October 29, 2021

North American Subbasin GSAs
c/o Sacramento Groundwater Authority
5620 Birdcage Street, Suite 180
Citrus Heights, CA 95610

Submitted via web: https://portal.nasbgroundwater.org/comment/new

Re: Public Comment Letter for North American Subbasin Draft GSP

Dear Rob Swartz,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the North American Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.

4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the North American Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

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Attachment A

Specific Comments on the North American Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **incomplete**. The GSP provides information on DACs, including identification by name and location on a map (Figure 3-8). Figure 3-3 highlights specific water systems as they relate to DACs, and water sources for DACs are identified as local water agencies and domestic wells. Tribal lands have been identified and mapped (Figure 3-2) within the subbasin.

However, we note the following deficiencies with the identification of these key beneficial users:

- The GSP fails to describe the population of each DAC.
- While the GSP provides a map of domestic well density on Figure 3-13, it fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin.

These missing elements are required for the GSAs to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS

- Provide the population of each identified DAC.
- Include a map showing domestic well locations and average well depth across the subbasin.

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

- On applicable figures in Section 3, make block group map layers more transparent so that the cities and features are visible underneath, to help with understanding the communities and beneficial users that lie within each block group.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. To assess ISWs, the GSP presents depth-to-water contours from Spring 2020. The GSP states (p. 5-52): *"For purposes of this GSP the rivers and creeks were assumed to be interconnected when the depth to water is less than 30 feet bgs and are subject to future refinements."* However, using seasonal groundwater elevation data over multiple water year types is an essential component of identifying ISWs. Using depth-to-groundwater contours from one point in time, especially after the 2015 SGMA benchmark date, is not sufficient evidence to state that reaches are not connected to groundwater. In California's Mediterranean climate, groundwater interconnections with surface water can vary seasonally and interannually, and that natural variability needs to be taken into account when identifying ISWs.

The GSP discounts surface water supported by perched groundwater as potential ISW. The GSP states (5-53): *"Studies along the upper reaches of Racoon Creek, generally east of Highway 65, show the area is underlain by the Ione Formation and, due to its low permeability, would tend to perch water. Therefore, the surface water is not connected to the principal aquifer."* However, shallow aquifers that have the potential to support well development, support ecosystems, or provide baseflow to streams are principal aquifers, even if the majority of the subbasin's pumping is occurring in deeper principal aquifers.[2] If areas of perched groundwater are discounted as ISWs, the GSP should provide more supporting evidence of 1) vertical groundwater gradients between the perched system and deeper principal aquifers, and 2) whether perched groundwater is providing significant or economic quantities of water to streams, wells (e.g., domestic wells), and ecosystems (e.g., GDEs).

RECOMMENDATIONS

- On the map of stream reaches in the subbasin (Figure 5-31), identify gaining and losing reaches in addition to interconnected and disconnected reaches. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.

- Provide depth-to-groundwater contour maps using data from additional time periods other than just spring of 2020. Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.

- Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

[2] "'Principal aquifers' refer to 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)]

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **incomplete**, due to use of inadequate temporal data to characterize groundwater conditions under GDEs. Appendix O (Identification of Likely Groundwater Dependent Ecosystems) presents groundwater contours from Spring 2020. The appendix states that this date was used because it has the most complete set of measurements. However, as stated above under the ISW section of this letter, use of depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) is essential to characterize groundwater conditions and the natural variability in conditions across the subbasin, and therefore should be used to determine the range of depth to groundwater around GDEs.

The GSP identified and mapped GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). Appendix O presents a complete inventory of flora and fauna, and identifies critical species in the subbasin. Appendix O states (p. 2): *"Quercus lobata (Valley Oak) was considered to have the deepest rooting depth of all species evaluated (24 feet). Therefore, with allowing for some capillary action of the soils, if depth to groundwater of less than 30 feet below ground surface groundwater was assumed to potentially being capable of supporting dependent ecosystems."* We recommend instead that a 80-foot depth-to-groundwater threshold be used when inferring whether Valley Oak polygons in the NC dataset are likely reliant on groundwater. This recommendation is based on a recent correction in TNC's rooting depth database, after finding a typo in the max rooting depth units for Valley Oak.[3] This resulted in a specific change in the max rooting depth of Valley Oak from 24 feet to 24 meters (80 feet). For all other phreatophytes, we continue to recommend that a 30-foot depth-to-groundwater threshold be used when inferring whether all other NC dataset polygons are likely reliant on groundwater.

The NC dataset is a starting point for mapping GDEs in the subbasin, and contains information on vegetation, wetlands, and hydrologic features that are commonly known to be reliant on groundwater. For practicality purposes, the conservative use of depth-to-groundwater thresholds can cost-effectively screen which NC dataset polygons are most likely reliant on groundwater (see Attachment D for more details). Because phreatophytes are foundation species within many GDEs, the depth-to-groundwater threshold is based on a phreatophyte's ability to access the water table and capillary fringe. For the majority of phreatophytes, 10 meters is considered indicative of a phreatophyte's ability to access the water table and capillary fringe due to the maximum rooting depth of most phreatophytes globally.[4,5] However, for potentially deeper rooted plants, such as Valley Oak, a deeper depth-to-groundwater threshold is required to ensure that this endemic and iconic California species is not inaccurately removed from the GSP's GDE map; until other local studies (e.g., isotopic source water analyses, rooting depth studies) prove otherwise.

RECOMMENDATIONS

- 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. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data

[3] TNC. 2021. Plant Rooting Depth Database. Available at: https://groundwaterresourcehub.org/sgma-tools/gde-rooting-depths-database-for-gdes/

[4] Canadell, J. et al. 1996. Maximum rooting depth of vegetation types at the global scale. *Oecologia*, 108:583-595.

[5] Doody, T. et al. 2017. Continental mapping of groundwater dependent ecosystems: A methodological framework to integrate diverse data and expert opinion. *Journal of Hydrology: Regional Studies.* 10:61-81.

to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as valley oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used, if these species are present in the subbasin. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether Valley Oak polygons from the NC Dataset are connected to groundwater.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[6,7] The integration of these ecosystems into the water budget is **insufficient**. The water budget did explicitly include the current, historical, and projected demands of native vegetation, but did not explicitly include the current, historical, and projected demands of managed wetlands. Table 3-1 states there are over 1,700 acres of managed wetlands in the subbasin, which are mapped on Figure 3-9. The omission of explicit water demands for managed wetlands is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions.

RECOMMENDATION

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including managed wetlands.

B. Engaging Stakeholders

Stakeholder Engagement during GSP Development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Notice and Communications Section of the GSP (Section 11).[8]

We note the following deficiencies with the overall stakeholder engagement process:

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[6] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[7] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

[8] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- The opportunities for public involvement and engagement for DACs, domestic well owners, tribes, and environmental stakeholders during the GSP development and implementation processes are described in very general terms. They include attendance at meetings, notices, direct mailers, social media, and discussions with environmental organizations for developing sustainable management criteria. Details about the nature of the engagement process for beneficial users are not provided in the Notice and Communications section (i.e. planning for public listening sessions, actions to improve accessibility and increase participation among a diversity of beneficial users).

- The GSP does not include a plan for continual opportunities for engagement through the *implementation* phase of the GSP for DACs, domestic well owners, tribes, and environmental stakeholders.

RECOMMENDATIONS

- In the Notice and Communications section, describe active and targeted outreach to engage DACs, domestic well owners, tribes, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- Describe efforts to consult and engage with DACs and domestic well owners within the subbasin.

- Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the subbasin within the GSP.[9]

- Describe efforts to consult and engage with environmental stakeholders within the subbasin.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[10,11,12]

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[9] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[10] "The description of undesirable results shall include [...] 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." [23 CCR §354.26(b)(3)]

[11] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[12] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

Disadvantaged Communities and Drinking Water Users
For chronic lowering of groundwater levels, the GSP presents an analysis of the impact of minimum thresholds on domestic wells. Minimum thresholds were established to maintain groundwater elevations above the shallowest perforated intervals of nearby wells. The GSP states (p. 8-19): *"As documented in Appendix B, domestic well construction was analyzed to identify the top of screen intervals for existing domestic wells. By maintaining water levels above the top screen, domestic users are protected. At each RMS location, the top screen interval for domestic wells is shown in reference to the applicable MT (see Appendix Q – SMC Hydrographs). MTs could result in slightly higher energy costs associated with greater pumping lifts in limited areas. No wells are expected to go dry."*

The GSP does not however, sufficiently describe or analyze direct or indirect impacts on DACs, drinking water users or tribes when defining undesirable results, nor does it describe how the existing minimum threshold groundwater levels are consistent with avoiding undesirable results to DACs and tribes in the subbasin.

For degraded water quality, the GSP establishes SMC for total dissolved solids (TDS) and nitrate. Minimum thresholds are set to state secondary maximum contaminant level (MCL) and the state primary MCL, respectively. SMC have not been established for other constituents of concern (COCs), however. The GSP states (8-26): *"As described in Section 5 – Groundwater Conditions, there are some areas of elevated total dissolved solids (TDS), arsenic (As), hexavalent chromium (CrVI), iron (Fe), and manganese (Mn). With no trends in As, CrVI, Fe, and Mn observed to date, the NASb is not setting SMCs for these constituents at this time."* The GSP continues (p. 8-27): *"It is also worth noting that in the Sacramento County portion of the NASb, there are well-documented larger areas of contamination and localized quality issues as described in Section 5 – Groundwater Conditions. As also described in that section, the NASb has maintained active coordination with regulators and responsible parties to address effective remediation of these contaminants. For that reason, there are no SMC for the contaminants in groundwater."* SMC should be established for <u>all</u> COCs in the subbasin that may be impacted and/or exacerbated by groundwater use or management, in addition to coordinating with water quality regulatory programs. Naturally occurring COCs can be exacerbated as a result of groundwater use or groundwater management within the subbasin.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[13]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs, drinking water users, and tribes.

[13] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that may be impacted or exacerbated by groundwater use and/or management. Ensure they align with drinking water standards.[14]

Groundwater Dependent Ecosystems and Interconnected Surface Waters

For chronic lowering of groundwater levels, the GSP states (p. 8-14): *"Following the calculations of the MTs, the resulting values were then compared to beneficial users to evaluate whether they would experience significant impacts at those future groundwater elevations. Hydrographs for each RMS showing actual groundwater elevations in comparison to baseline and model projected MTs are in Appendix Q – SMC Hydrographs."* Some of the hydrographs in Appendix Q show the 30 foot depth-to-water threshold used in the GDE identification. However, within the SMC section of the GSP, there is no further discussion or explanation of the impacts to GDEs, including discussion of the location of RMS wells in relation to GDEs or the impacts to GDEs when groundwater levels fall below the 30 foot threshold (or 80 feet within the context of Valley Oak).

For the depletion of interconnected surface water sustainability indicator, groundwater levels are used as a proxy. The GSP states (p. 8-42): *"Depletion of surface water is considered significant and unreasonable when the following occurs: 20% or more of the NASb interconnected surface water (ISW) representative monitoring sites (RMSs) have minimum threshold exceedances for 2 consecutive fall measurements (5 out of 23)."* The GSP continues (p. 8-43): *"The MTs for depletion of surface water are the same as for chronic lowering of groundwater, with the exception that only a subset of the RMS locations is considered interconnected with the surface water system."* However, no analysis or discussion is presented to describe how the SMC will affect GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. Furthermore, the GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin (see Attachment C for a list of environmental users in the subbasin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the

[14] "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." [23 CCR §354.34(c)(4)]

subbasin.[15] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[16]

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs should include “impacts on groundwater dependent ecosystems”.

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[17] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,18]

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[19] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[20] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using data from the American River Basin Study. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate extremely wet and dry scenarios into projected water budgets or select more appropriate extreme scenarios for the subbasin. The GSP assesses the effects of possible extreme conditions for a Hot-Dry (HD) scenario. Given the location of the subbasin between the American and Sacramento rivers,

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[15] “The description of undesirable results shall include [...] 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”. [23 CCR §354.26(b)(3)]

[16] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.” [23 CCR §354.28(b)(4)]

[17] “The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results.” [23 CCR §354.28(c)(6)]

[18] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California’s threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[19] “Each Plan shall 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.” [23 CCR §354.18(e)]

[20] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

a cool and wet scenario may also help identify potential vulnerabilities and/or opportunity areas for recharge projects. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

The GSP incorporates climate change into key inputs (e.g., precipitation and evapotranspiration) of the projected water budget. However, imported water was not quantified as part of surface water flow inputs for future water budgets. If the water budgets are incomplete, including the omission of projected climate change effects on imported water flow inputs, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, tribes, and domestic well owners.

RECOMMENDATIONS

- Incorporate climate change into imported water flow inputs for the projected water budget.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to a lack of specific plans to increase the Representative Monitoring Wells (RMWs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, tribes, GDEs, and ISWs in the subbasin.

Figure 7-8 (Representative Monitoring Wells for Chronic Lowering of Groundwater) and Figure 7-10 (Shallow Aquifer Water Quality Representative Monitoring Wells) show that no monitoring wells are located across portions of the subbasin near DACs, domestic wells, and tribes (see maps provided in Attachment E). Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[21]

The GSP provides some discussion of data gaps for GDEs and ISWs in Sections 7.4.6 (Chronic Lowering of Groundwater Levels Data Gaps), however, it does not provide specific plans, such as locations or a timeline, to fill the data gaps.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, tribes, GDEs, and ISWs to clearly identify potentially impacted areas. Increase the number of RMWs in the shallow aquifer across the subbasin as needed to adequately monitor all groundwater condition indicators. Prioritize proximity to DACs, domestic wells, tribes, and GDEs when identifying new RMWs.

[21] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

- Further describe the biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, drinking water users, and tribes. While the expansion of the Sacramento Regional Water Bank is described as a recharge project within the subbasin, the plan fails to specify any benefits the project will have to the environment or DACs. Therefore, potential project and management actions as currently proposed may overlook the protection of these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSAs plan to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For further guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[22]

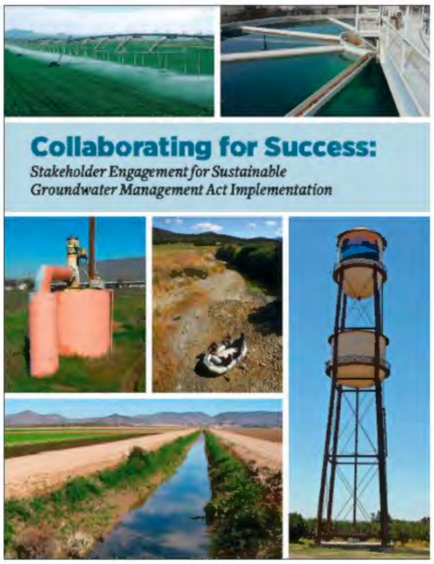
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[22] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

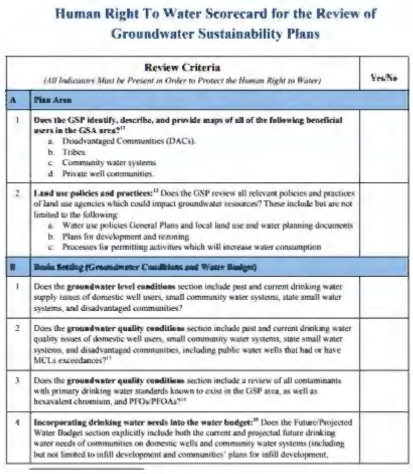
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

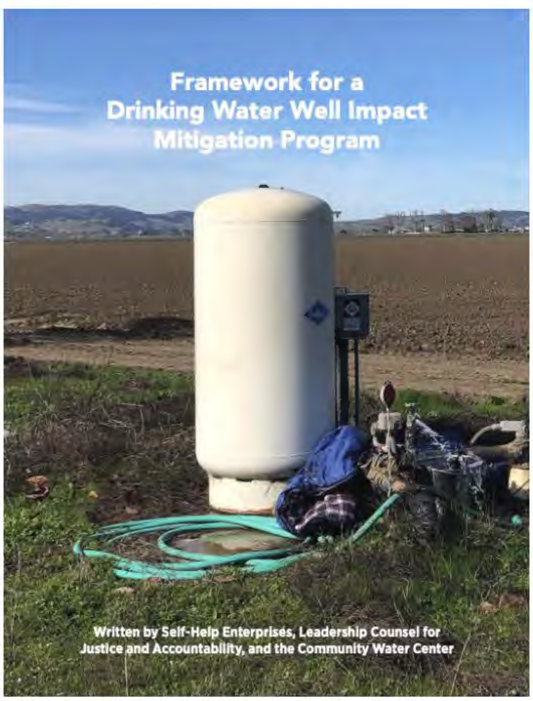


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

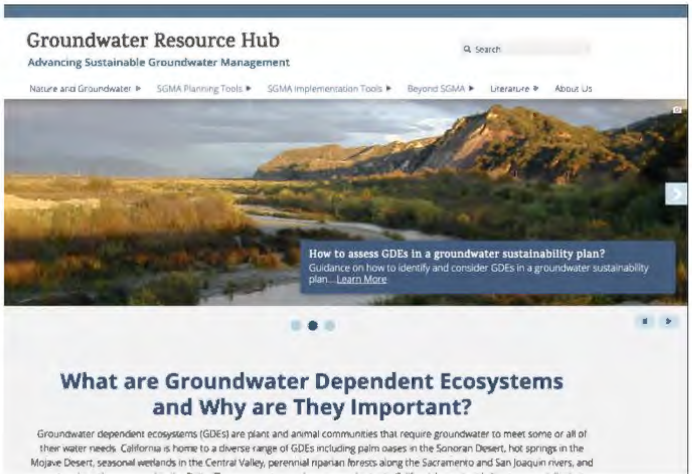
The [Human Right to Water Scorecard] was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

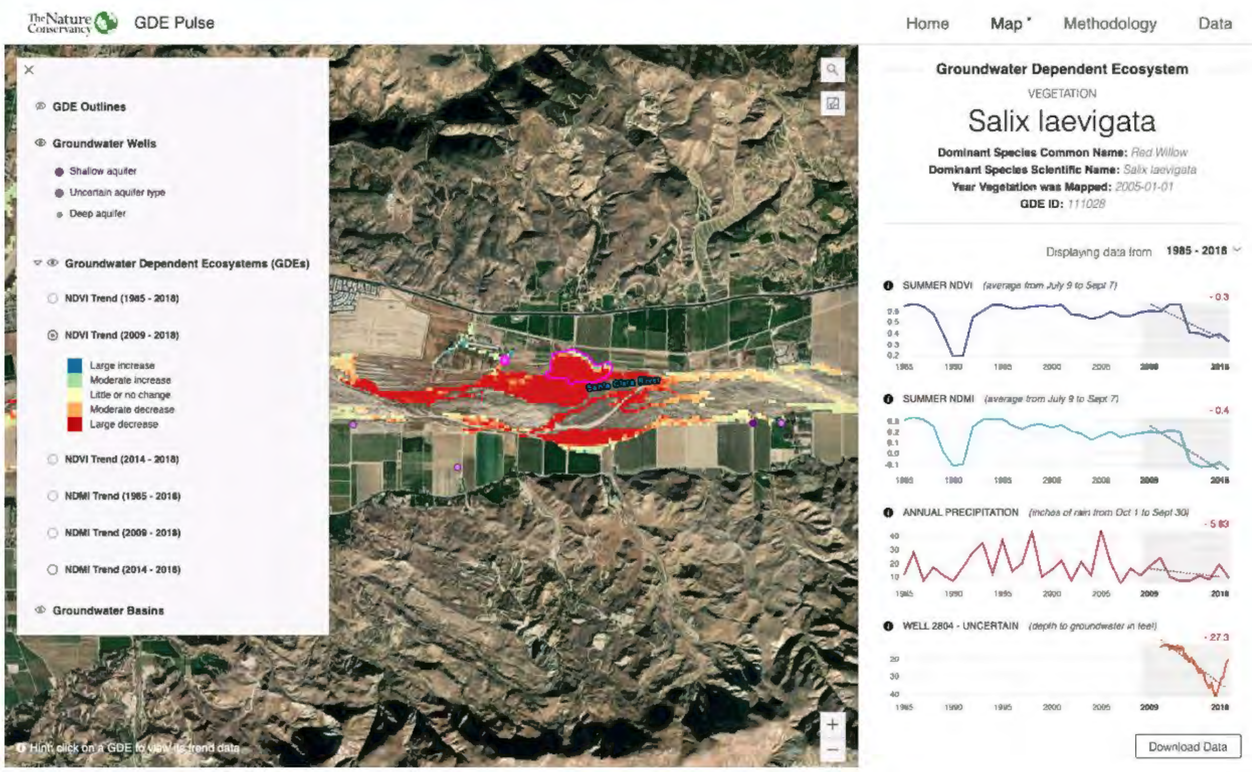
1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. 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. The following datasets are available for downloading:

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.

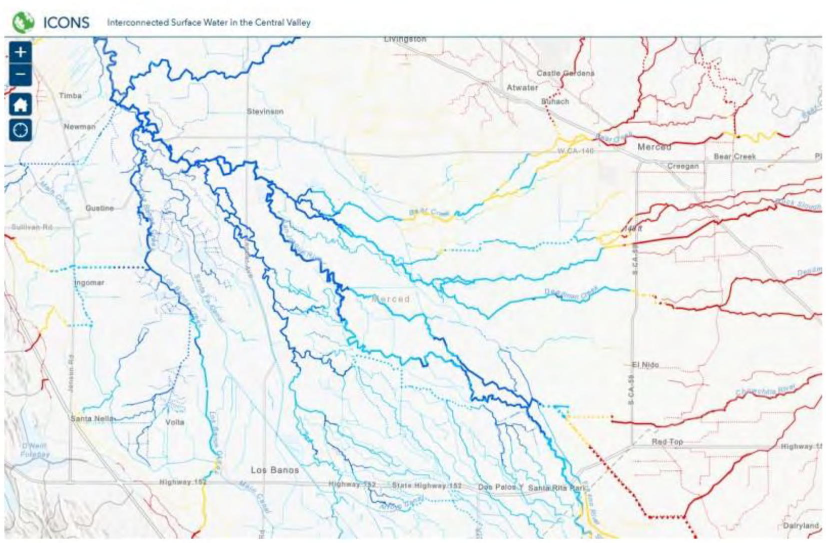
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water 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. 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.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the North American Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the North American Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	**State**	**Other**
BIRDS				
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Egretta thula	Snowy Egret			
Nycticorax nycticorax	Black-crowned Night-Heron			
Phalacrocorax auritus	Double-crested Cormorant			
Riparia riparia	Bank Swallow		Threatened	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Aythya affinis	Lesser Scaup			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus buccinator	Trumpeter Swan			
Cygnus columbianus	Tundra Swan			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	

Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
Branchinecta conservatio	Conservancy Fairy Shrimp	Endangered	Special	IUCN - Endangered
Cambaridae fam.	Cambaridae fam.			
Crangonyx spp.	Crangonyx spp.			
Cyprididae fam.	Cyprididae fam.			
Gammaridae fam.	Gammaridae fam.			
Gammarus spp.	Gammarus spp.			
Hyalella spp.	Hyalella spp.			
FISH				
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Pogonichthys macrolepidotus	Sacramento splittail		Special Concern	Vulnerable - Moyle 2013
Spirinchus thaleichthys	Longfin smelt	Candidate	Threatened	Vulnerable - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV spring	Central Valley spring Chinook salmon	Threatened	Threatened	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV winter	Central Valley winter Chinook salmon	Endangered	Endangered	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC

Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis sirtalis	Common Gartersnake			
Pseudacris regilla	Northern Pacific Chorus Frog			
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis sirtalis fitchi	Valley Gartersnake			Not on any status lists
INSECTS & OTHER INVERTS				
Ablabesmyia annulata				Not on any status lists
Ablabesmyia spp.	Ablabesmyia spp.			
Acentrella spp.	Acentrella spp.			
Aeshna spp.	Aeshna spp.			
Aeshnidae fam.	Aeshnidae fam.			
Agabus lutosus				Not on any status lists
Agabus spp.	Agabus spp.			
Alotanypus spp.	Alotanypus spp.			
Ambrysus spp.	Ambrysus spp.			
Anax junius	Common Green Darner			
Anax spp.	Anax spp.			
Anopheles spp.	Anopheles spp.			
Apedilum spp.	Apedilum spp.			
Argia agrioides	California Dancer			
Argia emma	Emma's Dancer			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Baetidae fam.	Baetidae fam.			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Belostoma spp.	Belostoma spp.			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Brillia spp.	Brillia spp.			
Caenis amica	A Mayfly			
Caenis latipennis	A Mayfly			
Caenis spp.	Caenis spp.			
Callibaetis spp.	Callibaetis spp.			
Camelobaetidius kickapoo				Not on any status lists
Camelobaetidius spp.	Camelobaetidius spp.			
Centroptilum album	A Mayfly			
Centroptilum spp.	Centroptilum spp.			

Ceraclea spp.	Ceraclea spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chimarra spp.	Chimarra spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Cladopelma spp.	Cladopelma spp.			
Cladotanytarsus marki				Not on any status lists
Cladotanytarsus spp.	Cladotanytarsus spp.			
Clinotanypus spp.	Clinotanypus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corisella decolor				Not on any status lists
Corixidae fam.	Corixidae fam.			
Cricotopus annulator				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus spp.	Cryptochironomus spp.			
Cryptotendipes spp.	Cryptotendipes spp.			
Culex spp.	Culex spp.			
Culicidae fam.	Culicidae fam.			
Culiseta spp.	Culiseta spp.			
Dicrotendipes adnilus				Not on any status lists
Dicrotendipes spp.	Dicrotendipes spp.			
Dubiraphia brunnescens	Brownish Dubiraphian Riffle Beetle		Special	
Dubiraphia spp.	Dubiraphia spp.			
Dytiscidae fam.	Dytiscidae fam.			
Dytiscus marginicollis				Not on any status lists
Enallagma boreale	Boreal Bluet			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Enallagma cyathigerum				Not on any status lists
Enallagma praevarum	Arroyo Bluet			
Enallagma spp.	Enallagma spp.			
Endochironomus spp.	Endochironomus spp.			
Ephydridae fam.	Ephydridae fam.			
Epitheca canis	Beaverpond Baskettail			
Erythemis collocata	Western Pondhawk			
Eukiefferiella spp.	Eukiefferiella spp.			
Euryhapsis spp.	Euryhapsis spp.			
Fallceon quilleri	A Mayfly			
Fallceon spp.	Fallceon spp.			
Gerridae fam.	Gerridae fam.			
Glyptotendipes spp.	Glyptotendipes spp.			
Gomphidae fam.	Gomphidae fam.			

Gomphus kurilis	Pacific Clubtail			
Gomphus spp.	Gomphus spp.			
Helochares normatus				Not on any status lists
Helophorus spp.	Helophorus spp.			
Hetaerina americana	American Rubyspot			
Hydraena spp.	Hydraena spp.			
Hydrophilidae fam.	Hydrophilidae fam.			
Hydrophilus triangularis				Not on any status lists
Hydropsyche alternans				Not on any status lists
Hydropsyche californica	A Caddisfly			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila ajax	A Caddisfly			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ironodes spp.	Ironodes spp.			
Ischnura cervula	Pacific Forktail			
Ischnura perparva	Western Forktail			
Ischnura spp.	Ischnura spp.			
Labrundinia spp.	Labrundinia spp.			
Laccobius spp.	Laccobius spp.			
Laccophilus spp.	Laccophilus spp.			
Larsia spp.	Larsia spp.			
Lepidostoma spp.	Lepidostoma spp.			
Leptoceridae fam.	Leptoceridae fam.			
Lestes congener	Spotted Spreadwing			
Libellula forensis	Eight-spotted Skimmer			
Libellula luctuosa	Widow Skimmer			
Libellula pulchella	Twelve-spotted Skimmer			
Libellula saturata	Flame Skimmer			
Libellula spp.	Libellula spp.			
Libellulidae fam.	Libellulidae fam.			
Limnophyes spp.	Limnophyes spp.			
Liodessus obscurellus				Not on any status lists
Liodessus spp.	Liodessus spp.			
Mesovelia spp.	Mesovelia spp.			
Micrasema spp.	Micrasema spp.			
Microchironomus nigrovittatus				Not on any status lists
Microchironomus spp.	Microchironomus spp.			
Micropsectra spp.	Micropsectra spp.			
Microtendipes spp.	Microtendipes spp.			
Microvelia spp.	Microvelia spp.			

Mideopsis pumila				Not on any status lists
Mideopsis spp.	Mideopsis spp.			
Mystacides alafimbriatus	A Caddisfly			
Mystacides spp.	Mystacides spp.			
Nanocladius spp.	Nanocladius spp.			
Nectopsyche dorsalis	A Caddisfly			
Nectopsyche gracilis	A Caddisfly			
Nectopsyche spp.	Nectopsyche spp.			
Ochthebius spp.	Ochthebius spp.			
Ophiogomphus arizonicus				Not on any status lists
Ophiogomphus occidentis	Sinuous Snaketail			
Ophiogomphus spp.	Ophiogomphus spp.			
Ordobrevia nubifera				Not on any status lists
Orthocladius spp.	Orthocladius spp.			
Oxyethira spp.	Oxyethira spp.			
Pachydiplax longipennis	Blue Dasher			
Pantala hymenaea	Spot-winged Glider			
Parachaetocladius spp.	Parachaetocladius spp.			
Parachironomus spp.	Parachironomus spp.			
Paracloeodes minutus	A Small Minnow Mayfly			
Parakiefferiella spp.	Parakiefferiella spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paraphaenocladius spp.	Paraphaenocladius spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Paratendipes spp.	Paratendipes spp.			
Peltodytes spp.	Peltodytes spp.			
Pentaneura inconspicua				Not on any status lists
Pentaneura spp.	Pentaneura spp.			
Perlodidae fam.	Perlodidae fam.			
Petrophila confusalis				Not on any status lists
Petrophila spp.	Petrophila spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Plathemis lydia	Common Whitetail			
Polypedilum albicorne				Not on any status lists
Polypedilum spp.	Polypedilum spp.			
Procladius spp.	Procladius spp.			
Progomphus borealis	Gray Sanddragon			
Protoptila spp.	Protoptila spp.			
Psectrocladius spp.	Psectrocladius spp.			
Psectrotanypus spp.	Psectrotanypus spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Pseudosmittia spp.	Pseudosmittia spp.			

Psychodidae fam.	Psychodidae fam.			
Rhagovelia spp.	Rhagovelia spp.			
Rheotanytarsus hamatus				Not on any status lists
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna californica	California Darner			
Rhionaeschna multicolor	Blue-eyed Darner			
Robackia demeijeri				Not on any status lists
Simuliidae fam.	Simuliidae fam.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Sperchon stellata				Not on any status lists
Stenochironomus spp.	Stenochironomus spp.			
Stylurus olivaceus	Olive Clubtail			
Sympetrum corruptum	Variegated Meadowhawk			
Tanypus spp.	Tanypus spp.			
Tanytarsus angulatus				Not on any status lists
Tanytarsus spp.	Tanytarsus spp.			
Tipulidae fam.	Tipulidae fam.			
Tramea lacerata	Black Saddlebags			
Tramea spp.	Tramea spp.			
Trichocorixa calva				Not on any status lists
Trichocorixa spp.	Trichocorixa spp.			
Tricorythodes explicatus	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus spp.	Tropisternus spp.			
Unionicolidae fam.	Unionicolidae fam.			
Uvarus subtilis				Not on any status lists
Wormaldia spp.	Wormaldia spp.			
Xenochironomus spp.	Xenochironomus spp.			
Zavrelimyia spp.	Zavrelimyia spp.			
Zoniagrion exclamationis	Exclamation Damsel			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Ferrissia spp.	Ferrissia spp.			
Galba spp.	Galba spp.			

Gonidea angulata	Western Ridged Mussel		Special	
Gyraulus circumstriatus	Disc Gyro			CS
Gyraulus crista	Star Gyro			CS
Gyraulus spp.	Gyraulus spp.			
Helisoma spp.	Helisoma spp.			
Hydrobiidae fam.	Hydrobiidae fam.			
Lymnaea spp.	Lymnaea spp.			
Lymnaeidae fam.	Lymnaeidae fam.			
Margaritifera falcata	Western Pearlshell		Special	
Menetus opercularis	Button Sprite			CS
Menetus spp.	Menetus spp.			
Physa acuta	Pewter Physa			Not on any status lists
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Planorbidae fam.	Planorbidae fam.			
Sphaeriidae fam.	Sphaeriidae fam.			
Sphaerium spp.	Sphaerium spp.			
Anodonta californiensis	California Floater		Special	
PLANTS				
Chloropyron molle hispidum			Special	CRPR - 1B.1
Downingia pusilla	Dwarf Downingia		Special	CRPR - 2B.2
Gratiola heterosepala	Boggs Lake Hedge-hyssop		Endangered	CRPR - 1B.2
Legenere limosa	False Venus'-looking-glass		Special	CRPR - 1B.1
Orcuttia viscida	Sacramento Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Sagittaria sanfordii	Sanford's Arrowhead		Special	CRPR - 1B.2
Alnus rhombifolia	White Alder			
Alopecurus pratensis	NA			
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Ammannia robusta	Grand Redstem			
Arundo donax	NA			
Baccharis salicina				Not on any status lists
Brodiaea nana				Not on any status lists
Callitriche heterophylla bolanderi	Large Water-starwort			
Callitriche marginata	Winged Water-starwort			
Cephalanthus occidentalis	Common Buttonbush			
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Crassula solieri	NA			Not on any status lists
Downingia bicornuta	NA			

Downingia cuspidata	Toothed Calicoflower			
Downingia ornatissima	NA			
Elatine brachysperma	Shortseed Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			
Elodea canadensis	Broad Waterweed			
Epilobium campestre	NA			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eryngium castrense	Great Valley Eryngo			
Eryngium vaseyi vallicola				Not on any status lists
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Gratiola ebracteata	Bractless Hedge-hyssop			
Helenium puberulum	Rosilla			
Isoetes howellii	NA			
Isoetes orcuttii	NA			
Juncus acuminatus	Sharp-fruit Rush			
Juncus diffusissimus	NA			
Juncus effusus pacificus				
Juncus uncialis	Inch-high Rush			
Lasthenia fremontii	Fremont's Goldfields			
Leersia oryzoides	Rice Cutgrass			
Lemna minor	Lesser Duckweed			
Lemna valdiviana	Pale Duckweed			
Limnanthes alba alba	White Meadowfoam			
Limnanthes floccosa californica	Shippee Meadowfoam	Endangered	Endangered	CRPR - 1B.1
Ludwigia hexapetala	NA			Not on any status lists
Ludwigia palustris	Marsh Seedbox			
Ludwigia peploides montevidensis	NA			Not on any status lists
Ludwigia peploides peploides	NA			Not on any status lists
Lycopus americanus	American Bugleweed			
Mimulus cardinalis	Scarlet Monkeyflower			
Mimulus guttatus	Common Large Monkeyflower			
Mimulus tricolor	Tricolor Monkeyflower			
Myosotis laxa	Small Forget-me-not			
Myosotis scorpioides	NA			
Myosurus apetalus	Bristly Mousetail			
Myriophyllum aquaticum	NA			

Navarretia intertexta	Needleleaf Navarretia			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Navarretia myersii myersii	Pincushion Navarretia		Special	CRPR - 1B.1
Panicum dichotomiflorum	NA			
Persicaria hydropiper	NA			Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Plagiobothrys distantiflorus	California Popcorn-flower			
Plagiobothrys greenei	Greene's Popcorn-flower			
Plagiobothrys undulatus	NA			Not on any status lists
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Pogogyne zizyphoroides				Not on any status lists
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Psilocarphus tenellus	NA			
Ranunculus bonariensis	NA			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rumex conglomeratus	NA			
Sagittaria latifolia latifolia	Broadleaf Arrowhead			
Salix breweri	Brewer's Willow			
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix melanopsis	Dusky Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus californicus	California Bulrush			
Sidalcea calycosa calycosa	Annual Checker-mallow			
Stachys stricta	Sonoma Hedge-nettle			

Triglochin scilloides	NA			Not on any status lists
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Veronica anagallis-aquatica	NA			

Attachment D

The Nature Conservancy

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[1] 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)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

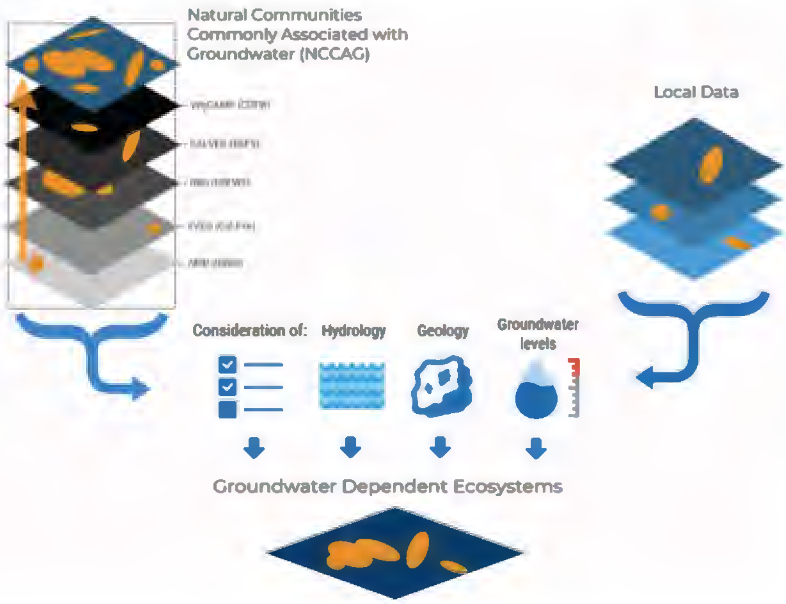


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] 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[3]. 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[4] on the Groundwater Resource Hub[5], 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*.

[3] 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

[4] "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/

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

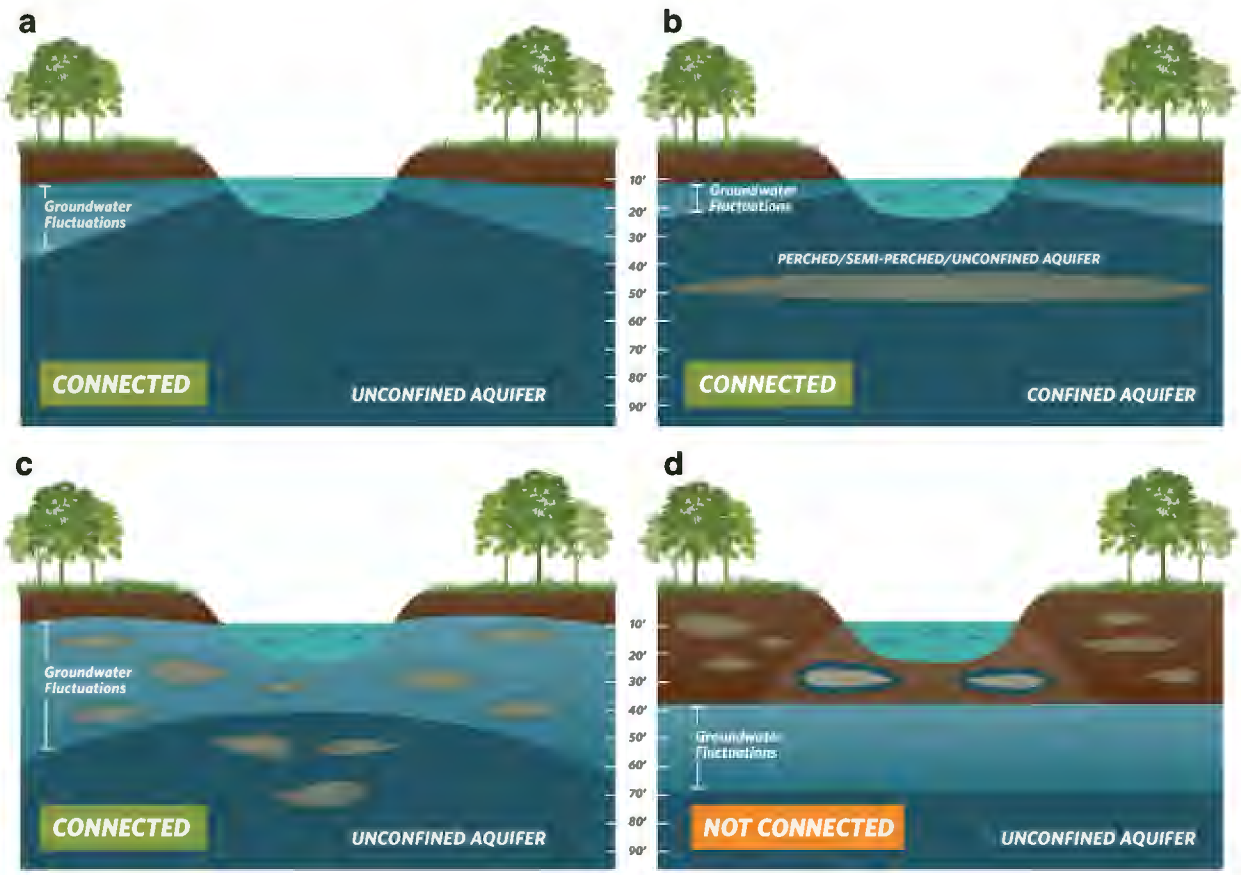


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying 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[6] 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[7] 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[8] 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[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network (see Best Practice #6).

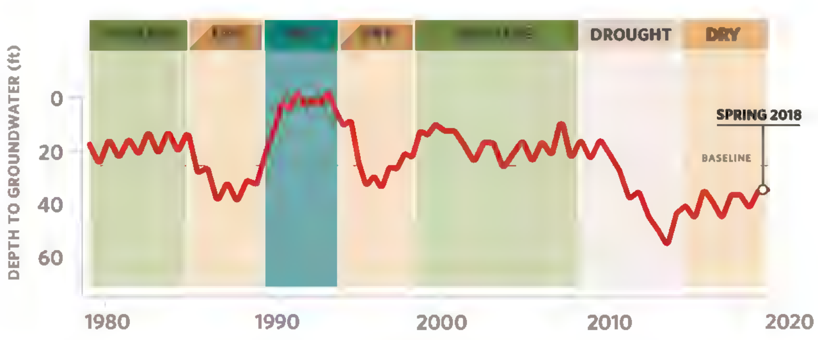


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so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

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[6] 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

[7] 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)]

[8] 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]).

[9] 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[10], 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.

[10] 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.

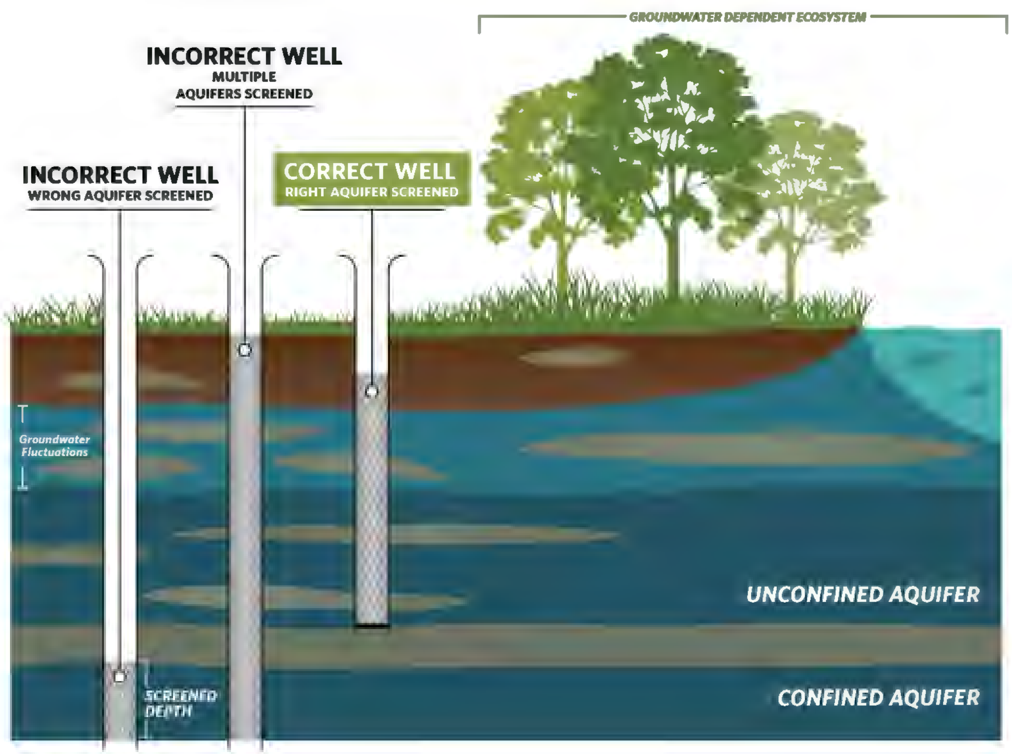

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

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)[11] 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.

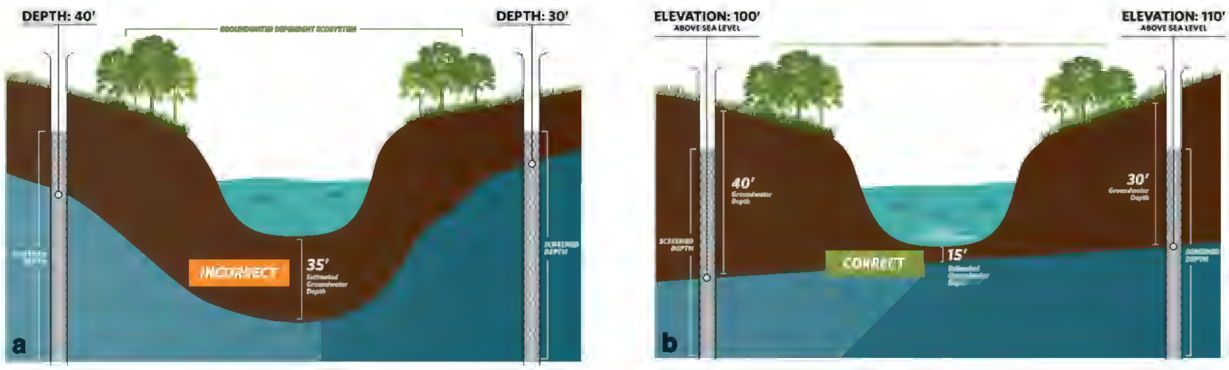

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

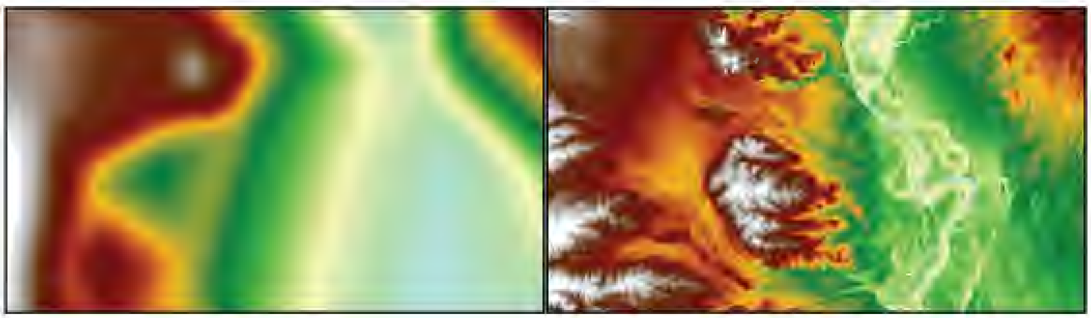

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation 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.

[11] 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

Maps of representative monitoring sites in relation to key beneficial users

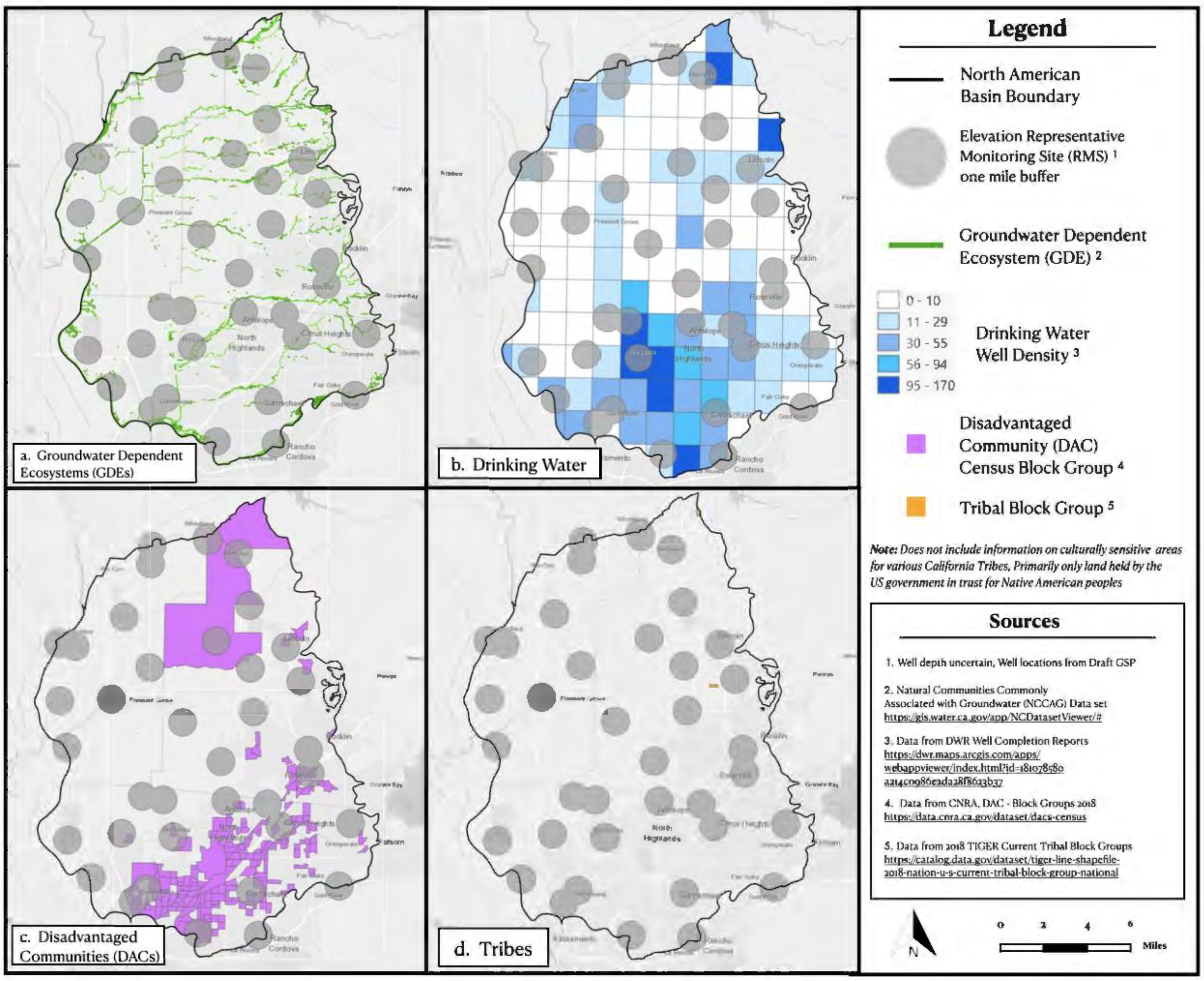

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

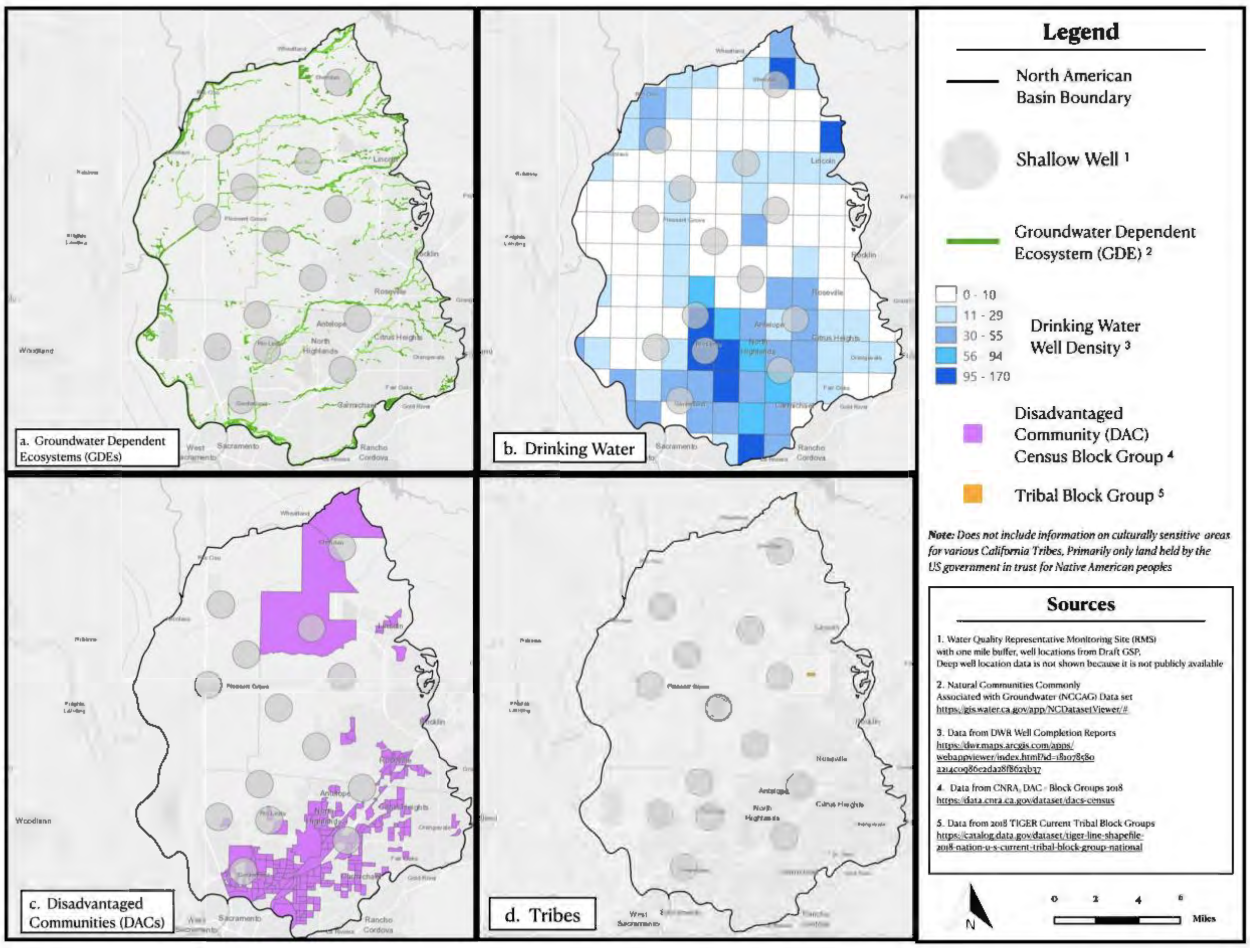

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.