.1.5.1, page 17
	b. Tribes		X		"There are no hydrologic surface water bodies or California tribes within the Subbasin."	2.1.5.1, page 17
	c. Small community public water systems (<3,300 connections)	X			"There are nine public water systems within the Subbasin, including Avenal, Huron, Three Rocks, Cantua Creek, Turk, Calfax, O'Neil Farms, El Porvenir and Five Points." It is not clear from the text which systems have fewer than 3,300 connections.	2.1.5.1, page17
2. What data were used to identify presence or absence of DACs?	a. DWR DAC Mapping Tool[2]		X		The data source used is not clear in the GSP.	2.1.5.1, page 17
	i. Census Places		X			
	ii. Census Block Groups		X			
	iii. Census Tracts		X			
	b. Other data source		X			
3. Groundwater Conditions section includes discussion of:	a. Drinking Water Quality	X			"Groundwater quality in the Subbasin is primarily characterized by the occurrence of total dissolved solids (TDS), boron, selenium, arsenic, and sulfate that in some locations may exceed drinking water standards in the	2.2.2.2, page 36

[1] Page numbers refer to the page of the PDF.
[2] DWR DAC Mapping Tool: https://gis.water.ca.gov/app/dacs/

					shallow portions of the Upper Aquifer (Carollo and LSCE, 2015)." "Beneficial uses of groundwater in the Subbasin include agriculture, domestic, and municipal uses. […] Groundwater quality data from private domestic wells is not readily available. As a result, the groundwater quality constituents of most interest for this beneficial use can be represented by TDS. Due to the presence of oxidation and reduction conditions, nitrate is likely not a constituent of concern in both the Upper and Lower Aquifers. However, since the Subbasin predominantly includes agricultural land uses, the potential for nitrate to occur in the Upper Aquifer is possible should oxidation and reduction conditions vary in the Subbasin and near the vicinity of domestic wells."	
	b. California Maximum Contaminant Levels (CA MCLs)[3] (or Public Health Goals where MCL does not exist, e.g. Chromium VI)		X		"Groundwater quality in the Subbasin is primarily characterized by the occurrence of total dissolved solids (TDS), boron, selenium, arsenic, and sulfate that in some locations may exceed drinking water standards in the shallow portions of the Upper Aquifer (Carollo and LSCE, 2015)."	2.2.2.2 page 36
4. What local, state, and federal standards or plans were used to assess drinking water BUs in the development of Minimum Thresholds (MTs)?	a. Office of Environmental Health Hazard Assessment Public Health Goal (OEHHA PHGs)[4]		X			
	b. CA MCLs[3]		X			
	c. Water Quality Objectives (WQOs) in Regional Water Quality Control Plans	X			"The measurable objectives for minimizing the degradation of groundwater quality from human activities is based on groundwater sample concentrations not exceeding the historic trends in background groundwater quality along with a degradation rate attributed to human activities and beneficial uses that does not exceed the existing or planned Basin Plan Amendments." "The minimum threshold for TDS is based on the Regional Water Quality Control Board Basin Plan Amendment that is currently being updated and developed. The minimum thresholds, if exceeded for a prolonged period, may indicate impacts from human activities at the land surface that will be addressed in coordination with Regional Water Quality Control Board direction."	3.2.4.1, page 14 3.3.5.3, page 31
	d. Sustainable Communities Strategies/ Regional Transportation Plans[5]		X			
	e. County and/or City General Plans, Zoning Codes and Ordinances[6]		X			
5. Does the GSP identify how environmental BUs and environmental stakeholders were engaged throughout the development of the GSP?		X			"Beneficial uses of groundwater in the Subbasin include domestic and agricultural. Agricultural water users are likely to be the most affected by implementing the GSP.…The Westside Subbasin's groundwater resources are primarily used for agricultural purposes and the typical users of groundwater include:	Section 2.1.5.1

[3] CA MCLs: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/MCLsandPHGs.html
[4] OEHHA PHGs: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/MCLsandPHGs.html
[5] CARB: https://ww2.arb.ca.gov/resources/documents/scs-evaluation-resources
[6] OPR General Plan Guidelines: http://www.opr.ca.gov/planning/general-plan/

				• Agricultural Water Users. The largest groups of interested parties within the Subbasin are water users that extract groundwater for agricultural uses. • Domestic Well Users. The District identified approximately 39 domestic well users within the Subbasin. • Municipal Well Operators. The Subbasin underlies eight communities, including a portion of the City of Avenal, the City of Huron and the communities of Three Rocks, Five Points, Cantua Creek, Turk, Calfax, O'Neil Farms, NASL and El Porvenir. To the District's knowledge, NASL has well that operates as a backup water supply, and Cantua Creek and El Porvenir are the only communities that plan to drill a well and extract groundwater for municipal use. • Public Water Systems. There are nine public water systems within the Subbasin, including Avenal, Huron, Three Rocks, Cantua Creek, Turk, Calfax, O'Neil Farms, El Porvenir and Five Points. • Local Planning Agencies. Fresno and Kings Counties have local planning and land use authority on land overlying the Subbasin. • Environmental Users. Both the Pilibos Wildlife Area and the Pleasant Valley Ecological Area overlie approximately 1,200 acres within the Subbasin. • Federal Government. NASL overlies approximately 11,500 acres, 8,500 of which are leased out to local farmers for agricultural purposes, along the Subbasin's eastern boundary. In addition to pumping groundwater for agricultural and domestic use, NASL also receives surface water from the District. • Disadvantaged Communities (incorporated and unincorporated). There are eight disadvantaged communities overlying the Subbasin, including, Avenal, Huron, Three Rocks, Cantua Creek, NASL, Calflax, and Turk. The City of Huron is planning to drill a groundwater well as a backup supply."	

Summary/ Comments
The GSP should identify the data sources that were used to identify the presence of DACs and provide maps of the DAC locations, and identify the population in each.

The GSP should include information on the number of service connections and/or population served by each water system. This information is valuable for the reader to understand the scale of the vulnerable population dependent on groundwater for drinking water.

The GSP should detail if nitrate concentrations have historically exceeded drinking water standards, present maps of nitrate concentrations in groundwater, and consider setting MTs and MOs for nitrate or provide further justification as to why sustainability management criteria are not required at this time. The GSP should also present maps of selenium, arsenic, boron, and sulfate concentrations in groundwater, and provide details and present maps of known groundwater contamination sites as listed on GeoTracker, to the extent data are available.

California Water Code §1305(f) defines that beneficial uses of waters of the State include “preservation and enhancement of fish, wildlife, and other aquatic resources and preserves”. The GSP should describe whether other beneficial uses and users of groundwater in the Subbasin are present, such as: GDEs; managed wetlands; Protected Lands, including conservation areas and other protected lands; and Public Trust Uses including wildlife, aquatic habitat, fisheries, and recreation.

The types and locations of environmental uses, species and habitats supported, and the designated beneficial environmental uses and users of surface waters that may be affected by groundwater extraction in the Subbasin should be specified. The GSP should explicitly identify the environmental users and take particular note of the species with protected status. The following are resources that can be used:

- Natural Communities Commonly Associated with Groundwater dataset (NC Dataset): https://gis.water.ca.gov/app/NCDatasetViewer/.
- The list of freshwater species can be found here: https://groundwaterresourcehub.org/sgma-tools/environmental-surface-water-beneficiaries/.
- The California Department of Fish and Wildlife’s California Natural Diversity Database (CNDDB): https://www.wildlife.ca.gov/Data/CNDDB.

2. Communications Plan

How were key beneficial users engaged and how was their input incorporated into the GSP process and decisions?

9-2

Selected relevant requirements and guidance:
GSP Element 2.1.5, "Notice & Communication" (§354.10):
Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:
(c) Comments regarding the Plan received by the Agency and a summary of any responses by the Agency.
(d) A communication section of the Plan that includes the following:
(1) An explanation of the Agency's decision-making process.
(2) Identification of opportunities for public engagement and a discussion of how public input and response will be used.
(3) A description of how the Agency encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin.
(4) The method the Agency shall follow to inform the public about progress implementing the Plan, including the status of projects and actions.

DWR Guidance Document for GSP Stakeholder Communication and Engagement[7]

Review Criteria	Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
1. Is a Stakeholder Communication and Engagement Plan (SCEP) included?	X			The GSP provides a link to the GSA's website where the SCEP is available.	2.1.5.2, page 18
2. Does the SCEP or GSP identify that ongoing engagement will be conducted during GSP implementation?	x			Public Outreach: During GSP development, the WWD GSP Program used multiple forms of outreach to communicate SGMA-related information and solicit input. The GSA intend to continue public outreach and provide opportunities for engagement during GSP implementation. This will include providing opportunities for public participation, especially from beneficial users, at public meetings, providing access to GSP information online, and continued coordination with entities conducting outreach to disadvantaged communities (DAC) in the Subasin. Announcements will continue to be distributed via email prior to public meetings (e.g., public workshops and GSA Board meetings). Emails will also be distributed as specific deliverables are finalized, when opportunities are available for public input and when this input is requested, or when items of interest to the stakeholder group arise, such as relevant funding opportunities. The WWD SGMA website, managed as part of GSP Administration, will be updated a minimum of quarterly, and with information related to the program. The website may be updated to add new pages as the program continues and additional activities are implemented. Additionally, the GSA will host public workshops to provide an opportunity for stakeholders and members of the public to learn about, discuss, and provide input on GSP activities, progress towards meeting the Sustainability Goals of this GSP, and the SGMA program.	5.1.2, pages 3-4
3. Does the SCEP or GSP specifically identify how DAC beneficial users	X			"Additionally, in order to encourage active involvement of a diverse social, cultural and economic elements of the population within the Subbasin, the	2.1.5.2, page 18-19

[7] DWR Guidance Document for GSP Stakeholder Communication and Engagement
https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Document-for-Groundwater-Sustainability-Plan---Stakeholder-Communication-and-Engagement.pdf

were engaged in the planning process?				District held all GSP development meetings publicly, allowed for public comment, collaborated with counties, state and federal agencies in the Westside Subbasin, maintained close communication with organizations representing disadvantaged and severely disadvantage communities, coordinated with neighboring GSA's, and provided monthly updates. The District held workshops during the development of this GSP, including bilingual (Spanish) workshops."	
4. Does the SCEP or GSP explicitly describe how stakeholder input was incorporated into the GSP process and decisions?	X			"The workshops provided the beneficial groundwater users and interested parties affected by the implementation of a platform to voice concerns, articulate questions, and provide ideas and feedback to staff. During the workshops, staff provided a presentation on components, potential impacts to current land use activity and allowed for public comment. The workshops were held about three- months apart, allowing the District time to incorporate the feedback provided at the previous workshop and present updates. Table 2-5 entitled "Public Outreach", lists the public meetings, workshops and outreach events hosted by the District." "Comments that the District received regarding the Westside Subbasin GSP were compiled and considered in the preparation of the GSP by District staff and consultants. Items presented at public meetings that were ultimately eliminated from the GSP included: dividing the Subbasin into management areas and unique groundwater allocations by area. Based on public feedback the GSA offered translation services at the workshops. The methodology described below was utilized in the review of comments received on the GSP. • The comments compliance with the GSP Emergency Regulations; • The viability of implementing the comment in the GSP; • Benefit to the beneficial users and interested parties in the Westside Subbasin; and •Impacts on achieving Sustainability by 2040. Copies of the comment letters received, and the GSA's responses are found in Appendix H"	2.1.5.2, page 19-21

Summary/ Comments

The Stakeholder Communications and Engagement and Communications plan is very clear and well-written; it would be helpful to better understand how stakeholder engagement during implementation will be incorporated into decision-making.

3. Maps Related to Key Beneficial Uses

Were best available data sources used for information related to key beneficial users?

9-3

Selected relevant requirements and guidance:
GSP Element 2.1.4 "Additional GSP Elements" (§354.8):
Each Plan shall include a description of the geographic areas covered, including the following information:
(a) One or more maps of the basin that depict the following, as applicable:
(5) The density of wells per square mile, by dasymetric or similar mapping techniques, showing the general distribution of agricultural, industrial, and domestic water supply wells in the basin, including de minimis extractors, and the location and extent of communities dependent upon groundwater, utilizing data provided by the Department, as specified in Section 353.2, or the best available information.

GSP Element 3.5 Monitoring Network (§354.34)
(b) Each Plan shall include a description of the monitoring network objectives for the basin, including an explanation of how the network will be developed and implemented to monitor groundwater and related surface conditions, and the interconnection of surface water and groundwater, with sufficient temporal frequency and spatial density to evaluate the affects and effectiveness of Plan implementation. The monitoring network objectives shall be implemented to accomplish the following:
(c) Each monitoring network shall be designed to accomplish the following for each sustainability indicator:
(1) Chronic Lowering of Groundwater Levels. Demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features by the following methods:
(A) A sufficient density of monitoring wells to collect representative measurements through depth-discrete perforated intervals to characterize the groundwater table or potentiometric surface for each principal aquifer.
(4) Degraded Water Quality. Collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues.
(6) Depletions of Interconnected Surface Water. Monitor surface water and groundwater, where interconnected surface water conditions exist, to characterize the spatial and temporal exchanges between surface water and groundwater, and to calibrate and apply the tools and methods necessary to calculate depletions of surface water caused by groundwater extractions. The monitoring network shall be able to characterize the following:
(A) Flow conditions including surface water discharge, surface water head, and baseflow contribution.
(B) Identifying the approximate date and location where ephemeral or intermittent flowing streams and rivers cease to flow, if applicable.
(C) Temporal change in conditions due to variations in stream discharge and regional groundwater extraction.
(D) Other factors that may be necessary to identify adverse impacts on beneficial uses of the surface water.
(f) The Agency shall determine the density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends based upon the following factors:
(3) Impacts to beneficial uses and users of groundwater and land uses and property interests affected by groundwater production, and adjacent basins that could affect the ability of that basin to meet the sustainability goal.

Review Criteria		Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
1. Does the GSP Include Maps Related to Drinking Water Users?	a. Well Density	X			Figure 2-3: Domestic Well Density Figure 2-5: Public Supply Well Density	Figure 2-3, 2-5
	b. Domestic and Public Supply Well Locations & Depths		X		Figures 2-3 and 2-5 show well density, but no maps are provided which show actual well locations. No information is presented on well depths.	
	i. Based on DWR Well Completion Report Map Application[8]?	X			"Well types, well depth data, and well distribution data were obtained from DWR's well completion report database, WWD pumping records, and from	2.1.3, page 1-2

[8] DWR Well Completion Report Map Application: https://www.arcgis.com/apps/webappviewer/index.html?id=181078580a214c0986e2da28f8623b37

					DWR's Well Completion Report Map Application (DWR, 2018)."	
	ii. Based on Other Source(s)?	X			"WWD pumping records"	2.1.3, page 1
2. Does the GSP include maps related to Groundwater Dependent Ecosystem (GDE) locations?	a. Map of GDE Locations	X			Figure 2-14: Potential Groundwater Dependent Ecosystems	Figure 2-14
	b. Map of Interconnected Surface Waters (ISWs)		X		"Subbasin does not likely contain GDEs or interconnected surface water. Future activities in the Subbasin are unlikely to have a negative impact on any existing vegetation."	2.2.2.4, page 44
	i. Does it identify which reaches are gaining and which are losing?		X			2.2.2.4, page 44
	ii. Depletions to ISWs are quantified by stream segments.		X			2.2.2.4, page 44
	iii. Depletions to ISWs are quantified seasonally.		X			2.2.2.4, page 44
3. Does the GSP include maps of monitoring networks?	a. Existing Monitoring Wells	X			Figure 2-51 shows the existing subsidence monitoring stations.	
	b. Existing Monitoring Well Data sources: i. California Statewide Groundwater Elevation Monitoring (CASGEM)	X			"Since 2011, the District has participated in the CASGEM Program. In collaboration with DWR, the District developed a groundwater monitoring network which currently includes 134 wells." The GSP does not provide a map of the 134 CASGEM wells.	2.1.2.3, page 3
	ii. Water Board Regulated monitoring sites		X			
	iii. Department of Pesticide Regulation (DPR) monitoring wells		X			
	c. SGMA-Compliance Monitoring Network	X			Figure 3-1 to 3-6 show the SGMA-compliance monitoring network for groundwater level (and groundwater storage), subsidence, and groundwater quality.	Figure 3-1 to 3-6
	i. SGMA Monitoring Network map includes identified DACs?		X			
	ii. SGMA Monitoring Network map includes identified GDEs?		X			

Summary/ Comments

The GSP (Section 2.1.5.1) indicates that there are approximately 39 domestic well users in the basin. However, Figure 2-3 seems to identify the location of only 20 domestic wells, and the DWR Well Completion Report dataset indicates there is on the order of 70 domestic wells in the basin. The GSP should provide more information to clarify these inconsistencies.

The GSP should provide the locations and depths of all domestic and public supply wells in the GSA area using the best available information and present this information on maps along with the proposed SGMA-compliance monitoring network so that the public can evaluate how well the monitoring network addresses these key beneficial users. Providing maps of the monitoring network overlain with location of DACs, GDEs, and any other sensitive beneficial users will allow the reader to evaluate adequacy of the network to monitor conditions near these beneficial users.

Based on the information available in the GSP, it appears that monitoring network selection did not specifically take into account the proximity of representative monitoring wells to beneficial users of groundwater, such as domestic wells, small water systems, and DACs. The GSP should provide additional information to demonstrate that the proposed network is adequate to "monitor impacts to the beneficial uses or users of groundwater," including DACs, domestic well users, and other beneficial users, pursuant to 23 CCR § 354.34(b)(2).

The GSP should provide data or analysis to back up the statement that the westside streams do not represent areas of potential GDEs or ISWs. Additional information should be included on the analysis of GDEs and westside streams, including citing field studies or modeling studies that show the hydrologic nature of these streams. Specifically indicate which streams GDE polygons were excluded from, identify any data gaps, and ensure that GDE polygons are retained until data gaps are reconciled. Finally, it is recommended to reconcile data gaps (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP to improve identification of ISWs prior to disregarding them in the GSP.

It is highly recommended to use depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network. Confirmation of GDEs should be done using depth to groundwater in the Shallow Zone. It is important to use care when considering rooting depths of vegetation. List the species in each GDE, and whether the GDE was eliminated or retained based on the 30-foot depth limit. In addition to providing a depth to groundwater contour map, the GSP should note practices used throughout the process. It is recommended to use depth to groundwater contour maps derived from subtracting groundwater levels from a Digital Elevation Model (DEM) to identify whether a connection to groundwater exists for the wetlands mapped in Figure 2-14.

Information on the historical or current groundwater conditions near the GDEs or the ecological conditions present needs to be added. Include an ecological inventory (see Appendix III, Worksheet 2 of the TNC GDE Guidance; https://groundwaterresourcehub.org/public/uploads/pdfs/TNC_NCdataset_BestPracticesGuide_2019.pdf) for all potential GDEs that includes vegetation or habitat types and rank the GDEs as having a high, moderate or low value and explain how each rank was characterized. it should also identify whether any endangered or threatened freshwater species of animals and plants, or areas with critical habitat were found in or near any of the GDEs since some organisms rely on uplands and wetlands during different stages of their lifecycle.

4. Water Budgets

9-4

How were climate change projections incorporated into projected/future water budget and how were key beneficial users addressed?

Selected relevant requirements and guidance:
GSP Element 2.2.3 "Water Budget Information" (Reg. § 354.18)
Each Plan shall include a water budget for the basin that provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current and projected water budget conditions, and the change in the volume of water stored. Water budget information shall be reported in tabular and graphical form.

Projected water budgets shall be used to estimate future baseline conditions of supply, ***demand****, and aquifer response to Plan implementation, and to identify the uncertainties of these projected water budget components. The projected water budget shall utilize the following methodologies and assumptions to estimate future baseline conditions concerning hydrology, water demand and surface water supply availability or reliability over the planning and implementation horizon:*
(b) The water budget shall quantify the following, either through direct measurements or estimates based on data:
(5) If overdraft conditions occur, as defined in Bulletin 118, the water budget shall include a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions.
(6) The water year type associated with the annual supply, demand, and change in groundwater stored.
(c) Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:
(1) Current water budget information shall quantify current inflows and outflows for the basin using the most recent hydrology, water supply, ***water demand****, and land use information.*

DWR Water Budget BMP[9]
DWR Guidance for Climate Change Data Use During GSP Development and Resource Guide[10]

Review Criteria	Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
1. Are climate change projections explicitly incorporated in future/ projected water budget scenario(s)?	X			"Variability due to climate change was incorporated into the WSGM using climate change factors and methodology outlined in the Climate Change Resource Guide and Guidance for Climate Change Data Use During Sustainability Plan Development prepared by DWR. (DWR, 2018) The 2030 and 2070 central tendency datasets were applied to WSGM data from March 2017 through October 2070."	2.3.4, page 47
2. Is there a description of the methodology used to include climate change?	X			"The projected water budget period used to for GSP analysis spans a total of 54 water years beginning in 2017 and ending in 2070 (October 2016 – September 2070). Data used to define the hydrology and datasets over this period corresponds to October 1965 through September 2018 (Table 2-8). Data from this period contain wet and dry periods and are representative of overall average conditions based on water year type. Precipitation,	2.3.4, page 46-47

[9] DWR BMP for the Sustainable <management of Groundwater Water Budget: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-4-Water-Budget.pdf
[10] DWR Guidance Document for the Sustainable Management of Groundwater Guidance for Climate Change Data Use During GSP Development: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Climate-Change-Guidance_Final.pdf

					reference evapotranspiration and streamflow assigned in the WSGM projected water budget period utilized historical data from the 1965 through 2018 period. In those months and/or years where historical data was not available, monthly and/or annual data from the most similar San Joaquin Water year type was used as a surrogate. Surface water data used in the projection were taken from the CalSim II 2030 Central Tendency Projection developed jointly by USBR and DWR for SGMA analysis (USBR, 2015). From the 2003 though 2018 historical period where CalSim data were not available, corresponding data from the nearest Sacramento Valley water year were used as a surrogate. Monthly CalSim II deliveries were aggregated by USBR contract water year and distributed in each month based on crop demand. CalSim II data deliveries were used in place of historical data because CalSim accounts for current factors such as the CVPIA that substantially reduced imports but are not included in the entire historical dataset. The projected water budget must also consider the impacts of climate change and future projections of land use and population. For the purposes of the projected water budget analysis, climate change was the only factor that was considered to have a significant influence. The other variables, land use and population, are expected to remain relatively static over the projected water budget period. Climate change influenced surface water deliveries, evapotranspiration, precipitation and natural streamflow. Variability due to climate change was incorporated into the WSGM using climate change factors and methodology outlined in the Climate Change Resource Guide and Guidance for Climate Change Data Use During Sustainability Plan Development prepared by DWR. (DWR, 2018). The 2030 and 2070 central tendency datasets were applied to WSGM data from March 2017 through October 2070. It is anticipated that SGMA and projected imported water supplies will have the largest influence on land use during the GSP 50-year planning and implementation horizon. Sustainable groundwater management will likely affect the amount of irrigated acreage within the Subbasin. For planning purposes, SGMA's impact on land use is evaluated in Section 4.2."	
3. What is used as the basis for climate change	a. DWR-Provided Climate Change Data and Guidance[11]	X			See above.	2.3.4, page 47

[11] DWR Guidance Document for the Sustainable Management of Groundwater Guidance for Climate Change Data Use During GSP Development: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Climate-Change-Guidance_Final.pdf
DWR Resource Guide DWR-Provided Climate Change Data and Guidance for Use During GSP Development: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Resource-Guide-Climate-Change-Guidance_v8.pdf

assumptions?	b. Other		X			See above. "Surface water data used in the projection were taken from the CalSim II 2030 Central Tendency Projection developed jointly by USBR and DWR for SGMA analysis (USBR, 2015)."	
4. Does the GSP use multiple climate scenarios?			X			"The 2030 and 2070 central tendency datasets were applied to WSGM data from March 2017 through October 2070."	2.3.4, page 47
5. Does the GSP quantitatively incorporate climate change projections?			X			The quantitative results are discussed in Section 2.3.7 and are presented in Table 2-14 to 2-19.	2.3.7, page 52-55
6. Does the GSP explicitly account for climate change in the following elements of the future/projected water budget?	a. Inflows:	i. Precipitation	X			"Climate change influenced surface water deliveries, evapotranspiration, precipitation and natural streamflow."	2.3.4, page 47
		ii. Surface Water	X				
		iii. Imported Water	X				
		iv. Subsurface Inflow		X			
	b. Outflows:	i. Evapotranspiration	X				
		ii. Surface Water Outflows (incl. Exports)	X				
		iii. Groundwater Outflows (incl. Exports)		X			
7. Are demands by these sectors (drinking water users) explicitly included in the future/projected water budget?	a. Domestic Well users (<5 connections)			X		Demands by specific users are not described in the Water Budget text.	
	b. State Small Water systems (5-14 connections)			X			
	c. Small community water systems (<3,300 connections)			X			
	d. Medium and Large community water systems (> 3,300 connections)			X			
	e. Non-community water systems			X			
8. Are water uses for native vegetation and/or wetlands explicitly included in the current and historical water budgets?			X			Evapotranspiration is included as an outflow category in the land surface budget; however, it is not split between type of evapotranspiration.	
9. Are water uses for native vegetation and/or wetlands explicitly included in the projected/future water budget?				X			

Summary/ Comments
The draft GSP does not include a description how the municipal and industrial (M&I) users are accounted for in the historical, current, or projected water budgets. The GSP should include detail on how these non-agricultural water users were accounted for in the water budget, if increased M&I groundwater use was considered and incorporated in the projected water budget, and quantify impacts to these users from projects and management actions implemented to achieve sustainability. It is recommended that the GSP clearly identify and quantify water demands of all drinking water users in the water budget, including domestic well users, as well as small and large public water systems. The GSP includes an assumption that land use and population will remain constant in the future. The GSP should provide further justification to support these assumptions. The GSP should separate evapotranspiration by land-use type (for example: agricultural, municipal and domestic, and native and riparian). Depending on the results of an updated review of GDEs, groundwater outflow to evapotranspiration should be identified as a groundwater budget component. Since potential GDEs (including wetlands, riparian vegetation, phreatophytes and other communities) are beneficial users of groundwater in the Westlands GSP area, it is appropriate to include them in these calculations.

5. Management Areas and Monitoring Network

How were key beneficial users considered in the selection and monitoring of Management Areas and was the monitoring network designed appropriately to identify impacts on DACs and GDEs? 9-5

Selected relevant requirements and guidance:
GSP Element 3.3, "Management Areas" (§354.20):

(b) A basin that includes one or more management areas shall describe the following in the Plan:
(2) The minimum thresholds and measurable objectives established for each management area, and an explanation of the rationale for selecting those values, if different from the basin at large.
(3) The level of monitoring and analysis appropriate for each management area.
(4) An explanation of how the management area can operate under different minimum thresholds and measurable objectives without causing undesirable results outside the management area, if applicable.
(c) If a Plan includes one or more management areas, the Plan shall include descriptions, maps, and other information required by this Subarticle sufficient to describe conditions in those areas.

CWC Guide to Protecting Drinking Water Quality under the SGMA[12]
TNC's Groundwater Dependent Ecosystems under the SGMA, Guidance for Preparing GSPs[13]

Review Criteria	Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
1. Does the GSP define one or more Management Area?		X		"Management areas have not been established in the Subbasin."	3.5, page 38
2. Were the management areas defined specifically to manage GDEs?			X		
3. Were the management areas defined specifically to manage DACs?			X		
a. If yes, are the Measurable Objectives (MOs) and MTs for GDE/DAC management areas more restrictive than for the basin as a whole?			X		
b. If yes, are the proposed management actions for GDE/DAC management areas more restrictive/ aggressive than for the basin as a whole?			X		
4. Does the GSP include maps or descriptions indicating what DACs are located in each Management Area(s)?			X		
5. Does the GSP include maps or descriptions indicating what GDEs are located in each Management Area(s)?			X		
6. Does the plan identify gaps in the monitoring network for DACs and/or GDEs?		X			
a. If yes, are plans included to address the identified deficiencies?		X		Section 3.4.1.5 states that there are no ISWs; however, there is no monitoring data or information provided in the GSP to support this statement.	

[12] CWC Guide to Protecting Drinking Water Quality under the SGMA: https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858
[13] TNC's Groundwater Dependent Ecosystems under the SGMA, Guidance for Preparing GSPs: https://www.scienceforconservation.org/assets/downloads/GDEsUnderSGMA.pdf

Summary/ Comments

If management areas are defined in the future, care should be taken so that they and the associated monitoring network are designed to adequately assess and protect against impacts to all beneficial users, including GDEs and DACs.

The GSP should identify ISWs as a data gap and a monitoring network should be employed to verify the status of ISWs prior to complete dismissal of ISWs from the GSP. This section of the GSP should include a statement that 1) there are potential ISWs, 2) there will be no increase in depletions of potential ISWs, 3) and the presence or absence of ISWs will be verified with monitoring wells screened at the appropriate depth. Based on the potential for GDEs in the Subbasin, the GSP should include:

- Characterization of biological resources for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.
- A description of data gaps / insufficiencies.
- Stated plans to reconcile data gaps in the monitoring network.

6. Measurable Objectives, Minimum Thresholds, and Undesirable Results

How were DAC and GDE beneficial uses and users considered in the establishment of Sustainable Management Criteria?

9-6

Selected relevant requirements and guidance:
GSP Element 3.4 "Undesirable Results" (§ 354.26):
(b) The description of undesirable results shall include the following:
(3) Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results

GSP Element 3.2 "Measurable Objectives" (§ 354.30)
(a) Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.

Review Criteria	Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
1. Are DAC impacts considered in the development of Undesirable Results (URs), MOs, and MTs for groundwater levels and groundwater quality?		X		Water Level MTs: "The primary detrimental effects to beneficial users from water levels falling below the minimum threshold area loss of significant well capacity, increased costs due to higher pumping lifts, lack of groundwater extraction due to groundwater levels declining below the pump setting depth or the bottom of the well, or subsidence impacts on well structures and above ground infrastructure, especially if the pumping is concentrated in a small geographic area." Water Quality MTs: "The effect of degraded groundwater quality from human activities on agricultural beneficial users is manifested in crop damage and reduced yields, and a reduction in the use of land for irrigated agriculture if the sole water supply is groundwater. Urban and domestic beneficial uses are impacted if water of degraded quality is the only source of water for potable use. The impacts include the need to utilize alternative sources of water that may be more expensive than groundwater and potential requirement to treat prior to use." The impacts to DACs are not explicitly considered in the GSP.	3.3.1.5, page 22 3.3.5.5, page 31
2. Does the GSP explicitly discuss how stakeholder input from DAC community members was considered in the development of URs, MOs, and MTs?		X		"The SMC presented in this chapter were developed using information from interested parties and public input and correspondence with the GSAs, public meetings, hydrogeologic analysis, groundwater dependent ecosystem analysis, and meetings with GSA technical representatives. The general process for establishing SMC included: • GSA public meetings that outlined the GSP development process and introduced interested parties to the SMC • Conducting GSP public meetings to present proposed methodologies to establish minimum thresholds and measurable objectives and receive additional public input. • Reviewing public input on preliminary SMC methodologies with GSA	3, page 2

				staff/technical representatives • Providing a Draft GSP for public review and comment • Establishing and modifying minimum thresholds, measurable objectives, and definition of undesirable results based on feedback from public meetings, public/interested party review of the Draft GSP, and input from GSA staff/technical representatives." Input from DACs is not explicitly discussed in the GSP.	
3. Does the GSP explicitly consider impacts to GDEs and environmental BUs of surface water in the development of MOs and MTs for groundwater levels and depletions of ISWs?		X		Section 2.2.2.2 Water Quality (p. 2-36) discusses water quality with respect to agricultural and municipal use but does not include metrics for GDEs and ISWs.	
4. Does the GSP explicitly consider impacts GDEs and environmental BUs of surface water and recreational lands in the discussion and development of Undesirable Results?		X		Section 3.4.1.1 only describes undesirable results relating to human beneficial uses of groundwater and neglects environmental beneficial uses / users that could be adversely affected by chronic groundwater level decline.	
5. Does the GSP clearly identify and detail the anticipated degree of water level decline from current elevations to the water level MOs and MTs?		X		The GSP does not clearly identify the anticipated degree of water level decline. However, the 2015 baseline water levels and MTs/MOs for each representative monitoring well are provided in Table 3-7 and 3-8.	Table 3-7, 3-8, page 20-22
6. If yes, does it include: b. Is this information presented in table(s)?		X			
c. Is this information presented on map(s)?		X			
d. Is this information presented relative to the locations of DACs and domestic well users?		X			
e. Is this information presented relative to the locations of ISW and GDEs?		X			
2. Does the GSP include an analysis of the anticipated impacts of water level MOs and MTs on drinking water users?		X		"Urban beneficial users should not be impacted since urban water supplies are primarily met with imported water supplies rather than groundwater. Groundwater use for urban beneficial users is limited in nature and primarily used to supplement imported water supplies. Domestic users of groundwater are not expected to be impacted by the minimum thresholds since those thresholds have already been experienced historical." The GSP does not clearly identified or quantify the impacts to drinking water users.	3.3.9, page 34
3. If yes: a. On domestic well users?		X			
b. On small water system production wells?		X			
c. Was an analysis conducted and clearly illustrated (with maps) to identify what wells would be expected to be partially and fully dewatered at the MOs?		X			
d. Was an analysis conducted and clearly illustrated (with maps) to identify what wells would be expected to be partially and fully dewatered at the MTs?		X			
e. Was an economic analysis performed to assess the increased operation costs associated with increased		X		"The primary detrimental effects to beneficial users from water levels falling below the minimum threshold area loss of significant well capacity, increased	3.3.1.5, page 22

	lift as a result of water level decline?				costs due to higher pumping lifts, lack of groundwater extraction due to groundwater levels declining below the pump setting depth or the bottom of the well, or subsidence impacts on well structures and above ground infrastructure, especially if the pumping is concentrated in a small geographic area." Detailed economic analysis was not performed.	

Summary/ Comments

The GSP should clarify how MTs for groundwater levels were established and how the approach is protective of key beneficial users in the subbasin, particularly domestic well users and members of DACs.

Based on information presented in Table 3-7, four representative monitoring wells have MOs set to more than 70 feet below the 2015 baseline conditions. The GSP should describe how MOs of 70 to nearly 130 feet below 2015 baseline conditions are sustainable and reasonable, and consistent with the methodologies and conclusions provided in the draft GSP.

An impact analysis should be performed and presented in the draft GSP that evaluates the potential impacts associated with the MTs/MOs on domestic and public drinking water supply wells. We recommend that the GSP present a thorough and robust analysis, supported by maps, that identifies: (1) which active domestic wells are likely to be impacted (including partially dewatered) at the MTs and at the MOs, and (2) the location of the likely impacted wells with respect to DACs and other communities and water systems dependent on groundwater. The GSP should also quantify the increased pumping costs associated with the increased lift at the projected lower water levels, in order to more fully and transparently consider the impacts to beneficial users.

The GSP should clearly present the presumed baseline total dissolved solids (TDS) concentration for each representative monitoring well in tables and maps.

The GSP should also clearly document how stakeholder input was considered and incorporated into the development of URs, MOs, and MTs.

GDEs should be included in the MO sections for Chronic Lowering of Water Levels and Water Quality, and the GSP should address whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment. This GSP states that there are no ISWs along the westside streams; however, this conclusion was based on well level that is not reasonably close to the drainages. In addition, there is no supporting data and information that demonstrates the groundwater in the drainages is not supporting ISWs. Section 3.2.5 should include a statement on the potential for ISWs, pending the characterization of the Shallow Zone and analysis of monitoring data or monitoring from additional wells to be installed in the future.

Sweeping statements, such as "interconnected surface water does not exist in the Subbasin and therefore no minimum objectives were developed for this sustainability indicator. If in the future data from a groundwater level monitoring indicate that surface water from the ephemeral streams in the Subbasin and groundwater are interconnected, minimum thresholds and measurable objectives will be developed" (Section 3.2.5.1) are dismissive of ISWs and should be identified as data gaps. Many of the wells are screened deeper and nested wells have not been installed to inform how shallow groundwater interacts with potential ISWs. Include all potential ISWs in the analysis and develop measurable objectives and minimum thresholds for these, to be managed until data gaps prove they are not interconnected.

It is recommended to include "possible adverse impacts to potential GDEs and ISWs" to the list of potential undesirable results for chronic lowering of groundwater levels.

The GDE Pulse web application developed by TNC provides easy access to 35 years of satellite data to view trends of vegetation metrics, groundwater depth (where available), and precipitation data. This satellite imagery can be used to observe trends for NC dataset polygons within and near the GSA. Over the past 10 years (2009-2018), some NC dataset vegetation polygons have experienced adverse impacts to vegetation growth and moisture.

For each identifiable GDE unit with supporting hydrological datasets, include the following:

- Plot and provide hydrological datasets for each GDE.
- Define the baseline period in the hydrologic data.
- Classify GDE units as having high, moderate, or low susceptibility to changes in groundwater.
- Explore cause-and-effect relationships between groundwater changes and GDEs.

For each identifiable GDE unit without supporting hydrological datasets, describe data gaps and / or insufficiencies.
Compile and synthesize biological data for each GDE unit by:

- Characterizing biological resources for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.
- Describing data gaps / insufficiencies.

Section 2.2.2.2 should specifically address degraded water quality from TDS and boron to the vegetative portion of GDEs and ISWs. Although selenium and arsenic are mentioned in this section, consider adding a statement that over-pumping and dewatering of aquitards has been identified as a potential source of elevated As concentrations above drinking water standards in San Joaquin Valley aquifers. The following is a link to a paper by Smith, Knight and Fendorf (2018) titled "Overpumping leads to California groundwater arsenic threat": https://www.nature.com/articles/s41467-018-04475-3

9-7

7. Management Actions and Costs

What does the GSP identify as specific actions to achieve the MOs, particularly those that affect the key BUs, including actions triggered by failure to meet MOs? What funding mechanisms and processes are identified that will ensure that the proposed projects and management actions are achievable and implementable?

Selected relevant requirements and guidance
GSP Element 4.0 Projects and Management Actions to Achieve Sustainability Goal (§ 354.44)
(a) Each Plan shall include a description of the projects and management actions the Agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin.
(b) Each Plan shall include a description of the projects and management actions that include the following:
(1) A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action.

Review Criteria			Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
1. Does the GSP identify benefits or impacts to DACs as a result of identified management actions?				X		The impacts to DACs are not explicitly identified. Several projects are expected to maintain or improve water quality, including Surface Water Imports, Groundwater Pumping Allocation, Agricultural-ASR Program, and Percolation Basins.	
2. If yes:	f.	Is a plan to mitigate impacts on DAC drinking water users included in the proposed Projects and Management Actions?		X			
	g.	Does the GSP identify costs to fund a mitigation program?		X			
	h.	Does the GSP include a funding mechanism to support the mitigation program?		X			
4. Does the GSP identify any demand management measures in its projects and management actions?			X				
5. If yes, does it include:	a.	Irrigation efficiency program		X			
	b.	Ag land fallowing (voluntary or mandatory)	X			Voluntary Fallowing of Agricultural Land	Table 3-1
	c.	Pumping allocation/restriction	X			4.2 Project No. 2 – Initial Allocation of Groundwater Extraction	4.2, page 10
	d.	Pumping fees/fines		X			
	e.	Development of a water market/credit system	X			"A landowner's groundwater allocation may be augmented through a Pilot Groundwater Credit Program which compensates water users that elect to implement groundwater replenishment strategies authorized by the GSA." "Similar to the gross groundwater pumping allocation, aquifer-specific groundwater credits may be banked and reduced in a subsequent year subject to the GSA's Rules and Regulations."	4.2.1.1, page 154 4.2.1.2, page 155
	f.	Prohibition on new well construction		X			
	g.	Limits on municipal pumping	X			Included as a potential action: "A few of the municipal and industrial groundwater well locations will be subject to the GSP if the extraction rates exceed 2 acre-feet per year.	4.1.2.3, page 12

					Currently, there are up to 18 locations that may be subject to this GSP. The GSA will continue to evaluate municipal and industrial groundwater use in cooperation with those users during the initial 5-year implementation period and may require these users to comply with GSP pumping and metering provisions during this time. At this time, these users are not subject to the allocation management action.”	
	h. Limits on domestic well pumping		X		“The majority of domestic users likely fall under the SGMA definition of de minimus extractors (pump less than 2 acre-feet per year) which are not required to meter groundwater usage (Wat. Code, §§ 10721(e), 10725.8(e).). Domestic Groundwater extraction is conservatively estimated to approximately 78 AFY and unlikely to substantially impact groundwater conditions within the Subbasin. Accordingly, there is no current plan on regulating or metering the amount of domestic extraction as part of the current GSP, assuming estimates of domestic use do not appreciably increase. The GSA will continue to provide and update estimates of domestic use during 5-year GSP updates.”	4.1.2.3, page 12
	i. Other		X			
6. Does the GSP identify water supply augmentation projects in its projects and management actions?		X				
7. If yes, does it include:	a. Increasing existing water supplies	X			4.1 Project No. 1 – Surface Water Imports	4.1, page 2
	b. Obtaining new water supplies		X			
	c. Increasing surface water storage		X			
	d. Groundwater recharge projects – District or Regional level	X			4.3 Project No. 3 – Aquifer Storage and Recovery 4.5 Project No. 5 – Percolation Basins	4.3, page 16 4.5, page 23
	e. On-farm recharge	X			“Groundwater replenishment alternatives include but are not limited to water conservation, on-farm recharge, sublateral over-irrigation, dry well injection, aquifer storage and recovery (ASR) and percolation ponds and basins.”	4.2.1.1, page 11
	f. Conjunctive use of surface water		X		These projects are identified in the GSP as conjunctive use strategies, although are not traditionally considered “conjunctive use”: 4.3 Project No. 3 – Aquifer Storage and Recovery 4.5 Project No. 5 – Percolation Basins	4.3, page 16 4.5, page 23
	g. Developing/utilizing recycled water		X			
	h. Stormwater capture and reuse		X			
	i. Increasing operational flexibility (e.g., new interties and conveyance)		X			
	j. Other		X			
8. Does the GSP identify specific management actions and funding mechanisms to meet the identified MOs for groundwater quality and groundwater levels?			X		Chapter 4 identifies many important projects; however, the descriptions of Measurable Objectives for these projects only identifies benefits to water level and storage through changes in allocation, imports, and pumping allowances; initiating injection programs; and adding percolation basin.	
9. Does the GSP include plans to fill identified data gaps by the first five-year report?		X			“Data gaps have been presented in the groundwater elevation, groundwater quality, and groundwater storage monitoring networks. The GSA will take the following steps, prior to the first five-year GSP update in 2025 to address	3.8.9.7, page 70

				these data gaps: • The GSA installed five new aquifer-specific nested monitoring wells within the Subbasin in areas where data gaps historically existed. These new wells will address the data gaps described in the Upper and Lower Aquifers for groundwater elevation data (Figure 3-7). Furthermore, these new wells will also be added to the groundwater quality monitoring networks in both aquifers to fill spatial coverage gaps. • The GSA will install sampling taps on groundwater level wells designated for groundwater quality monitoring. These wells will then be sampled simultaneously for groundwater elevation data and groundwater quality data. • Sampling events will be coordinated with well owners to prevent pumping and access issues. • Although no monitoring network is currently in place for interconnected surface water, the GSA will look at the data gaps brought forth in the GDE assessment and reevaluate this indicator in the future. In addition to these steps, the monitoring networks will be evaluated on a yearly and five-year basis. If additional data gaps arise, the GSA will consider the implications of these gaps, associated costs, and importance to the continued implementation of the GSP and take appropriate actions to address the gaps."	
10. Do proposed management actions include any changes to local ordinances or land use planning?		X			
11. Does the GSP identify additional/contingent actions and funding mechanisms in the event that MOs are not met by the identified actions?		X			
12. Does the GSP provide a plan to study the interconnectedness of surface water bodies?		X		"The assessment of surface water flows, and groundwater levels indicate that there are no interconnected surface waters in the Subbasin." "Although no monitoring network is currently in place for interconnected surface water, the GSA will look at the data gaps brought forth in the GDE assessment and reevaluate this indicator in the future." No detailed plan is provided in the GSP.	3.3.7, page 33 3.8.9.7, page 70
13. If yes: a. Does the GSP identify costs to study the interconnectedness of surface water bodies?		X			
b. Does the GSP include a funding mechanism to support the study of interconnectedness surface water bodies?		X			
14. Does the GSP explicitly evaluate potential impacts of projects and management actions on groundwater levels near surface water bodies?		X		There is little consideration for possible negative impacts on groundwater levels near surface water, or possible impacts on beneficial users and GDEs/ISW systems from proposed management actions or projects.	4.5.3.1

Summary/ Comments
The GSP should identify the potential impacts of the proposed projects or management actions on DACs. If impacts are expected, the GSP should include plans to monitor for, prevent, and/or mitigate against such impacts, provide the estimated costs, and identify the funding sources.

Since maintenance or recovery of groundwater levels, or construction of recharge facilities, may have potential environmental benefits in many cases it would be advantageous to demonstrate multiple benefits from a funding and prioritization perspective. For the projects already identified, the GSP should consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue. If ISWs will not be adequately protected by those listed, the GSP should include and describe additional management actions and projects targeted for protecting ISWs.

Describe the following potential effects on GDEs, land uses and property interests:

- Cause-and-effect relationships between GDE and groundwater conditions.
- Impacts to GDEs that are considered to be "significant and unreasonable".
- Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities.
- Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating). Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.

Katarina Campbell

From: Robert Urban <rurban@huleturban.com>
Sent: Thursday, October 31, 2019 6:32 PM
To: sgma@westlandswater.org; SGMA
Subject: DRAFT GSP comment sheet

ATTN: Kiti Campbell
Westlands Water District
3130 N Fresno Street, PO Box 6056
Fresno, CA 93703

Ms. Campbell:

Please use this email as the SGMA Comment Sheet for response to the Westlands Water District – Sustainable Groundwater Agency proposed DRAFT Groundwater Sustainability Plan. Thank you for your consideration to address these comments as part of the development and completion of preparation of the Groundwater Sustainability Plan for within the Groundwater Sustainability Agency's jurisdiction.

Date: October 31, 2019
Name: Robert Urban
Organization: Hulet Urban Group, Inc.
917 West Grande Avenue, Ste. 1324
Grover Beach, CA 93433
Phone: 805.503.5628
Subject: Comments on WWD's DRAFT Groundwater Sustainability Plan
Comment(s):

The following comments are provided by a Licensed Professional Geologist and Certified Engineering Geologist of the State of California. These comments are, in part, based on the technical understanding of hydrogeologic principals, over 20 years of professional experience in the practice of hydrogeology and numerical groundwater modeling, as well as direct experience with the hydrogeologic of conditions within the jurisdiction of the Westlands Water District boundaries.

10-1

1) Proposed fees for the compliance with the Sustainable Groundwater Management Act (SGMA) and implementation of proposed management practices in the attempt to sustainably manage the groundwater resources according to the DRAFT Groundwater Sustainability Plan (GSP) are indicated to be based on acreage (areal land extent) and NOT based on the amount of groundwater used by an entity (person, business, or other). Comparisons between proposed fees between acreage/quantity of groundwater used as compared to only quantity of water used is a fundamentally flawed that such a comparison is even warranted. Charging fees to implement the requirements of SGMA based on acreage defeats the purpose of the law, which consistently references that a GSA may "impose fees, including but not limited to, permit fees and fees on groundwater extraction or other regulated activity, to fund the costs of a groundwater sustainability program" [reference 10730 SGMA]. In addition, Section 10730.2 states: "A groundwater sustainability agency that adopts a groundwater sustainability plan pursuant to this part may impose fees on the extraction of groundwater from the basin to fund costs of groundwater management . . ." No where does SGMA make reference to charging fees based on owned acreage of land. The intent of WWD GSA's proposed fees for the implementation of SGMA appears to be based on a means to subsidize large landowners that utilize larger volumes of groundwater with the revenue generated from smaller landowners and large landowners that utilize smaller volumes of groundwater. This does not make any reasonable sense and is not justified.

Not all areas of within the GSA's boundaries utilize groundwater equally nor uniformly, which is a considerable and inaccurate presumption of the proposed management strategy and DRAFT GSP. The groundwater use varies not only in the predominantly current agricultural industry and furthermore, nor is it utilized uniformly as compared to other current or planned future uses and industries for the area. Many current and planned future uses will NOT utilize groundwater resources anywhere near as significantly as other users. By ascribing fees based on acreage and NOT groundwater volume use, this proposed strategy to fund the sustainability program based on acreage (land size) does NOT meet the objective of funding the management of basin sustainability proportionately to the direct amount of groundwater used by an entity or benefactors.

10-2

2) SGMA identifies that full implementation of the GSPs must occur on or before January 31, 2020. However, the Westlands Water District (WWD) GSA has stated in several meetings that "full implementation of the GSP will occur over a period of time" and has stated that planned elements will not occur until as late as the year of 2022.

Notably, in the public workshop meeting on October 30, 2019 for the public to present comments to the DRAFT GSP, it was stated that the monitoring of water wells that are not part of the WWD's network of water wells may be included for monitoring at a later date. Most other GSA's with proposed or approved GSPs have already included management strategies that include the monitoring (both quantity/quality of groundwater AND the groundwater levels) as part of their programs for any groundwater well not considered a *de minimis user* per SGMA. Not only does SGMA identify that groundwater levels are a significant indicator and has effect on adverse impacts to the sustainability of a basin, and therefore sustainability management, but during the WWD GSA meeting on October 30, 2019, the WWD GSA itself stated over five times the importance of groundwater levels on the sustainability of the basin. However, WWD GSA appears only concerned with monitoring the groundwater levels of a limited number of water wells within Its jurisdiction and not the breadth of high producing water wells within Its jurisdiction. Considering that most of the water wells within the WWD GSA boundaries are high volume using groundwater wells, it is prudent to include all of these wells for inclusion of not only the extracted quantity of water monitored but also the groundwater levels before, during, and after groundwater extractions. This is a critical component of hydrogeologic understanding of the basin, as well as necessary for calibrating, re-calibrating, refining, and updating the hydrogeologic numerical model through the sustainable management of the basin.

Regardless of whether the WWD GSA's consultant (Ludorff & Scaliminni) has evaluated what water wells to use in the *initial* development of the hydrogeologic model, numerical groundwater models almost always require refinement and additional data points to due to divergences in observed versus numerical model predictions. This is a fundamental tenant of numerical groundwater models. To not have groundwater monitoring data available for updating and refinement of the numerical groundwater model of the basin (which all of the sustainability management is to be based upon according to the precept of SGMA) is shortsighted.

The impact of a water user extracting groundwater at a higher rate (large volume in short period of time) as compared to a lower rate (lower volume over same period of time or a same large volume over a longer period of time) can have a dramatic effect on the sustainability of the groundwater basin. Without appropriate monitoring and management of the volume of groundwater, rates of extraction, and groundwater levels, the sustainability of a hydrogeologic basin is at risk and will continue to be at risk. The very lack of these practices, is in part, for the very reason why SGMA has become to existence and a necessity.

10-3

3) During the October 30, 2019 WWD GSA meeting and as indicated in the DRAFT GSP, the groundwater management strategy was stated to be "based on the 2015 groundwater levels" where these historically low levels were during a major drought. It is not appropriate to use a low level drought as the baseline for the sustainability of a hydrogeologic basin. Historic groundwater levels in the basin have been significantly higher than in the recent decades and have recently rebound significantly due to the increases in rainfall. As a natural effect of increased rain, the basin has already gained in groundwater volume and groundwater levels have increased. Oddly, the WWD GSA had established a minimum threshold based on this low groundwater level and a measurable objective that is achievable not by any actual sustainability management practices, but has already been achieved because of one increased rain season. SGMA requires achieving a minimum threshold because of the "sustainable management" practices, not because of a recent rains that have begun to replenish a basin that

has yet to actually recuperate to Its true resource potential. In short, how can the WWD GSA utilize a drought condition and an overdrawn hydrogeologic basin as the minimum lowering of acceptable groundwater levels when those conditions were resulting in conditions that would violate SGMA under full enactment after January 31, 2020?

10-4

4) I am officially objecting to the lack of appropriate time for thorough review of the DRAFT GSP elements. New details of the DRAFT GSP were introduced during the October 30, 2019 meeting and then the WWD GSA notified the attendees of the meeting that the comment deadline was October 31, 2019. The full and complete DRAFT GSP provided on the District's website appears incomplete with respect to the new information provided during the October 30, 2019 meeting. When questioned by at least two meeting participants regarding an appropriate time for review and comment, the WWD GSA representative stated that there would be another period for review and comment after the WWD Board adopts the DRAFT GSP. Although it is correct that there are other opportunities for review and comment by the public, as provided by laws and regulations, it is also true that the State law requires that there be a full 30-day review period provided for the review of the full and complete DRAFT GSP.

Thank you for your review and careful consideration of the above comments.

Best of regards,

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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

November 7, 2019

Sent Via Mail and Electronic Mail

Kiti Campbell
Westlands Water District
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Fresno, California 93703
Email: sgma@westlandswater.org

Subject: Comments on the Westside Subbasin Groundwater Sustainability Plan

Dear Ms. Campbell:

The California Department of Fish and Wildlife (Department) Central Region is providing comments on the Westside Subbasin Draft Groundwater Sustainability Plan (WSGSP) prepared by Westlands Water District pursuant to the Sustainable Groundwater Management Act (SGMA). As trustee agency for the State's fish and wildlife resources, the Department has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of such species (Fish & Game Code §§ 711.7 and 1802).

Development and implementation of Groundwater Sustainability Plans under SGMA represents a new era of California groundwater management. The Department has an interest in the sustainable management of groundwater, as many sensitive ecosystems and species depend on groundwater and interconnected surface waters. SGMA and its implementing regulations afford ecosystems and species-specific statutory and regulatory consideration, including the following as pertinent to Groundwater Sustainability Plans:

- Groundwater Sustainability Plans should identify and consider impacts to groundwater dependent ecosystems (GDEs), pursuant to 23 California Code of Regulations (CCR) § 354.16(g) and Water Code § 10727.4(l);

- Groundwater Sustainability Agencies should consider all beneficial uses and users of groundwater, including environmental users of groundwater pursuant to Water Code §10723.2 (e); and Groundwater Sustainability Plans should identify and consider potential effects on all beneficial uses and users of groundwater pursuant to 23 CCR §§ 354.10(a), 354.26(b)(3), 354.28(b)(4), 354.34(b)(2), and 354.34(f)(3);

- Groundwater Sustainability Plans should establish sustainable management criteria that avoid undesirable results within 20 years of the applicable statutory deadline, including depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water pursuant to 23 CCR § 354.22 *et seq.* and Water Code §§ 10721(x)(6) and 10727.2(b) and describe monitoring networks that can identify adverse impacts to beneficial uses of interconnected surface waters pursuant to 23 CCR § 354.34(c)(6)(D); and

- Groundwater Sustainability Plans should account for groundwater extraction for all Water Use Sectors including managed wetlands, managed recharge, and native vegetation pursuant to 23 CCR §§ 351(al) and 354.18(b)(3).

Accordingly, the Department values SGMA groundwater planning that carefully considers and protects GDEs, fish and wildlife beneficial uses, and users of groundwater and interconnected surface waters.

COMMENT OVERVIEW

The Department supports ecosystem preservation in compliance with SGMA and its implementing regulations based on Department expertise and best available information and science.

The Department recommends the WSGSP provide additional information and analysis that considers all environmental beneficial uses and users of groundwater in its sustainability management criteria and better characterize or consider surface water-groundwater connectivity. In addition, the Department is providing additional comments and recommendations below.

COMMENTS AND RECOMMENDATIONS

The Department comments for the WSGSP are as follows:

11-1

1. **Comment #1 Setting:** Section 2 Westside Subbasin Plan Area and Setting, 2.1 Description of Plan Area, 2.1.3 Summary of Jurisdictional and Plan Area (§ 354.8 (b)) (page 2-1) and Figure 2-2. The Department owns properties within the Westlands Water District including the Pilibos Wildlife Area (WA), the Pleasant Valley Ecological Reserve (ER), and a small triangular parcel on the western edge of the Mendota WA. The Pilibos WA and the Mendota WA do not have any wells. Pleasant Valley ER has wells; however, the previous owner retained the ownership and groundwater rights to these wells, and as such the Department does not own any wells on this ecological reserve.

11-2 2. **Comment #2. Interconnected Surface Waters:** Section 2 Basin Setting. 2.2.2.4 Surface Water (page 2-42). The interconnected surface water analysis lacks sufficient evidence to justify an absence of interconnected streams in the subbasin.

   a. *Issue:* The analysis of surface water interconnectivity is based on limited data and a non-representative baseline. The WSGSP claims that there are no interconnected surface waters in the basin using a depth-to-groundwater argument. The Upper Aquifer groundwater contours used to support the depth-to-groundwater analysis are based on limited data that is sparse in some areas of the subbasin and includes only 12 wells "in the vicinity of" streams. The analysis best captures groundwater conditions along the eastern boundary of the subbasin (page 2-35), though most of the streams originate along the western boundary of the subbasin. The narrative interconnected stream analysis states, "based on an evaluation of Upper Aquifer groundwater levels and contours of depth to groundwater, groundwater levels underlying the intermittent streams during the 2015 baseline period demonstrate that these streams are not interconnected with the groundwater system" (page 2-42). This analysis appears to rely on a non-specified single-point-in-time baseline hydrology. The 2015 baseline period falls several years into a historic drought when groundwater levels throughout the San Joaquin Valley were trending dramatically lower than usual due to reduced surface water availability. For example, the hydrograph for representative monitoring well 18S/16E-22Q03 is included on page 14 of Appendix 3.A of the WSGSP and is one of the 12 wells located in the vicinity of ephemeral streams used for the analysis of stream interconnectivity. The hydrograph for this well shows near record low groundwater elevations in 2015. Basing the surface water interconnectivity analysis on a snapshot of groundwater elevations during a historic drought is problematic and limited as an approach to understanding surface water-groundwater dynamics in the subbasin; this approach does not consider representative climate conditions or account for seasonal and interannual variability.

   b. *Recommendations:* The Department recommends that the WSGSP clarify what data were used to develop its Upper Aquifer groundwater elevation contours and utilize this data to evaluate potential interconnected surface water and groundwater conditions. Without knowing or identifying the data used in this analysis, expanding the Upper Aquifer/shallow groundwater monitoring will likely be required in order to fully analyze surface water-groundwater interconnectivity using representative baseline hydrology that reflects interannual and inter-seasonal variability.

11-3

3. **Comment #3. Groundwater-Dependent Ecosystems:** Section 2 Westside Subbasin Plan Area and Setting, 2.1.4.3 Impacts on Groundwater Dependent Ecosystems (page 2-16), 2.2.4.4.5 Groundwater Dependent Ecosystems (page 2-44), and Figure 2-14. The GDE identification section, pursuant to 23 CCR § 354.16 (g), is based on limited information to demonstrate exclusion of ecosystems that may depend on groundwater.

    a. *Issue*: Methods applied to the Natural Communities Commonly Associated with Groundwater (NCCAG) dataset to identify potential GDEs are not robust.

        i. Depth to Groundwater: A report completed by the California Department of Water Resources (CDWR) (1997) shows that a large area of the Westlands Water District in Kings County has 0 to 10 feet to depth to free water below the surface (see CDWR Figures 2, 3 and 5). As such, the Department does not concur that GDEs do not exist in the subbasin. The removal of areas with a depth to groundwater greater than 30 feet in Winter 2014/2015 relies on a single-point-in-time baseline hydrology, specifically a point in time that is several years into a historic drought when groundwater levels were trending significantly lower due to reduced surface water availability. Exclusion of potential GDEs based on this singular groundwater elevation measurement is questionable because it does not consider representative climate conditions (i.e., seasons and a range of water type years) and it does not account for GDEs that can survive a finite period of time without groundwater access (Naumburg et al. 2005), but that rely on groundwater table recovery periods for long term survival.

        ii. Adjacent to Surface Water: The GSP did not fully evaluate potential GDEs that depend on adjacent losing surface water bodies and a GDE's adaptability and opportunistic nature in accessing water supply. The WSGSP assumption that these potential GDEs are accessing and primarily dependent on surface water is based on proximity to a surface water source, but this assumption is not clearly justified and there is no acknowledgement of the potential for shifting reliance between surface and ground water. Additionally, GDEs that are near interconnected surface water bodies may depend on sustained groundwater elevations that stabilize the gradient or rate of loss of surface water, meaning that ecosystems near interconnected surface waters may depend on sustainable groundwater elevations. Therefore, it is possible that any of these potential GDEs rely on groundwater during specific seasons or water year types. The Department advises that riparian GDE beneficial users of groundwater and surface water are carefully considered in the analysis of undesirable results and minimum thresholds for depletions of interconnected surface waters. The Department further recommend the streams on the west side of the valley in the Coastal Range be further evaluated for GDEs, as there are riparian zones along those streams.

b. *Recommendations:* The Department recommends the WSGSP consider the following for information gathering related to GDEs:

   i. Depth to Groundwater: Develop a hydrologically robust baseline that includes areas with a depth to groundwater greater than 30 feet that relies on multiple, climatically representative years of groundwater elevation and that accounts for the inter-seasonal and inter-annual variability of GDE water demand.

   ii. Adjacent to Surface Water: Re-evaluate potential GDEs that are in proximity to a losing surface water body. The Department recommends that the WSGSP be more conservative and all-inclusive until there is evidence that the overlying ecosystem has no significant dependence on groundwater across seasons and water year types. The Department advises that these riparian GDE beneficial users of groundwater and surface water are carefully considered in the analysis of undesirable results and minimum thresholds for depletions of interconnected surface waters.

   iii. Include Additional References for Evaluation: The Department recognizes the NCCAG (Klausmeyer et al. 2018) provided by CDWR as a starting reference for GDEs; however, the Department recommends the WSGSP include additional resources for evaluating GDE locations. The Department recommends consulting other references including, but not limited to, the following tools and other resources: the California Department of Fish and Wildlife (CDFW) Vegetation Classification and Mapping Program (VegCAMP) (CDFW 2019A); the CDFW California Natural Diversity Database (CNDDB) (2019B); the California Native Plant Society (CNPS) Manual of California Vegetation (CNPS 2019A); the CNPS California Protected Areas Database (CNPS 2019B); the United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (USFWS 2018); the USFWS online mapping tool for listed species critical habitat (USFWS 2019); the United States Forest Service CALVEG ecological grouping classification and assessment system (USFS 2019); and other publications by

Klausmeyer et al. (2019), Rohde et al. (2018), The Nature Conservancy (TNC) (2014, 2019), and Witham et al. (2014).

11-4 4. **Comment #4. Threatened and Endangered Species:** 2.2.4.4.6 Ecological Conditions (page 2-44) and Figure 2-63. The Ecological Conditions identification section is based on limited information and a narrow definition to demonstrate exclusion of listed species habitats within the WSGSP.

a. *Issue*: The west side of the San Joaquin Valley supports many Federal and State listed species and the habitats on which they depend. The WSGSP states that "there are no critical habitats containing either threatened species or endangered species" within the Westside Subbasin and references Figure 2-63, which displays only federally designated critical habitats. This statement and figure could be misinterpreted to mean that no threatened or endangered species are present within the subbasin. Pursuant to U.S. Code § 1532(5)(A)(i)-(ii) and § 1532(5)(B)-(C), critical habitat for a threatened or endangered species is defined as "(a) the specific areas within the geographical area occupied by the species, at the time it is listed…on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection." It is important to note that pursuant this definition "critical habitat shall not include the entire geographical area which can be occupied by the threatened or endangered species." Therefore, a lack of federally designated critically habitat within the subbasin does not preclude the presence of species listed as threatened or endangered pursuant the Federal Endangered Species Act (16 U.S.C. § 1531 et seq. (1973)) or the California Endangered Species Act (Fish & G. Code, § 2050 et seq.). In fact, information from other publicly available databases including the California Natural Diversity Database reveals occurrence records for numerous threatened and endangered species including, but not limited to, the federally and State endangered palmate-bracted bird's beak (*Chloropyron palmatum*), California jewelflower (*Caulanthus californicus*), giant kangaroo rat (*Dipodomys ingens*), Fresno kangaroo rat (*Dipodomys nitratoides exilis*), and Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*); the State and federally endangered and state fully protected blunt-nosed leopard lizard (*Gambelia sila*); the federally endangered and State threatened San Joaquin kit fox (*Vulpes macrotis mutica*); the federally and State threatened giant gartersnake (*Thamnophis gigas*); the State threatened San Joaquin antelope squirrel (*Ammospermophilus nelsoni*), Swainson's hawk (*Buteo swainsoni*), and tricolored blackbird (*Agelaius tricolor*); and the federally endangered San Joaquin woollythreads (*Monolopia congdonii*) (CDFW 2019C). In addition, the Department's Pleasant Valley Ecological Reserve, designated as an ecological reserve in 2000 for the purpose of protecting sensitive animal species and the habitats upon which they depend, falls within the subbasin (CDFW 2019D). Further, the Lemoore Naval Air Station also falls within the subbasin and is known to support special-status species including, but not limited to, some of those listed above (CDFW 2019C).

b. *Recommendations*: As stated above, the Department recommends consulting other references that are presented above and provided in the Literature Cited section for evaluating special-status species and their habitats.

11-5 5. **Comment #5 Sustainable Management Criteria:** Section 3 Sustainable Management Criteria (starting page 3-1). Sustainable management criteria demonstrate no consideration of undesirable results for environmental beneficial uses and users of groundwater, and does not reflect a 'Critically Overdrafted' basin status.

a. *Issues:*

i. The WSGSP does not consider effects of minimum thresholds and associated undesirable results on environmental beneficial uses and users of groundwater. The WSGSP claims an absence of GDEs and an absence of impacts to ecological resources (page 2-44, see Comment 3 on GDEs). Therefore, the WSGSP does not analyze potential sustainability management criteria impacts to any environmental beneficial uses and users.

ii. Table 3-1 of the WSGSP indicates that undesirable results have been occurring historically and continue occurring under existing groundwater conditions for four sustainability criteria (page 3-3). Table 3-1 supports the subbasin characterization as 'Critically Overdrafted,' meaning "continuation of present water management practices [in the basin] would probably result in significant adverse overdraft-related environmental, social, or economic impacts" (CDWR "Critically Overdrafted") (CDWR 2019). The WSGSP identifies minimum groundwater elevations thresholds for representative monitoring wells, each of which serves as a threshold beyond which significant and unreasonable effects (i.e., undesirable results) are expected (page 3-18). Most proposed minimum thresholds (and several measurable objectives) suggest that groundwater elevations at representative wells can continue to decrease for the next 20 years, dropping further from historically low drought groundwater elevations. The WSGSP is concurrently: 1) claiming that undesirable results were present at baseline groundwater elevations and are present now, 2) noting that minimum thresholds are designed to protect against undesirable results, and 3) proposing minimum thresholds that are significantly lower than baseline groundwater elevations. The WSGSP explains that minimum thresholds have been designed to account for short-term fluxes below 2015 levels (page 3-19) but lacks details on how minimum thresholds will be enforced to only accommodate *short-term* decreases in groundwater elevation. Therefore, the WSGSP's minimum thresholds may allow for 20 implementation years of groundwater table decline, mirroring the historical trends that led to the subbasin's Critically Overdrafted status. Conceptually, there is a disconnect between the subbasin's 'Critically Overdrafted' designation and sustainable management criteria the allow for continued groundwater level decline.

b. *Recommendations:* The Department recommends that the WSGSP reconsider minimum thresholds and measurable objectives after the collection of additional shallow groundwater information and reanalyzing interconnected surface water and GDEs (see Comments 2 and 3 on Interconnected Surface Water and GDEs).

   i. Revise sustainable management criteria accounting for undesirable results for environmental beneficial users of groundwater and clarify how species and habitat groundwater needs were considered in the identification of sustainable management criteria.

   ii. Revise sustainable management criteria to reflect a 'Critically Overdrafted' subbasin designation by seeking to improve current groundwater conditions rather than allowing for continued aquifer depletions over the next two decades.

11-6

6. **Comment #6 Sustainable Management Criteria:** 3.3.4 Minimum Thresholds for subsidence, 3.3.4.1 Description of Minimum Threshold (page 3-25). Groundwater Sustainability Plan Regulations state that "the minimum thresholds for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results" (GSP § Reg.354.28(c)(5).). On WSGSP page 3-26, Table 3-9 provides the minimum threshold criteria for subsidence within the plan area. In areas near the Extensometer Station 14S/13E-11DS, the plan allows for 0.3 feet per year of subsidence. A portion of the Mendota WA exists within the GSP plan area east of this station. The threshold criteria presented within the plan does not take into consideration specific subsidence issues currently being encountered in the Mendota WA.

a. *Issue:* The Mendota WA has experienced land subsidence for decades. The first significance was subsidence at the Mendota Pool Dam, which caused the water level to be lower resulting in less ability to back water up the Fresno Slough to the Department's water inlets in the Mendota WA. This effect was later compounded when CDWR Division of Safety of Dams determined that water levels at the Mendota Pool had to be lowered further to maintain the integrity of the dam. Thus, these two incidents have significantly impacted Mendota WA's ability to flood using gravity flow and have impacted our lift pump sites. During the recent drought, landowners to the south pumped groundwater, further increasing subsidence along the southern portion of the Mendota WA, resulting in our water flowing backwards. The Department does not concur with allowing additional subsidence within areas in close proximity to the Mendota WA.

b. *Recommendation*: To avoid additional "significant and unreasonable" conditions within the Mendota WA, the Department recommends that the WSGSP and neighboring GSPs include Mendota WA as a subsidence management area with a zero feet subsidence criterion that no longer reduces the ability to deliver surface water supplies to and within the property.

11-7 **OTHER COMMENTS: Implementation of Project Actions Related to SGMA**

SGMA exempts the preparation and adoption of GSPs from the California Environmental Quality Act (CEQA) (WC § 10728.6); however, SGMA specifically states that implementation of project actions taken pursuant to SGMA are not exempt from CEQA (WC § 10728.6). The Department is California's **Trustee Agency** for fish and wildlife resources and holds those resources in trust by statute for all the people of the State (Fish & G. Code, §§ 711.7, subd. (a) & 1802; Pub. Resources Code, § 21070; CEQA Guidelines § 15386, subd. (a)). The Department, in its trustee capacity, has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitat necessary for biologically sustainable populations of those species (*Id.*, § 1802). Similarly, for purposes of CEQA, the Department is charged by law to provide, as available, biological expertise during public agency environmental review efforts, focusing specifically on projects and related activities that have the potential to adversely affect fish and wildlife resources.

The Department is also a **Responsible Agency** under CEQA (Pub. Resources Code, § 21069; CEQA Guidelines, § 15381), and the Department expects that it may need to exercise regulatory authority as provided by the Fish and Game Code for implementation of projects related to the WSGSP that are also subject to CEQA. These projects may be subject to the Department's lake and streambed alteration regulatory authority (i.e., Fish & G. Code, § 1600 et seq.). Notification pursuant to Fish and Game Code § 1602 is warranted if a project will (a) substantially divert or obstruct the natural flow of any river, stream, or lake; (b) substantially change or use any material from the bed, bank, or channel of any river, stream, or lake (including the removal of riparian vegetation); and/or (c) deposit debris, waste or other materials that could pass into any river, stream, or lake. Likewise, to the extent that implementation of any project may result in "take" as defined by State law of any species protected under the California Endangered Species Act (CESA) (Fish & G. Code, § 2050 et seq.), related authorization as provided by the Fish and Game Code will be required. The Department is required to comply with CEQA in its issuance of a Lake or Streambed Alteration Agreement or an Incidental Take Permit.

Water Rights: The implementation of SGMA does not alter or determine surface or groundwater rights (WC § 10720.5). It is the intent of SGMA to respect overlying and other proprietary rights to groundwater, consistent with section 1200 of the Water Code (Section 1(b)(4) of AB 1739). The capture of unallocated stream flows to artificially recharge groundwater aquifers are subject to appropriation and approval by the State Water Resources Control Board (SWRCB) pursuant to Water Code § 1200 et seq. The Department, as Trustee Agency, is consulted by SWRCB during the water rights process to provide terms and conditions designed to protect fish and wildlife prior to appropriation of the State's water resources. Certain fish and wildlife are reliant upon aquatic and riparian ecosystems, which in turn are reliant upon adequate flows of water. The Department therefore has a material interest in assuring that adequate water flows within streams for the protection, maintenance and proper stewardship of those resources. The Department provides, as available, biological expertise to review and comment on environmental documents and impacts arising from project activities.

CONCLUSION

In conclusion, the WSGSP needs to address all SGMA statutes and regulations, and the Department recommends the WSGSP seriously consider fish and wildlife beneficial uses and interconnected surface waters. The Department recommends that the WSGSP incorporate the above comments before it is submitted to CDWR. The Department appreciates the opportunity to provide comments on the WSGSP. If you have any further questions, please contact Dr. Andrew Gordus at Andy.Gordus@wildlife.ca.gov or (559) 243-4014 extension 239.

Sincerely,

Julie A. Vance
Regional Manager, Central Region

Enclosures (Literature Cited)

cc: Glen Allen, Water and Natural Resources Manager
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California Department of Water Resources

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State Water Resources Control Board

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VERBAL COMMENTS FROM THE OCTOBER 30, 2019 GSA HEARING

Comment #1

Request that the credits should roll over indefinitely with no expiration. 17-1

Commenter #2

Greg Milton, Geologist with the Bureau of Land Management

Responsible for managing the public lands to the west of the groundwater basin. One thing that we are allowed to do is redefine the groundwater basin. Asked the Directors to consider entraining the modifying the groundwater basin because it is a geopolitical boundary not a no flow boundary. The basin extends with hydrostatic graphic units and the same material that you are using as groundwater storage crops out in the hills that we manage so if you wanted to take a look at that then we will definitely entertain that message. 13-1 Other thing is I've been asked to extend our appreciation being allowed to review your Groundwater Sustainability Plan and we are very impressed with the level of effort that you are putting into this. If we can be of assistance, we want to be. 13-2

Commenter #3

Robert Urban, Certified Engineering Geologist

The groundwater sustainability plan seems to no include any monitoring of groundwater levels which you have repeatedly have stated that has an impact on the sustainability of the basin, so I would ask that you guys take a look at monitoring the groundwater levels as being a critical component of the GSP. 12-1

The other thing I noticed are based off of land size and not actual quantity of water, which according to the law there are all kinds of sorts of information that indicate that it should be off the quantity of water not a land-based decision. 12-2

Other things to consider for your management strategies we talk about units, quantities of water for the basin, but there are other things that we should consider like the efficiencies of the pumps, the wells themselves, the rate of which extraction is made all of these factors are key to the sustainability of the aquifer and does not appear to be part of the plan and we ask that you consider those. 12-3

VERBAL COMMENTS FROM THE NOVEMBER 19, 2019 BOARD MEETING

Comment #1

Amanda Monaco

I was wondering if you have had an opportunity to think thought any of our comments and responses to those comments specifically the drinking water mitigation or water quality. **14-1**

Is there going to be an opportunity for the public to provide input on how you respond to those comments? Or is that going to be done by staff? **14-2**

Will the responses be part of the adoption hearing? **14-3**

Given the written response are going to be part of the GSP, are the written response going to publish before the adoption date? **14-4**

Yes, the final GSP will be posted on the website.

Commenter #2

Mike Henry

I talked to various people on staff regarding the targeted pumping restrictions that could be effective as soon as 2020. There are still no rules and was hoping to get a better understanding of what that could mean us as soon as January 2020 **15-1**

DEPARTMENT OF THE NAVY
COMMANDING OFFICER
NAVAL AIR STATION
700 AVENGER AVENUE
LEMOORE, CALIFORNIA 93246-5001

IN REPLY REFER TO:
11330
Ser N00/1152
19 Dec 2019

Katarina Campbell
Westlands Water District
3130 N Fresno St
P.O. Box 6056
Fresno, CA 93703

Dear Ms. Campbell:

SUBJECT: COMMENTS - SUSTAINABLE GROUNDWATER MANAGEMENT PLAN

1. The purpose of this letter is to provide your office with the Navy's formal request that the following description of NAS Lemoore and associated Federal Reserve Water Rights be included in to the Final Groundwater Sustainability Management Plan (GSP). This language was provided to Westlands Water District on November 22, 2019; however, it was not adopted in the December 2019 version. This request is consistent with language adopted statewide by other GSAs where Navy bases are located. For purposes of clarity and statewide consistency, the Navy asks that the following specific language be included in the Final version of the GS:

Naval Air Station Lemoore

Naval Air Station Lemoore (NAS Lemoore) is located in the central portion of the San Joaquin valley, 35 miles south of Fresno, 80 miles northwest of Bakersfield and 7 miles west of Lemoore, California. The base lies primarily in Kings County with a small portion in Fresno County. NAS Lemoore consists of 18,784 acres of land. A majority of the land surrounding the airfield is leased for agricultural production (approx. 11,000 acres) to directly support military operations by providing a reduction in Bird Animal Strike Hazards for military aviation operations. The installation is divided into two areas, the Operations Area to the north and the Administration and Housing Area to the south. More than 13,500 personnel, including 2,411 civilians and contractors as well as 6,529 military personnel and their dependents, live and work on NAS Lemoore. There are two public schools located on the base, which primarily serve 2,580 children of military families. NAS Lemoore is the only military installation in the southern San Joaquin Valley. It provides quality of life services to over 8,700 retirees and 10,900 family members living in the tri-county area.

The primary mission of NAS Lemoore, as the Navy's premier Strike Fighter Master Jet Base, is to provide the infrastructure products and services that enable Commander Strike Fighter Wing Pacific to conduct operations in support of national security. In addition to the West Coast Strike Fighter Squadrons, NAS Lemoore supports critical Fleet Readiness Center West avionics for operations units in the Pacific Theater. NAS Lemoore plays a critical role in the United States national security.

Water sustainability is critical to military sustainability, resiliency, and compatibility. NAS Lemoore's primary water supply for municipal and industrial uses is the surface water delivered via the Central Valley Project system of aqueducts. NAS Lemoore operates a surface water treatment plant that provides all of the potable, industrial, firefighting and irrigation water for the base. In addition, NAS Lemoore has one operational well for drinking water supply, which is used as a backup in the case of an emergency.

Agriculture operations on the Navy's leased acreage purchase water from Westlands Water District surface water supply. Additionally, NASL has 29 Ground water wells in the agricultural lease area and are available for use by the lease. NASL employs effective water conservation measures contractually with its leases. One parcel composed of 1,238.2 acres is not in the Westlands Water District service area and relies solely on ground water for cultivation. NAS Lemoore's ground water use has been critical in keeping leased land in agriculture production during low water years and is directly correlated to the critical safety of aviation operations through the reduction in bird/animal strikes.

Appreciating the shared interest in assuring the sustainability of groundwater resources, the California Sustainable Groundwater Management Act (SGMA) provides that the federal government may voluntarily agree to participate in the preparation or administration of a groundwater sustainability plan, per Water Code Section 10720.3. Recognizing this shared interest, NASL has voluntarily participated in public meetings and workshops that have been held by the GSA Going forward NASL requests formal participation as ex-officio, nonvoting in the technical and other advisory committees established under the GSA. 16-1

While welcoming federal government participation, SGMA recognizes Federal Reserve Water Rights (FRWR) as distinct from those water rights based in state law and directs that FRWR be respected in full, and in case of any conflict between federal and state law, federal law shall prevail. Water Code § 10720.3(d). SGMA also directs that the groundwater sustainability agency consider the interests of all beneficial uses and users of groundwater, to specifically include the federal government, which further includes, but is not limited to, the military and managers of federal lands among those interests. Water Code § 10723.2. 16-2

Under U.S. Supreme Court case law defining the FRWR, federal agencies have an implied right to water to support the primary mission for which Congress and the Federal government have designated that land, including a provision of water for growth to support that mission.[1] It is also well established in the Supremacy Clause of the U.S Constitution, Article VI, Clause 2 and recognized by the Supreme Court that the Federal Government is not subject to state regulation, unless Congress clearly and unambiguously waives this sovereign immunity.[2] **16-3**

Consistent with its proactive and cooperative engagement with San Joaquin Valley Westside Basin's Ground Sustainability Agency (GSA), NASL has a vested interest in participating in the SGMA effort to support a groundwater basin that achieves a sustainable yield. Although not subject to formal regulation under SGMA, NASL is committed to being a good steward of water resources and to exploring partnerships that help to achieve groundwater sustainability, including projects that benefit both the Navy and the community. **16-4**

2. If you have any questions concerning our request, my point of contact is Donna Ogilvie and can be reached at donna.ogilvie@navy.mil or at (559) 998-4078.

Sincerely,

DOUGLAS M. PETERSON
Commanding Officer

[1] The FRWR was first recognized by the U.S. Supreme Court in the context of tribal interests (*See Winters v. United States*, 207 U.S. 564 5090 (1908)) and subsequently expanded to federal agencies (*See Cappaert v. United States*, 426 U.S. 128 (1976)), *Federal Power Commission v. Oregon*, 349 US 435 (1955)).
[2] *See Dep't of Energy v. Ohio*, 503 U.S. 607, 615 (1992). Such waivers must be unequivocally expressed, construed strictly in favor of the sovereign, and not enlarged beyond what the language of the waiver requires. *Id.*

County of Fresno

DEPARTMENT OF PUBLIC WORKS AND PLANNING
STEVEN E. WHITE, DIRECTOR

December 13, 2019

Mr. Jose Gutierrez
Chief Operating Officer
Westlands Water District
3130 North Fresno Street
Fresno, California 93703-6056

RE: Support for the Draft Westside Subbasin Groundwater Sustainability Plan

Dear Mr. Gutierrez,

The County of Fresno is the Groundwater Sustainability Agency (County of Fresno GSA-Westside) for areas within the Westside Subbasin that are located outside the boundaries of the Westland's Water District. The County also administers services to three disadvantaged communities within the Westside Subbasin through the Special Districts Division of the Department of Public Works and Planning.

Since filing as a GSA, the County has worked cooperatively with the Westlands Water District Groundwater Sustainability Agency (WWD GSA) towards the completion of the Westside Subbasin Groundwater Sustainability Plan (GSP). The County commends WWD GSA for development of the Draft GSP that incorporates preemptive augmentation strategies that complement the County's General Plan and support continued land use practices and policies. The County finds that the projects and management actions developed in the GSP promote continued conjunctive use of groundwater and surface water resources. Specifically, the development of a groundwater allocation optimizes the use of the Subbasin's aquifers, supports conjunctive use, equally allocates groundwater resources, and protects groundwater levels.

On January 7th, 2020 the Fresno County Board of Supervisors (Board) will consider adoption of the GSP for those areas covered by the County of Fresno GSA-Westside. Fresno County staff have reviewed the Draft GSP and coordinated revisions with WWD GSA staff culminating in a recommendation for approval to the Board.

Thank you for cooperating with the County of Fresno in the development the GSP for the Westside Subbasin that is consistent with SGMA Regulations. We look forward to continuing to work with the WWD GSA on the implementation of the GSP.

Sincerely,

Bernard Jimenez, Assistant Director

ADMINISTRATION
2220 Tulare Street, Sixth Floor / Fresno, California 93721 / Phone (559) 600-4078 / FAX (559) 600-4548

WATER WISE

December 23, 2019

Katarina Campbell
Westlands Water District
3310 North Fresno Street, P.O. Box 6056
Fresno, CA 93703

Re: Draft Groundwater Sustainability Plan for Westlands Water District

Dear Ms. Campbell,

The recently revised DRAFT Groundwater Sustainability Plan, posted December 13, 2019, for Westlands Water District provides more flexibility around implementation than the prior DRAFT presented to members at the October 30, 2019 workshop. Those changes are appreciated. However, with added flexibility comes uncertainty regarding implementation. 19-1
Two major components of the plan will be; 1) Rules and Regulations and 2) Targeted Pumping Reduction Incentive Program. These two areas require direct input from members of Westlands Water District, whom the plan impacts. It is critical for the success of our basin and the communities it supports, that the development process be open, transparent, and have input from all interested parties.

The two committees that have been identified for formation in the December 13, 2019 version of the GSP, 1) Advisory Committee and 2) Technical Committee filled as quickly as possible. Other GSA's in the San Joaquin Valley have used similar formats for writing their GSP's which has proven helpful in gaining practical implementation knowledge and most importantly support of the plans by the members. Westlands Water District would be well served to engage their members early and often prior to and during implementation.

The make-up of the Advisory Committee and Technical Committee must be inclusive of all of the diverse communities impacted by the Groundwater Sustainability Plan in Westlands Water District. Staff has indicated at a public meeting that this committee will be comprised of 8-11 people through a nomination process. There are a couple of key factors that will assist in making these committees effective. First, it is recommended that the committee be 19-2
made up of Westlands Water District members who do not currently sit on the Board of Directors for Westlands Water District. Second, there should be a simple application process accessible to everyone. Finally the Advisory Committee should be made up of representatives from the following constituency groups within Westlands Water District.

- El Porvenir; Resident or Rep
- Cantua Creek; Resident or Rep
- City of Huron; Representative
- Lemoore Naval Air Station; Representative
- Agriculture – Subsidence Area Cantua Creek; Landowner or Rep

- Agriculture – Subsidence Area Kettleman City; Landowner or Rep
- Agriculture – Permanent Crops; Landowner or Rep
- Agriculture – Non-Permanent Crop; Landowner or Rep
- Agriculture – Northern Region; Landowner or Rep
- Agriculture – Central Region; Landowner or Rep
- Agriculture – Southern Region; Landowner or Rep

Although the committees will have different roles, representatives to both committees should cover this list of interest parties. This make-up of the committees ensures we have input from all of those whom are impacted by groundwater and the GSP in Westlands Water District.

Thank you for your work on the DRAFT Groundwater Sustainability Plan. Countless hours have been consumed by planning and organization. Hopefully the DRAFT will lay a foundation for a program within Westlands Water District to obtain groundwater sustainability while keeping the vibrancy of Agriculture in our district.

Sincerely,

Sarah Clark Woolf
President, Water Wise

STATE OF CALIFORNIA – CALIFORNIA NATURAL RESOURCES AGENCY **GAVIN NEWSOM**, *Governor*

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

December 26, 2019

Thomas W. Birmingham
Westlands Water District
3130 North Fresno Street
P.O. Box 6056
Fresno, California 93703-6056

Dear Mr. Birmingham:

Thank you for affording the California Department of Water Resources (DWR) State Water Project (SWP) the opportunity to review the draft Westlands Water District, Westside Subbasin Groundwater Sustainability Plan (GSP) as required under the Sustainable Groundwater Management Act (SGMA) of 2014.

The SWP's chief goals regarding subsidence are to remediate past and ongoing damage to the California Aqueduct (Aqueduct) while also addressing the underlying causes. More than 66 miles of the Aqueduct are located within the Westlands Water District, Westside Subbasin Region, and subsidence in the region has reduced the Aqueduct's conveyance capacity and operational flexibility. The areas and magnitudes of these impacts can be found in DWR's California Aqueduct Subsidence Study (June 2017) and the California Aqueduct Subsidence Study: Supplemental Report (March 2019). We have completed an initial review of the draft GSP and find it does not adequately address the effects of land subsidence on the Aqueduct. Additionally, we have the following general comments:

1) We appreciate the GSPs consideration of critically subsided Aqueduct reaches and proposed remedial measures. Specifically, actions described in Project No. 4 present an opportunity to address our common interest in halting ongoing damage to the Aqueduct. **20-1**

2) The Westside Groundwater Model that provides the technical basis for the GSP does not appear to incorporate the contribution of the subsidence process to the water budget. We request relevant documentation to complete our review to gain an understanding of this model at it relates to the Aqueduct. **20-2**

3) The GSP assumes that "residual subsidence" of 0.1 foot per year will be acceptable on the Aqueduct. We are concerned that if this rate of subsidence continues through 2040 and possibly thereafter, it will further adversely impact the Aqueduct's conveyance capacity and operational flexibility. **20-3**

These comments are provided on behalf of the SWP. Regulatory decisions and actions under SGMA are managed separately by the Department's Sustainable Groundwater Management Office (SGMO).

The SWP looks forward to working with your agency to engage on these comments on the draft GSP. If you have any questions, please contact the California Aqueduct Subsidence Program Manager Mike Inamine at (916) 213-3810 or michael.inamine@water.ca.gov.

Sincerely,

for

Ted Craddock
Acting Deputy Director
State Water Project

Letter 1 Response — The Nature Conservancy
Sandi Matsumoto
October 31, 2019T

1-1 The references to beneficial uses and stakeholders in Section 2.1.5.1 complies with California Code of Regulations Tit. (GSP Regulations) 23, § 354.10, which was included to facilitate the notification and communication to other agencies and interested parties about the Westside Subbasin GSP. The information requested by commenter on beneficial uses and users of groundwater is included throughout Chapter 2.

DWR and TNC provides guidance on use of the NCCAG dataset in GSP development, stating that "[t]he Natural Communities dataset is provided by DWR as a reference dataset and potential starting point for the identification of GDEs in groundwater basins. The Natural Communities dataset and its source data can be reviewed by GSAs, stakeholders, and their consultants using local information and experience related to the validity of mapped features and understanding of local surface water hydrology, groundwater conditions, and geology..." This DWR guidance resulted in the methodology used for this GSP, which was to identify likely GDEs in the Subbasin by combining the NCCAG database with additional local data and knowledge. The database was a starting point to identify areas dependent on groundwater.

The two primary aquifers that are present in the majority of the Westside Subbasin are the Upper and Lower Aquifers which are separated by the Corcoran Clay. The "shallow zone" of the Upper Aquifer is identified as the upper 100 feet of the Upper Aquifer. The GSA evaluated the depth to water in the Upper Aquifer which determined that the depth to water was greater than 30 feet below ground surface (bgs) in areas where TNC identified "potential Groundwater Dependent Ecosystems" (GDE). The GSA would like to remind commenters that a GDE is defined by the Department of Water Resources' (DWR's) implementing regulations as "ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" (GSP Regulations, §351(m)). Although "near the ground surface" is not defined, a groundwater table that is in excess of 30 feet bgs, for example, cannot be reasonably considered as being near the ground surface. However, further analysis of shallow zone depth to groundwater indicates there may be some very small, scattered areas where potential GDEs may exist. For this reason, WWD GSA will install shallow wells in the western part of the Subbasin to determine if there is an impact on these areas from groundwater pumping. However, the GSA's current analysis of shallow zone groundwater levels indicates that there is no direct influence of groundwater pumping on shallow zone groundwater levels, and therefore, no influence of groundwater pumping on "potential" GDEs. Because potential GDEs are likely disconnected from the Subbasin's groundwater aquifer, there are no undesirable effects occurring with respect to depletions of interconnected surface waters (ISW).

1-2 Section 2.2.2.4 of the GSP describes the listed streams as ephemeral streams and indicates these streams are normally dry. There are no current or planned instream flow requirements for the ephemeral streams in the Westside Subbasin, such as Panoche Creek, Cantua Creek, Salt, Martinez, the Domengine, and the Arroyo Pasajero. In May 2010, the State Water Resource Control Board adopted Resolution No. 2010-0021, adopting the Water Quality Control Policy for Maintaining Instream Flows in Northern California Coastal Streams. This Resolution applies to Marin, Sonoma, Napa, Mendocino, and Humboldt Counties. This Resolution does not apply to Kings or Fresno Counties or any surface waterbodies in the Westside Subbasin.

1-3 Section 2.1.3 was updated based on the comment provided.

1-4 Section 2.1.3 was updated based on the comment provided.

1-5 Water Code § 10726.4(b) does not authorize the GSA to permit wells except as authorized by a county to issue well permits. The GSA has not been authorized to issue well permits by either Fresno or Kings county.

1-6 Section 2.2.17 of the GSP describes the procedure followed to define the base of freshwater. The WWD GSA screen interval data does not support altering the defined bottom of the Lower Aquifer.

1-7 GSP §354.14(c) provides, “[t]he hydrogeological model shall be represented graphically by at least two scaled cross-sections that display the information required by this section and are sufficient to depict major stratigraphic and structural features in the Subbasin.” There is no geologic justification for identifying the shallow zone. The groundwater conditions section of the GSP address GDEs and Interconnection Surface Water (ISW) concerns. See Response to Comment, 1-1, which lists additional work that will be done to identify potential GDEs.

The hydrogeological conceptual model presents information that will not change over a short period time. The pre-1980 referenced information still accurately describes the current geologic conditions.

1-8 This section will be updated. The shallow zone will not be identified as a Principal Aquifer but will be identified for the purpose of evaluating GDEs and ISW. See Response to Comment, 1-1, which lists additional work that will be done to identify potential GDEs.

1-9 Section 2.2.3.6 was updated based on the comment provided.

1-10 This comment was addressed by Comment 1-9. Figure 2-33b presents long term shallow zone water level data which identifies the relationship between the shallow zone and Upper Aquifer. See Response to Comment, 1-1, which lists additional work that will be done to identify potential GDEs.

1-11 The comment claims that the GSP is projecting an increased use of poor-quality water in the Shallow Zone. This is an incorrect interpretation of the GSP. The three figures that are referenced in the comment (Figures 2-43 through 2-45) show an improvement in groundwater quality in the Shallow Zone is an inaccurate interpretation by TNC. These figures represent TDS concentrations in the Upper Aquifer, not the Shallow Zone of the Upper Aquifer. Also, these maps generally show that available groundwater quality data is less in 2015 compared to 1990 and that it is difficult to conclude from these figures that there is an improvement in groundwater quality in the Upper Aquifer. See Response to Comments 1-1 and 1-10 that provides further justification for not identifying the Shallow Zone of the Upper Aquifer as a distinct aquifer system in the Subbasin.

1-12 Section 2.2.2.4 was updated to identify ISWs as a data gap.

1-13 There is limited shallow zone groundwater level data in the areas where the ephemeral streams exist. Shallow zone groundwater level data in other areas in the western portion of the Subbasin generally indicate that depth to water is deeper than 30 feet bgs. However, the GSA recognizes that there may be a few locations where it is less than 30 feet bgs in areas where TNC identified Potential GDEs. Further evaluation of the land use footprint of those areas will be conducted to determine the presence of Potential GDEs. Due to the lack of well sites immediately adjacent to the three ephemeral streams in the Subbasin, WWD GSA cannot definitively prove an absence of ISW. Thus, the WWD GSA will identify this lack of data as a data gap and will consider installing up to six shallow monitoring wells (less than 40 feet) near these three streams (two each). See Response to Comment, 1-1, which lists additional work that will be done to identify potential GDEs.

1-14 The data provided in comment 1-14 for the WWD GSA's consideration represents a detention area of the Subbasin that receives surface water from the San Luis Canal during wet hydrologic years and does not represent a GDE.

1-15 The comment is noted for the record and shall be forwarded to the decision-making body for its consideration.

1-16 The Sustainability Goal for the Westside Subbasin accounts for environmental benefits. The Sustainability Goal does not specifically call out GDEs and ISW due to the fact that it may only make up 0.25 percent of the basin's total area. However, as explained above, additional monitoring of these areas will be conducted and if GDEs and ISW are identified, they will be included in the Sustainability Goal.

1-17 See Response to Comments 1-1 and 1-13. The update to Section 2.2.4.4.5 addresses the lack of variation in the shallow zone due to recharge from irrigation.

1-18 See Response to Comments 1-1 and 1-13. The comment is noted for the record and shall be forwarded to the decision-making body for its consideration.

1-19 Measurable Objectives and Minimum Thresholds will be developed for ISWs if the presence of ISWs are confirmed as a result of future monitoring.

1-20 Subsurface inflows and outflows are controlled by groundwater gradients. The draft GSPs for adjacent subbasins set groundwater level Measurable Objectives that reduce subsurface inflows into the Westside Subbasin. The Westside Subbasin will not be responsible for continual lowering of groundwater elevations in adjacent subbasins. The mechanisms to prevent lowering of elevations in adjacent subbasins are the projects and management actions in Chapter 4, including the allocation program.

1-21 The one well that is labeled as TDS Data is not intended to be the only Upper Aquifer groundwater quality monitoring site. All wells displayed in Figure 3-5 are part of the Upper Aquifer monitoring network. The one TDS well was singled out because it is the only location that is not also included in the water level monitoring network. Section 3.2.4.1 has been updated to clarify this point.

Figures 2-41 through 2-48 show historic TDS concentrations across the entire Subbasin.

1-22 See Response to Comment 1-19. Historic shallow groundwater elevation data in the eastern part of the Subbasin shows no relationship to groundwater extractions or climatic conditions, but instead is likely influenced by recharge from irrigation. No data or monitoring sites are currently available that would allow for the development of Measurable Objectives and Minimum Thresholds for ISWs, but Measurable Objectives and Minimum Thresholds will be developed for ISWs if the presence of ISWs are confirmed as a result of future monitoring.

1-23 See Response to Comment 1-1 and 1-13.

1-24 See Response to Comment 1-1 and 1-13.

1-25 See Response to Comment 1-1 and 1-13.

1-26 This comment states an opinion and does not raise a specific concern about the adequacy of the GSP. The GSA will adopt Rules and Regulations through a robust public process incorporating stakeholder involvement beginning in 2020. However, the comment is noted for the record and will be forwarded to the decision-making body for its review and consideration.

1-27 See Response to Comments 1-1, 1-3 and 1-19.

1-28 See Response to Comments 1-1, 1-13 and 1-19.

1-29 See Response to Comments 1-1, 1-13 and 1-19.

1-30 Section 2.2.4.4.1 was updated based on the information provided.

1-31 The GSP regulations and Water Code do not require the level of detail that this comment is requesting, but as explained above additional monitoring will be conducted to identify any potential GDEs.

1-32 See Response to Comments 1-1 and 1-13.

1-33 See Response to Comments 1-1 and 1-13.

1-34 See Response to Comments 1-1 and 1-13.

1-35 This comment states an opinion and does not raise a specific concern about the adequacy of the GSP. The GSA will adopt Rules and Regulations through a robust public process incorporating stakeholder involvement beginning in 2020. See GSP, Chapter 6. However, the comment is noted for the record and will be forwarded to the decision-making body for its review and consideration.

1-36 See Response to Comment 1-19.

1-37 See Response to Comment 1-13.

Letter
2 Lindsay Cederquist
Response October 20, 2019

2-1 This comment states an opinion and does not raise a specific concern about the adequacy of the GSP. As identified in Section 4.2 of the GSP, the GSA will adopt Rules and Regulations, including a process for transfers and banking, consistent with California water law, through a robust public process incorporating stakeholder involvement beginning in 2020. The following measures are responsive to comments received regarding the initiation of the management measures, specifically that the groundwater allocations are being made effective too soon. The Draft GSP has been amended to provide the GSA Board with discretion to evaluate data, climate, water year and boundary conditions before commencement of the allocation program. Beginning with commencement of the allocation program in 2022, the GSP contemplates an 8-year transition period with a gradually declining allocation from 1.3 AF per acre to 0.6 AF per acre. This transition period was incorporated to account for the fact that the GSPs implemented by neighboring basins may affect conditions within the Westside Subbasin. This transition period will provide the WWD GSA sufficient time to coordinate with neighboring basins GSAs.

Neither the deferral of the allocation program nor the transition period is expected to adversely impact groundwater levels in the Subbasin. Historically groundwater use within the Westside Subbasin amounted to about 1.3 AF per acre as allocated pro rata over all irrigable acreage. The GSP will restrict carry-over and transfer of unused water to 0.6 AF per acre regardless of the actual groundwater allocation during any year of the transition period. Moreover, many properties within the Westside Subbasin do not presently have wells and it is unlikely that landowners will pursue the substantial expense of drilling new wells for the purpose of increasing their incremental groundwater use in a specific location for a term that is only a fraction of the useful life of the well.

The GSA contemplates that conditions on carry-over of the unused quantity of groundwater allocations and the transfer of unused allocation will substantially lessen the potential risks of harm to the Westside Subbasin.

Finally, the GSA will continue to maintain its reasonable discretion to incentivize and compel the provision of substitute water supplies and to accelerate and impose the full allocation program as may be required during any deferral and the transition period. The GSA will track all water use through a data management system.

2-2 This comment states an opinion and does not raise a specific concern about the adequacy of the GSP. However, the comment is noted for the record and will be forwarded to the decision-making body for its review and consideration. In addition, as noted in the GSP, the WWD GSA is tracking DWR’s projects to address subsidence at the San Luis Canal.

2-3 This comment states an opinion and does not raise a specific concern about the adequacy of the GSP. However, the comment is noted for the record and will be forwarded to the decision-making body for its review and consideration. Further, as identified in Section 4.2 of the GSP, the GSA will adopt Rules and Regulations, including a process for transfers, carryover, and banking, consistent with California water law, through a robust public process incorporating stakeholder involvement beginning in 2020.

2-4 This comment states an opinion and does not raise a specific concern about the adequacy of the GSP. However, the comment is noted for the record and will be forwarded to the decision-making body for its review and consideration.

2-5 Table 3-1 was modified to include private landowner groundwater recharge projects. See Response to Comment 2-1 regarding transition period for allocation. As identified in Section 4.2 of the GSP, the GSA will adopt Rules and Regulations, including a process for banking, consistent with California water law, through a robust public process incorporating stakeholder involvement beginning in 2020. The GSP has been revised to explain the threshold for undesirable results in Section 3.3.

2-6 This comment states an opinion and does not raise a specific concern about the adequacy of the GSP. However, the comment is noted for the record and will be forwarded to the decision-making body for its review and consideration.

2-7 Table 4-1 was updated to reflect an average projected 49% Central Valley Project surface water allocation. The remainder of the comment states an opinion or question and does not raise a specific concern about the adequacy of the GSP. However, the comment is noted for the record and will be forwarded to the decision-making body for its review and consideration.

2-8 Section 4.2 was updated to remove the reference to section 4.6. Allocations will be granted per acre. In addition, the Final GSP explains that because some portion of the 525,000 acres may have never been farmed and otherwise do not overlie a portion of the Subbasin that has groundwater in sufficient quality and quantity for beneficial use, the GSA may restrict or further condition the participation of these lands in the registration and transfer programs. The balance of the comment states an opinion and does not raise a specific concern about the adequacy of the GSP. As identified in Section 4.2, the GSA will adopt Rules and Regulations, including transfers, carryover, and banking, consistent with California water law, through a robust public process incorporating stakeholder involvement beginning in 2020.

2-9 Section 4.3 was updated based on the comment provided. The balance of the comment states an opinion and does not raise a specific concern about the adequacy of the GSP. As identified in Section 4.2, the GSA will adopt Rules and Regulations, including transfers, carryover, and banking, consistent with California water law, through a robust public process incorporating stakeholder involvement beginning in 2020. However, the comment is noted for the record and will be forwarded to the decision-making body for its review and consideration.

2-10 The pumping reduction program will provide a regional benefit to the Subbasin and ensure all interested parties have access to water. This comment states an opinion and does not raise a specific concern about the adequacy of the GSP. As identified in Section 4.2, the GSA will adopt Rules and Regulations, consistent with California water law, through a robust public process incorporating stakeholder involvement beginning in 2020. However, the comment is noted for the record and will be forwarded to the decision-making body for its review and consideration.

2-11 In Section 4.2, the GSA will adopt Rules and Regulations, including transfers, carryover, and banking, consistent with California water law, through a robust public process incorporating stakeholder involvement beginning in 2020. This comment states an opinion and does not raise a specific concern about the adequacy of the GSP. However, the comment is noted for the record and will be forwarded to the decision-making body for its review and consideration.

Letter 3 Response	Leadership Counsel for Justice and Accountability Amanda Monaco and Nataly Escobedo Garcia October 31, 2019

3-1 In general, this comment states an opinion and does not raise a specific concern about the adequacy of the GSP. However, the comment is noted for the record and will be forwarded to the decision-making body for its review and consideration.

It should also be noted that during an in-person meeting on August 14th and the letter dated on September 13th, the Leadership Counsel for Justice and Accountability (Leadership Counsel) and the WWD GSA discussed the fact that neither party is aware of any known contaminants in the Subbasin and thus the comment regarding contamination plumes provided in your letter does not apply to the Westside Subbasin. By maintaining pre-2015 conditions, implementation of the Groundwater Sustainability Plan (GSP) will avoid degradation of water quality for all beneficial uses, including drinking water for disadvantaged communities.

A summary of the water budget for the historic, current and projected water budget analysis periods is provided in the GSP per SGMA regulations. A report on the development, calibration and findings from the groundwater model used to develop these estimates has been prepared and will be submitted as an appendix to the final GSP.

3-2 The WWD GSA developed the Draft GSP in accordance with Article X, Section 2 of the California Constitution, common law water rights doctrine, the Sustainable Groundwater Management Act, California the Department of Water Resources' (DWR)'s Emergency GSP Regulations and DWR's Best Management Practices. By maintaining pre-2015 conditions, implementation of GSP will avoid degradation of water quality for all beneficial uses, including drinking water for disadvantaged communities such as Cantua Creek and El Porvenir. Other sections of this comment state an opinion or makes general statements and does not state specific concerns about the adequacy of the Draft GSP. The comment is acknowledged for the record and will be forwarded to decision-making body for its consideration.

3-3 The GSA has been and continues to be committed to an open and transparent GSP development process. To date, the GSA has held 17 workshops, received 45 staff updates and provided 2 outreach events in Cantua Creek. The outreach events in the community were held at the times requested by the community. The GSA has also spearheaded a substantial proactive community outreach effort, in which the GSA has worked closely with the Leadership Counsel to provide outreach to the communities within the GSA by mailing workshop notices, providing information in both English and Spanish, and providing translation services at the GSA workshops. During GSP implementation, the WWD GSA will continue outreach efforts for all beneficial user groups.

WWD GSA already follows this process and indicated such in section 2.1.5 of the GSP.

3-4 The WWD GSA made the data available, however, due to website limitations not all appendixes were posted online but were made available upon request. The final GSP, including all appendices, will be posted on the DWR website.

Table 2-9 shows modeling results for inflows and outflows. Table 2-10 summarizes the total amount of surface water delivered over a ten-year period. The tables do not need to be modified; however, the section 2.3.3.1 description was modified in response to this comment.

Agricultural water demand accounts for the vast majority of groundwater use in the Subbasin. Municipal, industrial and residential water demand was accounted for in the groundwater model by assigning an urban and residential land use class. Municipal, residential and industrial water demand was aggregated with agricultural demand for reporting purposes. Estimated water demand from domestic wells is small relative to the total groundwater budget and very likely represents less than one tenth of one percent of the total groundwater budget.

Modeling to support the groundwater allocation framework in Project and Management Action (PMA) No. 2 includes changes in irrigated land that fluctuates based on water availability. Land use assumptions are further detailed in Appendix I.

The Subbasin intends to achieve sustainability with respect to groundwater levels and storage. This will be clarified in the GSP.

This inconsistency is described in detail in Appendix I. This discrepancy occurs due to the surface water supply exceeding the demand within the groundwater model for a given period. This occurs as a result of coarse (nonspecific) or inconsistent land use data from DWR surveys, poor quantification of cultural irrigation practices and a more limited understanding of surface water distribution particularly in early years within the calibration period. We recognize this as a limitation and are working with the code developers at USGS in improving the model platform to better account for these uncertainties.
The baseline water budget presented in the GSP does not demonstrate groundwater sustainability by 2040. Groundwater sustainability will require implementation of the groundwater pumping allocation framework and other Projects and Management Actions set forth in Chapter 4 to achieve sustainability. The baseline model run relies on a fixed land use developed in accordance with CCR §354.18(c)(3) which states: "Projected water demand shall utilize the most recent land use, evapotranspiration, and crop coefficient information as the baseline condition for estimating future water demand." Modeling developed to support PMA No. 2 (groundwater allocations) was developed to include adaptive fallowing to alleviate groundwater overdraft and is detailed in Appendix I. The model simulation for PMA No. 2 does not simulate overdraft conditions.

3-5 The WWD GSA maintained an open line of communication with the communities and the County Service Area representatives in the Westside Subbasin. See Response to Comment 3-3. As indicated in Chapter 3, the GSA developed the sustainable management criteria's minimum thresholds and measurable objectives consistent with the DWR's Best Management Practices and applicable DWR GSP Emergency Regulations (GSP Regulations, §§ 354.22 et seq.).

Minimum thresholds are established to protect 2015 groundwater levels in the Subbasin. WWD GSA is not aware of any domestic, municipal or industrial wells going dry in 2015 and 2016 during severe drought conditions; thus, the GSP's undesirable results are protective of all beneficial uses, including domestic well owners and disadvantaged communities. No data was provided by the Leadership Council that shows otherwise. As explained in Chapter 6, the WWD GSA will continue to collaborate with disadvantaged community beneficial users.

The WWD GSA offers the following response to the concern regarding dewatering of wells, and the request that there must be a process to address threats to drinking water wells. Historically, groundwater levels within the Westside Subbasin have fluctuated from year to year, largely dependent upon the availability of surface water and associated use of groundwater as an alternative water supply. The GSP anticipates that these historical fluctuations will occur above established defined thresholds for the purpose of avoiding undesirable results. Because the GSP will manage water levels consistent with 2015 conditions then prevailing in the Westside Subbasin, it is not expected that existing wells will be impaired. New wells should be drilled to reasonable depths and perforated within zones likely to supply the quantity and quality of water required for beneficial use during wet and dry cycles.

A groundwater well operated at a level that is not in conformity with the prevailing standards within the Westside Subbasin may not constitute a reasonable method of use and there is no property right or requirement that an unreasonable method and manner of use be maintained. (J*oslin v. Marin Municipal Water District* (1967) 67 Cal.2d 135.) However, to the extent any person or entity believes that they are being adversely impacted by the implementation of the GSP and the failure to maintain a specific groundwater level for the purpose of protecting the production capacity of a specific groundwater well(s), they may avail themselves of the Complaint procedures set forth in Chapter 6. They may seek an evaluation by the Technical Advisory Committee and the GSA Board, including any special considerations if the identified wells provide potable drinking water for beneficial use and any further relief.

The GSA retains discretion and authority to enter into or recommend a “physical solution” where necessary to avoid undesirable results and substantial injury to landowners. (*City of Lodi v. East Bay Mun. Dist*. (1936) 7 Cal.2d 321.)

3-6 SGMA does not attempt to resolve all water quality issues but aims to ensure that operation of a basin within its sustainable yield does not cause undesirable results, including water quality degradation. Water Code Section 10727.2 and the GSP regulations require GSAs to characterize the groundwater quality and identify undesirable results associated with groundwater quality in the GSPs for their basin. Consistent with State Water Board Guidance, any projects or management actions adopted by a GSA within their GSPs should not cause degradation of water quality that could lead to an undesirable result. It is the responsibility of a GSA to ensure that *its* management of groundwater conditions in the basin and *any other action taken by the GSA* will not significantly and unreasonably degrade water quality. A GSA’s authority does not, however, limit or supersede the authorities of the State Water Board, the Regional Water Quality Control Boards (Regional Water Boards), the California Department of Public Health, or county or city governments (Water Code §10726.8 (a), (e), & (f)).

As provided in Sections 2.2.2.2 and 3.2.4 of the GSP: The measurable objectives for minimizing the degradation of groundwater quality from human activities is based on groundwater sample concentrations not exceeding the historic trends in background groundwater quality along with a degradation rate attributed to human activities and beneficial uses that does not exceed the existing or planned Basin Plan Amendments. Based on the review of groundwater quality, the constituents evaluated for all beneficial users are TDS, which is a proxy for other constituents. The basis for establishing the measurable objective is to minimize the additional contribution of TDS from human activities that would degrade water quality, rather than attempt to improve naturally-occurring, background water quality that in some areas is impacted by marine sediments from the Coast Range.

At a minimum, for municipal and domestic wells, water quality must meet potable drinking water standards specified in Title 22 of the California Code of Regulations. For irrigation wells, water quality should generally be suitable for agriculture use. The WWD GSA will continue to use the existing water quality monitoring network to assess Subbasin conditions, and further develop the groundwater quality network over the GSP's planning and implementation horizon, in accordance with adaptive management needs and as necessary to meet the GSP's sustainability goal. The GSP indicates that in general water quality in the Subbasin is good and generally meets regulatory standards for intended beneficial use, although there are some areas in which TDS, boron, selenium, arsenic, and sulfate may exceed drinking water standards in the shallow portions of the Upper Aquifer. The elevated concentrations of these constituents are primarily naturally occurring as a result of the geologic composition of the aquifer materials (from the Coast Range) (USGS, 2017). Available Subbasin-wide data does not suggest that domestic wells will be impaired by **increasing** groundwater contamination as a result of GSP implementation.

Fresno and Kings Counties review the water testing results submitted by the owner or their certified laboratory to verify potable quality for domestic use. However, it remains the responsibility of the private well owner to maintain the ongoing health standards and safety of their water supply. At a minimum, testing for bacteria and nitrates is required by an owner or applicant to verify a potable water supply prior to Counties' issuance of a building or septic system permit. If the water sample results do not meet health standards for drinking water, or if an applicant fails to submit water testing results from a private water well, building occupancy will not be granted by the Counties. By proactively monitoring groundwater levels and groundwater quality in the Subbasin, the GSA will be able to ascertain if undesirable results to domestic well owners will potentially result in impairment to beneficial use.

It is noted that private domestic wells require regular maintenance and typically have an average lifespan of 30 to 50 years with pump lifespans of 5 to 10 years. One well failing in the Subbasin does not necessarily indicate an impairment or an undesirable result. Well failure can be the result of several factors including but not limited to age, well casing material and depth, screen and filter pack clogging due to bio-fouling or mineral encrustation and poor well construction. If it is determined that declining groundwater levels or deteriorating water quality is the result of management actions taken by the GSA, then the GSA will evaluate potential impacts and options at that time.

Minimum thresholds are established at representative monitoring sites established in accordance with guidelines published by DWR.

3-7 There are no known subsidence issues affecting disadvantaged communities. No subsidence issues were identified during preparation of the Hydrologic Conceptual Model or brought up at public meetings to date. During GSP updates, the WWD GSA will continue to review all available subsidence data.

3-8 The initial GSP effort will fill substantial gaps in groundwater quality information within the Subbasin. There are very few wells (particularly in the Upper Aquifer) meeting DWRs criteria for inclusion in the groundwater quality monitoring. The GSA intends to review groundwater quality measurements collected for the Irrigated Lands Regulatory Program to gain a better understanding of current groundwater quality conditions within the Subbasin. Subsequent annual and 5-year updates will continue to identify and fill water quality data gaps. The GSP will be updated to describe a revised monitoring network.

3-9 Chapter 4's projects and management actions are all augmentation strategies designed to increase storage, increase groundwater levels, and define a path to achieve sustainability. Further projects and managements actions defined in Chapter 4 are drought mitigation measures that benefit all beneficial users of groundwater. The comment is inaccurate regarding project information and does not constitute substantial evidence.

3-10 This comment states an opinion or makes general statements and does not state specific concerns about the adequacy of the Draft GSP. The comment also cites to well data not relevant to the Westside Subbasin, based on information reviewed during the preparation of the Draft GSP. The comment is acknowledged for the record and will be forwarded to the decision-making body for its consideration.

3-11 Clusters of domestic groundwater wells do not exist in the Westside Subbasin. The GSP includes a robust Aquifer Storage and Recovery (ASR) project in Chapter 4 that will benefit all beneficial users. The comment is inaccurate regarding project information and does not constitute substantial evidence.

3-12 Pumping buffer zones are provided for in PMA No. 4. While the current rationale for PMA No. 4 is to address subsidence issues around the SLC identified by DWR and United States Bureau of Reclamation (USBR), as the GSP states "...the GSA has developed a process to require groundwater pumping reductions in portions of the Subbasin and when necessary to immediately and directly relieve the groundwater pumping stress when continued pumping would produce significant undesirable results."

3-13 The majority of this comment states an opinion or makes general statements and does not state specific concerns about the adequacy of the Draft GSP. The comment is acknowledged for the record and will be forwarded to the decision-making body for its consideration. Further, as described in Section 4.2, the GSA will adopt Rules and Regulations, consistent with principles of California water law, through a robust public process incorporating stakeholder involvement, including from non-profit organizations, beginning in 2020. Further, as set forth above and in the response to comment 1-1, the District identified potential ISWs and GDEs through DWR's recommended NCCAG dataset. As described in Chapter 2 and the supporting documentation, groundwater levels are generally thirty feet or more below ground surface, including in areas identified as potential ISWs and GDEs by the NCCAG dataset. Consequently, the withdrawal of groundwater in a manner consistent with the stated thresholds should not present a risk of surface water depletion and significant and unreasonable adverse impacts, including to fish, wildlife, and aquatic habitat resources. However, monitoring facilities and historical data, outside of the monitoring well data utilized to develop the Westside Subbasin GSP, are not presently available to assess the presence of ISWs and GDEs in sufficient detail to establish more specific sustainable management criteria. (See Section 3.2.5.) Thus, this sustainability indicator has been identified as a data gap. Section 2.2.2.4.1 and Section 3.8.7 describe how the District plans to address the data gaps associated with ISWs, including the plan to install shallow wells on the western part of the Subbasin to determine if there is an impact on potential ISWs or GDEs from groundwater pumping. The District has retained discretion to, where necessary, accelerate and impose management measures as may be required to avoid causing undesirable results, including a substantial depletion of ISWs resulting in a significant and unreasonable impact on fish, wildlife, and aquatic habitat, and to balance public trust values. (See GSP Chapter 4.).

3-14 This comment states an opinion or makes general statements and does not state specific concerns about the adequacy of the Draft GSP. The comment is acknowledged for the record and will be forwarded to the decision-making body for its consideration. With regards to SGMA fees, as discussed in public meetings, communities such as Cantua Creek and El Porvenir with be exempt from a SGMA fee.

3-15 The WWD GSA disagrees that the GSP does not contain adequate plans for community engagement in the plan. The GSA has been and continues to be committed to an open and transparent GSP development process. To date, the GSA has held 15 workshops and received 40 Board updates. The GSA has spearheaded a substantial proactive community outreach effort, where GSA have worked closely with the Leadership Counsel for Justice and Accountability (Leadership Counsel) to provide outreach to the communities within the GSA by mailing workshop notices, develop information in English and Spanish, and provide translation services at the GSA workshops. The GSA has and will continue to meet with interested parties because the interests of the community are important and community input is critical to the overall development of a GSP. The GSA is now considering the outreach activities to be conducted during implementation and are committed to continued stakeholder engagement. Chapter 4 discusses public noticing in the context of each Project and Management Action specified in the GSP. In support of these efforts, Chapter 5 specifies an initial $15,000 budget to support outreach efforts, which can be amended and allocated to the most effective engagement strategies. (See Page 5-3.) Further, the WWD GSA follows a Stakeholder Outreach and Communication Plan to guide continued stakeholder engagement throughout implementation of the GSP. (Available here: https://wwd.ca.gov/wp-content/uploads/2019/10/stakeholder-communication.pdf.pdf) Additionally, the GSA will have outreach activities and meetings during the implementation phase at which there will be opportunities for seeking and incorporating feedback from the public on an ongoing basis.
Lastly, the WWD GSA also shall continue to fully comply California's Open Meeting Laws and Water Code section 10728.4, which requires all plan amendments to be approved at a public hearing. We appreciate your continued involvement to assist WWD GSA with outreach efforts.

As explained in Chapter 6, the GSA will establish an Advisory Committee ("AC") that in the discretion of the GSA will be comprised of between eight and eleven representatives from stakeholder groups within the Westside Subbasin. The purpose of the AC is to increase effective collaboration and communication between and among stakeholders, such as the Leadership Council. The GSP provides: "A minimum of 60 percent of its members shall be active agricultural groundwater producers <u>with at least one each from domestic groundwater users, Fresno County GSA representative, disadvantaged communities and non-governmental organizations."</u> (emphasis added.) The WWD GSA disagrees that this is an imbalance of interests. Instead, this provides a voice to domestic, environmental, and disadvantaged community needs.

3-16 The WWD GSA developed the Draft GSP in accordance with Article X, Section 2 of the California Constitution, common law water rights doctrine, the Sustainable Groundwater Management Act, DWR's Emergency GSP Regulations and DWR's Best Management Practices. The WWD GSA disagrees with the comment that drinking water wells will continue to go dry. This comment states an opinion or makes general statements and does not state specific concerns about the adequacy of the Draft GSP. The comment is acknowledged for the record and will be forwarded to the decision-making body for its review and consideration.

3-17 The WWD GSA developed the Draft GSP in accordance with Article X, Section 2 of the California Constitution, common law water rights doctrine, the Sustainable Groundwater Management Act, DWR's Emergency GSP Regulations and DWR's Best Management Practices. This comment states an opinion or makes general statements and does not state specific concerns about the adequacy of the Draft GSP. The comment is acknowledged for the record and will be forwarded to the decision-making body for its review and consideration.

3-18 See Response to Comment 1-1. Because potential GDEs are likely disconnected from the Subbasin's groundwater aquifer, there are no undesirable effects occurring with respect to depletions of interconnected surface waters (ISW). Accordingly, the GSP does not impact public trust resources. To the extent that monitoring determines there are ISWs, they will be addressed in the GSP annual updates.

Letter 4 Response	Leadership Counsel for Justice and Accountability Focused Technical Review October 31, 2019

4-1 Please refer to Section 3.3 for the process that that the GSA used to establish minimum thresholds., including the discussion relating to the protection of domestic wells. For further discussion, see Response to Comment 3-6. The remaining comments noted and will be forwarded to the decision-making body for its consideration along with the final GSP.

4-2 C-1: The referenced studies (Carollo and LSCE, 2015) provide details on nitrate concentrations that have historically exceeded drinking water standards. The referenced studies also indicate that due to the denitrification process, nitrate is not a chemical of concern (USGS, 2017).
C-2: The referenced studies (Carollo and LSCE, 2015) provide details on the historic concentrations of selenium, arsenic, boron, and sulfate. Additional text was added to the water quality section.
C-3: Please refer to section 3.3.5 for the process that the GSA used to establish Water Quality minimum thresholds.
C-4: Upper Aquifer TDS data are limited. Available data are presented in Chapter 2 (Basin Setting – Figure 2-41). Table 3-22 indicates which of the water quality Upper Aquifer representative sites have historical data. For those without data, nearby wells were utilized. Water quality sustainable management criteria will likely be updated once more data is collected.
C-5: Section 3.4.1.4 was updated in response to this comment.
C-6: The comment is noted for the record and shall be forwarded to the decision-making body for its consideration.
C-7: See Table 3-25 which indicates TDS and nitrate will be sampled bi-annually.

4-3 Appendix I will be submitted with the final GSP. The WWD GSA made the data available however, due to website limitations not all appendixes were posted online. These were made available by the GSA upon request. The final GSP, along with Appendix I, will be available from the Department of Water Resources website. The commenter can review the data when posted and provide comments to the Department of Water Resources during the 60-day public comment period.

Agricultural water demand accounts for the vast majority of groundwater use in the Subbasin. Municipal and industrial and residential water demand was accounted for in the groundwater model by assigning an urban and residential land use class. Municipal, residential and industrial water demand was aggregated with agricultural demand for reporting purposes. Estimated water demand from domestic wells is small relative to the total groundwater budget and very likely represents substantially less than 0.1 percent of the total groundwater budget. The GSP will be updated to describe how non-agricultural water use is accounted for in the GSP. This inconsistency is described in detail in Appendix I. The discrepancy occurs due to the surface water supply exceeding the demand within the groundwater model for a given period. This occurs as a result of coarse or inconsistent land use data from DWR surveys, poor quantification of cultural irrigation practices and a more limited understanding of surface water distribution particularly in early years within the calibration period. We recognize this as a limitation and are working with the code developers at USGS in improving the model platform to better account for these uncertainties. The GSP will be updated to clarify water budget discrepancies.

The baseline model run relies on a fixed land use developed in accordance with CCR §354.18(c)(3) which states: "Projected water demand shall utilize the most recent land use, evapotranspiration, and crop coefficient information as the baseline condition for estimating future water demand." Modeling developed to support PMA No. 2 (groundwater allocations) was developed to include land fallowing to alleviate groundwater overdraft and is detailed in Appendix I. The GSP will be updated to further clarify land use assumptions as needed. The baseline run was developed using the fixed land use, described above. PMA No. 2 (groundwater allocations) is the primary management action targeted towards more effectively managing groundwater pumping and storage through a groundwater allocation. The simulated water budget, taking the groundwater allocation into account, included in Appendix I, demonstrates stable groundwater storage through the 2040 and 2070 planning horizons."

4-4 The comment is inaccurate regarding project information and does not constitute substantial evidence. The analysis prepared in the attached figures is an inaccurate depiction of the Westside Subbasin; it has identified Upper Aquifer wells in areas of the Subbasin where only one aquifer exists. Additionally, the data used to generate the domestic well location in the Subbasin is inaccurate. Please see Figure 2-3 for a complete list of domestic wells in the Subbasin. Chapter 2 was updated to remove the confusion in displaying the GAMA network data and update the information with the *active* domestic well locations documented by the District. In 2019, the District surveyed all of the domestic well locations shown in the GAMA network and updated its records based on the survey results. The GSA found there are 38 domestic wells in the Subbasin. Lastly, the analysis appears to propagate an analysis done in an adjacent Subbasin that is not appropriate nor representative of the Westside Subbasin's aquifer characteristics.

4-5 The comment is inaccurate regarding project information and does not constitute substantial evidence. See Response to Comment 4-4. Additionally, the figure does not provide background information on how the Minimum Thresholds and Measure Objectives are projected and the GSA is unable to evaluate the figures projections.

4-6 The comment is inaccurate regarding project information and does not constitute substantial evidence. See Response to Comment 4-5.

4-7 The comment is inaccurate regarding project information and does not constitute substantial evidence. See Response to Comment 4-5.

4-8 The comment is inaccurate regarding project information and does not constitute substantial evidence. See Response to Comment 4-5.

Letter 5 Response

Kings River Water Agency
Steve Haugen
October 31, 2019

5-1

The KRWA comment letter inaccurately assumes that the ASR program discussed in the Draft GSP relied on Kings River Flood Flows. However, the WWD GSA envisions the CVP allocation as the predominate water type for injection into the Westside Basin. Westlands historically has diverted the maximum amount of water available from Kings River flood flows by agreement with the Kings River Water Association and up to the capacity of its diversion channel and pumps; such diversions already occur and would continue with or without implementation of the Ag-ASR program. In addition, the Ag-ASR program could and would be implemented regardless of whether it had access to Kings River water, as Kings River flood flows represent an insubstantial portion of the program's identified water sources.

Letter	Wonderful orchards
6	Rob Yraceburu
Response	October 31, 2019

6-1 This comment states an opinion and does not raise a specific concern about the adequacy of the GSP. As described in Section 4.2, the GSA will adopt Rules and Regulations, consistent with principles of California water law, through a robust public process incorporating stakeholder involvement beginning in 2020.

6-2 This comment states an opinion and does not raise a specific concern about the adequacy of the GSP. However, the comment is noted for the record and will be forwarded to the decision-making body for its review and consideration.

Letter 7 Response
North Fork Kings GSA
Mark McKean
October 31, 2019
7-1

7-1 The WWD GSA looks forward to coordinating with the NFKGSA regarding subsurface boundary flows and groundwater conditions in neighboring portions of the Subbasin. As stated in Section 2.3.5.4 of the GSP, our estimation of the Subbasin's sustainable yield includes maintaining historic lateral subsurface flows between the Westside Subbasin and adjacent GSAs. Projected groundwater flows in and out of the Subbasin in the baseline condition is summarized in Tables 2-15, 2-17 and 2-19 and Figures 2-69, 2-71 and 2-73 for each of the three climate change projections, respectively. Crop projections are described in detail in Appendix I, which will be included in the final GSP submittal. Crop water use can be inferred from the 'Evapotranspiration' term Tables 2-14, 2-16 and 2-18 and Figures 2-68, 2-70 and 2-72. Crop water requirements are further described in Appendix I, which will be included in the final GSP submittal.

A summary of the water budget for the historic, current and projected water budget analysis periods is provided in the GSP as per SGMA regulations. A report on the development, calibration and findings from the groundwater model used to develop these estimates has been prepared and will be submitted as an appendix to the final GSP. The WWD GSA made the data available however, due to website limitations not all appendixes were posted online, although they were made available upon request. The final GSP, along with all appendices will be available from the Department of Water Resources website. The commenter can review the data when posted and provide comments to the Department of Water Resources during the 60-day public comment period as needed.

7-2 Minimum thresholds (MTs) were established based on measured water levels in 2015 or 2016 (in many cases the lowest in the historic record) and allow for an additional 40-foot decline in non-subsidence prone areas to allow for operational flexibility. Measurable objectives (MOs) were established based on the 2016 water levels plus the hydraulic head change between 2016 and 2017 simulated in the numerical model as described in Section 3.2.1.1. In many cases, measured water groundwater levels from 2017 are already greater than the established MO. Both threshold levels were established to be protective of groundwater resources in the Subbasin and are considered achievable within the GSP implementation period.

7-3 The data gaps section has been amended in Response to Comments about characterizing the shallow portion of the Upper Aquifer. This additional monitoring may address the commenters concerns regarding monitoring. The GSA will continue to use the existing groundwater level monitoring network to assess Subbasin conditions, and further develop the groundwater level network over the GSP's planning and implementation horizon, in accordance with adaptive management needs and as necessary to meet the GSP's sustainability goal.

7-4 As indicated in the Draft GSP, the GSA plans to manage pumping in the Subbasin. The Draft GSP optimizes the use of both the Upper Aquifer and Lower Aquifer through a groundwater allocation. The groundwater allocation discussed in Section 4.2 of the Draft GSP is an augmentation strategy that is protective of 2015 groundwater levels and will not adversely impact the ability of neighboring GSAs to obtain sustainability.

7-5 Historic lateral subsurface flows into and out of the Subbasin are summarized in Figure 2-66 and Table 2-11. Projected groundwater flows into and out of the Subbasin in the baseline condition is summarized in Tables 2-15, 2-17 and 2-19 and Figures 2-69, 2-71 and 2-73 for each of the three climate change projections, respectively.

7-6 The sustainable yield estimated in the HCR was refined from 170,000 AFY to 210,000 AFY to 270,000 AFY based on results from the groundwater model. The baseline model estimated that groundwater pumping ranged from 312,000 to 466,000 AFY. When adjusted for impacts to boundary flows and declines in groundwater storage, the estimated sustainable yield ranges from 269,000 to 293,000 AFY which is consistent with the sustainable yield estimated in the historic period and within the range of independent estimates developed by WWD and the Special USBR Task Force summarized in Section 2.3.3.4 of the GSP. The projected water budget was developed using land use guidelines developed by DWR. Modeling to support PMA No. 2 includes a more representative estimation of projected land and water use. Details regarding the baseline and PMA No. 2 model runs will be provided in Appendix I submitted with the final GSP.

7-7 Development of surface water estimates followed the DWR Best Management Practices to project future surface water allocation as described in detail in Section 4.1 of the GSP. CVP allocations are based on projections developed using the CalSim II model from Coordinated Long-Term Operation of the Central Valley Project and State Water Project as recommended by DWR. This includes changes to projected imports due to climate change and environmental flows. These were adjusted to account for supplemental imports from WWD and water users based on historic amounts. This was further refined based on amounts summarized in the update to the Coordinated Operation Agreement between the DWR and USBR. Values used to adjust raw CVP allocations were taken directly from USBR December 2018 Environmental Assessment (18-35-MP). The balance of the comment states an opinion and does not raise a specific concern about the adequacy of the GSP.

7-8 The Aquifer specific allocation was developed to optimize conjunctive use in the Westside Subbasin. The groundwater pumping will be monitored in both the Upper Aquifer and Lower Aquifer to evaluate future groundwater conditions using this allocation framework. These programs will be developed in more detail with interested parties' input.

7-9 The NFKGSA inaccurately assumes that the ASR program discussed in the Draft GSP relied on Kings River Flood Flows. However, the WWD GSA envisions the CVP allocation as the predominate water type for injection into the Basin. WWD historically has diverted the maximum amount of water available from Kings River flood flows by agreement with the Kings River Water Association and up to the capacity of its diversion channel and pumps; such diversions already occur would continue with or without implementation of the Ag-ASR program. In addition, the Ag-ASR program could and would be implemented regardless of whether it had access to Kings River water, as Kings River flood flows represent an insubstantial portion of the program's identified water sources.

7-10 Comment noted for the record. We look forward to continuing to coordinate with the North fork Kings GSA.

Letter	North Kings GSA
8	Kassy Chauban
Response	October 31, 2019

8-1 See Response to Comment 7-9.

Letter 9 Response	The Nature Conservancy, Audubon California, Clean Water Action, Clean Water Fund, and Local Government Commission Jennifer Clary, Danielle Dolan, Samantha Arthur, and Sandi Matsumoto October 31, 2019

9-1 Figure 2-2 lists the Bureau of Land Management as the source. This Figure was revised to include the Disadvantaged Communities in the Subbasin based on DWR's Disadvantaged Communities (DACs) Mapping Tool (https:// gis. Water.ca.gov/app/dac).

Elevated nitrate concentrations are not present in the Westside Subbasin. Section 2.2.2. addresses nitrate in the Subbasin and Appendix I describes the historical water quality data.

9-2 Comment noted for the record.

9-3 The GSP was updated to address items identified, including:
1. A more thorough description of domestic and public supply wells in Section 2.1.1;
2. Clarifying the GSAs assessment of GDEs and interconnected surface water in Section 2.2.2.4.5;
3. Updates to Figure 2-5 based on refined knowledge of public supply wells and to show DACs to better identify beneficial users. Regulations do not require inclusion of State Water Board and DPR monitoring networks and review of these monitoring networks suggest that they do not significantly improve our existing monitoring network.

9-4 Climate change is accounted for in the groundwater model used to calculate projected inflows and outflows. See section 5.2 of Appendix I (Westside Subbasin Numerical Groundwater Flow Model) for more information. As described in Sections 2.3.6 and 2.3.7 of the GSP, the climate change sensitivity analysis was conducted (per DWR guidance) for 2070 conditions, versus the GSP planning horizon goal of 2040. The results of the climate change sensitivity analysis were used to account for variability in hydrologic inputs due to climate change projections to better evaluate impacts of projects and management actions on projected groundwater conditions.

The water budget will be updated to detail how water use by sector was calculated and separate ET by water use sector.

Updates to GDE components to water budget results will be made (if necessary) based on information obtained from addressing comments relating to the GDE approach.

9-5 The comment on management areas is noted for the record and will be forwarded to the decision-making body for its consideration.

With respect to interconnected surface water (ISW), the comment is noted for the record and shall be forwarded to the decision-making body for its review and consideration. The GSP will be updated to include a proposed monitoring network to better characterize groundwater-surface water interaction in ephemeral streams in the western portion of the Subbasin.

9-6 In Response to Comments, ISWs have been identified as a data gap and the GSP will be updated to include a proposed monitoring network to better characterize groundwater-surface water interaction in ephemeral streams in the western portion of the Subbasin (See section 3.8.9.7). The GSA has also identified data gaps with respect to GDEs. The GSP will be updated to address this data gap through the updated proposed monitoring network. See Response to Comments 1-1 and 1-13.

With respect to the comment on Table 3-7. In some instances, 2016 water levels were substantially lower than those observed in 2015. In these cases, 2016 water levels were used to establish measurable objectives. While occurring one year after 2015, these are also considered reflective of "baseline conditions".

With respect to domestic and public drinking water supply, public water supply and domestic well maps will be updated in the GSP to better illustrate communities dependent on groundwater and DACs. There are currently no DACs which rely on groundwater as a primary source of drinking water. Notably, the GSA has been informed that the City of Huron and the communities of Cantua Creek and Three Rocks (El Porvenir) intend to construct wells to serve as a primary or backup source of drinking water. However, since these wells are not yet constructed, it is not possible to evaluate projected impacts on these drinking water wells. MOs and MTs in conjunction with the monitoring network were developed in accordance with BMPs provided by DWR to monitor characterize groundwater conditions throughout the Subbasin. The methodology used was utilized to ensure that all existing beneficial users are protected from undesirable results in a manner that is operationally feasible from a monitoring perspective. It should be noted that the monitoring network can be updated in the future should the current network fail to capture undesirable results to beneficial users including those reliant on groundwater for drinking water.

With respect to the comment regarding baseline TDS concentration in representative monitoring wells, the GSA recognizes baseline water quality conditions as a data gap. The monitoring plan will include establishing baseline water quality conditions at all wells included in the monitoring well network. Wells used to establish baseline conditions will be sampled for TDS and other chemicals useful in evaluating groundwater quality. Results from the baseline assessment and subsequent monitoring results will be included in subsequent GSP reporting and updates.

Public input was considered in the development of the monitoring network MOs and MTs. This information was presented at public meetings held by the GSA and open for comment.

9-7 The GSP will be updated to evaluate potential benefits or impacts on DACs identified through DWR's Disadvantaged Communities Mapping Tool: https:// gis. water.ca.gov/app/dac. Impacts on GDEs and interconnected surface water will be monitored and addressed as necessary. However, as described in Section 2.2.2.4.1 and 2.2.2.4.5, GDEs and interconnected surface water do not appear to be of concern in the Subbasin based on existing data and analyses.

Letter 10 Response

Hulet Urban Group, Inc
Robert Urban
October 31, 2019

10-1 The WWD GSA developed the Draft GSP to account for GSP implementation cost recovery through the option of a land-based or volumetric charges. At the outset, the WWD GSA plans to recover costs via a land-based charge. In addition to the fee authority granted by SGMA, a GSA retains any separate fee authority granted to it by any other laws. (Wat. Code, § 10730.8.) The District thus may also elect to adopt a charge or assessment under its water district fee authority pursuant to Water Code section 35470 *et seq*. Additionally, it is also important to note that the GSP proposes to uniformly allocate the Sustainable Yield on a per acre basis, subject to considerations such as groundwater quality and accessibility. The groundwater allocation equitably distributes groundwater and thus, supports a land-based charge. However, the GSA retains its discretion to later adopt volumetric charges. Any fee adopted by WWD GSA shall comply with the requirements specified in Water Code section 10730 *et seq*. And the California Constitution. For additional detail regarding costs, please refer to Chapter 5.

10-2 DWR has designated the Westside Subbasin as high-priority and in critical overdraft. This means the WWD GSA must adopt a GSP, submit the GSP to DWR, and begin implementation of the GSP on or before January 31, 2020. However, SGMA does not require the sustainability goal to be achieved immediately after the GSP is implemented. Rather, the goal must be achieved within 20 years of implementation of the GSP. (See Water Code § 10727.2(b)(1).) The monitoring network was developed in accordance with BMPs provided by DWR to monitor characterize groundwater conditions throughout the Subbasin. The methodology used was designed to ensure that all beneficial users are protected from undesirable results in a manner that is operationally feasible from a monitoring perspective. It should be noted that the monitoring network can be updated in the future should the current network fail to capture undesirable results to beneficial users.

10-3 Minimum thresholds and measurable objectives were established based on SGMA, and DWR's implementing regulations and guidelines provided by DWR. (See, e.g., Water Code § 10727.2(b)(4).) They are intended to be protective of groundwater resources in the Subbasin and designed to avoid undesirable results as defined in the SGMA, including subsidence.

10-4 The Westside Subbasin GSP was published to the WWD website on September 23, 2019. The Draft GSP was available for public for 35 days. The presentation on October 30th covered Draft GSP content and was the same information presented by the GSA at Board meetings held on October 14th, 15th and 18th. The GSA also held a hearing on December 18

Commenter DFW filed a comment letter 8 days after the comment period closed, but in the interest of promoting stakeholder involvement, the WWD GSA provides the following response.

Letter	California Fish and Wildlife
11	Julie Vance
Response	November 7, 2019

11-1 The comment is noted. Section 2.1.5 and Figure 2-2 were updated to include the Mendota Wildlife Area.

11-2 The comment is noted. Section 2.2.4.4.1 was updated to identify interconnected surface waters as a data gap. The WWD GSA will consider DFW's recommendations in implementing additional monitoring. See further discussion of GDEs and ISWs in Response to Comment 1-1, 1-13, and 1-19. The GSP adequately considers impacts to GDEs and the GSA maintains there are likely no interconnected surface waters within the Subbasin. Because potential GDEs are disconnected from the Subbasin's groundwater aquifer, there are no undesirable effects occurring with respect to depletions of ISW. Naturally, this conclusion extends to fish and wildlife species that may depend on habitats located within the Subbasin. Nonetheless, as explained above, the GSA will implement additional monitoring to determine if there are any GDEs or ISWs.

11-3 Section 2.2.4.4.5 and Figure 2-14 were updated. The WWD GSA will consider DFW's recommendations in implementing additional monitoring. The eastern portion of the basin was identified as GDEs supported by irrigation. The GSA will also determine if there are interconnected surface waters in the western portion of the basin. See further discussion of GDEs and ISW in Response to Comment 1-1, 1-13, and 1-19.

11-4 The comment is noted. A sentence was added to section 2.2.4.4.6 stating that the absence of critical habitats does not exclude other potential endangered species in the Subbasin.

11-5 ISW sustainable management criteria will be developed if interconnected surface waters are confirmed in the Subbasin. GDEs that are not supported by irrigation also will be considered if their presence in the western portion of the Subbasin is confirmed. See further discussion of GDEs and ISW in Response to Comment 1-1, 1-13, and 1-19.

11-6 Comment noted for the record. The Westside Subbasin will coordinate with the Delta-Mendota Subbasin in the event of undesirable results in the Mendota Wildlife Area.

11-7 The WWD GSA acknowledges that preparation of a GSP is exempt from the California Environmental Quality Act (CEQA) but that specific projects may require CEQA compliance and approval from responsible agencies, such as DFW. WWD GSA will comply with CEQA and all other applicable rules for individual projects as they are further defined. (Water Code § 10728.6.)

12 Response to verbal comment	*Bureau of Land Management* Greg Milton October 30, 2019 Hearing

12-1 The comment is noted for the record and will be forwarded to the decision-making body for its review and consideration.

12-2 The comment is noted for the record and will be forwarded to the decision-making body for its review and consideration.

13 Response to verbal comment	Hulet Urban Group, Inc Robert Urban October 30, 2019 Hearing

13-1 See Chapter 3 for the Westside Subbasin GSP monitoring network, which includes substantial discussion of groundwater level monitoring.

13-2 See Response to Comment 10-1

13-3 The monitoring network was developed in accordance with BMPs provided by DWR to monitor characterize groundwater conditions throughout the Subbasin. The methodology used was designed to ensure that all beneficial users are protected from undesirable results in a manner that is operationally feasible from a monitoring perspective. It should be noted that the monitoring network can be updated in the future should the current network fail to capture undesirable results to beneficial users.

Extraction rates will be better quantified through metering of all production wells during GSP implementation. Within the context of SGMA, we do not see a relationship between pump efficiency and the sustainability of the aquifer.

14 response to verbal comment	Leadership Counsel for Justice and Accountability Amanda Monaco November 19, 2019
14-1	Please refer to Response to Comment 3-6.
14-2	Staff diligently worked to respond to all comments. The comments and responses to comments will be considered by the Board before the final GSP is adopted.
14-3	The Response to Comments will be included in the final GSP that is presented before the Board at the adoption hearing.
14-4	The final GSP, which includes Response to Comments, will be posted on the website prior to the meeting in which the Board considers adoption of the final GSP.

15 response to verbal comment	Mike Henry November 19, 2019 GSA meeting
15-1	As stated in Chapter 4, the targeted pumping restrictions will likely be a voluntary program in most years. In January 2020, if the program is implemented, surface water supplies will be made available to the affected landowners. In the future, if the GSA is compelled to mandate the program to avoid undesirable impacts, then the implementation requirements will be outlined in the Rules and Regulations. Over the next year, the GSA will develop the Rules and Regulations, with interested parties' input, to support the project and management actions.

Commenter Naval Air Station Lemoore filed a comment letter 26 days after the comment period closed, but in the interest of promoting stakeholder involvement, the WWD GSA provides the following response.

Letter 16 response	Naval Air Station Lemoore Commander Douglas Peterson December 19, 2019
16-1	Pursuant to Chapter 6 and the Stakeholder Communication and Engagement Plan, the WWD GSA would welcome the Naval Air Station Lemoore's (NASL) involvement on technical and advisory committees.
16-2	The WWD GSA has amended Chapter 6 to clarify that the Westside Subbasin GSP does not propose to limit NASL's federal reserved rights to the extent such rights exist under federal law.
16-3	See above.
16-4	The comment is noted for the record and will be forwarded to the decision-making body for its review and consideration.

17 response to verbal comment	Leadership Counsel for Justice and Accountability Amanda Monaco October 30, 2019 Hearing
17-1	The comment is noted for the record and will be forwarded to the decision-making body for its review and consideration.

Letter 18 response

Fresno County
Bernard Jimenez
December 13, 2019

18-1 The WWD GSA appreciates the letter of support. The letter will be forwarded to the decision-making body for its review and consideration.

Letter 19 response
Water Wise
Sarah Woolf
December 23, 2019

19-1 The comment is noted for the record and will be forwarded to the decision-making body for its review and consideration.

19-2 The comment is noted for the record and will be forwarded to the decision-making body for its review and consideration.

Letter 20 response

DWR
Ted Craddock
December 26, 2019

20-1 The comment is noted for the record and will be forwarded to the decision-making body for its review and consideration.

20-2 The Westside Groundwater Model (WSGM) simulates changes in groundwater storage at the water table and due to the compressibility of water using the Layer Property Flow (LPF) package. The change in groundwater storage due to the deformation of the aquifer matrix is simulated using the Subsidence (SUB) package. The change in storage due to the expandability/compressibility of the aquifer matrix is included in the storage values reported from model results. Since water is a relatively incompressible fluid, most of the simulated change in groundwater storage in the Lower Aquifer can be attributed to elastic and inelastic subsidence. This technical information was provided to DWR on December 16, 2019.

20-3 The WWD GSA has coordinated closely with the Department of Water Resources (DWR) to address local subsidence based on best available information. On June 25, 2018, the WWD GSA met with DWR to discuss subsidence concerns along the San Luis Canal. DWR focused its concern on areas surrounding checks 16, 17 and 21 and encouraged the GSA to utilize the Phase I California Aqueduct Subsidence Study (CASS Report) as a reference. As supported by DWR in response to comment 20-1 above, the GSA developed project and management action # 4 to reduce the reliance on the Lower Aquifer near checks 16, 17 and 21 when critical head levels pose a subsidence concern. As indicated in Chapter 3, the residual subsidence minimum threshold along the San Luis Canal was developed based on DWR's CASS report. Residual subsidence is a result of historical groundwater pumping that occurred in the region prior to the construction of the San Luis Canal and prior to development of the GSP.

The amount of residual subsidence used to develop the GSPs measurable objective (MO) for subsidence were determined based on the rate of residual subsidence (10%) assumed in DWR's CASS Report and the amount of subsidence observed during the 2012-2016 drought (DWR, 2017). Projects and management actions included in the GSP have been developed to restrict any future active subsidence near the California Aqueduct and the WWD GSA ***does not*** anticipate that the amount of active and residual subsidence described in the MO will occur in most years during the GSP implementation period. Further, as conditions in the Subbasin improve, it is expected that residual subsidence will be reduced overtime. Once the Subbasin is no longer experiencing current rates of residual subsidence, the GSA will evaluate whether it is feasible to lower the MO for subsidence during subsequent updates to the GSP.

On December 11, 2019, the WWD GSA and DWR had a follow up meeting after the State Water Project division had an opportunity to review the draft GSP. During the meeting, DWR expressed its appreciation with almost all components of the GSP with the exception of the residual subsidence rate established in the draft GSP. Through the meeting discussion, and by way of this response, the WWD GSA acknowledged DWR's disagreement with the established rate. However, DWR did not propose an alternative rate of acceptable residual subsidence for the GSA's consideration. Accordingly, the WWD GSA will maintain this MO in the Final Draft.

However, The WWD GSA recognizes that the GSP is a living document and will continue to work closely and collaborate with DWR as additional data and reports are released. To this end, WWD GSA has reserved discretion to take appropriate actions to avoid undesirable results, including significant and unreasonable land subsidence that interferes with surface land uses. As described above, these actions include to incentivize and compel targeted mitigation measures that will supply substitute water supplies to specific wells in lieu of pumping groundwater as required, to modify a sustainable management criteria in response to changing conditions and to take any actions deemed necessary and appropriate to avoid significant and unreasonable land subsidence. These measures may be implemented and enforced by the District at any time, as needed, to avoid undesirable results. (See GSP Chapter 4.)

APPENDIX I

Westside Groundwater Model

LSCE

Westside Subbasin Numerical Groundwater Flow Model Report

December 2019

Prepared for
Westlands Water District

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LIST ABBREVIATIONS & ACRONYMS

AF	Acre-feet
AFY	Acre-feet per year
ASR	Aquifer Storage and Recovery
BAS	MODFLOW Basic Package
BIS	UC Davis Basic Irrigation Scheduling
BMP	Best Management Practices
C2VSIM	California Central Valley Groundwater-Surface Water Simulation Model
CalSim II	California Water Resources Simulation Model II
CDEC	California Data Exchange Center
cfs	Cubic feet per second
CIMIS	California Irrigation Management Information System
CIR	One-Water Farm Process – Crop Irrigation Requirement
COA	Cooperated Use Agreement
CVRWQCB	Central Valley Regional Water Quality Control Board
CSS	Composite scaled sensitivity
CVHM	USGS Central Valley Hydrologic Model
CVP	Central Valley Project
DDW	California Division of Drinking Water
DIS	MODFLOW Discretization Package
DOI	U.S. Department of Interior
DWR	California Department of Water Resources
ET	Evapotranspiration
ET_0	Reference Evapotranspiration
Farm	One-Water Farm Process Water Balance Subregion
FEI	One-Water Farm Process - Evaporation due to Irrigation Parameter
FEP	One-Water Farm Process - Evaporation due to Precipitation Parameter
FMP	One-Water Farm Process
FONSI	Finding of no Significant Impact

ft	feet or foot
ft/d	feet per day
FTR	One-Water Farm Process - Consumptive use fractions of transpiration
GHB	MODFLOW General-Head Boundary Package
GIS	Geographic Information Systems
GPM	Gallons per minute
GSP	Groundwater Sustainability Plan
HCR	Hydrogeologic Conceptualization Report
K_c	Crop Coefficient
KDSA	Kenneth D. Schmidt & Associates
km	Kilometers
KRWA	Kings River Water Association
LAK	MODFLOW Lake Package
LPF	MODFLOW Layer Property Flow Package
LSCE	Luhdorff & Scalmanini, Consulting Engineers
MAE	Mean absolute error
ME	Mean error
One-Water	MODFLOW One-Water Hydrologic Flow Model Version 2.0
MNW2	MODFLOW Multi-Node Well Package Version 2
MODFLOW	Modular three-dimensional finite difference groundwater flow model
MT3D-USGS	Modular 3D Transport Modeling Software - United States Geological Survey
NRD	One-Water Farm Process - Non-routed deliveries
NRMSE	Normalized Root mean squared error
NWT	MODFLOW Newton-Raphson Solver Package
OC	MODFLOW Output Control Package
OFE	One-Water Farm Process - On-farm Efficiency Parameter
PCGN	MODFLOW Preconditioned Conjugate-Gradient Solver with Improved Nonlinear Control Solver Package
PMA	Projects and Management Action
PRISM	Prism Climate Group
R	Linear Correlation Coefficient

RMSE	Root mean squared error
ROWD	Report of Waste Discharge
SFR	MODFLOW Streamflow Routing Package
SGMA	Sustainable Groundwater Management Act
SIS	Sequential Indicator Simulation
SJR	San Joaquin River
SJRRP	San Joaquin River Restoration Program
SLC	San Luis Canal
Ss_{ke}	Elastic skeletal specific storage
Ss_{kv}	Inelastic skeletal specific storage
SSURGO	National Cooperative Soil Survey Geographic Database
SUB	MODFLOW Subsidence Package
Subbasin	Westside Subbasin
TDS	Total Dissolved Solids
TFDR	One-Water Farm Process - Total farm delivery requirement
T-ProGS	Transition Probability Geostatistical Software
UCODE 2014	Model Parameter Estimation and Sensitivity Analysis Software
UPW	MODFLOW Upstream Weighting Package
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USGS	United States Geological Survey
VIC	Variable Infiltration Capacity Modeling Software
WSGM or Model	Westside Subbasin Groundwater Model
WSIP	Water Storage Investment Program
WWD or District	Westlands Water District

EXECUTIVE SUMMARY

ES 1 MODEL DEVELOPMENT

The numerical model was developed using the One-Water Hydrologic Flow Model (One-Water) Version 2.0. One Water is a fully 3D integrated hydrologic flow modeling software developed by the U.S. Geological Survey (USGS) to evaluate groundwater-surface water interaction and conjunctive use. One-Water integrates various processes and packages to enable the robust and dynamic simulation of supply-and-demand agricultural water budgets, surface water, and groundwater flow. One-Water is based largely on the Farm Process (FMP) developed under the MODFLOW-2005 platform.

ES 1.1 Model Discretization

The groundwater model domain includes an approximately 2,700 square mile rectangular portion of the western San Joaquin Valley encompassing the Subbasin and surrounding areas (**Figure ES-1**). The western model boundary was established using a no flow boundary condition where alluvial deposits contact lower permeability consolidated marine deposits. The model domain was discretized horizontally onto an orthogonal finite difference grid with sides measuring 0.25 miles (**Figure ES-1**). The groundwater flow model was discretized vertically into 18 layers. Vertical discretization was primarily informed by the location and extent of lacustrine deposits including the Corcoran clay, Tulare Lake Beds, and A, B, C and D Clays.

The period from January 1, 1988 through December 31, 2015 was selected to calibrate the groundwater flow model. The simulation period is divided into 336 monthly stress period. Each stress period is divided evenly into two timesteps where the flow equations are calculated by the model.

ES 1.2 Boundary Conditions

The active portion of the model domain was divided into 36 areas designated as farms in FMP for which agricultural supply and demand are calculated (**Figure ES-2**). Major inputs to the Farm Process include climate data (precipitation and reference evapotranspiration), surface water deliveries, land use, crop parameters and soil parameters. These inputs were developed using a variety of District and publicly available data in conjunction with available data from neighboring GSAs.

Groundwater pumping is allocated dynamically to meet the consumptive demand within a farm. Wells Within WWD, wells were assigned based on the known location of pumping wells within the Subbasin. Outside the Subbasin, groundwater pumping was allocated from virtual wells derived from the U.S. Geological Survey Central Valley Hydrologic Model (CVHM) (**Figure ES-3**).

Lateral subsurface flow into and out of the model domain was simulated using the General Head Boundary (GHB) package. Groundwater levels in each GHB cell were assigned based on simulated water levels in adjacent cells in CVHM. Surface water features were simulated using a combination of the Streamflow Routing (SFR) and Lake packages. The Lake package was used to represent the Mendota Pool while the

SFR package was used to represent the San Joaquin River, Kings River and ephemeral streams draining the coast ranges in the western portion of the model domain (**Figure ES-4**).

ES 1.3 Aquifer Properties

Subsurface geology was incorporated into the numerical model from a combination of well log data and previous studies and reports outlined in the HCR. These data were grouped into 4 texture categories and subdivided with respect to Sierran derived sediments and Coast Range derived sediments for Upper and Lower Aquifers. The texture data used to develop a three-dimensional model of the subsurface geology within the model domain using Transition Probability Geostatistical Software (T-ProGS) (**Figure ES-5**).

Output from the geostatistical model were upscaled and merged with the spatial information of known clays to assign hydraulic properties. These include the hydraulic conductivity, specific yield and elastic and inelastic skeletal storativity used to simulate confined storage and land surface subsidence.

ES 1.4 Initial Conditions

Initial groundwater elevation in each model cell at the start of the model simulation period (January 1988) was initialized using measured groundwater elevation from wells within the model domain. Initial heads were refined to better represent vertical and horizontal gradients using a 7-year model spin-up period using average hydrologic conditions.

ES 2 MODEL RESULTS

Model calibration was achieved using trial and error and automated parameter estimation using UCODE. Model calibration for hydraulic head, subsidence and groundwater pumping were evaluated with respect to common model fit statistics. The model fit is generally adequate for targets used in model calibration and estimated parameter values fall within ranges reported in the literature and other known information.

ES 2.1 Water Budget

The water budget was calculated within the model domain and for the Subbasin for the 1989-2015 DWR water years (October through September). Water budgets are subdivided with respect to the land surface and groundwater systems. The land surface system water budget summarizes annual inflows and outflows from the FMP including precipitation, surface water imports, groundwater pumping, evapotranspiration and net deep percolation (**Figure ES-6**). The groundwater budget summarizes annual inflows and outflows from the groundwater system including deep percolation, stream leakage, lateral subsurface flow and groundwater pumping (**Figure ES-7**).

The cumulative decline in groundwater storage was nearly 517,000 AF over the historical water budget period (19,000 AFY). This amount of groundwater storage decline represents less than 4% of total outflow and less than 6% of total groundwater pumping. This suggests that the Subbasin groundwater budget is relatively balanced over the model calibration period. Given a long-term average pumping of 324,000 AFY and a decline in storage of 19,000 AFY, the approximate historic sustainable yield for the basin estimated from the WSGM is 305,000 AFY.

ES 3 PREDICTIVE MODEL DEVELOPMENT

The numerical model was used to simulate projected groundwater conditions over the 50-year planning horizon used for GSP development. Predictive scenarios were developed to conduct the projected water budget assessment, develop measurable objectives and minimum thresholds and evaluate the efficacy of projects and management actions. Predictive model scenarios were developed using guidelines outlined in the DWR Modeling BMP (2016).

ES 3.1 Baseline Model

A baseline model was developed to serve as a comparative benchmark for predictive scenarios and analysis of climate change. The baseline model relies largely on historic data over a 50-year period spanning from 1965-2015 to simulate future groundwater conditions. During periods where no historic data is available (dependent on data source), values were assigned from surrogate water years using the closest DWR Water Year Hydrologic Classification Indices (Water Year Index).

The delineation of water balance sub-areas (farms) was updated for the predictive modeling period such that the MODFLOW farms representing the District were reduced to one. Surface water imports within the model domain were assigned using output from the California Water Resources Simulation Model II which provides monthly projected diversion amounts for CVP contractors. District surface water imports from CalSim II were increased to include updated Cooperative Use Agreement benefits as well as supplemental transfers from water users and the District. Within WWD, land use provided by the district for 2016 was used to assign land use types for the entire scenario.

ES 3.2 Climate Change

Model uncertainty due to climate change was evaluated in accordance with Section 354.18(c)(3) of the GSP regulations. Model inputs for climate projections were developed using guidelines outlined in the DWR "Guidance for Climate Change Data Use During Groundwater Sustainability Plan Development" document (DWR, 2018). Based on these guidelines, model runs reflecting the central tendency of 2030 (near future) and 2070 (late future) of the ensemble of climate scenarios provided by DWR were selected such that three total climate projections were evaluated:

- No Climate Change
- 2030 Climate Change
- 2070 Climate Change

Model inputs altered for projections influenced by climate change include surface water deliveries, streamflow, reference evapotranspiration and precipitation.

ES 3.3 Projects and Management Actions

Model projections were used to evaluate Projects and Management Actions (PMAs) considered by WWD as part of GSP preparation and described in Chapter 4 of the GSP:

1. Project No. 1 – Surface Water Imports
2. Project No. 2 – Initial Allocation of Groundwater Extraction
3. Project No. 3 – Aquifer Storage and Recovery
4. Project No. 4 – Targeted Pumping Reductions
5. Project No. 5 – Percolation Basins

Of these, PMAs No. 2 through 4 were simulated using the groundwater model to evaluate impacts. PMA 1 is considered an existing management action which was included in the Baseline model projection. PMA No. 5 is still in the early phases of development and lacks sufficient information to simulate using the numerical model.

ES 4 PREDICTIVE MODEL RESULTS

Analysis of predictive model results focus on output from the GSP current water budget year (2016), the 20-year GSP planning horizon in 2040 and the 50-year GSP planning horizon in 2070. Results include land surface and groundwater budgets, groundwater levels, change in groundwater levels and subsidence. Relative differences between the baseline and a given PMA are also assessed to evaluate the efficacy of each project.

ES 4.1 Baseline Model

The WSGM Baseline model simulates relatively stable groundwater conditions through 2040, but a considerable amount of groundwater overdraft over the 50-year GSP planning horizon (**Table ES-1**). Groundwater overdraft is substantial over both periods in the 2070 Climate Change projection where less surface water is assigned to WWD on average. Simulated groundwater levels show a commensurate decline at the end of 2070 but are relatively stable in the No Climate Change and 2030 Climate change runs at the end of the 20-year planning horizon. Simulated subsidence is considerable (particularly in the southern portion of the Subbasin) at the end of the 50-year planning horizon in the No Climate Change and 2030 Climate Change projections. Simulated subsidence in the 2070 Climate Change projection is substantial at the end of the 20-year planning horizon and severe at the end of the 50-year period.

Table ES-1: Projected Change in Groundwater Storage in the Westside Subbasin

Scenario	No Climate Change (afy)		2030 Climate Change (afy)		2070 Climate Change (afy)	
	2040	2070	2040	2070	2040	2070
Baseline	-9,000	-53,000	-8,000	-47,000	-66,000	-112,000
PMA No. 2	22,000	-7,000	23,000	-8,000	7,000	-11,000
PMA No. 3	4,000	-47,000	5,000	-42,000	-54,000	-107,000
PMA No. 4	-9,000	-51,000	-8,000	-45,000	-66,000	-107,000

Sustainable yield for the Subbasin was estimated using a methodology to account for groundwater overdraft and changes in aggregate lateral subsurface flow between the Subbasin and adjacent GSAs. Accordingly, the estimated sustainable yield calculated from the Baseline model scenario results ranges from 267,000 AFY to 294,000 AFY (**Table ES-2**).

Table ES-2: Projected Sustainable Yield in the Westside Subbasin

Scenario	No Climate Change (afy)		2030 Climate Change (afy)		2070 Climate Change (afy)	
	2040	2070	2040	2070	2040	2070
Baseline	267,000	270,000	269,000	271,000	290,000	294,000
PMA No. 2	276,000	261,000	277,000	266,000	258,000	241,000
PMA No. 3	303,000	294,000	306,000	294,000	320,000	317,000
PMA No. 4	267,000	268,000	269,000	271,000	290,000	294,000

ES 4.2 PMA No. 2

Simulated results from the numerical model show substantial benefits to the aquifer system in response to PMA No. 2. Results from the No Climate Change, 2030 Climate and 2070 Climate Change simulations show groundwater storage is relatively stable over the 20 and 50-year GSP planning horizons compared to the Baseline model scenarios (**Table ES-1**). These improvements are also simulated in simulated in the spatial distribution of groundwater levels and groundwater and subsidence.

The PMA No. 2 simulates more optimal use of water and land management. Incorporating flexibility in irrigated acreage with respect to available water supply is more representative of agricultural practices within the Subbasin. This scenario also optimizes the utilization of available water supply and reduces groundwater pumping during dry periods mitigating impacts on the aquifer system.

Estimated sustainable yield ranges from 267,000 AFY to 278,000 AFY in the 20-year planning horizon and from 249,000 AFY and 263,000 AFY in the 50-year planning horizon (**Table ES-2**).

ES 4.3 PMA No. 3

Results from the No Climate Change, 2030 Climate and 2070 Climate Change simulations show increased groundwater levels particularly in the Lower Aquifer surrounding injection periods (shown in 2040). Results from the end of the 50-year planning horizon suggest that benefits tend to dissipate after several years. Groundwater levels at the water table are not substantially impacted by injection presumably because injection occurs at depth and due to differences in how water is stored and released from an unconfined system (water filling and draining pore spaces) compared to a confined system (matrix deformation). Results suggest that water injected for ASR produces a net increase in lateral subsurface flow accounting for the majority of water injected. Groundwater storage increases by between a 21% and 22% of the proportion of injected water

Estimated sustainable yield ranges from 303,000 AFY to 320,000 AFY in the 20-year planning horizon and from 294,000 AFY and 317,000 AFY in the 50-year planning horizon (**Table ES-2**).

ES4.4 PMA No. 4

Simulated results from the numerical model show localized benefits to the aquifer system in response to pumping reductions near Check 16, 17 & 20. Relative differences in groundwater levels are more pronounced in the Lower Aquifer (where pumping occurs) and are generally isolated to the time period during and shortly after pumping reductions are implemented. Simulated impacts of pumping reduction on groundwater storage are less substantial. Relative impacts to land surface subsidence are also relatively localized to the areas where pumping reductions are simulated. Relative impacts are substantially greater in the 2070 Climate Change projection where total subsidence is greater.

Estimated sustainable yield ranges from 267,000 AFY to 290,000 AFY in the 20-year planning horizon and from 268,000 AFY and 2940,000 AFY in the 50-year planning horizon (**Table ES-2**).

ES 5 SUMMARY AND CONCLUSIONS

An integrated hydrologic model (WSGM) was developed for the Westside Subbasin to support SGMA analysis and the preparation of a GSP. The model was calibrated to historic groundwater levels, subsidence and compaction measurements and estimated groundwater pumping and provides insights into hydrologic responses in the Subbasin. The model was calibrated to historical groundwater levels, groundwater pumping and subsidence and compaction data.

WSGM was used to simulate projected groundwater conditions through the 50-year GSP planning horizon ending in 2070. Model inputs were developed based on GSP modeling BMPs published by DWR used to develop a Baseline scenario. The model was developed using a combination of historic data and projected surface water deliveries and land use. Short term (2030 Climate Change) and long term (2070 Climate Change) were also considered. The model was used to evaluate projected groundwater conditions and the efficacy of proposed PMAs.

Results from the projected model were used to evaluate land surface water budgets, groundwater budgets and sustainability indicators (water levels, subsidence and groundwater storage). Output from the predictive model runs suggest:

- The Baseline model run results shows substantial declines in groundwater levels and groundwater storage and considerable amounts of land surface subsidence
- Simulated impacts are exacerbated in the 2070 Climate Change projection
- The model shows that implementation of PMA No. 2 substantially alleviates impacts on sustainability indicators through management of groundwater pumping and irrigated acreage.
- The model shows that groundwater injection simulated in PMA No. 3 results in moderate impacts to sustainability indicators
- The model shows that pumping reductions simulated near the SLC in PMA No. 4 leads to localized reduction in land surface subsidence and can substantially alleviate subsidence impacts near the canal
- Sustainable yield calculated from output from all scenarios ranges roughly between 250,000 and 300,000 AFY.

1 INTRODUCTION

This Numerical Model Report for the Westside Subbasin (Subbasin) groundwater sustainability plan (GSP) has been prepared for the Westlands Water District (WWD) groundwater sustainability agency (GSA) to summarize the development and calibration of the Westside Subbasin Groundwater Model (WSGM or model), a numerical integrated hydrologic model. This report includes a summary of model development, calibration, model results including water budgets, and analysis of projected projects and management actions.

1.1 Background

The model was developed to simulate surface and near-surface farm-related processes and groundwater movement in the Subbasin. The development of a calibrated model is intended to support WWD water resources management activities and GSP development and implementation. The model utilizes data that is described in the Hydrogeologic Conceptualization Report (HCR) (LSCE, 2018) and the Basin Setting section of the GSP to improve the understanding of hydrologic processes and their relationship to key sustainability metrics within the Subbasin. The model was also developed to be used as a platform to develop predictive modeling scenarios aimed at evaluating the impact of future management actions, projects, and adaptive management strategies used to reach sustainability objectives in the Subbasin as part of GSP implementation.

1.2 Objectives and Approach

Numerical groundwater models are structured tools developed to represent the physical basin setting and simulate groundwater flow, or flow and transport processes by integrating a multitude of data (e.g. lithology, groundwater levels, surface water features, groundwater pumping, etc.) that compose the conceptualization of the natural geologic and hydrogeologic environment. The model of the Subbasin was developed in accordance with the best management practices developed by the California Department of Water Resources (DWR) (DWR, 2016). The objective of the calibrated model documented in this report is to simulate historical hydrologic conditions in the Subbasin. The modeling approach was developed to effectively quantify key hydrologic processes related to SGMA sustainability indicators that may or have occurred in the Subbasin:

1. Lowering of Groundwater Levels
2. Reduction of Groundwater Storage
3. Degraded Water Quality
4. Land Subsidence
5. Depletion of Interconnected Surface Water

The numerical model was developed using the United States Geological Survey's USGS) One-Water Hydrologic Flow Model Version 2.0 (Hanson et al., 2014) (One-Water). This code was selected as the modeling platform due to its versatility in simulating crop-water demands in the predominantly agricultural setting of the Subbasin, groundwater surface-water interaction and the ability to couple with a robust and peer-reviewed solute transport code MT3D-USGS (Bedekar et al., 2016). The model was calibrated to a diverse set of available historical data using industry standard techniques including trial and error and automated parameter estimation. Model sensitivity was evaluated using a mathematically and statistically robust approach provided in UCODE 2014 (Poeter et al., 2014). The solute transport model was not used in the development of the GSP and therefore is not described further in this report.

1.3 Report Organization

This report is organized into the following sections:

- Section 2: Model Code
- Section 3: Model Development
- Section 4: Groundwater Flow Model Results
- Section 5: Predictive Model Development
- Section 6: Predictive Model Results
- Section 7: Predictive Model Analysis
- Section 8: Model Uncertainty and Limitations
- Section 9: References

2 MODEL CODE

The model cod selected for the Subbasin model is described below. The model code that was selected is in the public domain and suitable for GSP purposes. The decision to select the model code for the Subbasin model was based on providing WWD with a modeling tool that can be used for multiple purposes, including GSP development and other regulatory programs. With these objectives in mind, the code described below was determined to be most suitable.

2.1 MODFLOW One Water Hydrologic Model Version 2.0

The One-Water Hydrologic Flow Model (One-Water) is an integrated hydrologic flow modeling software developed by the USGS to evaluate groundwater-surface water interaction and conjunctive use (Hanson et al., ***2014***). One-Water integrates various processes and packages to enable the robust and dynamic simulation of supply-and-demand agricultural water budgets, surface water, and groundwater flow. One-Water is based largely on the Farm Process (FMP) developed under the MODFLOW-2005 platform (Harbaugh, 2005). Similar to previous versions of MODFLOW, One-Water is a three-dimensional, finite difference modeling code which utilizes the concept of modularization to represent various aspects of the hydrologic system (McDonald and Harbaugh, 1988). Modularization is represented by individual model code packages that simulate different water budgets and other processes that occur in groundwater basins.

2.2 Model Packages

The components of the model (model packages) utilized in the model of the Subbasin are described below.

Basic Package: The MODFLOW Basic (BAS) package specifies the location of active and inactive model cells and initial heads used at the start of the simulation.

Discretization Package: The MODFLOW Discretization (DIS) package specifies the spatial and temporal model geometry. The spatial discretization includes the row and column spacing and model cell top and bottom elevations. The temporal discretization includes the number and length of model stress periods and timesteps. A MODFLOW stress period is a length of time where specified model stresses are constant. A stress period may be broken up into one or more timesteps for which flow equations are solved.

Output Control Package: The Output Control (OC) package specifies the printing of simulated groundwater heads and volumetric budget.

Preconditioned Conjugate-Gradient Solver with Improved Nonlinear Control Package: The Preconditioned Conjugate-Gradient Solver with Improved Nonlinear Control (PCGN) package (Naff and Banta, 2008) is used to solve the system of hydrologic equations governing groundwater flow and groundwater-surface water interaction. The PCGN package is used in models where there is substantial nonlinearity. Unlike the standard Preconditioned Conjugate-Gradient package, the PCGN package provides added stability in these types of simulations by solving linear approximations of nonlinear equations and solved using Picard iteration.

Layer Property Flow Package: Layer Property Flow (LPF) package specifies the hydraulic properties within model cells. These include the horizontal hydraulic conductivity, vertical hydraulic conductivity, specific yield and specific storage.

Subsidence Package: The Subsidence (SUB) package is used to simulate changes in groundwater storage and compaction of aquifer systems. The SUB package accounts for storage changes due to the deformation of the aquifer system in confined aquifers, while the LPF package accounts for storage changes due to specific yield and the compressibility of water.

Multi-Node Well Package: The Multi-Node Well (MNW2) package is a head dependent flux boundary condition used to simulate pumping from wells which penetrate multiple model cells vertically. As applied in this model, the MNW2 package includes corrections for the hydraulic head inside of a well using the Theim (1906) equation based on the well radius, transmissivity and hydraulic head within a model node.

General-Head Boundary Package: The General-Head Boundary (GHB) package is a head dependent flux boundary condition used in this model to simulate lateral subsurface flow into and out of the model domain. The flux between a model cell and GHB cell is calculated based on the hydraulic head in the model and GHB cell and the conductance specified between them.

Streamflow Routing Package: The Streamflow Routing (SFR) package is used to simulate streams and groundwater-surface water interaction in the model.

Lake Package: The Lake (LAK) package is used to simulate lakes and exchange between lakes and groundwater in the model. The LAK package also allows for interaction with streams within the model domain.

2.3 Farm Process

The MODFLOW Farm Process (FMP) was developed for MODFLOW to dynamically simulate water supply and demand components in irrigated agricultural landscapes (Schmidt, 2004; Schmidt et al., 2006). These include plant water demand, evaporation, precipitation, surface water delivery, groundwater pumping, direct groundwater uptake by plants and deep percolation to the water table from applied irrigation (**Figure 2-1**). One of the primary advantages of FMP is that irrigation demand and water supply are dynamically coupled to the groundwater system such that root water uptake and groundwater pumping vary depending on the water table elevation providing a robust link between these systems.

In a strict sense, FMP is a “demand-driven and supply constrained model structure”, where the model estimates the groundwater pumping required to meet irrigation demand for a given farm within the model domain (Hanson et al., 2014). The irrigation demand, or total farm delivery requirement (TFDR), is a function of the irrigation requirement (CIR) and on-farm irrigation efficiency (OFE):

$$TFDR = \sum_{Farm} (CIR/OFE)$$

with

$$CIR = T_i + E_i$$

where:

CIR	is the crop irrigation requirement
T_i	is the transpiration supplied by irrigation ($T_i = T_{c\text{-}act} - T_{gw\text{-}act} - T_{p\text{-}act}$)
$T_{c\text{-}act}$	is the crop transpiration requirement
$T_{gw\text{-}act}$	is the portion of transpiration supplied by groundwater at steady-state
$T_{p\text{-}act}$	is the portion of transpiration supplied by precipitation at steady-state
E_i	is the evaporation loss from irrigation
OFE	is the on-farm efficiency, defined as the fraction of beneficially applied irrigation water to the field (specified)

In simplified terms, the water demand for a given farm (composed of evaporation and transpiration) is first met by uptake from groundwater (in instances where the crop roots intersect the water table), precipitation, and surface water supplies. If the crop water demand exceeds this supply, then the water demand will be met by groundwater pumped from wells. The FMP prioritizes irrigation supply to utilize available surface water deliveries for a given farm first and any additional demand (if necessary) is through groundwater pumping.

2.4 Parameter Estimation

Parameter estimation was conducted using UCODE 2014 (Poeter et al., 2014). UCODE is a parameter estimation code that calculates model parameters which minimize the model error (or difference between observed data and simulated values). This is achieved using modified Gauss-Newton iteration (Marquardt-Levenberg method) which minimizes the least squares objective function value *(Sb).*

As part of the parameter estimation process, the sensitivity of the simulated values is calculated (Hill and Tiedman,2007). The sensitivity of all (or groups of) simulated parameters are summarized by the "composite scaled sensitivity" (CSS). The CSS is used to determine which parameters affect simulated model equivalents (such as water levels or subsidence) the most. This approach provides a statistically robust approach to model sensitivity analysis (Hill and Tiedman, 2007).

3 MODEL DEVELOPMENT

This section describes the spatial and temporal (time-series) structure of the model and the input data that was utilized for model development. The model development process utilized data and information that was available at the time of model development and is described in greater detail in the hydrogeologic conceptual model report (LSCE, 2018). Additional data has been collected since model development, especially in areas surrounding the Subbasin that are within the extent of the model domain. These data will be incorporated in future model updates.

3.1 Discretization

The discretization of the model describes the spatial extent of the modeled area, the model layering and model cell size, along with the temporal or time series element of the model. The discretization of the model focused on creating a model structure that would allow the model to simulate groundwater conditions on a Subbasin scale and also on a subarea or "farm" scale with sufficient detail and resolution that is balanced by the length of time (run time) for each model run. This model is not intended to provide information or results on a resolution down to a to a parcel or well scale. For those purposes, a more local, site specific model that is carved out of this model would be recommended.

3.1.1 Spatial Discretization and Model Layering

The groundwater model domain includes an approximately 2,700 square mile rectangular portion of the western San Joaquin Valley encompassing the Subbasin and surrounding areas (**Figure 3-1**). The model domain includes a minimum distance of five miles from the Subbasin boundary to capture the impacts of potential management strategies in the Subbasin on adjacent subbasins to the east, north and south. This buffer was selected based on preliminary groundwater pumping simulations using the USGS Central Valley Hydrologic Model (CVHM) (Faunt, et al., 2009). In these scenarios, pumping wells were added along the Subbasin boundary to evaluate the radius of influence resulting from groundwater pumping above and below the Corcoran clay. The western model boundary was established using a no flow boundary condition where alluvial deposits contact lower permeability consolidated marine deposits and volcanics as mapped by the USGS and described in the Hydrogeologic Conceptual Model Report (LSCE, 2018). The no flow boundary was selected to represent the low permeability deposits because the contribution of subsurface inflow from these deposits is likely a very small amount compared to other sources of water to the model domain. The model domain was discretized horizontally onto an orthogonal finite difference grid. The cells in the groundwater model are identified by row and column numbers. The model has 312 rows and 140 columns. The grid spacing for the model consists of squares with sides measuring 0.25 miles (**Figure 3-1**).

The top of the model was based on the land surface as determined by a 10-meter digital elevation model developed by the USGS. The bottom of the model domain was initially set as the base of post-Eocene continental deposits and base of fresh water determined by the CVHM (Faunt, et al., 2009). The lower extent of the model was later lowered by 400 feet (ft) to accommodate potential management scenarios where water is injected into wells perforated below the base of fresh water.

The groundwater flow model was discretized vertically into 18 layers (**Figure 3-2**). Vertical discretization was primarily informed by the location and extent of lacustrine deposits including the Corcoran clay, Tulare Lake Beds, and A, B, C and D Clays (LSCE, 2018; Croft and Gordon, 1968; Croft 1972).

Model layers 1 through 9 represent the aquifer system that overlies the Corcoran clay (upper aquifer). Model layers 2, 4, 6 and 8 are used to represent the A, B, C, and D clays, respectively where they are present in the model domain. Layers 3, 5, 7, and 9 represent intervening layers of generally coarser-grained materials. Model layers 10, 11 and 12 represent the Corcoran clay. The Corcoran clay encompasses the majority of the model domain except near the San Joaquin River (SJR) in the northeast and at the western extent of the model domain near the model boundary and west of Huron. Depth to the top of the Corcoran clay ranges from approximately 150 ft in the northern and northeastern area of the model domain to over 750 ft in the western and southern areas of the model domain (**Figure 3-3**). Throughout most of the Subbasin, depth to the top of the Corcoran clay exceeds 500 ft. Thickness of the Corcoran clay ranges from 40 to 120 ft. Model Layers 13 through 18 represent the aquifer system that underlies the Corcoran clay (lower aquifer). The vertical discretization is generally finer near the Corcoran clay and model layer thickness increases with depth. In the southern portion of the domain, model layer 14 is used to represent the F-clay as mapped by Croft (1972).

3.1.2 Model Linearization

The model was developed with the flexibility to build and compile input files and execute using either the LPF package with the PCGN solver or the Upstream Weighting (UPW) package with the Newton solver (NWT). The NWT solver provides a robust solution for nonlinear problems where layer drying and rewetting can produce convergence issues using other numerical schemes (Niswonger et al., 2011). Conversely, a linearized version of the same problem can be solved using the LPF package in combination with a host of other available solvers – in this instance the PCGN solver was employed. The process of linearization includes setting dry layers to inactive and enabling the “STORAGECOEFFICIENT” option in the LPF package. This approach results in substantially shorter runtimes which can be useful during predictive model runs. Comparisons between solutions produced using both methods yielded similar calibration statistics and water budgets.

3.1.3 Temporal Discretization

The period from January 1, 1988 through December 31, 2015 which includes the 1989 through 2015 DWR water year (October through September) was selected to calibrate the groundwater flow model. This period was selected because it represents long-term annual average hydrologic conditions when evaluating the primary sources of natural recharge (rainfall). When compared to annual imported surface water, the period represents average to dry conditions. The simulation period is divided into 336 monthly stress periods. The simulation period is transient in which water budget components and boundary conditions vary on a monthly basis. During each stress period model stresses (such as precipitation, reference evapotranspiration (ET_o), general head boundaries, crop coefficients) are held constant. Each stress period is divided evenly into two timesteps where the flow equations are calculated by the model.

3.2 Farm Process

The MODFLOW Farm Process (FMP) was utilized in the model to simulate agricultural water supply and demand and dynamically calculate agricultural water budgets, groundwater pumping and recharge. A description of the components of the FMP are described below.

3.2.1 Farm Delineation

The active portion of the model domain was divided into 36 areas designated as farms in FMP for which agricultural supply and demand are calculated (**Figure 3-4**). Within the Subbasin, farms were delineated based on areas of common geologic, hydrogeologic, or land use features. Outside of the Subbasin, farms were generally delineated based on boundaries of entities receiving surface water deliveries from the U.S. Bureau of Reclamation (USBR) through the Central Valley Project (CVP). Areas which do not receive CVP water were delineated on GSA boundary lines.

3.2.2 Climate

3.2.2.1 Precipitation

Rainfall data was specified at each model cell for each stress period within the simulation period. The model relied on monthly spatial precipitation data developed by Prism Climate Group (http://prism.oregonstate.edu/) (PRISM) from 1988 through 2015 on a 4-kilometer (km) resolution. The PRISM data was gridded and assigned to model cells based on whether the center of the model cell falls within each PRISM precipitation data cell (**Figure 3-5**).

3.2.2.2 Reference Evapotranspiration

Reference evapotranspiration (ET_o) was specified for each model cell for each monthly stress period from reference evapotranspiration data maintained by the California Irrigation Management Information System (CIMIS). Reference evapotranspiration data available from 1988 through 2003 were from weather stations located within and in the vicinity of the model domain. Values for each model cell for this period were interpolated from the point values at each station with available data for each month using inverse distance weighting (**Figure 3-6**). Statewide modeled ET_o data from CIMIS are available on a 2-kilometer (km) grid from 2003 through 2015. These data are derived from a combination of remote sensing data from satellites and the information collected from CIMIS stations were used in place of the interpolated station data from December 2003 through December 2015 (**Figure 3-7**). The spatial models developed by CIMIS were used to assign ET_o to model cells from 2003 to 2015.

3.2.2.3 Surface Water Deliveries

Since 1968, WWD has relied on surface water deliveries through the CVP as a major source of imported water (LSCE, 2018; WWD, 2012). Water is delivered primarily from the San Luis Canal (SLC). Water is also obtained from exchanges and transfers. Conveyance within WWD occurs primarily through 1,034 miles of buried pipe. FMP allows for non-routed deliveries, semi-routed deliveries and fully routed deliveries. The latter two include linkages to the SFR package to allow water to be diverted from streams and excess irrigation to enter stream segments as return flow. Since losses through seepage within the conveyance system is small based on correspondence with GSA staff, imported surface water for farms within the model domain were specified as non-routed deliveries (NRDs). Since little is known about surface water deliveries and conveyance outside of WWD, imported water was simulated using NRDs in these areas as well.

For the model area within WWD, data for monthly surface water deliveries by turnout were assigned to locations based on available information relating turnouts to the fields served by water delivered at each turnout. Data that correlate turnouts with fields where turnout water was discharged are available from WWD for the years 1999 through 2015; however, location (spatial) data representing fields are only available for 2004 through 2015. Review of the available spatial field data indicate that field geometry and identity change from year to year, although such changes are generally not major. Using the available data, surface water deliveries at each turnout were assigned to fields for each of the years between 1999 and 2015. For the years simulated prior to 1999, 1999 data was used. Since spatial data for fields were not available for the years prior to 2004, 2004 spatial data was used for those years from 198 through 2003. Following the relational steps described above, monthly surface water delivery volumes at each turnout were evenly distributed within the fields served by each turnout for the entire model period from 1989 through 2015. It is understood that water discharged at each turnout may not always be used entirely within the field served by a turnout, with some water potentially routed elsewhere based on farming practices. WWD did not have data on when, where, or how much water delivered at each turnout was used on other fields, therefore, the flow model assumed that all water delivered at each turnout was utilized on the field served by the respective turnout.

The results from the analysis conducted to distribute surface water deliveries by fields within WWD were then used to designate monthly surface water deliveries by model cell within each field. This was necessary because the groundwater model surface water deliveries, and consequently the simulated groundwater pumping, are computed for each water balance subregion (farm) as part of the Farm Process in MODFLOW. Firstly, model cells were related to fields based on the location of the cell center. Then the total volume of surface water delivered to each field was evenly divided among the model cells representing the field. This analysis was done separately for all monthly stress periods to account for the changing spatial configuration of fields and resulting spatial relationships to model cells that occur throughout the model duration (**Figure 3-8)**.

Surface water deliveries for each farm located outside of WWD were specified from known surface water imports. For entities with CVP allocations, estimates were made from monthly surface water delivery tables provided by the USBR. In instances where the receiving entity is bisected by the model domain, the delivered amount was scaled by the fraction of the entity within the model domain. Surface water delivery records for entities in the southern Kings and Tulare Lake Subbasins (North Fork Kings GSA, South Fork Kings GSA, Mid-Kings GSA, Southwest Kings GSA, El Rico GSA) receive water from the Kings River Water Association (KRWA) are not publicly available. Surface water deliveries in Farms 24-27 were provided by David Bean (Wood Group) taken in the overlap areas between WSGM and the Tule Lake Groundwater Model. Roughly 25% of Farm 24 was included in the Tule Lake Groundwater Model. Deliveries to Farm 24 in its entirety were calculated by scaling the values provided to the full farm area.

Table 3-1: Relationship between Farm Delineation and Jurisdictional Areas

Entity	Farm-ID
Westlands Water District[1]	1-9
Broadview WD[2]	10
San Luis WD[2]	11
Panoche WD[2]	12
Mercy Springs WD[2]	13
Firebaugh Canal WD & Wildren WD[2]	14
Central California ID[2]	15
Columbia Canal Co.[2]	16
Farmers Water District[3]	17
Marchini/Dudley-Indart/CGH/Meyers East[2]	18
Mendota Wildlife Area[2]	19
City of Mendota & Surrounding[3]	20
Traction Ranch[2]	21
Tranquility ID & Fresno Slough WD[2]	22
James ID & Reclamation #1606[2]	23
North Fork Kings GSA[1]	24
South Fork/Mid Kings GSA[1]	25
Southwest Kings GSA[1]	26
El Rico GSA[1]	27
McMullin Area GSA (Undistricted)[3]	28
Madera County GSA[3]	29
Fresno ID[2]	30
Chowchilla WD[2]	31
Gravelly Ford WD[2]	32
McMullin Area GSA (Mid-Valley WD)[2]	33
Pleasant Valley WD[2]	34
Pleasant Valley WD & City of Coalinga[2]	35
City of Avenal & Surrounding[2]	36

1. Surface water delivery internally estimated
2. Surface water delivery provided by USBR
3. No surface water delivery

3.2.2.4 Groundwater Pumping

Within the FMP, groundwater pumping is allocated dynamically when direct groundwater uptake from crops, precipitation, and surface water deliveries within a model stress period are not able to meet the consumptive demand within a farm. Wells were specified using the Multinode Well (MNW2) package (Konikow et. al., 2009). Within WWD, wells were assigned based on the known location of pumping wells within the Subbasin. Outside the Subbasin, where well location and construction information was not readily available at the time of model development, groundwater pumping was allocated from virtual wells corresponding to well construction and location in The Central Valley Hydrologic Model Version 2

(CVHM) (Faunt et. al.,2009). The well locations in the model domain outside of WWD will be updated following incorporation of data received from adjacent GSAs.

Within WWD, 932 irrigation supply wells were simulated. Wells included in the model were selected based on whether groundwater pumping was metered at a specific well from 2011 through 2015. Of these, 252 wells had no available construction information. In these instances, the average top and bottom perforation elevations of wells within the same township were assigned to wells with unknown construction. Of the 932 wells within WWD, 63 wells are screened in the upper aquifer above the Corcoran clay, 398 are screened in the lower aquifer below the Corcoran clay, 313 wells are composite (screened both above and below the Corcoran clay), and 158 wells are unclassified since they were constructed some distance laterally from the Corcoran clay (**Figure 3-9**). Outside of WWD, wells were assigned at 1,102 locations corresponding to Multi-Node farm wells within the CVHM model. Of these, 16 are virtual wells assigned to lands within the former Broadview Water District, which were annexed to WWD in 2005. This area includes one Upper Aquifer well, three Lower Aquifer wells and 12 composite wells (**Figure 3-9**).

3.2.2.5 Off-season Irrigation

Many fields are irrigated during the fall and winter to maintain or build soil moisture or other purposes. The practice of pre-irrigation is common for many annual crops prior to planting. Irrigation also occurs in orchards during the off-season to maintain soil moisture. Off season irrigation was handled through the "Added Demand" function in the FMP. This additional demand was set at a baseline of 0.2 ft per month during the off-season months. In instances where there are high surface water deliveries in winter months, though no demand to consume it, the excess water is allocated to fields that are set to receive off-season irrigation for that month. Since the FMP does not include a soil moisture component, this added water percolates to the water table and acts as a source of groundwater recharge to the system.

3.2.3 Land Use

Land use type was specified in each model cell for each year within the modeling period to estimate the consumptive use for irrigated and non-irrigated landscapes. These include irrigated agricultural areas, fallowed lands and areas with native vegetation as well as urban areas, water bodies and dairies and feedlots. Land use data was derived from a combination of DWR Land Use Survey's and WWD-supplied land use data.

DWR performs detailed surveys of land use in each county on an irregular basis, usually every 5 to 10 years. Several of these datasets were available for the counties that overlap the model area (Fresno, Kings, Madera, Merced, and San Benito Counties). The DWR data is highly accurate for the year the survey was conducted, but it is a snapshot in time, and, as mentioned above, these surveys are only produced periodically. Each grid cell for each year of the model was assigned land use types based on the data for the county in which the grid cell is located and the year the survey was conducted that correlates to the closest model simulation year (**Table 3-2**).

Table 3-2: Summary of DWR Land Use Surveys Used in Model Years from Fresno, Kings, Madera, Merced And San Benito Counties

Year	Fresno All	Fresno West	Fresno East	Kings	Madera	Merced	San Benito
1988-1990	1986			1991	1995	1995	1997
1991-1993	1994			1991	1995	1995	1997
1994-1997	1994			1996	1995	1995	1997
1998	2000			1996	1995	1995	1997
1999	2000			1996	2001	2002	1997
2000-2004	2000			2003	2001	2002	2002
2005-2006		2000	2009	2003	2001	2002	2002
2007-2015		2000	2009	2003	2011	2002	2002

WWD maintains a record of crop type grown on the field scale within the District from 2001 through 2015. Data were available in a Geographic Information Systems (GIS) format for the years from 2004 to 2015 and in tabular format from 2001 to 2003. For 2001 through 2015, the WWD land use data were used (where available) in place of the DWR land use data. DWR data was used in instances where either no land use was assigned to a field in the 2004 through 2015 data, or the available WWD data could not be assigned to a physical field in the 2001 to 2003 dataset.

The DWR land use classifications and the WWD land use classifications are similar, but not identical. Both were consolidated into a smaller number of categories to provide common reference, and to simplify the analysis and crop parameterization for the FMP. Crops were grouped by similarity of their irrigation methods, evapotranspiration rates, seasonal growth patterns, and total acreage into 24 composite land use groups for which crop and field parameters were assigned for the FMP. For each year, one land use type was assigned to each model cell based on the dominant land use type (largest area) within the cell (**Table 3-3**). Crop type assignment from 1988 and 2015 are shown in **Figures 3-10** and **3-11**, respectively.

Table 3-3: Crop Type Classification for The Farm Process

Crop ID	Crop	Crop ID	Crop
1	Alfalfa	**13**	Lettuce-Spring
2	Almonds	**14**	Onions
3	Melons	**15**	Pasture
4	Carrots/Broccoli	**16**	Fruits/Nuts
5	Citrus	**17**	Safflower/Canola
6	Corn	**18**	Beets
7	Cotton	**19**	Tomatoes
8	Beans	**20**	Wheat
9	Field Crops	**21**	Fallow/Native Veg.
10	Hay	**22**	Water
11	Grapes	**23**	Dairies
12	Lettuce-Fall	**24**	Urban

3.2.4 Farm Parameterization

3.2.4.1 Crop Coefficients

The consumptive use for a given crop in each stress period is a function of the reference evapotranspiration (ET_o) multiplied by the crop coefficient (K_c). Where available, K_c for a given crop type was determined from daily K_c estimates from crop water demand models provided by WWD. Values were provided only during the growing season for most crops for three weather zones within WWD. Analysis of the data provided showed that there was some variation in the estimated daily K_c between years and weather stations for some crops. As a result, these data were plotted, and a representative K_c was developed and used as initial values in the model. Outside of the growing period, daily K_c was assumed to be the bare earth K_c value for the given Julian day as estimated from the UC Davis Basic Irrigation Scheduling (BIS) application developed by Snyder et al. (2000), and further described in Snyder et al (2008). Monthly K_c was calculated by taking an average of the daily K_c.

Several crops were not included in the data provided by WWD. For these crops, literature values reported in Snyder (2000), Snyder (2008) and Allen (1998) were used to estimate monthly K_c values. After grouping the crops into the final 24 land use classes, the K_c of the dominant crop type was used in each land use type. Crop coefficients were adjusted during model calibration within the ranges listed in the literature references. Final values are shown in **Section 4**.

3.2.4.2 Consumptive Use Fractions

Consumptive use fractions determine the proportion of each model cell which transpiration (FTR), evaporation due to irrigation (FEI) and evaporation due to precipitation (FEP) occur. Both FTR and FEI are user supplied values, where FEP is simply the proportion of the cell which transpiration does not occur (1 – FTR). Consumptive use fractions depend on the type of crop and growth stage of the crop. Consumptive use fractions were estimated from literature values and similar models and scaled during model calibration. Calibrated values for crop consumptive use fractions (FTR) are presented in **Section 4**.

3.2.4.3 On-farm Efficiency

On-farm efficiency (OFE), or irrigation efficiency, is defined as the proportion of applied water which is consumptively used by a crop. Irrigation efficiency was prescribed as a function of irrigation method for crop types represented in the model. Irrigation methods include Furrow/Sprinkler, Sprinkler/Drip, and Drip. An additional irrigation method was added to provide a representative irrigation method for urban areas and dairies. While overall irrigation efficiency has generally increased over time, irrigation efficiency for each irrigation method was held constant throughout the simulation period. Improvements to overall irrigation efficiency were achieved by changing the irrigation method for a number of crops over time. This adjustment was made based on the irrigation method data for crops provided by WWD (**Table 3-4**). Irrigation efficiency was adjusted during model calibration within reasonable ranges. Final values are presented in **Section 4.**

3.2.4.4 Soils

Spatial information on soil types and characteristics were acquired through the National Cooperative Soil Survey Geographic Database (SSURGO; NRCS, 2018). These data were processed and analyzed by first extracting soil map units sufficiently buffered and clipped around the model domain. Each soil map unit area was related to its major soil component, which were then related to primary soil horizons. Each primary soil horizon was designated into one of six general soil types (silty clay, sandy clay, clayey loam, sandy loam, clayey sand, and silty sand) based on grain size distributions (**Figure 3-12**). Saturated hydraulic conductivity values and ranges were extracted directly from SSURGO for these primary soil horizons. Capillary rise values and ranges for various soil materials were estimated by first aggregating a combination of known values calculated or observed by sources including the CVHM (Faunt, 2009), Fetter (2001), Heath (1983), and the USDA (2010), into discrete minimum, average, and maximum values. These capillary rise values were then volumetrically weighted for soil material distributions within the deepest and primary soil horizons within the buffered model area map units. The average-minimum, average-average, and average-maximum volumetrically weighted capillary rise values were then designated into the six general soil type categories for modeling purposes. The capillary fringe rise was adjusted during model calibration within reasonable ranges consistent with literature values.

Table 3-4: Irrigation Method by Crop Type

Crop	1988 - 2006	2007-2015
Alfalfa Hay	Furrow/Sprinkler	Furrow/Sprinkler
Almonds	Drip	Drip
Melons	Furrow/Sprinkler	Sprinkler/Drip
Carrots	Furrow/Sprinkler	Sprinkler/Drip
Oranges	Drip	Drip
Corn-Field; Silage	Furrow/Sprinkler	Furrow/Sprinkler
Cotton-Pima	Furrow/Sprinkler	Sprinkler/Drip
Beans	Furrow/Sprinkler	Sprinkler/Drip
Field Crops	Furrow/Sprinkler	Sprinkler/Drip
Grain Hay	Non-Irrigated	Non-Irrigated
Grapes-Table	Drip	Drip
Lettuce-Fall	Furrow/Sprinkler	Sprinkler/Drip
Lettuce-Spring	Furrow/Sprinkler	Drip
Onions-Dehydrated	Furrow/Sprinkler	Sprinkler/Drip
Pasture	Non-Irrigated	Non-Irrigated
Pistachios	Drip	Drip
Safflower; Canola	Furrow/Sprinkler	Furrow/Sprinkler
Sugar Beets	Furrow/Sprinkler	Sprinkler/Drip
Tomatoes	Furrow/Sprinkler	Drip
Wheat	Non-Irrigated	Non-Irrigated
Native Vegetation	Non-Irrigated	Non-Irrigated
Water	Non-Irrigated	Non-Irrigated
Dairies	Urban	Urban
Urban	Urban	Urban

3.3 Boundary Conditions

3.3.1 General Head Boundary Condition

Lateral subsurface flow into and out of the model domain was simulated using the General Head Boundary (GHB) package (Harbaugh et al, 2000) (**Figure 3-13**). In the general head boundary, a groundwater elevation is specified at an external reference or "ghost" cell outside of the model domain where the water level is known or extrapolated from known data. The groundwater flux into or out of the domain at the model edges is calculated from the difference in groundwater elevations between the ghost cell and model cell with a conductance value assigned between them. Flow to and from a GHB cell and a model cell is a product of the hydraulic gradient and conductance by:

$$Q = (h_m - h_{ghb})\frac{kA}{L}$$

where: C is the conductance
k is the hydraulic conductivity
A is the cell area
L is the distance from the model cell the GHB cell
h_m is the hydraulic head in the model cell
h_{ghb} is the hydraulic head in the GHB cell

Hydraulic head in GHB nodes varied spatially and temporally. Groundwater levels in each GHB cell were assigned based on simulated water levels in adjacent cells in the CVHM. Since model discretization in CVHM does not align with the model layering in WSGM, groundwater levels in the CVHM were mapped to GHB based on cell elevations and thicknesses to the closest CVHM model cell. The simulation period of CVHM is from April 1961 through September 2003; which excludes over 12 years of data needed for the WSGM modeling period. As a result, hydraulic head data from October 2003 through December 2015 was generated by extending the CVHM model through 2017. The additional two years were added to provide 2016 and 2017 data needed for predictive scenarios. Datasets for CVHM model extension were developed by substituting existing data from similar water year types based on DWR Water Year Indices for the San Joaquin Valley (**Table 3-5**).

Conductance in GHB cells was assigned based on the hydraulic conductivity in each model cell along the lateral boundary and the cell thickness and distance. Hydraulic conductivity and cell thickness are updated internally in MODFLOW-OWHM based on the cell thickness and hydraulic conductivity specified in respective cells where a GHB is assigned. The length to the model cell and GHB cell was assigned as the horizontal model discretization (1320 ft).

Table 3-5: Water Year Type Relationship for CVHM Model Extension through 2017

Water Year	San Joaquin Valley DWR Water Year Index	Water Year Type	Existing CVHM Model Data Used	Corresponding San Joaquin Valley Water Year index
2004	2.21	D	2001	2.20
2005	4.75	W	1997	4.13
2006	5.90	W	1995	5.95
2007	1.97	C	1991	1.96
2008	2.06	C	1994	2.05
2009	2.72	BN	2003	2.81
2010	3.55	AN	2000	3.38
2011	5.58	W	1998	5.65
2012	2.18	D	2001	2.20
2013	1.71	C	1990	1.51
2014	1.16	C	1990	1.51
2015	0.81	C	1990	1.51
2016	2.35	D	2002	2.34
2017	6.46	W	1998	5.65

3.3.2 Groundwater-Surface Water Interaction

Surface water features were simulated using a combination of the Streamflow Routing (SFR) and Lake (LAK) packages (Prudic et al., 2004; Merritt and Konikow, 2000). Major streams and canals were simulated using the SFR package and include the north and south forks of the Kings River, the SJR, the James and Chowchilla Bypass as well as major ephemeral streams located in the western portion of the model domain and eastern flank of the Coast Range (**Figure 3-13**). The LAK package was used in conjunction with the SFR package to simulate the Mendota Pool and Fresno Slough.

Streams within the model domain were delineated into 19 segments based on the location of major tributaries as well as substantial variations in streambed geometry. The SFR package was structured such that the depth of the stream is calculated using Manning's equation using a fixed channel width for each segment determined from aerial photography. Manning's roughness coefficient was estimated from reported literature values and evaluation of the SJR (Chow, 1959; Mussetter Engineering, 2000). Streambed elevations were assigned at each model cell and determined from a digital elevation model. Values for streambed thickness and streambed hydraulic conductivity were given initial values and adjusted during model calibration.

The San Joaquin River was divided into three segments to account for diversions through the Chowchilla Bypass and flows into and out of the Mendota Pool. Average monthly flows in the SJR at the model boundary were computed from streamflow data at the Gravelly Ford gage, downloaded from the California Data Exchange Center (CDEC) from August 1997 through 2015 (DWR CDEC, 2017). Where data was not available at the Gravelly Ford gage from January 1988 through July 1997, data from releases at Friant Dam acquired from the USGS were used to reconstruct the streamflow record at Gravelly Ford using a linear regression relationship (USGS National Water Information System, 2017). Flow in the San Joaquin River below the bifurcation control structure at the Chowchilla Bypass were computed based on operational guidelines which state that flows in the SJR above the control structure exceeding 2,500 cubic feet per second (cfs) are to be diverted through the Chowchilla Bypass (DWR, 2010).

The north and south fork of the Kings River were each simulated using the SFR package. The north fork of the Kings River was modeled with two SFR segments to better represent hydraulic properties of the river channel as well as the James Bypass. Very limited stream gage data was available for the north and south forks of the Kings River. In the south fork of the Kings River, the south fork bypass diversion amount specified at the Army Weir within the fine grid version of the California Central Valley Groundwater-Surface Water Simulation Fine Grid Model (C2VSIM-FG) model was used to assign flow where gage data was not available (Brush, 2013; Brush et. al., ***unreleased***). This data correlated well with measured flow at the U.S. Army Corps of Engineers (USACE) gage below the Army Weir. Sources for discharge in the north fork of the Kings River was less reliable from regional models. As a result, the hydrograph at this location was reconstructed based on measured flow at the James Bypass plus diversions specified in the C2VSIM-FG model between the USACE gage at Crescent Weir and the James Bypass. This methodology ignores stream-aquifer interaction between Crescent Weir and the James Bypass, but was shown to fit observed data considerably better than north fork flow simulated in either C2VSIM or CVHM models.

Streamflow in coast range drainages in the western portion of the model domain are generally ephemeral, flowing predominantly in the winter and spring in years when flow occurs. The Los Gatos Creek watershed was divided into 7 segments based on where tributaries merged with the mainstem of the Los Gatos Creek (**Figure 3-13**). Both Cantua Creek and Little Panoche Creek do not have substantial flows and were simulated using one SFR segment each. The Panoche Creek system was divided into 3 segments to account for where Silver Creek joins Panoche Creek. Discharge measurement in Los Gatos Creek and Cantua Creek were available from the USGS for most of the calibration period. Discharge in ungaged tributaries was estimated using the Drainage Area Ratio Method (Hirsh, 1979; Emerson et al., 2005; Mahamoud, 2008). The method assumes that the difference in flows between two drainages is directly proportionate to the differences in their drainage areas or:

$$Y_{ij} = \frac{A_y}{A_x} X_{ij}$$

where: Y_{ij} is the flow at the ungaged location
X_{ij} is the flow at the gaged location
A_y is the drainage area of the ungaged basin
A_x is the drainage area of the gaged basin

The Mendota Pool and Fresno Slough was simulated using the LAK package. The LAK package is used to simulate stage, volume and water balance within lake features. The LAK package includes processes to simulate exchanges between groundwater and streams simulated with the SFR package. Inflows to the lake include flow from the SJR and James Bypass specified using the SFR package as well as inflow from the Delta Mendota Canal simulated as a runoff term. Diversions from the Mendota Pool include withdrawal from multiple entities or programs including Tranquility Irrigation District, James Irrigation District, the Mendota Wildlife Area, WWD, Meyers Farming, Terra Linda, Coelho-Gardner-Hanson, Hughes, Wilson, Fresno Slough Water District, Traction Ranch, Warren Act, and Reclamation 1606, Central California Irrigation District and Columbia Canal Company. Any excess water in the Mendota Pool flows over the Mendota Dam into the SJR. Lakebed hydraulic properties (governing exchange between the lake and groundwater) were based on previous estimates of seepage amounts from the Pool (KDSA and LSCE, 2000).

The hydraulic conductivity of the streambed and lakebed materials and Manning's roughness coefficient are presented in **Section 5**.

3.4 Aquifer Properties

Subsurface geology was incorporated into the numerical model from a combination of well log data and previous studies and reports outlined in the HCR. The primary source of subsurface lithologic data was the existing database of well logs developed by the USGS for the CVHM model, geophysical logs, and well completion reports from DWR. These data were used to develop a three-dimensional model of the subsurface geology within the model domain used to assign aquifer properties. A description of the geostatistical modeling approach is described below.

3.4.1 Geostatistical Model

Geostatistical modeling was developed using Transition Probability Geostatistical Software (T-ProGS) (Carl and Fogg, 1996; Carl and Fogg, 1997). TProGS is used to develop a conditional simulation of subsurface heterogeneity based on 3-D Markov chain models. Markov chain models are used to calculate the facies type at a given point given the occurrence of a facies type at another point and the specified probability of transitioning from one facies to another over a given distance or "lag". The transition probability t_{jk} at a given lag h can be defined by:

$$t_{jk}(h) = \Pr\{k \text{ occurs at } \mathbf{x} + \mathbf{h} | j \text{ occurs at } \mathbf{x}\}$$

Where: k and j refer to categories or geologic facies
$\mathbf{h}$ is a separation factor (or "lag")
$\mathbf{x}$ is a spatial location vector

The advantage of the transition of probability/Markov chain approach is in facilitating the incorporation of readily available borehole data from drillers logs in combination with observable geologic concepts, processes and attributes. In this study, the volumetric proportion of each facies type and mean facies lengths were incorporated into model development.

The Markov chain models are used to develop a conditional simulation of subsurface heterogeneity in the aquifer system (Carl, 1999). The conditional simulation is developed using a sequential indicator simulation (SIS) based on transition probability-based cokriging equations (Deutsch and Journel, 1992). Within the simulation grid, hard data (known borehole data) is honored. TProGS then applies a "simulated quenching" procedure in order to fit the transition probabilities calculated in the initial SIS simulation and those in the Markov model (Carl, 1999).

Compared to variogram approaches (such as sequential gaussian or indicator kriging), TProGS produces more realistic simulations of the subsurface. It is particularly advantageous in cases where subsurface data are sparsely distributed in the horizontal direction.

3.4.1.1 Geologic Framework & Texture Data

The geostatistical model was developed using texture data from 1,962 well logs. Of these, 1,837 were categorized by the USGS and included in CVHM (Faunt et. al, 2009) while the remaining 125 were categorized by LSCE and used to fill gaps where existing data were sparse. Due to the poor data quality of many drillers' reports, low quality logs were rejected based on standards used by Burrow (2004) and Faunt (2009). Texture data were subdivided into 4 texture classes based on texture, hydrofacies and geologic interpretation and shown in **Table 3-6** (Fleckenstein et. al, 2006). The borehole data were then discretized onto a 1-foot interval for analysis and incorporation into TProGS.

Table 3-6: Attributes of Major Hydrofacies (from Fleckenstein, 2006)

Hydrofacies	Geologic Interpretation	Texture
Muds	Floodplain	Clays, silty clays, shale
Muddy Sand	Proximal Floodplain	Silty and clayey sands, sandy clays, silts
Sand	Sands	Sands (fine to coarse)
Coarse Sand & Gravel	Gravel and Coarse Sand	Gravel and coarse sand

Based on analysis of the volume fractions of each facies within the borehole data, the model domain was subdivided into 4 unique zones representing different depositional environments. Subdomains correspond to deposits derived from the Sierra Nevada versus those derived from the Coast Range as well as those deposited in the upper aquifer versus lower aquifer. In general, the Coast Range deposits show a higher volumetric proportion of muddy sand than Sierra derived deposits (**Figure 3-14**). Each zone was represented using a separate Markov chain models and used to develop 4 unique simulations within the model domain (**Table 3-7**).

3.4.1.2 Markov Chain Models

Vertical Markov chain models were fit to the borehole data directly and are shown for each sub-domain in **Figure 3-15**. Plots on the off-diagonal represent the transition probabilities for one facies to another (e.g. channel to levee) while diagonal entries show the auto-transitions from a category to itself (e.g. sand to sand).

In the horizontal direction, Markov models were calculated based on mean facies lengths, volumetric proportions and transition probabilities using a transition probability matrix. Markov chain models were oriented to the strike direction of the principle depositional trends with no dip assigned. To simplify model development, symmetry in the juxtaposition tendencies (meaning the transition probability of mud to muddy sand is the same as muddy sand to mud) was assumed (Carl, 1999; Weissman et. al, 1999).

Furthermore, the most common facies (mud) was assumed as a background category reducing the number of parameters required in Markov chain model development. Volumetric proportions were calculated directly from the data. Mean lengths for each facies were derived largely from studies conducted by Weissman et. al (1999) on the Kings River alluvial fan and by Traum (2014) on the SJR alluvial fan. The values assumed in each subdomain are shown in **Table 3-7**.

Table 3-7: Mean Hydrofacies Length and Volumetric Proportions in Model Sub-domains

Hydrofacies	Volume Fraction	Mean Length (ft)		
		X	Y	Z
Shallow (Coastal)				
Muds	0.42	2,517	1,674	22
Muddy Sand	0.36	2,100	1,400	28
Sand	0.13	3,000	1,600	14
Coarse Sand & Gravel	0.1	2,460	1,400	13
Shallow (Sierran)				
Muds	0.42	4,455	2,223	12
Muddy Sand	0.16	2,600	1,300	19
Sand	0.39	4,000	1,800	10
Coarse Sand & Gravel	0.03	2,100	700	15
Deep (Coastal)				
Muds	0.36	1,673	1,094	22
Muddy Sand	0.42	2,100	1,400	25
Sand	0.18	3,000	1,600	20
Coarse Sand & Gravel	0.04	2,460	1,400	11
Deep (Sierran)				
Muds	0.53	5,212	1,094	32
Muddy Sand	0.24	2,600	1,300	32
Sand	0.2	4,000	1,800	15
Coarse Sand & Gravel	0.04	2,100	700	13

3.4.1.3 Simulation

Each model domain was discretized into rectilinear cells with a quarter-mile spacing (1,320 ft) in the horizontal direction and a 3-ft vertical spacing to conduct the sequential indicator simulation. The simulations were sequentially merged do develop a composite model (**Figure 3-16**). While TProGS can produce any number of equally probable simulations, one was selected to represent the subsurface geostatistical model used to develop the numerical groundwater model.

3.4.1.4 Upscaling Hydraulic Parameters

Discrepancies in the vertical discretization between the groundwater flow model grid and the geostatistical simulation grid required that results from the geostatistical model be upscaled to the numerical model grid. This was achieved through assigning hydraulic parameters to each respective hydrofacies category. The geostatistical model cells which fall within each numerical model grid were averaged to obtain the upscaled value for the groundwater model cell. For vertical hydraulic conductivity, a harmonic mean was used. All other values (Kh, Sy, Porosity, Ss_{ke}, Ss_{kv}) were calculated using an arithmetic average (**Figure 3-17**).

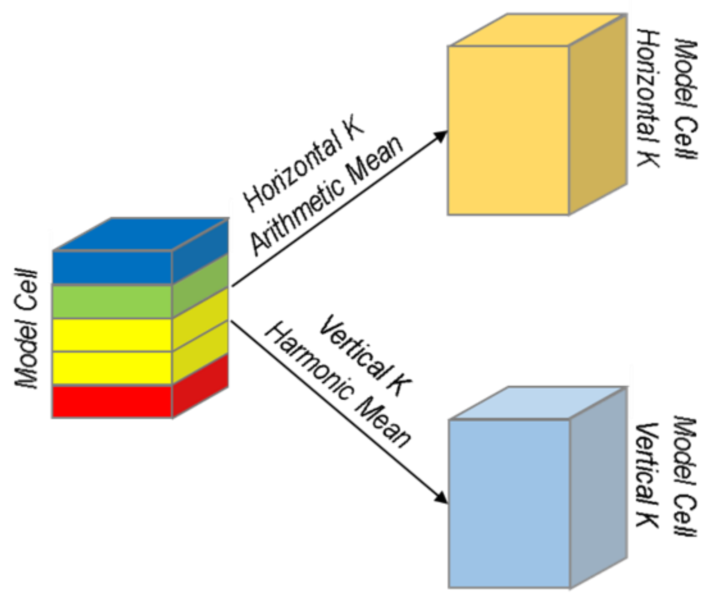

Figure 3-17. Vertical upscaling of hydraulic parameters from 3-ft vertical discretization to model cell thickness. Vertical hydraulic conductivity upscaled using a harmonic mean; (Kh, Kv, Sy, Porosity, Sske, Sskv) upscaled using an arithmetic mean.

3.4.2 Hydraulic Conductivity

Hydraulic conductivity was assigned using the LPF package (Harbaugh, 2005). Hydraulic conductivity is a measure of the permeability (or ability to transmit water) of a material. Initial values of horizontal and vertical hydraulic conductivity were specified for each lithology type based on ranges reported in the literature (Fetter, 2001). Values were subsequently adjusted during model calibration.

Hydraulic conductivity has been recognized to decrease with depth. Commonly this is assumed to be an exponential relationship between K and depth (Anderman and Hill, 2003; Faunt et. al, 2004) given by:

$$K_{depth} = K_{surface} 10^{\lambda d}$$

Where: K_{depth} is the hydraulic conductivity at depth d [L/T]

K_{depth} is the hydraulic conductivity at a reference surface [L/T]

λ is the depth-dependence coefficient [L^{-1}]

d is the depth below the reference surface [L]

Depth dependency of hydraulic conductivity was calculated for each cell in the geostatistical model using a dependence coefficient prior to upscaling to the model cell. Since the parent material of coastal and

Sierran derived sediment are different, a unique depth dependence coefficient was assigned to cells in each depositional environment, respectively.

3.4.3 Storage and Aquifer System Compaction

Aquifer storage properties and aquifer compaction were simulated using a combination of the SUB and UPW packages (Hoffman et al., 2003; Harbaugh, 2005). The LPF package was used largely to simulate storage changes at the water table. The SUB package was used to simulate aquifer compaction and storage changes occurring in the confined aquifer system.

The specific yield and specific storage owing to the compressibility of water are assigned in the UPW package. In an unconfined system, the change in groundwater storage is largely controlled by the specific yield. The specific yield is a dimensionless storage coefficient equal to the ratio of water which an aquifer will yield due to gravity-driven drainage compared to the total bulk aquifer volume. The specific yield is approximately equal to the porosity of a bulk aquifer unit minus some volume of water which remains in the pore spaces due to capillary forces. It is not uncommon for an unconfined aquifer to yield 20 to 30 percent of its total volume in water. The specific storage attributed to the compressibility of water is equal to the compressibility of water (1.4×10^{-6} ft^{-1}) multiplied by the porosity of a given texture class.

The SUB package solves for changes in compaction and groundwater storage based on changes in the hydraulic head, the preconsolidation stress (or preconsolidation head in the SUB package), and coefficients governing the elastic and inelastic skeletal storage (Höffman et al., 2003). In a confined system such as the Lower Aquifer, the amount of water a unit volume of aquifer releases or takes up per unit change in hydraulic head is determined by the specific storage (L^{-1}). Since the porous medium in a confined aquifer is always saturated, changes in groundwater storage due to changes in hydraulic head are determined by the compressibility/expandability of the pore spaces leading to deformation of the aquifer skeleton and (to a lesser extent) the compressibility of water. Deformation of the aquifer skeleton can occur either elastically (recoverable) or inelastically (permanent) and is dependent on the composition of the aquifer material and the amount of stress (effective stress) within the aquifer. Inelastic deformation occurs when the effective stress within the fine-grained material in an aquifer system exceeds the maximum effective stress leading to permanent changes in the arrangement of grains and is represented by an inelastic L^{-1}. Elastic deformation occurs when the maximum effective stress is not exceeded and is represented using an elastic L^{-1}.

The SUB package requires the user to supply the inelastic skeletal storativity and elastic skeletal storativity. Initial values for each material property were assigned to the four lithologic categories and scaled to the model cell using the process outlined in **Section 3.4.1**. Inelastic and elastic skeletal storativity were derived from specific storage values and multiplied by the layer thickness. The process for estimating the preconsolidation head is outlined in **Section 3.5**.

3.5 Initial Conditions

Initial conditions define the state of the aquifer system at the beginning of the model calibration period in January 1988. In the groundwater flow model, these include the hydraulic heads and preconsolidation head in each model cell. Initial groundwater elevation in each model cell at the start of the model simulation period (January 1988) was initialized using measured groundwater elevation from wells within the model domain. Wells in the uppermost shallow zone (<100 ft), upper aquifer and lower aquifer were interpolated to develop a groundwater elevation surface for each respective portion of the aquifer system. Initial hydraulic heads from the shallow system were applied to the uppermost layer. Hydraulic heads in the upper aquifer were applied to cells between the water table and the top of the Corcoran clay (layers 2 through 9). Initial hydraulic heads in the lower aquifer were applied to layers 10 through 18.

Initial heads were further adjusted through the utilization of a 7-year model spin up period. The purpose of the spin up period is to further refine hydraulic gradients and provide a solution that honors the groundwater flow equation within the model. Model stresses during this period were assigned using inputs from an average hydrologic year type (2000). Initial hydraulic heads in the shallow, upper and lower aquifer systems are shown in **Figures 3-18** through **3-20**.

Preconsolidation head was estimated using pilot point methodology (Doherty, 2003; Siade, et. al., 2015). Pilot points are a set of 2D scattered points with assigned values used to interpolate values for each model cell. Since the preconsolidation head is always at or below the initial hydraulic head, the pilot points in the numerical model represent the negative offset from the initial hydraulic head. These were assigned at 29 points in the upper and lower aquifers and calculated through automated parameter estimation using UCODE (**Figure 3-21**). Values at each model cell were interpolated using the natural neighbor technique (Sibson, 1981).

3.6 Calibration

The groundwater flow model was calibrated through both trial and error and automated procedures. UCODE 2014 was used to evaluate model sensitivity and estimate parameters (Poeter et. al., 2014; Hill and Tiedman, 2007). The calibration process involves adjusting model parameter values to improve the model fit to observed data. Model parameters included in calibration were aquifer properties (Kh, Kv, Ss_{ke}, Ss_{kv}, Sy, Porosity) and FMP parameters such as rooting depth, crop coefficients and irrigation efficiencies. A list and description of model parameters adjusted during calibration are provided in **Table 4-1**.

Observations used to constrain parameter values included 9,277 water level observations from 155 wells (**Figure 3-22**), 2,252 subsidence and compaction observations (**Figure 3-23**), and total measured groundwater pumping from wells within each of the nine farms from 2012 through groundwater flow model results.

Results from the groundwater flow model calibration are presented below. Results include calibrated parameter values, model fit to observed data, global (model-wide) water budgets and Subbasin-specific water budgets.

4 MODEL RESULTS

4.1 Aquifer Parameters

Aquifer properties were assigned based on reported literature values and adjusted during model calibration. In some cases, local or field measurements of aquifer properties were available from previous studies. In other instances, values were assigned based on values reported in Fetter (2001) or estimated based on professional judgement. Calibrated parameters generally fall within estimated ranges shown in **Table 4-1**.

4.1.1 Hydraulic Conductivity

Hydraulic conductivity in the horizontal direction ranges from 0.65 feet per day (ft/d) in Sierran derived fine-grained deposits to 1,000 ft/d in Coast Range derived sand and gravel deposits. Calibrated horizontal hydraulic conductivity in clays and silts are higher than values reported in the literature due to the fact that these lithologic categories in the model represent the dominant material type and often include coarse, more permeable deposits such as sand (**Table 4-1**). In addition to the designation of aquifer parameters to clays in general, assignment of aquifer parameters to the Tulare Lakebed clay units (A through F clays) were separately designated with values that were lower than general clay sediments due to the higher percentage of clay materials in the model layers that represent the Tulare Lakebed clay units. The horizontal hydraulic conductivity of the A through F clays are 0.01 ft/d and model results are relatively insensitive to variations in these hydraulic conductivity values. Vertical hydraulic conductivity ranges from approximately 7 x 10^{-4} ft/d in muds to 11 ft/d in sand and gravel. Hydraulic conductivity of the A, B, C, D and F clays and E clay are 1 x 10^{-3} ft/d and 3 x 10^{-5} ft/d, respectively. Simulated transmissivity (hydraulic conductivity multiplied by aquifer thickness) of the upper and lower aquifer is shown in **Figure 4-1** and **4-2**, respectively. The distribution of hydraulic conductivity in cross section is shown in **Figure 4-3a** through **4-3d**.

4.1.2 Storage Coefficients

One-Water requires the input of values for specific yield and specific storage to represent storage coefficients of aquifer materials. Specific yield ranges from 0.10 in muds to 0.31 in sand and gravel (**Table 4-1**). Calibrated specific yield of the A through F clays is 0.03. However, since cells containing the A through F clays are generally confined, the specific yield of these units does not affect simulated results. Calibrated values for specific yield are consistent with ranges reported in previous studies and literature values.

The Subsidence Package (SUB) in MODFLOW utilizes elastic and inelastic skeletal storage to simulate compaction of fine-grained sediments. Elastic skeletal specific storage (Ss_{ke}) affects the change in groundwater storage with respect to a change in hydraulic head. Elastic skeletal specific storage ranges from 1.1 x 10^{-6} ft^{-1} in sand and gravel to 6.0 x 10^{-6} ft^{-1} in muds (**Table 4-1**). Inelastic skeletal specific storage (Ss_{kv}) affects the change in groundwater storage with respect to change in hydraulic head when the hydraulic head is below the preconsolidation head. Inelastic skeletal specific storage is higher in fine grained materials and small in coarse grained materials, which primarily only deform elastically. Calibrated inelastic skeletal specific storage ranges from 1.10 x 10^{-6} ft^{-1} in sand and gravel to 3.8 x 10^{-4} ft^{-1} in mud. Ss_{kv} of the E clay is substantially lower than estimated in Helm (1977) and lower than expected in fine grained