CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE
715 P Street, 8th Floor | Sacramento, CA 95814 | P.O. Box 942836 | Sacramento, CA 94236-0001

July 27, 2023

Trevor Joseph
Sacramento Groundwater Authority
2295 Gateway Oaks Dr, Suite 100
Sacramento, CA, 95833
tjoseph@rwah2o.org

RE: Sacramento Valley – North American Subbasin 2022 Groundwater Sustainability Plan

Dear Trevor Joseph,

The Department of Water Resources (Department) has evaluated the groundwater sustainability plan (GSP) submitted for the Sacramento Valley – North American Subbasin and has determined the GSP is approved. The approval is based on recommendations from the Staff Report, included as an exhibit to the attached Statement of Findings, which describes that the North American Subbasin satisfies the objectives of the Sustainable Groundwater Management Act (SGMA) and substantially complies with the GSP Regulations. The Staff Report also proposes recommended corrective actions that the Department believes will enhance the GSP and facilitate future evaluation by the Department. The Department strongly encourages the recommended corrective actions be given due consideration and suggests incorporating all resulting changes to the GSP in future updates.

Recognizing SGMA sets a long-term horizon for groundwater sustainability agencies (GSAs) to achieve their basin sustainability goals, monitoring progress is fundamental for successful implementation. GSAs are required to evaluate their GSPs at least every five years and whenever the Plan is amended, and to provide a written assessment to the Department. Accordingly, the Department will evaluate approved GSPs and issue an assessment at least every five years. The Department will initiate the first periodic review of the North American Subbasin no later than January 24, 2027.

Please contact Sustainable Groundwater Management staff by emailing sgmps@water.ca.gov if you have any questions related to the Department's assessment or implementation of your GSP.

Thank You,

Paul Gosselin

Paul Gosselin
Deputy Director
Sustainable Groundwater Management

Attachment:

1. Statement of Findings Regarding the Approval of the Sacramento Valley – North American Subbasin Groundwater Sustainability Plan

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

STATEMENT OF FINDINGS REGARDING THE APPROVAL OF THE SACRAMENTO VALLEY – NORTH AMERICAN SUBBASIN GROUNDWATER SUSTAINABILITY PLAN

The Department of Water Resources (Department) is required to evaluate whether a submitted groundwater sustainability plan (GSP or Plan) conforms to specific requirements of the Sustainable Groundwater Management Act (SGMA or Act), is likely to achieve the sustainability goal for the basin covered by the Plan, and whether the Plan adversely affects the ability of an adjacent basin to implement its GSP or impedes achievement of sustainability goals in an adjacent basin. (Water Code § 10733.) The Department is directed to issue an assessment of the Plan within two years of its submission. (Water Code § 10733.4.) This Statement of Findings explains the Department's decision regarding the Plan submitted by the Reclamation District 1001 Groundwater Sustainability Agency (GSA), Sacramento Groundwater Authority GSA, South Sutter Water District GSA, Sutter County GSA, and West Placer GSA (collectively referenced to as the GSAs or Agencies) for the North American Subbasin (Basin No. 5-021.64).

Department management has discussed the Plan with staff and has reviewed the Department Staff Report, entitled Sustainable Groundwater Management Program Groundwater Sustainability Plan Assessment Staff Report, attached as Exhibit A, recommending approval of the GSP. Department management is satisfied that staff have conducted a thorough evaluation and assessment of the Plan and concurs with staff's recommendation and all the recommended corrective actions. The Department therefore **APPROVES** the Plan and makes the following findings:

A. The Plan satisfies the required conditions as outlined in § 355.4(a) of the GSP Regulations (23 CCR § 350 et seq.):

    1. The Plan was submitted within the statutory deadline of January 31, 2022. (Water Code § 10720.7(a); 23 CCR § 355.4(a)(1).)

    2. The Plan was complete, meaning it generally appeared to include the information required by the Act and the GSP Regulations sufficient to warrant a thorough evaluation and issuance of an assessment by the Department. (23 CCR § 355.4(a)(2).)

    3. The Plan, either on its own or in coordination with other Plans, covers the entire Subbasin. (23 CCR § 355.4(a)(3).)

B. The general standards the Department applied in its evaluation and assessment of the Plan are: (1) "conformance" with the specified statutory requirements, (2) "substantial compliance" with the GSP Regulations, (3) whether the Plan is likely to achieve the sustainability goal for the Subbasin within 20 years of the implementation of the Plan, and (4) whether the Plan adversely affects the ability of an adjacent basin to implement its GSP or impedes achievement of sustainability goals in an adjacent basin. (Water Code § 10733.) Application of these standards requires exercise of the Department's expertise, judgment, and discretion when making its determination of whether a Plan should be deemed "approved," "incomplete," or "inadequate."

   The statutes and GSP Regulations require Plans to include and address a multitude and wide range of informational and technical components. The Department has observed a diverse array of approaches to addressing these technical and informational components being used by GSAs in different basins throughout the state. The Department does not apply a set formula or criterion that would require a particular outcome based on how a Plan addresses any one of SGMA's numerous informational and technical components. The Department finds that affording flexibility and discretion to local GSAs is consistent with the standards identified above; the state policy that sustainable groundwater management is best achieved locally through the development, implementation, and updating of local plans and programs (Water Code § 113); and the Legislature's express intent under SGMA that groundwater basins be managed through the actions of local governmental agencies to the greatest extent feasible, while minimizing state intervention to only when necessary to ensure that local agencies manage groundwater in a sustainable manner. (Water Code § 10720.1(h)) The Department's final determination is made based on the entirety of the Plan's contents on a case-by-case basis, considering and weighing factors relevant to the particular Plan and Subbasin under review.

C. In making these findings and Plan determination, the Department also recognized that: (1) The Department maintains continuing oversight and jurisdiction to ensure the Plan is adequately implemented; (2) the Legislature intended SGMA to be implemented over many years; (3) SGMA provides Plans 20 years of implementation to achieve the sustainability goal in a basin (with the possibility that the Department may grant GSAs an additional five years upon request if the GSA has made satisfactory progress toward sustainability); and, (4) local agencies acting as GSAs are authorized, but not required, to address undesirable results that occurred prior to enactment of SGMA. (Water Code §§ 10721(r); 10727.2(b); 10733(a); 10733.8.)

D. The Plan conforms with Water Code §§ 10727.2 and 10727.4, substantially complies with 23 CCR § 355.4, and appears likely to achieve the sustainability goal for the Subbasin. It does not appear at this time that the Plan will adversely

affect the ability of adjacent basins to implement their GSPs or impede achievement of sustainability goals.

1. The sustainable management criteria and goal to maintain groundwater levels at, or within 18 feet, of fall 2014 and 2015 conditions are sufficiently justified and explained. The GSAs' developed their sustainable management criteria based on their thorough understanding of the Subbasin's hydrology and anticipated changing conditions over the planning and implementation horizon. The Plan relies on decades of credible information and science to quantify the groundwater conditions that the Plan seeks to avoid and provides an objective way to determine whether the Subbasin is being managed sustainably in accordance with SGMA. (23 CCR § 355.4(b)(1).)

2. The Plan demonstrates an understanding of where data gaps exist and generally commits to filling some known data gaps during GSP implementation. (23 CCR § 355.4(b)(2).)

3. The projects and management actions proposed, which focus largely on reducing groundwater pumping though the expansion of the conjunctive use and water banking programs, are reasonable and commensurate with the level of understanding of the Subbasin setting. The projects and management actions described in the Plan provide a feasible approach to achieving the Subbasin's sustainability goal and should provide the GSAs with greater versatility to adapt and respond to changing conditions and future challenges during GSP implementation. (23 CCR § 355.4(b)(3).)

4. The Plan provides a detailed explanation of how the varied interests of groundwater uses and users in the Subbasin were considered in developing the sustainable management criteria and how those interests, including shallow domestic wells and groundwater dependent ecosystems, would be impacted by the chosen minimum thresholds. (23 CCR § 355.4(b)(4).)

5. The Plan's projects and management actions appear feasible at this time and appear capable of preventing undesirable results and ensuring that the Subbasin is managed within its sustainable yield within 20 years. The Department will continue to monitor Plan implementation and reserves the right to change its determination if projects and management actions are not implemented or appear unlikely to prevent undesirable results or achieve sustainability within SGMA timeframes. (23 CCR § 355.4(b)(5).)

6. The Plan includes a reasonable assessment of overdraft conditions and includes reasonable means to mitigate overdraft, if present. (23 CCR § 355.4(b)(6).)

7. At this time, it does not appear that the Plan will adversely affect the ability of an adjacent basin to implement its GSP or impede achievement of sustainability goals in an adjacent basin. The Plan states that the proposed minimum thresholds would have minimal impacts on the adjacent subbasins based on the limited lowering of average groundwater levels at the subbasin boundaries and a negligible change in anticipated future boundary flows based on model projections with climate change and project implementation. Further, the GSAs met with representatives from each of the other subbasins and it was agreed that the minimum thresholds would not impact the ability of the other agencies to sustainably manage their respective subbasins. (23 CCR § 355.4(b)(7).)

8. Because a single plan was submitted for the Subbasin, a coordination agreement was not required. (23 CCR § 355.4(b)(8).)

9. The five GSAs and their associated member agencies, Sacramento Groundwater Authority GSA; Reclamation District 1001 GSA; South Sutter Water District GSA; Sutter County GSA; and West Placer GSA (Placer County Water Agency, Placer County, and the cities of Roseville and Lincoln), have historically implemented numerous projects and management actions to address problematic groundwater conditions in the Subbasin. For instance, the Plan notes that cones of depression have historically occurred in both the northern agricultural areas and in the southern urban areas of the Subbasin, but local agency groundwater management responses have led to the stabilization or recovery of groundwater levels in these areas. The GSAs, and their member agencies, history of groundwater management provide a reasonable level of confidence, at this time, that the GSAs have the legal authority and financial resources necessary to implement the Plan. (23 CCR § 355.4(b)(9).)

10. Through review of the Plan and consideration of public comments, the Department determines that the GSAs adequately responded to comments that raised credible technical or policy issues with the Plan, sufficient to warrant approval of the Plan at this time. The Department also notes that the recommended corrective actions included in the Staff Report are important to addressing certain technical or policy issues that were raised and, if not addressed before future, subsequent plan evaluations, may preclude approval of the Plan in those future evaluations. (23 CCR § 355.4(b)(10).)

E. In addition to the grounds listed above, DWR also finds that:

1. The Plan sets forth minimum thresholds for chronic lowering of groundwater levels that take into consideration the depths of shallow

domestic wells. The GSAs developed the minimum thresholds based on a modeling analysis in combination with a domestic well impact analysis. The Plan uses the modeling analysis to determine the amount of adjustment relative to the fall 2014 and 2015 “baseline” levels, and the domestic well impact analysis to verify that the thresholds were set at a level that would not cause an unreasonable depletion of supply. The Plan’s compliance with the requirements of SGMA and substantial compliance with the GSP Regulations supports the state policy regarding the human right to water (Water Code § 106.3). The Department developed its GSP Regulations consistent with and intending to further the policy through implementation of SGMA and the Regulations, primarily by achieving sustainable groundwater management in a basin. By ensuring substantial compliance with the GSP Regulations, the Department has considered the state policy regarding the human right to water in its evaluation of the Plan. (23 CCR § 350.4(g).)

2. The Plan acknowledges and identifies interconnected surface waters within the Subbasin. The GSAs proposes initial sustainable management criteria to manage this sustainability indicator and measures to improve understanding and management of interconnected surface water. The GSAs acknowledge, and the Department agrees, many data gaps related to interconnected surface water exist. The GSAs should continue filling data gaps, collecting additional monitoring data, and coordinating with resources agencies and interested parties to understand beneficial uses and users that may be impacted by depletions of interconnected surface water caused by groundwater pumping. Future periodic evaluations of the Plan and amendments to the Plan should aim to improve the initial sustainable management criteria as more information and improved methodology becomes available.

3. The basin is not currently in a state of long-term overdraft and projections of future basin extractions are likely to stay within current and historic ranges, at least until the next periodic evaluation by the GSA and the Department. Basin groundwater levels and other SGMA sustainability indicators are unlikely to deteriorate while the GSA implements the Department’s recommended corrective actions. State intervention is not necessary at this time to ensure that local agencies manage groundwater in a sustainable manner. (Wat. Code § 10720.1(h).)

4. The California Environmental Quality Act (Public Resources Code § 21000 *et seq*.) does not apply to the Department’s evaluation and assessment of the Plan.

Accordingly, the GSP submitted by the Agencies for the North American Subbasin is hereby **APPROVED.** The recommended corrective actions identified in the Staff Report will assist the Department's future review of the Plan's implementation for consistency with SGMA and the Department therefore recommends the Agencies address them by the time of the Department's periodic review, which is set to begin on January 24, 2027, as required by Water Code § 10733.8. Failure to address the Department's Recommended Corrective Actions before future, subsequent plan evaluations, may lead to a Plan being determined incomplete or inadequate.

Signed:

Karla Nemeth
Karla Nemeth, Director
Date: July 27, 2023

Exhibit A: Groundwater Sustainability Plan Assessment Staff Report – Sacramento Valley – North American Subbasin

State of California
Department of Water Resources
Sustainable Groundwater Management Program
Groundwater Sustainability Plan Assessment
Staff Report

Groundwater Basin Name:	Sacramento Valley – North American Subbasin (No. 5-021.64)
Submitting Agency:	Reclamation District 1001 GSA; Sacramento Groundwater Authority GSA; South Sutter Water District GSA; Sutter County GSA; and West Placer GSA
Submittal Type:	Initial GSP Submission
Submittal Date:	January 24, 2022
Recommendation:	Approved
Date:	July 27, 2023

The Reclamation District 1001 Groundwater Sustainability Agency (GSA); Sacramento Groundwater Authority GSA; South Sutter Water District GSA; Sutter County GSA; and West Placer GSA (collectively referenced to as the GSAs or Agencies) submitted the North American Subbasin Groundwater Sustainability Plan (GSP or Plan) for the North American Subbasin (Subbasin) to the Department of Water Resources (DWR or Department) for evaluation and assessment as required by the Sustainable Groundwater Management Act (SGMA)[1] and GSP Regulations.[2] The GSP covers the entire Subbasin for the implementation of SGMA.

After evaluation and assessment, Department staff conclude that the Plan includes the required components of a GSP; demonstrates a thorough understanding of the Subbasin based on what appears to be the best available science and information; sets well explained, supported, and reasonable sustainable management criteria to prevent undesirable results as defined in the Plan; and proposes a set of projects and management actions that will likely achieve the sustainability goal defined for the Subbasin.[3] Department staff will continue to monitor and evaluate the Subbasin's progress toward achieving the sustainability goal through annual reporting and future periodic evaluations of the GSP and its implementation.

[1] Water Code § 10720 *et seq*.
[2] 23 CCR § 350 *et seq*.
[3] 23 CCR § 350 *et seq*.

- ***Based on the current evaluation of the Plan, Department staff recommend the GSP be approved with the recommended corrective actions described herein.***

This assessment includes five sections:

- **Section 1 – Summary:** Overview of Department staff's assessment and recommendations.
- **Section 2 – Evaluation Criteria:** Describes the legislative requirements and the Department's evaluation criteria.
- **Section 3 – Required Conditions:** Describes the submission requirements, Plan completeness, and basin coverage required for a GSP to be evaluated by the Department.
- **Section 4 – Plan Evaluation:** Provides an assessment of the contents included in the GSP organized by each Subarticle outlined in the GSP Regulations.
- **Section 5 – Staff Recommendation:** Includes the staff recommendation for the Plan and any recommended or required corrective actions, as applicable.

1 SUMMARY

Department staff recommend approval of the North American GSP. The GSAs have identified areas for improvement of their Plan (e.g., adding additional monitoring sites to the groundwater level and surface water monitoring networks, confirmation of interconnected surface water, and additional water quality sampling to assess trends in the northern portion of the Subbasin). Department staff concur that those items are important and recommend the GSAs address them as soon as possible. Department staff have also identified additional recommended corrective actions within this assessment that the GSAs should consider addressing by the first periodic evaluation of the Plan. The recommended corrective actions generally focus on the following:

(1) clarifying the definition of the bottom of the Subbasin,
(2) amending or clarifying the undesirable result definition for degraded water quality,
(3) establishing sustainable management criteria for land subsidence utilizing a monitoring network that directly measures land elevation change,
(4) continuing to fill data gaps; collecting additional monitoring data; and coordinating with resources agencies and interested parties to understand beneficial uses and users that may be impacted by depletions of interconnected surface water caused by groundwater pumping (and potentially refine sustainable management criteria), and
(5) addressing discrepancies between the monitoring network tables in the Plan and information provided on the SGMA Portal's Monitoring Network Module.

Addressing the recommended corrective actions identified in Section 5 of this assessment will be important to demonstrate, on an ongoing basis, that implementation of the Plan is likely to achieve the Subbasin's sustainability goal.

2 EVALUATION CRITERIA

The GSAs submitted a single GSP to the Department to evaluate whether the Plan conforms to specified SGMA requirements[4] and is likely to achieve the sustainability goal for the North American Subbasin.[5] To achieve the sustainability goal for the Subbasin, the GSP must demonstrate that implementation of the Plan will lead to sustainable groundwater management, which means the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results.[6] Undesirable results must be defined quantitatively by the GSAs.[7] The Department is also required to evaluate whether the GSP will adversely affect the ability of an adjacent basin to implement its GSP or achieve its sustainability goal.[8]

For the GSP to be evaluated by the Department, it must first be determined that the Plan was submitted by the statutory deadline,[9] and that it is complete and covers the entire basin.[10] If these conditions are satisfied, the Department evaluates the Plan to determine whether it complies with specific SGMA requirements and substantially complies with the GSP Regulations.[11] Substantial compliance means that the supporting information is sufficiently detailed and the analyses sufficiently thorough and reasonable, in the judgment of the Department, to evaluate the Plan, and the Department determines that any discrepancy would not materially affect the ability of the Agency to achieve the sustainability goal for the basin, or the ability of the Department to evaluate the likelihood of the Plan to attain that goal.[12]

When evaluating whether the Plan is likely to achieve the sustainability goal for the Subbasin, Department staff reviewed the information provided and relied upon in the GSP for sufficiency, credibility, and consistency with scientific and engineering professional standards of practice.[13] The Department's review considers whether there is a reasonable relationship between the information provided and the assumptions and conclusions made by the GSA, including whether the interests of the beneficial uses and users of groundwater in the basin have been considered; whether sustainable management criteria and projects and management actions described in the Plan are commensurate with the level of understanding of the basin setting; and whether those projects and management actions are feasible and likely to prevent undesirable results.[14]

[4] Water Code §§ 10727.2, 10727.4.
[5] Water Code § 10733(a).
[6] Water Code § 10721(v).
[7] 23 CCR § 354.26 *et seq.*
[8] Water Code § 10733(c).
[9] 23 CCR § 355.4(a)(1).
[10] 23 CCR §§ 355.4(a)(2), 355.4(a)(3).
[11] 23 CCR § 350 *et seq.*
[12] 23 CCR § 355.4(b).
[13] 23 CCR § 351(h).
[14] 23 CCR §§ 355.4(b)(1), (3), (4), and (5).

The Department also considers whether the GSA has the legal authority and financial resources necessary to implement the Plan.[15]

To the extent overdraft is present in a basin, the Department evaluates whether the Plan provides a reasonable assessment of the overdraft and includes reasonable means to mitigate the overdraft.[16] The Department also considers whether the Plan provides reasonable measures and schedules to eliminate identified data gaps.[17] Lastly, the Department's review considers the comments submitted on the Plan and evaluates whether the GSA adequately responded to the comments that raise credible technical or policy issues with the Plan.[18]

The Department is required to evaluate the Plan within two years of its submittal date and issue a written assessment of the Plan.[19] The assessment is required to include a determination of the Plan's status.[20] The GSP Regulations define the three options for determining the status of a Plan: Approved,[21] Incomplete,[22] or Inadequate.[23]

Even when review indicates that the GSP satisfies the requirements of SGMA and is in substantial compliance with the GSP Regulations, the Department may recommend corrective actions.[24] Recommended corrective actions are intended to facilitate progress in achieving the sustainability goal within the basin and the Department's future evaluations, and to allow the Department to better evaluate whether the Plan adversely affects adjacent basins. While the issues addressed by the recommended corrective actions do not, at this time, preclude approval of the Plan, the Department recommends that the issues be addressed to ensure the Plan's implementation continues to be consistent with SGMA and the Department is able to assess progress in achieving the sustainability goal within the basin.[25] Unless otherwise noted, the Department proposes that recommended corrective actions be addressed by the submission date for the first periodic assessment.[26]

The staff assessment of the GSP involves the review of information presented by the GSA, including models and assumptions, and an evaluation of that information based on scientific reasonableness, including standard or accepted professional and scientific methods and practices. The assessment does not require Department staff to recalculate or reevaluate technical information provided in the Plan or to perform its own geologic or engineering analysis of that information. The staff recommendation to approve a Plan

[15] 23 CCR § 355.4(b)(9).
[16] 23 CCR § 355.4(b)(6).
[17] 23 CCR § 355.4(b)(2).
[18] 23 CCR § 355.4(b)(10).
[19] Water Code § 10733.4(d); 23 CCR § 355.2(e).
[20] Water Code § 10733.4(d); 23 CCR § 355.2(e).
[21] 23 CCR § 355.2(e)(1).
[22] 23 CCR § 355.2(e)(2).
[23] 23 CCR § 355.2(e)(3).
[24] Water Code § 10733.4(d).
[25] Water Code § 10733.8.
[26] 23 CCR § 356.4 *et seq*.

does not signify that Department staff, were they to exercise the professional judgment required to develop a GSP for the basin, would make the same assumptions and interpretations as those contained in the Plan, but simply that Department staff have determined that the assumptions and interpretations relied upon by the submitting GSA are supported by adequate, credible evidence, and are scientifically reasonable.

Lastly, the Department's review and approval of the Plan is a continual process. Both SGMA and the GSP Regulations provide the Department with the ongoing authority and duty to review the implementation of the Plan.[27] Also, GSAs have an ongoing duty to provide reports to the Department, periodically reassess their plans, and, when necessary, update or amend their plans.[28] The passage of time or new information may make what is reasonable and feasible at the time of this review to not be so in the future. The emphasis of the Department's periodic reviews will be to assess the progress toward achieving the sustainability goal for the basin and whether Plan implementation adversely affects the ability of adjacent basins to achieve their sustainability goals.

3 REQUIRED CONDITIONS

A GSP, to be evaluated by the Department, must be submitted within the applicable statutory deadline. The GSP must also be complete and must, either on its own or in coordination with other GSPs, cover the entire basin.

3.1 SUBMISSION DEADLINE

SGMA required basins categorized as high- or medium-priority and not subject to critical conditions of overdraft to submit a GSP no later than January 31, 2022.[29]

The GSAs submitted their Plan on January 24, 2022.

3.2 COMPLETENESS

GSP Regulations specify that the Department shall evaluate a GSP if that GSP is complete and includes the information required by SGMA and the GSP Regulations.[30]

The GSAs submitted an adopted GSP for the entire Subbasin. After an initial, preliminary review, Department staff found the GSP to be complete and appearing to include the

[27] Water Code § 10733.8; 23 CCR § 355.6.
[28] Water Code §§ 10728 *et seq.*, 10728.2.
[29] Water Code § 10720.7(a)(2).
[30] 23 CCR § 355.4(a)(2).

required information, sufficient to warrant a thorough evaluation by the Department.[31] The Department posted the GSP to its website on January 31, 2022.[32]

3.3 Basin Coverage

A GSP, either on its own or in coordination with other GSPs, must cover the entire basin.[33] A GSP that is intended to cover the entire basin may be presumed to do so if the basin is fully contained within the jurisdictional boundaries of the submitting GSAs.

The GSP intends to manage the entire North American Subbasin and the jurisdictional boundary of the submitting GSAs fully contains the Subbasin.[34]

4 Plan Evaluation

As stated in Section 355.4 of the GSP Regulations, a basin "shall be sustainably managed within 20 years of the applicable statutory deadline consistent with the objectives of the Act." The Department's assessment is based on a number of related factors including whether the elements of a GSP were developed in the manner required by the GSP Regulations, whether the GSP was developed using appropriate data and methodologies and whether its conclusions are scientifically reasonable, and whether the GSP, through the implementation of clearly defined and technically feasible projects and management actions, is likely to achieve a tenable sustainability goal for the basin. The Department staff's evaluation of the likelihood of the Plan to attain the sustainability goal for the Subbasin is provided below.

4.1 Administrative Information

The GSP Regulations require each Plan to include administrative information identifying the submitting Agency, its decision-making process, and its legal authority;[35] a description of the Plan area and identification of beneficial uses and users in the Plan area;[36] and a description of the ability of the submitting Agency to develop and implement a Plan for that area.[37]

The five GSAs collectively take responsibility for groundwater management in the Subbasin and each participated in the development and adoption of its GSP.[38] The GSAs

[31] The Department undertakes a preliminary completeness review of a submitted Plan under section 355.4(a) of the GSP Regulations to determine whether the elements of a Plan required by SGMA and the Regulations have been provided, which is different from a determination, upon review, that a Plan is "incomplete" for purposes of section 355.2(e)(2) of the Regulations.
[32] https://sgma.water.ca.gov/portal/gsp/preview/100.
[33] Water Code § 10727(b); 23 CCR § 355.4(a)(3).
[34] North American Subbasin GSP, Section 2.1, p. 31.
[35] 23 CCR § 354.6 *et seq*.
[36] 23 CCR § 354.8 *et seq*.
[37] 23 CCR § 354.6(e).
[38] North American Subbasin GSP, ES Overview and ES 1, p. 17.

selected the Sacramento Groundwater Authority as the lead agency for developing and implementing the Plan.[39] For the decision-making process, each of the five GSAs have jurisdiction in their respective area for managing groundwater under California Water Code Section 10721.[40] As such, each GSA approves decisions via a board of directors, joint-powers agreement, memorandum of agreement, or a combination thereof.[41]

The Subbasin spans approximately 342,000 acres and includes the counties of Placer, Sacramento, and Sutter.[42] The Subbasin is bounded by four rivers — the Bear, Feather, American, and Sacramento (to the north, south, and west) — and the Sierra Nevada foothills (to the east).[43] The western portion of the Subbasin consists of relatively flat floodplains, whereas the eastern region is characterized by low rolling uplands.[44] The North American Subbasin adjoins four other subbasins: South Yuba (No. 5-021.61) to the north; Sutter (No. 5-021.62) and Yolo (No. 5-021.67) to the west; and South American (No. 5-021.65) to the south. A map showing the Subbasin boundaries and adjacent subbasins is shown in Figure 1 below.

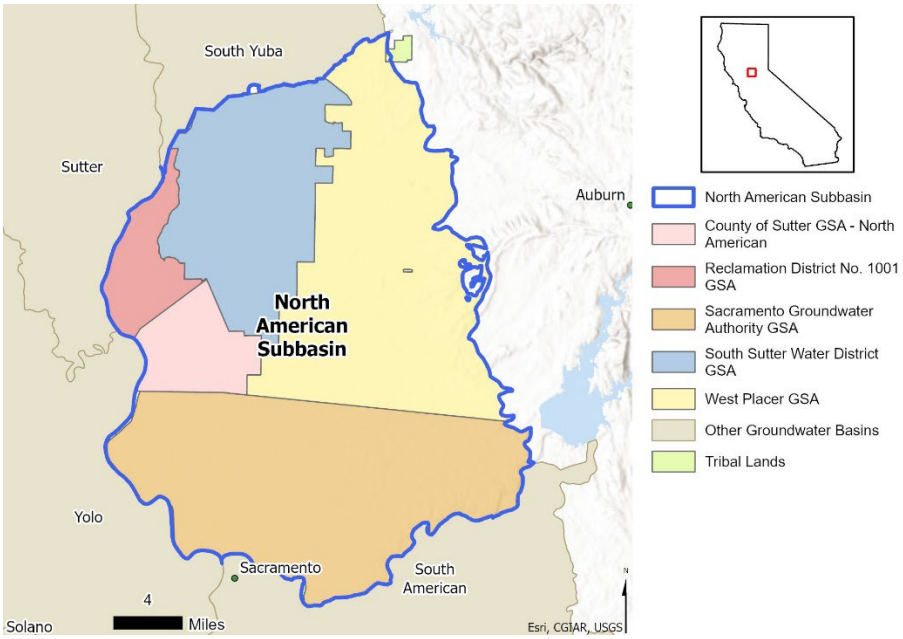

Figure 1: North American Subbasin Location Map.

The GSP lists the general land use categories and their approximate percentages (relative to the total area of the Subbasin) as follows: 40% urban, 30% agricultural, and

[39] North American Subbasin GSP, Section 2.2, p. 34, Appendix A, p. 379.
[40] North American Subbasin GSP, Section 11.6, p. 354.
[41] North American Subbasin GSP, Section 11.6, p. 354.
[42] North American Subbasin GSP, Section 3.1, p. 35.
[43] North American Subbasin GSP, Section 3.1, p. 35, Figure 3-1, p. 36.
[44] North American Subbasin GSP, Section 3.1, p. 35.

less than 1% riparian vegetation; while close to 30% of the land is not classified.[45] Approximately 50% of the agricultural acreage in the Subbasin produces rice and about 10% is utilized for permanent crops (such as orchards and vineyards).[46] The Plan includes a figure[47] depicting the Subbasin's total acreage, land use categories, and agricultural cropping patterns. According to the GSP, there are federal, state, county, and tribal agencies with land use jurisdiction in the Subbasin.[48]

The GSP provides descriptions of the water use sectors (urban, domestic, agriculture, environmental, and groundwater remediation) and types (groundwater, surface water, recycled water, and water reuse).[49] Currently, surface water (primarily from the American, Bear, and Sacramento rivers)[50] provides approximately 60% of the water needed by the Subbasin, whereas groundwater accounts for roughly 40% of the total water supply.[51]

The Plan explains that through historical and current conjunctive use programs, the Sacramento Groundwater Authority and its member agencies have managed groundwater and reversed historical declining groundwater level trends in the Subbasin.[52] The Sacramento Groundwater Authority and the Regional Water Authority continue to support the expansion of conjunctive use and have developed a "Water Accounting Framework" that encourages water purveyors to bank water when available.[53] The Plan also notes that four agencies (Placer, Sacramento, and Sutter counties and the City of Roseville) have well-permitting authority and have adopted ordinances that meet or exceed DWR's Bulletins 74-81 and 74-90.[54]

Each GSA developed and implemented a Communication and Engagement Plan (C&E) that describes stakeholder engagement.[55] Each C&E has the following elements: goals and desired outcomes, stakeholder identification, venues for engaging, and an implementation timeline.[56] During GSA formation and GSP development, public briefings consisted of notifications, postings on websites,[57] public meetings (GSA, board, and community), and targeted engagement.[58]

The Plan contains sufficient detail regarding the beneficial uses and users of groundwater, water use types, existing water monitoring and resource programs, and types and distribution of land use and land use plans within the Subbasin. Department

[45] North American Subbasin GSP, Section 3.4, p. 43.
[46] North American Subbasin GSP, Section 3.4, p. 45.
[47] North American Subbasin GSP, Figure 3-5, p. 46.
[48] North American Subbasin GSP, Section 3.3, p. 37.
[49] North American Subbasin GSP, Sections 3.7-3.8.4, pp. 51-62.
[50] North American Subbasin GSP, Table 3-3, p. 60.
[51] North American Subbasin GSP, Section 3.8, p. 55.
[52] North American Subbasin GSP, Section 3.13, p. 80.
[53] North American Subbasin GSP, Section 3.13, p. 80.
[54] North American Subbasin GSP, Section 3.17, pp. 83-85.
[55] North American Subbasin GSP, Section 11.1, p. 341.
[56] North American Subbasin GSP, Section 11.1, p. 341.
[57] https://nasbgroundwater.org/ and https://westplacergroundwater.com/
[58] North American Subbasin GSP, Section 11.1, pp. 341-342.

staff conclude that the administrative information included in the Plan substantially complies with the requirements outlined in the GSP Regulations.

4.2 Basin Setting

GSP Regulations require information about the physical setting and characteristics of the basin and current conditions of the basin, including a hydrogeologic conceptual model; a description of historical and current groundwater conditions; and a water budget accounting for total annual volume of groundwater and surface water entering and leaving the basin, including historical, current, and projected water budget conditions.[59]

4.2.1 Hydrogeologic Conceptual Model

The hydrogeologic conceptual model is a non-numerical model of the physical setting, characteristics, and processes that govern groundwater occurrence within a basin, and represents a local agency's understanding of the geology and hydrology of the basin that support the geologic assumptions used in developing mathematical models, such as those that allow for quantification of the water budget.[60] The GSP Regulations require a descriptive hydrogeologic conceptual model that includes a written description of geologic conditions, supported by cross sections and maps,[61] and includes a description of basin boundaries and the bottom of the basin,[62] principal aquifers and aquitards,[63] and data gaps.[64]

The Subbasin overlies the Sierra Nevada block mountain range, which dips westward beneath the Sacramento Valley.[65] The structural setting of the Subbasin is dominated by down-warping caused by tectonic activity and sediment consolidation.[66] The Plan identifies the major geologic units of the Subbasin as Mesozoic igneous and metamorphic basement rocks with nine overlying Cenozoic sedimentary formations. The Plan provides detailed descriptions of these units including their general locations and information such as approximate thickness, depositional environment, and water-bearing characteristics of each unit.[67]

The lateral boundaries of the Subbasin are defined by the surficial contact between alluvium and bedrock of the Sierra Nevada mountain range to the east, the Bear River to the north, the Feather and Sacramento Rivers to the west, and the American River to the

[59] 23 CCR § 354.12.
[60] DWR Best Management Practices for the Sustainable Management of Groundwater: Hydrogeologic Conceptual Model, December 2016: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-3-Hydrogeologic-Conceptual-Model_ay_19.pdf.
[61] 23 CCR §§ 354.14 (a), 354.14 (c).
[62] 23 CCR §§ 354.14 (b)(2-3).
[63] 23 CCR § 354.14 (b)(4) *et seq.*
[64] 23 CCR § 354.14 (b)(5).
[65] North American Subbasin GSP, Section 4.5, p. 94.
[66] North American Subbasin GSP, Section 4.6, p. 94.
[67] North American Subbasin GSP, Sections 4.7.2-4.8.4, pp. 97-99 and 101.

south.[68] The Plan defines the vertical extent of the Subbasin as one of two depositional contacts (whichever is encountered first): either the contact with the Sierra Nevada basement rock or the contact with marine sediments (which the Plan equates as the base of fresh water).[69] The vertical occurrence of bedrock varies across the Subbasin, deepening from east to west.[70] The base of fresh water occurs near ground surface in the eastern portion of the Subbasin and deepens to more than 2,000 feet below mean sea level as it approaches the southwest corner of the Subbasin.[71] The Plan indicates that the continentally-derived sediments of the Mehrten Formation and its five overlying units are fresh water-bearing.[72] The three sedimentary units, underlying the Mehrten Formation, contain marine-derived (or partially marine-derived) sediments and are considered non-water or non-fresh water bearing.[73]

After evaluation of the information provided Plan (i.e., discussion on the vertical extent of the Subbasin, the geologic formation descriptions, and the provided cross-sections), Department staff note the Plan's definition of the bottom of the Subbasin is unclear. The Plan states that the Subbasin's vertical extent is partially defined by the top of the marine sediments, which are considered the base of fresh water.[74] However, the Plan also provides a contour map[75] identifying the elevation of base of fresh water where the electrical conductivity of groundwater remains less than 3,000 micromhos.[76] Additionally, the Plan indicates that the Valley Springs Formation (directly underlying the Mehrten Formation) is comprised of "mostly fluvial sediments" (i.e., deposited by a river).[77] However, it is unclear whether this formation is part of the vertical extent of the Subbasin. Department staff recommend the GSA Investigate and provide further clarity on the definition of the bottom of the Subbasin in areas not defined by the occurrence of bedrock (see Recommended Corrective Action 1).

The Plan describes one principal aquifer in the Subbasin and presents an evaluation in Appendix F to justify this determination.[78] Historically, the Subbasin was described by the Department as containing two major aquifers: an upper aquifer spanning the topmost 200-300 feet of the Subbasin and a lower aquifer extending from 200-300 feet down to the base of fresh water.[79] However, the Plan indicates that no studies have identified a regionally extensive fine-grained layer that separates these zones. Furthermore, the Plan states that both the upper and lower zones show similar trends in groundwater levels, groundwater gradients, and response to pumping and recharge, and that groundwater

[68] North American Subbasin GSP, Section 4.1, p. 87.
[69] North American Subbasin GSP, Section 4.1, p. 87.
[70] North American Subbasin GSP, Section 4.6, p. 94, Figures 4-9 through 4-11, pp.105, 109, and 113.
[71] North American Subbasin GSP, Section 4.1, p. 87.
[72] North American Subbasin GSP, Sections 4.7, pp. 95-98.
[73] North American Subbasin GSP, Sections 4.8, pp. 98-99.
[74] North American Subbasin GSP, Section 4.1, p. 87.
[75] North American Subbasin GSP, Figure 4-1, p. 88.
[76] North American Subbasin GSP, Section 4.1. p. 87.
[77] North American Subbasin GSP, Sections 4.7.4 and 4.8.1, pp. 97-98, Sections 4.9.1-4.9.3, pp. 104-113.
[78] North American Subbasin GSP, Appendix F, pp. 519-528.
[79] North American Subbasin GSP, Section 4.11, p. 121.

quality is variable across the Subbasin.[80] The Plan notes that the determination of a single principal aquifer is consistent with assessments made by the Yuba and South American subbasins (north and south of the Subbasin, respectively).[81]

The Plan states that the Subbasin contains a meandering (and interconnected) system of interbedded fine- and coarse-grained sediments, representative of deposits formed in fluvial environments.[82] The GSP describes the shallow Turlock Lake and Laguna formations as exhibiting unconfined aquifer characteristics.[83] However, the deeper Mehrten Formation (while still vertically interconnected with overly units) displays some characteristics of confinement based on "delayed responses to pumping and recharge effects imposed in the shallower portions of the aquifer."[84] Additionally, the GSP notes that several inactive faults have been identified in the Subbasin including the Willows Fault. While only this specific fault was discussed in detail, this structure is not anticipated to impact groundwater flow due to its depth.[85]

Groundwater uses/users in the Subbasin include groundwater dependent ecosystems; stakeholders and agencies involved in groundwater/land use management; remediation projects; and municipal, domestic, and agricultural water supply. Municipal users are concentrated in the southern and eastern parts of the Subbasin, and only the communities of Rio Linda, Arden, and Del Paso Manor rely solely on groundwater.[86] Domestic well users are scattered throughout the Subbasin in both urban and rural areas. Agricultural users occupy the central, western, and northern parts of the Subbasin and rely on groundwater for irrigation and to augment surface water supplies.[87] Groundwater dependent ecosystems occupy three percent of the Subbasin's total land area and provide habitat to native and non-native wildlife.[88] Remediation of the former McClellan Air Force Base and the Aerojet Superfund Site uses approximately 5,000 acre-feet per year (AFY) for pumping, treating, and discharging groundwater to surface water.[89]

The Plan explains that hydrogeologic investigations have taken place in the Subbasin since 1912. The Plan states that "there are no data gaps that would affect the ability to sustainably manage the Subbasin within the next 5 years."[90] However, the Plan identifies some data gaps that would improve the GSAs' understanding of groundwater conditions in the Subbasin, including:

- continued groundwater quality sampling in the northern portions of the Subbasin,

[80] North American Subbasin GSP, Appendix F, pp. 520-525.
[81] North American Subbasin GSP, Table 4-1, p. 122.
[82] North American Subbasin GSP, Section 4.11, p. 121.
[83] North American Subbasin GSP, Section 5.5, pp. 146.
[84] North American Subbasin GSP, Section 5.5, pp. 146.
[85] North American Subbasin GSP, Section 4.6, p. 94.
[86] North American Subbasin GSP, Section 8.7.1, p. 51.
[87] North American Subbasin GSP, Section 8.7.3 and Figure 3-9, pp. 51-52.
[88] North American Subbasin GSP, Section 3.7.4, p. 53.
[89] North American Subbasin GSP, Section 3.7.5, p. 53.
[90] North American Subbasin GSP, Section 4.14, p. 125.

- an assessment to better understand the hydraulic relationship between the shallow and deeper aquifer formations (loosely described as “aquifers” in the GSP), which might include evaluating the effects of groundwater pumping from the deeper aquifers in adjacent subbasins; evaluating the relationship between the Willows Fault and the aquifers; and geophysical mapping of the aquifers,
- and confirmation of areas with interconnected surface waters.[91]

The information provided in the GSP that comprises the hydrogeologic conceptual model substantially complies with the requirements outlined in the GSP Regulations. In general, the Plan’s descriptions of the regional geologic setting, the Subbasin’s physical characteristics, and the principal aquifer appear to utilize the best available information and science. Department staff are aware of no significant inconsistencies or contrary technical information to that presented in the Plan.

4.2.2 Groundwater Conditions

The GSP Regulations require a written description of historical and current groundwater conditions for each of the applicable sustainability indicators and groundwater dependent ecosystems that includes the following: groundwater elevation contour maps and hydrographs,[92] a graph depicting change in groundwater storage,[93] maps and cross-sections of the seawater intrusion front,[94] maps of groundwater contamination sites and plumes,[95] maps depicting total subsidence,[96] identification of interconnected surface water systems and an estimate of the quantity and timing of depletions of those systems,[97] and identification of groundwater dependent ecosystems.[98]

The GSP provides current and historical groundwater level information. The GSP splits the Subbasin into three regions referred to as “Western,” “Central,” and “Eastern.”[99] The GSP provides a total of 124 hydrographs that depict short- and long-term groundwater elevations as well as hydraulic gradients within the principal aquifer.[100] Based on review of the hydrographs, groundwater levels in the Western area of the Subbasin appear relatively stable with historical lows typically occurring in the mid-1960s, late-1970s, or between 2014 and 2016. The long-term hydrographs in the Central area of the Subbasin generally show declining trends up until the mid-1990s, but the Plan notes that levels have generally stabilized or increased slightly since that time due to increased surface water availability.[101] Short-term hydrographs in the Central area of the Subbasin generally

[91] North American Subbasin GSP, Section 5.13, p. 191.
[92] 23 CCR §§ 354.16 (a)(1-2).
[93] 23 CCR § 354.16 (b).
[94] 23 CCR § 354.16 (c).
[95] 23 CCR § 354.16 (d).
[96] 23 CCR § 354.16 (e).
[97] 23 CCR § 354.16 (f).
[98] 23 CCR § 354.16 (g).
[99] North American Subbasin GSP, Section 5.1, p. 127.
[100] North American Subbasin GSP, Appendix G through K, pp. 529-680.
[101] North American Subbasin GSP, Section 5.2.2, p. 135.

show stable groundwater conditions with historical lows between 2014 and 2016. Groundwater levels in the Eastern area of the Subbasin generally show stable groundwater level trends; however, most hydrographs are short-term with historical lows occurring in 2016.

The GSP includes a description of the change in groundwater storage and a graph[102] depicting the annual and cumulative changes in groundwater storage. The GSP states that the cumulative change in storage for water years 2009 through 2018 has increased by approximately 300,000 acre-feet.[103]

The GSP includes a description of current and historical groundwater quality issues and provides chemical distribution and trend maps. The GSP identifies arsenic, chromium (total and hexavalent), iron, manganese, nitrate, and total dissolved solids as the water quality constituents of interest based on previous studies in the Subbasin (as well as boron, based on its effect on agriculture).[104] The GSP states that, in general, "the quality of groundwater in the Subbasin is suitable for nearly all uses, with the exception of contamination plumes and localized, naturally-occurring and human-caused quality issues, which may affect the supply, beneficial uses, and potential management of groundwater in the Subbasin." [105] The GSP also describes several groundwater contamination sites and plumes throughout the Subbasin including ongoing remediation efforts (most notably the former McClellan Air Force Base and Aerojet Superfund sites).[106]

The GSP includes a description of current and historical land subsidence conditions in the Subbasin.[107] The GSP also includes maps depicting the current extent, cumulative total, and annual rate of subsidence in the Subbasin.[108] The GSP states that InSAR data, collected from January 2015 through October 2020, shows land subsidence ranged from a total of 0 to -0.25 feet with most of the Subbasin experiencing a maximum displacement of less than -0.05 foot and just a "small area in the western portion of the Subbasin where the subsidence is greater than -0.15 foot."[109]

The GSP identifies interconnected surface water within the Subbasin. To determine which rivers and creeks are connected to groundwater, the GSP utilized a depth-to-groundwater map as an "initial indication of whether the rivers and creeks are interconnected or disconnected."[110] The Plan states that for the "purposes of this GSP, the rivers and creeks were assumed to be interconnected when the depth to water is less than 30 feet [below

[102] North American Subbasin GSP, Figure 5-9, p. 149.
[103] North American Subbasin GSP, Section 5.7, p. 148.
[104] North American Subbasin GSP, Section 5.8, p. 150.
[105] North American Subbasin GSP, Section 5.8.1, p. 150.
[106] North American Subbasin GSP, Section 5.8.3, pp. 171-173.
[107] North American Subbasin GSP, Section 5.10, pp. 174-175.
[108] North American Subbasin GSP, Figures 5-29 and 5-30, pp. 181-182.
[109] North American Subbasin GSP, Section 5.10, p. 175.
[110] North American Subbasin GSP, Section 5.11, p. 183.

ground surface (bgs)].” [111] However, Department staff note that it is unclear why the 30 feet bgs groundwater level is a reasonable metric for identifying hydraulically connected surface water and groundwater.

Appendix O[112] of the GSP (groundwater dependent ecosystems analysis) describe the method used to develop the depth-to-groundwater map, which is based on groundwater level measurements from spring 2020. The GSP notes that spring 2020 was utilized because it has “the most complete set of measurements,” including measurements from four new shallow monitoring wells.[113] However, it is unclear to Department staff how a single season’s groundwater levels are sufficient to develop this depth and how spring 2020 relates to the long-term connection or disconnection of groundwater and surface water in the Subbasin. It is also unclear why 2020 was selected when the model only simulates through 2018, which also could have been used to provide an estimate of interconnected and disconnected streams in the Subbasin and address data gaps.

To further evaluate the connectivity of surface water with groundwater, the GSAs conducted an analysis of groundwater level hydrographs and isotope data.[114] The GSAs reviewed hydrographs from monitoring wells adjacent to rivers, creeks, and levees to determine if groundwater levels respond to changes in surface water and, therefore, are considered interconnected.[115] In some cases, the GSP utilizes water quality (stable isotopes), low permeability geologic composition, and perched groundwater conditions to support the connectivity determination.[116] The GSP claims that the lower permeability Ione Formation tends to perch groundwater, and therefore surface water was determined not to be connected to the principal aquifer for a portion of the Eastern section of the Subbasin underlain by the formation.[117] However, it somewhat unclear how groundwater conditions in the lower permeability Ione Formation relate to recent and historical trends, how seasonal fluctuations of groundwater levels may affect perched groundwater (possibly resulting in intermittent connectively), or what other mechanisms or geologic conditions could be present by which perched groundwater may be connected to the principal aquifer through vertical, horizonal, or lateral flow.

The GSP provides a contour map (Figure 5-31)[118] showing reaches where surface water is anticipated to either be interconnected or disconnected from groundwater, along with hydrographs showing groundwater levels and stream gauge measurements. However, the map lacks the necessary detail to understand if it is a reliable depiction of interconnected surface water. For example, the map does not label the contours or distinguish between gaining or losing portions of the streams, and the hydrograph details

[111] North American Subbasin GSP, Section 5.11, p. 183.
[112] North American Subbasin GSP, Appendix O, pp. 817-920.
[113] North American Subbasin GSP, Appendix O, p. 821.
[114] North American Subbasin GSP, Section 5.11, pp. 183-185
[115] North American Subbasin GSP, Section 5.11, p. 183.
[116] North American Subbasin GSP, Section 5.11, pp. 183-184.
[117] North American Subbasin GSP, Section 5.11, p. 184.
[118] North American Subbasin GSP, Figure 5-31, p. 185.

are blurry and do not provide enough resolution to interpret the data. Additionally, the wells shown are sparse and there appears to be several differences between the hydrographs shown in Figure 5-31[119] and those presented in Appendix N (for the same wells).[120] For example, when comparing Figure 5-31 and Appendix N, wells 1516 and 1518 appear to differ significantly.

There are also significant portions of streams and creeks which appear to be disconnected from groundwater. However, this determination appears to be primarily made by the 30 feet bgs depth-to-groundwater contours as there are no corresponding shallow monitoring wells. The GSP notes that confirmation of areas likely to be interconnected would improve the GSAs' "overall knowledge of groundwater conditions" in the Subbasin. However, this is not acknowledged as a formal data gap needing to be addressed in the Plan. As stated in the Plan, this data gap "would [not] affect the ability to sustainably manage the Subbasin."[121] Department staff note the data gaps related to interconnected surface water raises concerns and believe that more information is needed to determine whether the following statement is true. Therefore, Department staff conclude that the Plan should continue to fill (and provide a schedule to address) data gaps for interconnected surface water, including confirmation of areas considered to be likely interconnected with groundwater, in order to better understand and avoid potential impacts to beneficial uses and users (See Recommended Corrective Action 2). Furthermore, Department staff noted that a few elements described in the Plan relating to the identification of interconnected surface water (e.g., the use of spring 2020 water levels, the depth-to-water measurement of 30 feet bgs, and perched groundwater in the Ione formation) may warrant further consideration and analysis in future periodic evaluations of Plan as additional data is gathered during GSP implementation.

The GSP includes a description of groundwater dependent ecosystems in the Subbasin along with two maps of groundwater dependent ecosystem locations and one map of Valley Oak occurrence.[122] The GSP ranks the likelihood that groundwater dependent ecosystems are present at a given location based on depth to groundwater, presence of groundwater dependent vegetation, and potential presence of endangered or threatened species.[123] The GSP states that the National Communities Commonly Associated with Groundwater Dataset (NCCAG) was used to initially determine the location of potential groundwater dependent ecosystems.[124] The Plan explains how this dataset was compared to the depth-to-groundwater map to further narrow down potential groundwater dependent ecosystem locations. The Plan utilized a depth-to-water of 30 feet bgs for this purpose and states that the 30 foot threshold "is associated with the overwhelming majority of groundwater dependent ecosystem plant species' maximum rooting depths,

[119] North American Subbasin GSP, Figure 5-31, p. 185.
[120] North American Subbasin GSP, Appendix N, pp. 737-750.
[121] North American Subbasin GSP, Section 5.13, p. 191.
[122] North American Subbasin GSP, Section 5.12 and Figures 5-32 through 5-34, pp. 187-190.
[123] North American Subbasin GSP, Appendix O, p. 819.
[124] North American Subbasin GSP, Appendix O, p. 820.

and thus would most likely contain groundwater-supported priority habitat."[125] The Plan explains that all areas designated as potential groundwater dependent ecosystems "were then evaluated for the types of vegetation or species present to further refine whether the potential groundwater dependent ecosystems are likely, less likely or not likely to be present."[126] The GSP used the California Department of Fish and Wildlife RareFind5 database for the purpose of identifying critical species. Finally, a point system was used to prioritize the likeliness of groundwater dependent ecosystems based on depth-to-groundwater (30 feet bgs), vegetation diversity (NCCAG database), and the potential presence of critical species (RareFind5).[127]

In general, the Plan sufficiently describes the historical and current groundwater conditions in the Subbasin. However, Department staff found some elements described in the Plan relating to the identification of interconnected surface water unclear. The Plan acknowledges some data gaps that may warrant further study.[128] Department staff believe that filling these data gaps are important and encourage the GSAs to do so. Overall, Department staff conclude that the information provided in the GSP regarding the Subbasin's groundwater conditions substantially complies with the requirements outlined in the GSP Regulations.

4.2.3 Water Budget

GSP Regulations require 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,[129] and the sustainable yield.[130]

The North American Subbasin GSP provides a historical water budget for water year (WY) 2009 through WY 2018. The GSP states that the historical period is chosen as the "most recent, modeled, representative hydrologic period to represent historical conditions in the Subbasin."[131] The GSP uses the groundwater flow CoSANA model to develop the historical water budget.[132] The CoSANA model, which covers the entire Subbasin as well as the adjoining South American and Cosumnes subbasins, is built on the Integrated Water Flow Model (IWFM) software and incorporates all data from the preexisting Sacramento Area Integrated Water Resources Model.[133] The GSP states that the average annual change in storage over the recent historical water budget period (WY 2009-2018) is calculated from tabulated[134] inflows and outflows to be a surplus of

[125] North American Subbasin GSP, Section 5.12, p. 187.
[126] North American Subbasin GSP, Section 5.12, p. 187.
[127] North American Subbasin GSP, Appendix O, pp. 822-826.
[128] North American Subbasin GSP, Section 5.13, p. 191.
[129] 23 CCR §§ 354.18 (a), 354.18 (c) *et seq*.
[130] 23 CCR § 354.18 (b)(7).
[131] North American Subbasin GSP, Section 6.5, p. 207.
[132] North American Subbasin GSP, Section 6.3, p. 196.
[133] North American Subbasin GSP, Appendix P, p. 942.
[134] North American Subbasin GSP, Table 6-13, pp. 206-207.

approximately 31,900 AFY.[135] Similarly, the average annual change in storage over the entire historical model calibration period (WY 1995-2018) is a surplus of 26,661 AFY.[136]

The GSP provides a current water budget using 50 years of historical hydrology (WY 1970 through WY 2019) "in conjunction with water supply, demand, and land use information reflecting the current level of development"[137] and is developed from the CoSANA Current Conditions Baseline (CCBL) model scenario results.[138] The GSP uses water years 2009 through 2019 as representative of current conditions with the exception being for the City of Sacramento whose current level of development used the City's Groundwater Master Plan.[139] The average annual change in storage associated with the current water budget is a surplus of 14,900 AFY.

Most elements of the current water budget are well described in the GSP and appear to use best available science and information. However, Department staff note that the current water budget does not "quantify current inflows and outflows for the Subbasin using the most recent hydrology, water supply, water demand, and land use information."[140] Rather, the current water budget is based upon the CCBL and utilizes 50 years of historical hydrology with many budget components (related to water supply or model inputs) averaged over the same 10-year period chosen for the recent historical water budget (WY 2009-2018). The GSP explains that recent extreme conditions are intentionally muted in the current water budget because it would be difficult to interpret in light of local water management operations.[141] The Plan states that "[i]nstead, to analyze the long-term effects of current land and water use on groundwater conditions and to accurately estimate current inflows and outflows for the basin, a Current Conditions Baseline scenario is developed using the CoSANA model."[142] Department staff disagree with this rationale, as drought conditions such as 2012 through 2015 and wet conditions such as 2017 have a real impact that should be highlighted as part of the current water budget. Current conditions are meant to look at recent water demands with recent water supplies which may look very different than long-term historical hydrologic conditions. Department staff note that it may be acceptable to use WY 2009 to 2018 as current conditions for hydrology, water supply, water demand, and land use if each component has been relatively consistent through that period.

The GSP provides both a baseline projected water budget (PCBL) and a baseline projected water budget which incorporates climate change (PCBL with Climate Change). Both projected water budgets are based upon 50 water years of historical hydrology (WY 1970 through WY 2019) to represent WY 2020 through WY 2070 conditions. The

[135] North American Subbasin GSP, Section 6.5, p. 209.
[136] North American Subbasin GSP, Appendix P, p. 940.
[137] North American Subbasin GSP, Section 6.6, p. 211.
[138] North American Subbasin GSP, Appendix P, p. 1069.
[139] North American Subbasin GSP, Section 6.6, p. 211.
[140] 23 CCR § 354.18(c)(1).
[141] North American Subbasin GSP, Section 6.4.2, p. 197.
[142] North American Subbasin GSP, Section 6.4.2, p. 197.

hydrogeological framework, geometry, and parameters are the same as for the CCBL and water budget terms are developed from the CoSANA model. Initial conditions for both projected water budgets are the same as the CCBL and set at WY 2018 for groundwater levels and soil conditions.[143]

The GSP appears to thoroughly consider and account for future land use changes, water demands, and water supply in developing the projected baseline scenarios. The PCBL utilizes the historical hydrology without climate change to estimate projected conditions where future water demands are based upon 2015 urban water management plans; general plans, and other planning documents; or information provided by purveyors.[144] Specifically, land use conditions, and their associated demands, are modified from 2015 conditions to "reflect the 2040 land use conditions or the closest data available from planning documents,"[145] which largely translates into an increased urban footprint (and conversely, a decrease in agricultural, native, and riparian land use). Several PCBL water budget terms consequently reflect this change in land use when compared to the CCBL or historical water budget, including runoff, percolation, and return flows.

The PCBL with Climate Change is similar to the PCBL, with adjustments made to precipitation, stream inflow, and potential evapotranspiration inputs based upon the American River Basin Study's (Bureau of Reclamation) 2070 central tendency (2070CT) scenario.[146] A 2070 hot-dry scenario is also simulated in order "to address uncertainty and the effects of a possible extreme condition"[147] and compared to the 2070CT scenario. For the PCBL with Climate Change, water use changes are incorporated via agricultural water demands calculated within the CoSANA model and "[u]rban water use is assumed to remain unchanged, based on assumed changes in conservation and landscape choices"[148] in comparison to the PCBL without climate change. The GSP states that under climate change conditions agricultural demand increases, notably the evapotranspiration term, which is largely met from additional groundwater pumping.[149] The average annual change in storage associated with the PCBL is a surplus of 5,400 AFY and a deficit of 3,500 AFY for the PCBL with Climate Change.[150] The PCBL with Climate Change is the only model simulation which shows an annual overdraft.

Most elements of the projected water budget are well described in the GSP and appear to use the best available science and information. However, comparing the projected, current, and historical water budgets (which are based upon the PCBL with Climate Change, PCBL, CCBL, and historic model scenarios), Department staff noted the

[143] North American Subbasin GSP, Appendix P, p. 1087.
[144] North American Subbasin GSP, Section 6.7, pp. 214-215.
[145] North American Subbasin GSP, Appendix P, p. 1087.
[146] North American Subbasin GSP, Appendix P, pp. 1108-1109.
[147] North American Subbasin GSP, Appendix P, p. 1109.
[148] North American Subbasin GSP, Appendix P, p. 1108.
[149] North American Subbasin GSP, Appendix P, p. 1116.
[150] North American Subbasin GSP, Table 6-13, pp. 206-207.

following discrepancies which the GSAs should evaluate to ensure internal consistency and consider explaining or rectifying in the next periodic evaluation of the Plan:

- In Table 6-6 (American River),[151] direct return flow to streams is constant (17,800 AFY) across the CCBL, PCBL, and PCBL with Climate Change water budget scenarios. Given the adjusted crop evapotranspiration demands associated with climate change, explanation is not provided for why associated return flows are not also adjusted relative to changes in applied irrigation water.
- In Table 6-7 (Bear River),[152] local tributary inflows (which include small watersheds for unmodelled streams) are constant across the CCBL, PCBL, and PCBL with Climate Change water budget scenarios. It is unclear why climate-driven changes in precipitation, especially, would not be reflected in the tributary/small watershed inflows. Infiltration to groundwater is also shown as zero across all water budget scenarios; however, an explanation is not given.
- In Table 6-8 (Sacramento River),[153] infiltration to groundwater is shown as zero across all water budget scenarios; however, an explanation is not given.
- In Table 6-9 (Feather River),[154] tributary inflows, groundwater discharge, surface runoff, and direct return flow to streams are largely zero (the surface runoff for the CCBL shows 1 AFY); however, an explanation is not given.
- In Table 6-13 (groundwater system), [155] Department staff noted that stream infiltration quantities do not appear to match corresponding infiltration to groundwater volumes in Tables 6-6 through 6-9, for all water budget scenarios.
- In Table 6-14 (key water budget components),[156] residential agriculture-related pumping is constant at 20,600 AFY across all water year types over the period of WY 1990 to WY 2018 as well as over the 10-year average period of WY 2009-2018. The GSP does not provide explanation for why it is constant under these different time periods given that this term is estimated elementally by IWFM[157] and agricultural land use is changing in the PCBL and PCBL with Climate Change.
- Numerous table references in Section 6 of the GSP text also appear to be incorrect, which makes evaluation of textual and tabular references challenging for Department staff.

The GSP estimates the Subbasin's sustainable yield to be 336,000 AFY. The sustainable yield is estimated as the pumping value with an associated zero change in storage via model simulation of projected conditions with both climate change and implementation of

[151] North American Subbasin GSP, Table 6-6, p. 202.
[152] North American Subbasin GSP, Table 6-7, p. 202.
[153] North American Subbasin GSP, Table 6-8, p. 203.
[154] North American Subbasin GSP, Table 6-8, p. 203.
[155] North American Subbasin GSP, Table 6-13, pp. 206-207.
[156] North American Subbasin GSP, Table 6-14, p. 211.
[157] North American Subbasin GSP, Appendix P, p. 1008.

projects and management actions.[158] The GSP further indicates that this value was estimated by "identifying a level of pumping that would result in no long-term change in groundwater in storage and then verifying that this level of pumping would avoid undesirable results."[159] Per the GSP, this approach was selected because: (1) current levels of storage and groundwater levels are "broadly considered satisfactory by stakeholders and are not known to have caused significant and unreasonable conditions" and (2) the minimum thresholds are "defined based wholly or partly on CoSANA-simulated conditions using the same modeling simulation showing zero change in storage," and simulated groundwater levels stay above the thresholds.[160]

While Department staff have identified discrepancies in the Plan's water budget tables, the discrepancies noted due not appear to limit the understanding of the Subbasin or prevent the GSAs from implementing their Plan. Department staff conclude that the historical, current, and projected water budgets included in the Plan substantially comply with the requirements outlined in the GSP Regulations.

4.2.4 Management Areas

The GSP Regulations provide the option for one or more management areas to be defined within a basin if the GSA has determined that the creation of the management areas will facilitate implementation of the Plan. Management areas may define different minimum thresholds and be operated to different measurable objectives, provided that undesirable results are defined consistently throughout the basin.[161]

The Plan does not propose the use of management areas in the Subbasin.

4.3 Sustainable Management Criteria

GSP Regulations require each Plan to include a sustainability goal for the basin and to characterize and establish undesirable results, minimum thresholds, and measurable objectives for each applicable sustainability indicator, as appropriate. The GSP Regulations require each Plan to define conditions that constitute sustainable groundwater management for the basin including the process by which the GSA characterizes undesirable results and establishes minimum thresholds and measurable objectives for each applicable sustainability indicator.[162]

4.3.1 Sustainability Goal

GSP Regulations require that GSAs establish a sustainability goal for the basin. The sustainability goal should be based on information provided in the GSP's basin setting

[158] North American Subbasin GSP, Section 6.9, p. 222.
[159] North American Subbasin GSP, Section 6.9, p. 222.
[160] North American Subbasin GSP, Section 6.9, p. 222.
[161] 23 CCR § 354.20.
[162] 23 CCR § 354.22 *et seq*.

and should include an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation.[163]

The GSP describes the sustainability goal for the Subbasin as to:

> Manage groundwater resources sustainably for beneficial uses and users to support the lasting health of the Subbasin's community, economy, and environment. This will be achieved through the monitoring and management of established sustainable management criteria; continued expansion of conjunctive management of groundwater and surface water; proactively working with local well permitting and land use planning agencies on effective groundwater policies and practices; continued GSA coordination and stakeholder engagement; and continued improvement of our understanding of the Subbasin.[164]

The GSP describes various measures that the GSAs will implement to achieve the sustainability goal for the Subbasin.[165] Based on review of the Subbasin's sustainability goal and the Plan's description of the measures to achieve it, Department staff conclude that the GSP covers the specific items listed in the GSP Regulations.

4.3.2 Sustainability Indicators

Sustainability indicators are defined as any of the effects caused by groundwater conditions occurring throughout the basin that, when significant and unreasonable, cause undesirable results.[166] Sustainability indicators thus correspond with the six undesirable results – chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon, significant and unreasonable reduction of groundwater storage, significant and unreasonable seawater intrusion, significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies, land subsidence that substantially interferes with surface land uses, and depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water[167] – but refer to groundwater conditions that are not, in and of themselves, significant and unreasonable. Rather, sustainability indicators refer to the effects caused by changing groundwater conditions that are monitored, and for which criteria in the form of minimum thresholds are established by the agency to define when the effect becomes significant and unreasonable, producing an undesirable result.

GSP Regulations require that GSAs provide descriptions of undesirable results including defining what are significant and unreasonable potential effects to beneficial uses and users for each sustainability indicator.[168] GSP Regulations also require GSPs provide the criteria used to define when and where the effects of the groundwater conditions cause

[163] 23 CCR § 354.24.
[164] North American Subbasin GSP, Section 8.1, p. 271.
[165] North American Subbasin GSP, Section 8.1.1, p. 272.
[166] 23 CCR § 351(ah).
[167] Water Code § 10721(x).
[168] 23 CCR §§ 354.26 (a), 354.26 (b)(c).

undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.[169]

GSP Regulations require that the description of minimum thresholds include the information and criteria relied upon to establish and justify the minimum threshold for each sustainability indicator.[170] GSAs are required to describe how conditions at minimum thresholds may affect beneficial uses and users,[171] and the relationship between the minimum thresholds for each sustainability indicator, including an explanation for how the GSA has determined conditions at each minimum threshold will avoid causing undesirable results for other sustainability indicators.[172]

GSP Regulations require that GSPs include a description of the criteria used to select measurable objectives, including interim milestones, to achieve the sustainability goal within 20 years.[173] GSP Regulations also require that the measurable objectives be established based on the same metrics and monitoring sites as those used to define minimum thresholds.[174]

The following subsections thus consolidate three facets of sustainable management criteria: undesirable results, minimum thresholds, and measurable objectives. Information, as presented in the Plan, pertaining to the processes and criteria relied upon to define undesirable results applicable to the Subbasin, as quantified through the establishment of minimum thresholds, are addressed for each applicable sustainability indicator. A submitting agency is not required to establish criteria for undesirable results that the agency can demonstrate are not present and are not likely to occur in a basin.[175]

4.3.2.1 Chronic Lowering of Groundwater Levels

In addition to components identified in 23 CCR §§ 354.28 (a-b), for the chronic lowering of groundwater, the GSP Regulations require the minimum threshold for chronic lowering of groundwater levels to be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results that is supported by information about groundwater elevation conditions and potential effects on other sustainability indicators.[176]

The GSP describes potential significant and unreasonable effects of chronic lowering of groundwater levels as domestic and irrigation wells going dry, municipal wells decreasing in capacity or going dry, increased costs associated with lowering or replacement of pumps, significantly reducing creek flows over time due to surface water depletion,

[169] 23 CCR § 354.26 (b)(2).
[170] 23 CCR § 354.28 (b)(1).
[171] 23 CCR § 354.28 (b)(4).
[172] 23 CCR § 354.28 (b)(2).
[173] 23 CCR § 354.30 (a).
[174] 23 CCR § 354.30 (b).
[175] 23 CCR § 354.26 (d).
[176] 23 CCR § 354.28(c)(1) *et seq*.

reducing or eliminating groundwater dependent ecosystems, adversely impacting adjacent basins in meeting their sustainability goals, and delaying contamination cleanup activities.[177]

The GSP quantitatively defines an undesirable result for the chronic lowering of groundwater levels as occurring when "20% or more of all [Subbasin] representative monitoring sites have minimum threshold exceedances for 2 consecutive Fall measurements (8 out of 41 wells)."[178] The GSP states that were an undesirable result to occur, about 20% of the total area of the Subbasin would be experiencing a minimum threshold exceedance based on relatively even spacing of the representative monitoring wells.[179] The Plan explains that the use of '20%' helps with early detection of potential impacts of a regional nature representing overdraft conditions in relatively small portions of the Subbasin that require local agencies' actions to correct them. For instance, the Plan notes that cones of depression have historically occurred in both the northern agricultural areas and in the southern urban areas of the Subbasin, but local agency groundwater management responses have led to the stabilization and even recovery of groundwater levels in these areas.[180] The Plan explains that an exceedance of 20% of the representative monitoring site minimum thresholds could indicate that "undesirable results are emerging from conditions that exceed the currently assumed future conditions, which could impact beneficial uses and users."[181] The GSP states that possible causes of undesirable results include a significant increase in pumping, a significant reduction in natural recharge, or an increase in out-of-basin demand for surface water (e.g., exports).[182]

The Plan sets minimum thresholds at the average of fall 2014 and fall 2015 groundwater levels for eight (out of 41) representative monitoring wells. For the remaining 33 representative monitoring wells, the Plan sets the thresholds at levels ranging from 1 to 18 feet below the 2014/2015 level.[183] The GSAs developed the minimum thresholds based on a modeling analysis in combination with a domestic well impact analysis. The Plan uses the modeling analysis to determine the amount of adjustment relative to the 2014/2015 level, and the domestic well impact analysis to verify that the thresholds were set at a level that would not cause an unreasonable depletion of supply. For some representative monitoring wells that were constructed after 2014/2015, the GSP uses the average fall water level between 2018 and 2020 instead.[184] The GSP presents the historical hydrographs for each of the 41 representative monitoring sites in Appendix Q.[185]

[177] North American Subbasin GSP, Section 8.4.1.1, p. 280.
[178] North American Subbasin GSP, Section 8.4.1, p. 279.
[179] North American Subbasin GSP, Section 8.4.1, pp. 279-280.
[180] North American Subbasin GSP, Section 8.4.1, p. 280.
[181] North American Subbasin GSP, Section 8.4.1, p. 280.
[182] North American Subbasin GSP, Section 8.4.1.2, p. 281.
[183] North American Subbasin GSP, Table 8-1, p. 285.
[184] North American Subbasin GSP, Section 8.4.2.1, p. 284.
[185] North American Subbasin GSP, Appendix Q, pp. 1415-1459.

The Plan explains that the first part of the methodology used to establish minimum thresholds (the amount of adjustment for each representative monitoring well) was based on information derived from a detailed comparative modeling analysis. Through this analysis, the GSAs approximated what groundwater conditions could look like after "a 50-year hydrologic sequence if all of the demand, climate, and conjunctive use operations projections were realized."[186] The GSP provides additional details of this model scenario (referred to as "PMA with Climate Change" scenario) in the GSP's Projects and Management Actions section;[187] however, Department staff noted that this specific scenario is not one of the four model simulations described in Appendix P[188] (i.e., Historical, CCBL, PCBL, and PCBL with Climate Change).The Plan explains that the modeling analysis was used to obtain the "relative change" in groundwater levels expected at the end of the 50-year simulation period — which was then used to calculate the minimum thresholds as the adjustment to the 2014/2015 level.[189]

Department staff note that the GSAs' description of how they obtained the relative groundwater elevation change over the 50-year simulation is unclear. The Plan states that Figure 8-5[190] "shows the 50-year simulation projected water level changes from baseline conditions at each groundwater representative monitoring location,"[191] and further explains that these elevations represent the "relative changes to groundwater levels projected at the end of the 50-year groundwater modeling simulation."[192] Based on this description, it is unclear to Department staff what the GSP is referring to as "baseline conditions" in context with how the relative changes were derived. Similarly, the overall methodology used to derive the minimum thresholds is also confusing to staff given the Plan's repeated use of the term "baseline," used for referring to both measured 2014/2015 conditions and modeled scenarios CCBL and PCBL (i.e., Current Conditions Baseline and Projected Conditions Baseline). For increased transparency, Department staff encourage the GSAs to provide additional clarification on how the minimum thresholds were calculated in future periodic evaluations of the Plan.

The GSP describes the rationale for the use of the 2014/2015 baseline[193] and for setting the minimum thresholds below these levels. Additionally, the Plan states the following:

> The [Subbasin] is currently under its estimated sustainable yield by more than 10 percent. Therefore, the [Subbasin] is in position to support additional development and land use changes that will result in increased groundwater use. With these

[186] North American Subbasin GSP, Section 8.4.2.1, pp. 281-284.
[187] North American Subbasin GSP, Section 9.2.1, pp. 320-325.
[188] North American Subbasin GSP, Appendix P, p. 939.
[189] North American Subbasin GSP, Figure 8-5, p. 283, Section 8.4.2.1, p. 284.
[190] North American Subbasin GSP, Figure 8-5, p. 283.
[191] North American Subbasin GSP, Section 8.4.2.1, p. 282.
[192] North American Subbasin GSP, Section 8.4.2.1, p. 284.
[193] North American Subbasin GSP, Section 8.4.2.1, p. 284.

> land use changes and projected climate change, some portions of the basin could expect to experience lower groundwater elevations in the future.[194]

The GSAs conducted a domestic well impact analysis to verify that groundwater levels at the selected minimum thresholds will not cause an unreasonable depletion of supply. The analysis evaluated 1,331 domestic wells (out of approximately 2,412 domestic wells Subbasin-wide) located in the vicinity of representative monitoring sites with projected declines of five feet or more.[195] The remaining 1,081 wells, not considered in the well impact analysis, were in areas with projected declines of less than 5 feet. Based on the analysis, at the minimum threshold level no domestic wells up to 50 years old would go dry, and less than one percent (9 wells) could have water levels drop below the first open interval.[196] Of wells that are greater than 50 years old, two percent (26 wells) would potentially go dry and less than five percent (65 wells) could have water levels drop below their first open interval. However, the Plan also notes that many wells greater than 50 years old may no longer be in use.[197] Additionally, the Plan states that impacts to agricultural or municipal wells are unlikely if the minimum threshold is reached, as these wells are typically constructed deeper than domestic wells.[198] Department staff noted slight discrepancies in the total number of impacted wells between Section 8.4.2.5[199] of the GSP and Tables B-3 and B-4[200] of Appendix B.

The GSAs also conducted an evaluation of existing groundwater dependent ecosystems, comparing current conditions (i.e., spring 2020) to anticipated future spring groundwater conditions (which the Plan appears to conflate as the minimum thresholds) which were developed from the same 50-year simulation period used to establish the sustainable management criteria.[201] The Plan states that at “minimum thresholds” they anticipate an approximate two percent decrease in total area of vegetated groundwater dependent ecosystems and a less than one percent decrease in designated wetlands.[202] However, the Plan notes that these two classifications may be coincident.[203] Of the potentially impacted areas, more than 70 percent of the vegetated groundwater dependent ecosystems were designated as low priority, meaning that neither critical species (i.e., with a State or Federal classification such as “endangered,” “threatened,” etc.) nor diverse vegetation was present. All the potentially impacted wetland areas were also designated as low priority.[204]

[194] North American Subbasin GSP, Section 8.4.2.1, p. 282.
[195] North American Subbasin GSP, Section 8.4.2.5, pp. 289-290, Appendix B, pp. 401-439.
[196] North American Subbasin GSP, Section 8.4.2.5, p. 289.
[197] North American Subbasin GSP, Section 8.4.2.5, pp. 289-290.
[198] North American Subbasin GSP, Section 8.4.2.5, p. 290.
[199] North American Subbasin GSP, Section 8.4.2.5, pp. 289-290.
[200] North American Subbasin GSP, Appendix B, pp. 438-439.
[201] North American Subbasin GSP, Appendix O, p. 821 and 826.
[202] North American Subbasin GSP, Section 8.4.2.5, p. 290, Appendix O, p. 826.
[203] North American Subbasin GSP, Appendix O, p. 826.
[204] North American Subbasin GSP, Section 8.4.2.5, p. 290.

The Plan establishes measurable objectives based on the approximate average historical spring groundwater levels from 2010 through 2019 to represent "current conditions" and claims that no negative impacts to beneficial uses and users have been reported at these levels.[205] The Plan sets interim milestones on a 5-year frequency with values reflecting minor groundwater elevation declines in parts of the Subbasin. The last interim milestone groundwater elevations coincide with the measurable object for each representative monitoring site.[206]

While Department staff are unclear on how the relative changes in groundwater levels — used for the derivation of the minimum thresholds — were calculated, staff conclude that the Plan's overall discussion of groundwater levels appears comprehensive and includes adequate support, justification, and information to understand the Agencies' process, analysis, and rationale. Department staff determine that the Plan's approach to establishing sustainable management criteria for water levels is supported by the GSAs' thorough understanding of the Subbasin's hydrology and anticipated changing conditions over the planning and implementation horizon. As previously discussed, the current water budget for the Subbasin shows a surplus of 14,900 AFY; however, projected conditions indicate that the Subbasin will be operating much closer to its sustainable yield in the future. As such, Department staff encourage the GSAs to be more transparent in future periodic evaluations of the Plan in highlighting the anticipated timing for the events that could significantly change groundwater demand and supply in the Subbasin, including the conversion of agricultural land to municipal use, the reduction of Sacramento River surface water diversions, increased reliance on groundwater pumping in the Subbasin, and the accrual of benefits from projects and management actions. Department staff believe this information is relevant for better understanding the Subbasin's progress relating to sustainable management criteria, especially interim milestones.

4.3.2.2 Reduction of Groundwater Storage

In addition to components identified in 23 CCR §§ 354.28 (a-b), for the reduction of groundwater storage, the GSP Regulations require the minimum threshold for the reduction of groundwater storage to be a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results. Minimum thresholds for reduction of groundwater storage shall be supported by the sustainable yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin.[207]

The Plan uses groundwater levels as a proxy for the reduction of groundwater storage sustainability indicator. The definitions of undesirable results,[208] minimum thresholds,[209]

[205] North American Subbasin GSP, Section 8.4.3.2, p. 291.
[206] North American Subbasin GSP, Table 8-3, p. 293.
[207] 23 CCR § 354.28(c)(2).
[208] North American Subbasin GSP, Section 8.5.1, p. 295.
[209] North American Subbasin GSP, Section 8.5.2, p. 295.

measurable objectives,[210] and interim milestones[211] for reduction of groundwater storage are the same as those established for the chronic lowering of groundwater.

The GSP states that groundwater levels can be "directly correlated to reduction of storage."[212] The Plan explains that using the same modeling scenario for the chronic lowering of groundwater levels shows that the Subbasin's "future projected inflows are balanced with projected outflows."[213] According to the Plan, this indicates that using the same minimum thresholds and measurable objectives as the chronic lowering of groundwater levels would also result in meeting this sustainability indicator.[214] Department staff generally understand the GSAs' reasoning for using groundwater levels as a proxy for storage based on projected future conditions in which the Subbasin's inflows and outflows are balanced (and given that the sustainability criteria was at least partially derived based on modeling simulations showing zero change in storage).

Based on the Department's review of the Plan, it appears likely that the Subbasin will operate within its sustainable yield. Staff conclude that the GSP's discussion and presentation of information related to the significant and unreasonable reduction of groundwater storage covers the specific items listed in the GSP Regulations.

4.3.2.3 Seawater Intrusion

In addition to components identified in 23 CCR §§ 354.28 (a-b), for seawater intrusion, the GSP Regulations require the minimum threshold for seawater intrusion to be defined by a chloride concentration isocontour for each principal aquifer where seawater intrusion may lead to undesirable results.[215]

The Plan states that the seawater intrusion sustainability indicator is not applicable to the Subbasin because "the nearest occurrence of saline water intrusion into waterways, the Sacramento-San Joaquin River Delta, is about 40 miles west of the Subbasin boundary."[216] Department staff concur with this conclusion.

4.3.2.4 Degraded Water Quality

In addition to components identified in 23 CCR §§ 354.28 (a-b), for degraded water quality, the GSP Regulations require the minimum threshold for degraded water quality to be the degradation of water quality, including the migration of contaminant plumes that impair water supplies or other indicator of water quality as determined by the Agency that may lead to undesirable results. The minimum threshold shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin.

[210] North American Subbasin GSP, Section 8.5.3, p. 296.
[211] North American Subbasin GSP, Section 8.5.3, p. 296.
[212] North American Subbasin GSP, Section 8.5, p. 294.
[213] North American Subbasin GSP, Section 8.5, p. 294.
[214] North American Subbasin GSP, Section 8.5, p. 294.
[215] 23 CCR § 354.28(c)(3).
[216] North American Subbasin GSP, Section 8.6, p. 296.

In setting minimum thresholds for degraded water quality, the Agency shall consider local, state, and federal water quality standards applicable to the basin.[217]

The GSP establishes sustainable management criteria thresholds for two constituents of concern (COCs) in the Subbasin: nitrate (as N) and total dissolved solids (TDS). The Plan notes that other COCs are present in the Subbasin including arsenic, hexavalent chromium, iron, and manganese. These constituents will be monitored by the GSAs for increasing trends but are not anticipated to be affected by groundwater management activities. The Plan also notes that some larger areas of contamination exist within the Sacramento County portion of the Subbasin; however, the GSAs do not set criteria for any of the associated constituents as their concentrations are either stable or they are being effectively remediated by other parties. The GSAs note that they have maintained active coordination with regulators and responsible parties to address effective remediation of these contaminants.[218]

The Plan explains that significant and unreasonable effects associated with undesirable results include the degradation of groundwater quality to the point in which it does not meet state drinking water standards or agricultural water quality goals.[219] The Plan states that this would impact beneficial uses and users through either potentially expensive treatment or increased use of an alternative water supply (e.g., surface water), which may be economically or physically infeasible for certain beneficial users.[220] The GSP further describes significant and unreasonable degradation of water quality as exceeding agricultural water quality goals for TDS resulting in lower crop yields.[221]

The Plan developed separate sustainable management criteria for *shallow aquifer* wells (i.e., domestic and self-supplied wells) and *public water system* wells (i.e., municipal wells). The Plan selected 16 representative monitoring wells to represent the *shallow aquifer* well group, which are typically shallower than public water system wells.[222] For the *public water system* well group, all 247 of the identified public water supply wells in the Subbasin will be used in the Plan's representative monitoring network.[223] Undesirable results for degraded water quality are defined as follows:

- For *shallow aquifer* wells, the Plan quantitively defines an undesirable result as occurring when: "25% of the representative monitoring sites TDS or nitrate (as N) concentrations exceed state maximum contaminant levels (MCLs)."[224]
- For *public water system* wells, the Plan quantitively defines an undesirable result as occurring when either: "the basin wide average TDS concentrations of <u>all</u> public

[217] 23 CCR § 354.28(c)(4).
[218] North American Subbasin GSP, Section 8.7, pp. 296-297.
[219] North American Subbasin GSP, Section 8.7.1.3, p. 298.
[220] North American Subbasin GSP, Section 8.7.1.3, p. 298.
[221] North American Subbasin GSP, Section 8.7.1.1, p. 298.
[222] North American Subbasin GSP, Table 7-5, p. 250.
[223] North American Subbasin GSP, Section 7.7.2, p. 249.
[224] North American Subbasin GSP, Section 8.7, p. 297.

> water system wells exceeds 400 [milligrams per liter (mg/l)]" OR "the basin wide average nitrate (as N) concentration of all public water system wells exceeds 8 mg/l."[225]

The Plan explains that the undesirable result definitions are intended to avoid exceedances of State drinking water standards for domestic and municipal wells. The Plan notes that the undesirable result definitions also consider the agricultural water quality goals for TDS (i.e., 450 mg/l)[226] resulting in lower crop yields.[227] The Plan, however, does not explain the technical justification for the undesirable results quantitative metrics. It is unclear to Department staff whether the undesirable result definition for the *public water system* well group is adequate for avoiding significant and unreasonable effects due to the requirement of an average concentration across all wells (see Recommended Corrective Action 3). Department staff note that a Subbasin-wide average of 400 mg/l for TDS or 8 mg/l for nitrate (as N), across more than 200 representative monitoring sites, would likely indicate that a substantial number of public supply wells are already in exceedance of the MCLs. The Plan describes possible causes of undesirable results as changes in pumping distribution and volumes resulting in altered hydraulic gradients and changes in land use practices that contaminate the groundwater quality or cause an increase in recharge of poor-quality water.[228]

The Plan establishes minimum thresholds for groundwater quality based on State drinking water standards for the designated COCs. The thresholds are set at the State's secondary recommended MCL of 500 mg/l for TDS and at the State's primary MCL of 10 mg/l for nitrate (as N) for all representative monitoring sites in the *public water system* and *shallow aquifer* groups.[229]

The GSAs also intend to monitor groundwater quality using "Sentry Wells," which are distinct from representative monitoring sites and do not have assigned sustainability criteria. Per the GSP, the purpose of these wells is to provide "early warning of groundwater quality changes (spatially or vertically)," due to shifting groundwater use or changes in water levels, prior to the formal occurrence of minimum threshold exceedances.[230]

The GSP establishes the measurable objectives for *shallow aquifer* wells approximately 10 percent higher than "recent concentrations" for TDS and nitrate reported in each representative monitoring well.[231] This is based on the recognition that concentrations may increase slightly due to projected future declines in water levels. The Plan notes that for wells without historical groundwater quality data, measurable objectives will be

[225] North American Subbasin GSP, Section 8.7, p. 297.
[226] North American Subbasin GSP, Section 8.7.2.5, p. 301.
[227] North American Subbasin GSP, Section 8.7.1.1, p. 298.
[228] North American Subbasin GSP, Section 8.7.1.2, p. 298.
[229] North American Subbasin GSP, Section 8.7.2.1, p. 299.
[230] North American Subbasin GSP, Section 8.7.2.7, pp. 301-302.
[231] North American Subbasin GSP, Table 8-6, p. 303.

established "prior to the next 5-year GSP update" (i.e., periodic evaluation).[232] Department staff note the use of the term 'recent concentrations' is vague as the GSP does not provide the recency or number of samples these values were derived from.

The GSP establishes the measurable objective for *public water system* wells at 300 mg/l for TDS and 3 mg/l for nitrate.[233] The Plan explains that these concentrations are "slightly higher" than the average historical concentrations from more than 300 public supply well samples for TDS and nitrate. Again, the Plan explains that the measurable objectives are slightly higher than historical average conditions due to groundwater levels projected to be slightly lower in 2042, possibly increasing concentrations.[234]

Interim milestones for the *shallow aquifer* wells are set as the same concentrations as the measurable objects. The Plan states that these concentrations "effectively represent current conditions."[235] Based on this rationale, while not explicitly stated in the GSP, Department staff extrapolate that the interim milestones are also the same as the measurable objective for the *public water system* wells. Although, this should be clarified in future periodic evaluations of the Plan.

Department staff generally conclude that the GSP's discussion and presentation of information on degradation of water quality covers the specific items listed in the Regulations in an understandable format using appropriate data.

4.3.2.5 Land Subsidence

In addition to components identified in 23 CCR §§ 354.28 (a-b), the GSP Regulations require the minimum threshold for land subsidence to be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results.[236] Minimum thresholds for land subsidence shall be supported by identification of land uses and property interests that have been affected or are likely to be affected by land subsidence in the basin, including an explanation of how the Agency has determined and considered those uses and interests, and the Agency's rationale for establishing minimum thresholds in light of those effects and maps and graphs showing the extent and rate of land subsidence in the basin that defines the minimum thresholds and measurable objectives.[237]

The Plan states that historical subsidence has been "very limited" and "gradual through time," with no significant related impacts documented in the Subbasin.[238] The Plan's analysis showed a historical relationship of approximately 0.01 foot of subsidence per foot of groundwater level decline between the 1950s and 1970s relating to the

[232] North American Subbasin GSP, Section 8.7.3.1, p. 303.
[233] North American Subbasin GSP, Table 8-5, p. 303.
[234] North American Subbasin GSP, Section 8.7.3.1, p. 302.
[235] North American Subbasin GSP, Section 8.7.3.2, p. 304.
[236] 23 CCR § 354.28(c)(5).
[237] 23 CCR §§ 354.28(c)(5)(A-B).
[238] North American Subbasin GSP, Section 8.8.1, p. 304.

"development of the pumping depression beneath the central portion of the Subbasin."[239] The Plan notes that the Subbasin lacks the "presence of thick, laterally extensive clay deposits" generally susceptible to subsidence.[240]

The GSP describes significant and unreasonable effects from subsidence as shifting land gradients causing problems for crops that rely on precise irrigation depths (e.g., rice), damage to pipelines and wells, shifting of grades to sewer and storm drains preventing proper drainage, damage to local roads and highways or structural damage to buildings, and lowering of levee crowns adjacent to rivers increasing flood risk.[241]

The Plan quantitatively defines an undesirable result for subsidence as occurring when "the rate of inelastic subsidence exceeds 0.5 feet over a five-year period over an area covering approximately five or more square miles."[242] The Plan claims this rate would not exceed historical rates of subsidence in which undesirable results did not occur. The Plan contends that anything less than this would represent a "highly localized phenomenon" unlikely to affect the overall sustainably of the Subbasin.[243] The Plan states undesirable results are not anticipated to occur based on projected future groundwater conditions and the GSAs' understanding of the Subbasin's hydrogeologic setting.

The GSP uses groundwater levels as a proxy for minimum thresholds, measurable objectives, and interim milestones. The GSAs evaluated historical land subsidence and groundwater level data and concluded that a close correlation exists between groundwater levels and land subsidence. The GSP states that "a relationship of approximately 0.01 feet of subsidence per 1 foot of groundwater drawdown has been observed."[244] The Plan notes that due to time constraints and limited availability of InSAR data the GSAs did not use InSAR for the development of subsidence sustainability criteria but may incorporate it in the future.[245]

The minimum thresholds are established at the lower elevation between either the recorded historical low groundwater level or the model projected groundwater level minus the fall 2014/2015 baseline (i.e., the minimum threshold established for the chronic lowering of groundwater). The GSP states that where thresholds are set at the historical low groundwater level, "subsidence would not be expected until the level exceeded the minimum threshold." The GSP states that, based on the observed relationship between subsidence and groundwater drawdown, the maximum projected long-term drawdown within the Subbasin is about 18 feet — which equates to approximately 0.18 feet of

[239] North American Subbasin GSP, Section 7.8, p. 254.
[240] North American Subbasin GSP, Section 8.8.1, p. 304.
[241] North American Subbasin GSP, Section 8.8.1.3, p. 305.
[242] North American Subbasin GSP, Section 8.8.1, p. 304.
[243] North American Subbasin GSP, Section 8.8.1.1, p. 304.
[244] North American Subbasin GSP, Section 8.8.2.1, p. 305.
[245] North American Subbasin GSP, Section 8.8.2.1, p. 307.

subsidence. The GSP claims that this amount subsidence would not have any significant impacts on infrastructure overlying the Subbasin.[246]

Department staff generally understand the Plan's rationale for using groundwater levels as a proxy for subsidence. However, Department staff note that while undesirable results related to land subsidence may not have occurred in the past, there is potential that undesirable results could occur in the future given the GSAs' proposed management strategy to lower groundwater levels below historical lows in some parts of the Subbasin. Given the uncertainty of these novel conditions, Department staff conclude that groundwater levels may not be a suitable proxy for land subsidence. Department staff believe that it is critical for the GSAs to monitor land subsidence using a method that can directly measure land elevation changes and provide quantitative data. Therefore, Department staff recommend the GSAs establish sustainable management criteria for land subsidence utilizing a monitoring network that directly measures land elevation change such as remote sensing data, survey monuments, or global positioning system stations (see Recommended Corrective Action 4).

The Plan explains that the measurable objectives and interim milestones established for chronic lowering of groundwater levels "represent the desired state for a sustainable groundwater basin," and therefore those same values are used for the land subsidence criteria.[247]

While Department staff conclude that groundwater levels are not a suitable proxy for land subsidence given the GSAs' proposed management strategy to lower groundwater levels below historical lows, this fault does not preclude plan approval at this time due to the Subbasin's definition of undesirable results providing a quantitative metric to limit subsidence and the minimal amount of recorded historical land subsidence.

4.3.2.6 Depletions of Interconnected Surface Water

SGMA defines undesirable results for the depletion of interconnected surface water as those that have significant and unreasonable adverse impacts on beneficial uses of surface water and are caused by groundwater conditions occurring throughout the basin.[248] The GSP Regulations require that a Plan identify the presence of interconnected surface water systems in the basin and estimate the quantity and timing of depletions of those systems.[249] The GSP Regulations further require that minimum thresholds be set based on the rate or volume of surface water depletions caused by groundwater use, supported by information including the location, quantity, and timing of depletions, that adversely impact beneficial uses of the surface water and may lead to undesirable results.[250]

[246] North American Subbasin GSP, Section 8.8.2.1, p. 305.
[247] North American Subbasin GSP, Sections 8.8.3.1 and 8.8.3.2, p. 309.
[248] Water Code § 10721(x)(6).
[249] 23 CCR § 354.16 (f).
[250] 23 CCR § 354.28 (c)(6).

The Plan acknowledges the presence of interconnected surface waters in the Subbasin and assumes that rivers and creeks in the Subbasin are interconnected with groundwater when the depth to water is less than 30 feet bgs.[251] In their assessment of interconnected surface water, the GSAs also evaluated groundwater level hydrographs and conducted isotope analysis (for correlation with changes in surface water levels and water quality parameters) from monitoring wells constructed at various locations along rivers and creeks.[252] At this time, Department staff are generally satisfied that the GSAs have adopted a reasonable approach to identify the location of interconnected surface waters in the Subbasin; however, additional information related to filling interconnected surface water identification data gaps is requested in Recommended Corrective Action 2.

The GSP does not quantify the rate or volume of surface water depletions due to groundwater pumping as the sustainable management criteria as required by the GSP Regulations.[253] Instead, the GSP proposes the use of groundwater levels as a proxy for this sustainability indicator and conducted a seepage analysis to partially justify this approach. The Plan states that groundwater levels are a suitable proxy, as interconnected surface water depletions are "directly related to the gradient between the surface water system at the groundwater interface and the groundwater Subbasin."[254] Department staff conclude that at this time the GSP has not demonstrated, with adequate evidence, that the use of groundwater elevations as a proxy for depletions of interconnected surface water is sufficient to quantify the location, quantity, and timing of depletions.

The GSP describes significant and unreasonable effects from the depletion of interconnected surface water as the reduction of available surface water for: downstream and in-basin diverters; riparian and aquatic habitat and species (including Central Valley Steelhead and Chinook Salmon); and adjacent groundwater dependent ecosystems.[255] The Plan states that sustainable management criteria for interconnected surface water including undesirable results,[256] minimum thresholds,[257] measurable objectives,[258] and interim milestones[259] are all the same as those established for the chronic lowering of groundwater. The monitoring network for interconnected surface water consists of a subset of 21 representative wells from the chronic lowering of groundwater levels monitoring network.

The GSP defines an undesirable result as when "20% or more of the Subbasin's interconnected surface water representative monitoring sites have minimum threshold exceedances for 2 consecutive Fall measurements (5 out of 21)."[260] However, the GSP

[251] North American Subbasin GSP, Section 5.11, p. 183.
[252] North American Subbasin GSP, Section 5.11, pp. 183-185.
[253] 23 CCR § 354.28 (c)(6).
[254] North American Subbasin GSP, Section 8.9, p. 309.
[255] North American Subbasin GSP, Section 8.9.1.3, p. 314.
[256] North American Subbasin GSP, Section 8.9.1, pp. 313-314.
[257] North American Subbasin GSP, Section 8.9.2, pp. 314-317.
[258] North American Subbasin GSP, Section 8.9.3.1, p. 317.
[259] North American Subbasin GSP, Section 8.9.3.2, p. 317.
[260] North American Subbasin GSP, Section 8.9.1, p. 313.

provides minimal discussion (or justification) for how the definition of an undesirable result was arrived (other than how it was used for the chronic lowering of groundwater). The Plan states that "the criteria used to define significant and undesirable results for depletion of surface water is inherently focused on the protection of beneficial uses and users," as they avoid drawing down groundwater levels "such that a gradient is induced that results in significant and unreasonable depletion of surface water that could impact downstream users, riparian and aquatic habitat and species in the river corridor, or adjacent [groundwater dependent ecosystems]."[261] The Plan explains that undesirable results could occur from increased groundwater extractions resulting in additional seepage from local rivers and tributaries.[262]

The interconnected surface water minimum thresholds appear to allow for an approximate average of 4 feet of groundwater decline, and a maximum of 13 feet, relative to 2014 and 2015 conditions.[263] The Plan states the modeling scenario methodology used to establish the chronic lowering of groundwater sustainability criteria is also suitable for interconnected surface water, as "the effects on surface water flows resulting from land use changes and coincident additional use of groundwater can be observed." The Plan describes how the modeled groundwater extractions are projected to increase from their "Current Conditions Baseline by some 40,000 AFY under the Projected Conditions Baseline with Climate Change."[264] Under these conditions, the Plan anticipates the most significant drawdown of groundwater elevations to occur near the Sacramento River. The Plan includes an analysis of seepage along the Sacramento River, based on the modeled results, which indicate that the river will lose about 5,800 AFY over the 50-year simulation period.[265] However, the Plan notes that future municipal development will also take some agricultural land out of production that currently diverts water from the river, resulting in a net increase of about 17,200 AFY of flow in the Sacramento River.[266] The Plan further claims that the projected pumping and land use changes along the Sacramento River represent "a net improvement to Sacramento River flows on an annual basis" as these changes establish a new year-long baseline demand rather than a typical 6-month growing season demand.[267]

Along with the Sacramento River, the GSAs modeled the anticipated seepage from interconnected reaches of several other rivers and creeks in the Subbasin to evaluate potential impacts on aquatic species. The Plan states that "Central Valley Steelhead and Chinook Salmon are known to rely on the Sacramento, Feather, and American rivers, and Central Valley Steelhead are known to enter western Placer County creeks through the Natomas Cross Canal and the westernmost segment of Steelhead Creek."[268] The GSP

[261] North American Subbasin GSP, Section 8.9.1.1, pp. 313-314.
[262] North American Subbasin GSP, Section 8.9.1.2, p. 314.
[263] North American Subbasin GSP, Table 8-1, p. 285, Table 8-9, p. 315.
[264] North American Subbasin GSP, Section 8.9, p. 309.
[265] North American Subbasin GSP, Section 8.9, p. 309.
[266] North American Subbasin GSP, Section 8.9, p. 310.
[267] North American Subbasin GSP, Section 8.9, p. 310.
[268] North American Subbasin GSP, Section 8.9, p. 310.

provides the projected average monthly flows in each of these reaches, the projected future seepage from each reach (to or from the groundwater system), and the percentage of surface water flow that is lost or gained from seepage by month.[269] The maximum projected seepage — expected to be between two and three percent — occurs in Steelhead Creek (aka Natomas East Main Drain).[270] The Plan notes that these seepage rates occur in "summer months when the fish species would not be migrating." The Plan also notes that at "no time do any of these reaches go dry."[271]

Based on review of the GSP's depletions of interconnected surface water sustainability criteria, Department staff conclude that the GSAs' use of the same sustainability thresholds developed for the chronic lowering of groundwater levels to be lacking sufficient justification. For example, the Plan partially defends the use of this criteria by highlighting that the projected land use changes in the Subbasin represent a "net improvement to Sacramento River flows" (as described above); however, the GSP does not provide a timeframe for when these changes will occur. Additionally, the Plan only mentions benefits to the Sacramento River, so it is unclear to Department staff what effect, if any, this would have on the Subbasin-wide interconnected surface water-groundwater system.

As another line of evidence for supporting the interconnected surface water sustainability criteria in the GSP, the GSAs included the seepage analysis for other rivers and creeks in the Subbasin.[272] However, there appears to be some ambiguity regarding the specific groundwater conditions these seepage rates represent. It is unclear to Department staff if these rates are simply representative of monthly averages that can be expected over the 50-year modeling period, or if they relate to drier periods. It is also unclear if the seepage rates are indicative of groundwater conditions occurring throughout the Subbasin if the GSAs were to manage groundwater levels at, or near, the established minimum thresholds. Additionally, because the GSAs used fall 2014 and 2015 water levels for the "baseline" when establishing their sustainability criteria, it is unclear how the minimum thresholds relate to the simulated water levels in the 50-year model run (which does not incorporate that baseline). If the Plan continues to utilize the proposed sustainability criteria for interconnected surface water in the future, Department staff encourage the GSAs to conduct additional analysis of the effects on beneficial uses and users of interconnected surface water with respect to the minimum thresholds and provide an explanation for how groundwater levels managed at, or near, the thresholds will not lead to undesirable results in the Subbasin.

Separately, while the Plan includes the estimated average annual volume of depletions (stream seepage) for the major rivers and streams in the Subbasin, the GSP does not estimate the location, quantity, and timing of depletion of interconnected surface waters

[269] North American Subbasin GSP, Table 8-8, pp. 312-313.
[270] North American Subbasin GSP, Table 8-8, pp. 312-313.
[271] North American Subbasin GSP, Section 8.9, p. 310.
[272] North American Subbasin GSP, Table 8-8, pp. 312-313.

as required by the GSP Regulations. Department staff understand that quantifying depletions of surface water from groundwater extractions is a complex task that likely requires developing new, specialized tools, models, and methods to understand local hydrogeologic conditions, interactions, and responses. During the initial review of GSPs, Department staff have observed that most GSAs have struggled with this new requirement of SGMA. However, staff believe that most GSAs will more fully comply with regulatory requirements after several years of Plan implementation that includes projects and management actions to address the data gaps and other issues necessary to understand, quantify, and manage depletions of interconnected surface waters. Accordingly, Department staff believes that affording GSAs adequate time to refine their Plans to address interconnected surface waters is appropriate and remains consistent with SGMA's timelines and local control preferences.

The Department will continue to support GSAs in this regard by providing, as appropriate, financial and technical assistance to GSAs, including the development of guidance describing appropriate methods and approaches to evaluate the rate, timing, and volume of depletions of interconnected surface water caused by groundwater extractions. Once the Department's guidance related to depletions of interconnected surface water is publicly available, the GSA, where applicable, should consider incorporating appropriate guidance approaches into their future periodic updates to the GSP (See Recommended Corrective Action 5a). GSAs should consider availing themselves of the Department's financial or technical assistance, but in any event must continue to fill data gaps, collect additional monitoring data, and implement strategies to better understand and manage depletions of interconnected surface water caused by groundwater extractions and define segments of interconnectivity and timing within their jurisdictional area (See Recommended Corrective Action 5b). Furthermore, GSAs should coordinate with local, state, and federal resources agencies as well as interested parties to better understand the full suite of beneficial uses and users that may be impacted by pumping induced surface water depletion (See Recommended Corrective Action 5c).

4.4 MONITORING NETWORK

The GSP Regulations describe the monitoring network that must be developed for each sustainability indicator including monitoring objectives, monitoring protocols, and data reporting requirements. Collecting monitoring data of a sufficient quality and quantity is necessary for the successful implementation of a groundwater sustainability plan. The GSP Regulations require a monitoring network of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the basin and evaluate changing conditions that occur through implementation of the Plan.[273] Specifically, a monitoring network must be able to monitor impacts to beneficial uses and users,[274] monitor changes in groundwater conditions relative to measurable objectives

[273] 23 CCR § 354.32.
[274] 23 CCR § 354.34(b)(2).

and minimum thresholds,[275] capture seasonal low and high conditions,[276] include required information such as location and well construction and include maps and tables clearly showing the monitoring site type, location, and frequency.[277] Department staff encourage GSAs to collect monitoring data as specified in the GSP, follow SGMA data and reporting standards,[278] fill data gaps identified in the GSP prior to the first periodic update,[279] update monitoring network information as needed, follow monitoring best management practices,[280] and submit all monitoring data to the Department's Monitoring Network Module immediately after collection including any additional groundwater monitoring data that is collected within the Plan area that is used for groundwater management decisions. Department staff note that if GSAs do not fill their identified data gaps, the GSA's basin understanding may not represent the best available science for use to monitor basin conditions.

The GSP has identified approximately 160 monitoring wells screened within the Subbasin's principal aquifer to include in the groundwater level monitoring network.[281] According to the GSP, 41 wells are used as representative monitoring sites for chronic lowering of groundwater levels.[282] However, Department staff note that there are a total of 131 wells uploaded to the Department's SGMA Portal Monitoring Network Module (MNM) with 42 representative monitoring sites in the MNM. The Department's review of the groundwater level monitoring network is based on information provided in the MNM and information provided in the GSP.

The GSP proposes to use the representative wells from the chronic lowering of groundwater levels network as a proxy for the groundwater storage monitoring network because changes in groundwater storage are directly dependent on changes in groundwater levels.[283]

The GSP states that the degraded water quality monitoring network is created from public water supply wells regulated by the State Water Resources Control Board's Division of Drinking Water, wells from the Irrigated Lands Regulatory Program, and dedicated monitoring wells.[284] The GSP states that analysis of the public water supply wells meets the water quality reporting monitoring requirements in California Code of Regulations Title 22 and that the remaining wells are sampled once every one or two years depending on

[275] 23 CCR § 354.34(b)(3).
[276] 23 CCR § 354.34(c)(1)(B).
[277] 23 CCR §§ 354.34(g-h).
[278] 23 CCR § 352.4 *et seq*.
[279] 23 CCR § 354.38(d).
[280] Department of Water Resources, 2016, Best Management Practices and Guidance Documents.
[281] North American Subbasin GSP, Section 7.2, p. 224, Tables 7-1 and 7-2, pp. 225 and 227-229.
[282] North American Subbasin GSP, Table 7-3, p. 233.
[283] North American Subbasin GSP, Section 7.5, pp. 244-245.
[284] North American Subbasin GSP, Section 7.7.1, pp. 246-247, Section 7.7.2, p. 253.

the well.[285] Wells will be sampled for nitrate (as N) and TDS, which are identified as the COCs in the Subbasin with established sustainability criteria.[286]

The GSP states that 12 wells from the chronic lowering of groundwater levels network will be used as a proxy for land subsidence; however, all 41 wells are listed as representative monitoring sites on Table 8-7[287] of the sustainable management criteria section of Plan (and 40 are listed on MNM).[288] The GSP explains that groundwater levels from these wells will also be compared to subsidence data at one extensometer site in the Subbasin.[289] Department staff recommend the GSAs establish monitoring for land subsidence utilizing a method that directly measures land elevation change such as remote sensing data, survey monuments, or global positioning system stations (See Recommended Corrective Action 4). Department staff also encourage the GSAs to consider utilizing InSAR in the land subsidence monitoring network as it is the best available monitoring method that can achieve the criteria defined in the GSP Regulations[290] to identify the rate and extent of land subsidence.

The GSP has identified approximately 24 shallow stream-adjacent monitoring wells from the chronic lowering of groundwater levels network to include in the monitoring network for depletions of interconnected surface water (however, again the total number of sites is inconsistent throughout the GSP and with the MNM).[291] Each of the shallow stream-adjacent monitoring wells are fitted with a pressure transducer to collect groundwater level data. The shallow monitoring wells in the network are adjacent to the American, Bear, Feather, and Sacramento Rivers and along some canals and creeks generally near the edges of the Subbasin. The monitoring network also includes eight stream gages managed by DWR, USGS, and the City of Roseville.[292] All monitoring wells and stream gages collect continuous data in 15-minute or hourly increments.[293] All the stream gages are paired with at least two shallow monitoring wells; approximately seven wells monitor locations where no stream gauges are installed.[294]

While the GSP does provide descriptions and maps identifying the location of monitoring sites for the chronic lowering of groundwater levels, degraded water quality, and the depletion of interconnected surface water monitoring networks, Department staff encountered inconsistent or incomplete information within the GSP regarding the total number of monitoring sites, representative monitoring sites, and/or monitoring frequencies at these sites. Department staff have determined that additional information should be provided in the GSP regarding the monitoring networks for these sustainability

[285] North American Subbasin GSP, Section 7.7.3, p. 253.
[286] North American Subbasin GSP, Section 7.7.3, p. 253, Section 8.7, 297.
[287] North American Subbasin GSP, Table 8-7, p. 306.
[288] North American Subbasin GSP, Section 7.8.2, p. 255, Figure 7-13, p. 257, Table 7-6, p. 258.
[289] North American Subbasin GSP, Section 7.8.2, p. 254.
[290] 23 CCR § 354.34(c)(5)
[291] North American Subbasin GSP, Section 7.9.2, p. 259, Figure 7-14, p. 261, Table 7-3, p. 233.
[292] North American Subbasin GSP, Table 7-7, p. 262.
[293] North American Subbasin GSP, Table 7-7, p. 262, Section 7.9.3, p. 264.
[294] North American Subbasin GSP, Table 7-8, p. 263.

indicators. The GSP did not clearly and consistently report, in tabular format, the monitoring site type or measurement frequency for each site in the chronic lowering of groundwater levels, degraded water quality, and depletions of interconnected surface water monitoring networks as required by the GSP Regulations.[295] Providing this information and clearly identifying which sites are being used as representative monitoring sites will provide the Department with additional clarity on how monitoring in the Subbasin will comply with the requirements of the GSP Regulations and SGMA (see Recommended Corrective Action 6). It is imperative the GSAs work to ensure the information defining the monitoring network is consistent within the GSP, consistent with the Department's Monitoring Network Module, and follow the data and reporting standards.

While a recommended corrective action was identified, Department staff conclude that the description of the monitoring network included in the Plan substantially complies with the requirements outlined in the GSP Regulations. Overall, the Plan describes in sufficient detail a monitoring network that promotes the collection of data of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the Subbasin and evaluate changing conditions that occur through Plan implementation.

4.5 Projects and Management Actions

The GSP Regulations require a description of the projects and management actions the submitting Agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin.[296] Each Plan's description of projects and management actions must include details such as: how projects and management actions in the GSP will achieve sustainability, the implementation process and expected benefits, and prioritization and criteria used to initiate projects and management actions.[297]

While the Subbasin currently shows a surplus of groundwater in storage, projected demand due to planned new developments, along with changes in agriculture and projected water supply, indicate that the Subbasin will be operating with inflows and outflows much more closely balanced in the future.[298] Based on modeled future conditions with a central tendency climate change scenario, over a 50-year planning horizon, the Subbasin is projected to have an average annual decline in groundwater storage of about 3,500 AFY.[299]

The Plan intends to resolve this potential future deficit primarily through the expansion of the Subbasin's conjunctive use program (i.e., Project 1) with an anticipated net benefit of

[295] 23 CCR § 354.34 (h)
[296] 23 CCR § 354.44 (a).
[297] 23 CCR § 354.44 (b) *et seq.*
[298] North American Subbasin GSP, ES-6 and Table ES-1, p. 23.
[299] North American Subbasin GSP, Section 6.8, p. 220.

reducing groundwater pumping by approximately 5,000 AFY.[300] The Plan also explains that urban water purveyors under the Regional Water Authority have been planning for the completion of the Sacramento Regional Water Bank (Water Bank), which will "increase the use of the Subbasin as a storage reservoir as surface water reservoirs and the snowpack evolve under climate change."[301] The Plan describes how the Water Bank establishes a framework for accounting of the storage and recovery of water and, once complete, will likely maximize the benefits of the conjunctive use program[302] — which Department staff understand to mean the realization of the full 5,000 AFY pumping reduction.

The GSP also identifies supplemental projects that can be implemented if projected conditions are worse than expected. The Plan explains that supplemental projects are currently at a "feasibility level" and are in an ongoing planning process. For this reason, Department staff understand that the GSAs many not yet have all the information required by the GSP Regulations[303] for these projects and management actions. However, Department staff encourage the GSAs to update the GSP to provide the criteria that would trigger termination of the projects and management actions (where applicable), as additional information is gathered to better define/refine the projects and management actions. Furthermore, the GSAs should also provide the additional information required by the GSP Regulations[304] (e.g., legal authority, permitting, funding, public outreach, etc.) in future periodic evaluations of the Plan if supplemental projects are advanced from a feasibility stage to planning and implementation.

Overall, the GSP presents a set of projects and management actions that seem to be based on the best available information and science and will likely allow the Subbasin to reach sustainability once implemented. The Plan adequately describes proposed projects and management actions in a manner that is generally consistent and substantially compliant with the GSP Regulations.[305]

4.6 Consideration of Adjacent Basins/Subbasins

SGMA requires the Department to "…evaluate whether a groundwater sustainability plan adversely affects the ability of an adjacent basin to implement their groundwater sustainability plan or impedes achievement of sustainability goals in an adjacent basin."[306] Furthermore, the GSP Regulations state that minimum thresholds defined in each GSP be designed to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.[307]

[300] North American Subbasin GSP, ES-9, p. 25, Section 9.2.1, pp. 320-325.
[301] North American Subbasin GSP, Section 9, p. 319.
[302] North American Subbasin GSP, Section 9.2.1, p. 321.
[303] 23 CCR § 354.44 (b).
[304] 23 CCR § 354.44 (b)
[305] 23 CCR § 354.44 *et seq.*
[306] Water Code § 10733(c).
[307] 23 CCR § 354.28(b)(3).

The North American Subbasin shares boundaries with four other groundwater subbasins (South Yuba to the north; Sutter to the northwest; Yolo to the southwest; and South American to the south). The Plan states that the proposed minimum thresholds would have minimal impacts on the adjacent subbasins evidenced by "limited lowering of average groundwater levels at the [subbasin] boundaries" and a negligible change in anticipated future boundary flows based on model projections with climate change and project implementation.[308] Further, the GSAs met with representatives from each of the other subbasins and it was agreed that the minimum thresholds would not impact the ability of the other agencies to sustainably manage their respective subbasins.[309]

Based on information available at this time, Department staff have no reason to believe that groundwater management in the Subbasin will adversely affect groundwater conditions in the adjacent subbasins. Department staff will continue to review periodic evaluations of the Plan to assess whether implementation of the North American GSP is potentially impacting adjacent subbasins.

4.7 Consideration of Climate Change and Future Conditions

The GSP Regulations require a GSA to consider future conditions and project how future water use may change due to multiple factors including climate change.[310]

Since the GSP was adopted and submitted, climate change conditions have advanced faster and more dramatically. It is anticipated that the hotter, drier conditions will result in a loss of 10% of California's water supply. As California adapts to a hotter, drier climate, GSAs should be preparing for these changing conditions as they work to sustainably manage groundwater within their jurisdictional areas. Specifically, the Department encourages all GSAs to:

1. Explore how their proposed groundwater level thresholds have been established in consideration of groundwater level conditions in the basin based on current and future drought conditions;
2. Explore how groundwater level data from the existing monitoring network will be used to make progress towards sustainable management of the basin given increasing aridification and effects of climate change, such as prolonged drought;
3. Take into consideration changes to surface water reliability and that impact on groundwater conditions;
4. Evaluate updated watershed studies that may modify assumed frequency and magnitude of recharge projects, if applicable; and
5. Continually coordinate with the appropriate groundwater users, including but not limited to domestic well owners and state small water systems, and the appropriate

[308] North American Subbasin GSP, Section 8.4.2.4, p. 288.
[309] North American Subbasin GSP, Section 8.4.2.4, p. 288.
[310] 23 CCR § 354.18.

overlying county jurisdictions developing drought plans and establishing local drought task forces[311] to evaluate how their Plan's groundwater management strategy aligns with drought planning, response, and mitigation efforts within the basin.

[311] Water Code § 10609.50.

5 STAFF RECOMMENDATION

Department staff recommend approval of the GSP with the recommended corrective actions listed below. The North American Subbasin GSP conforms with Water Code Sections 10727.2 and 10727.4 of SGMA and substantially complies with the GSP Regulations. Implementation of the GSP will likely achieve the sustainability goal for the Subbasin. The GSAs have identified several areas for improvement of their Plan and Department staff concur that those items are important and should be addressed as soon as possible. Department staff have also identified additional recommended corrective actions that should be considered by the GSAs for the first periodic evaluation of their GSP. Addressing these recommended corrective actions will be important to demonstrate that implementation of the Plan is likely to achieve the sustainability goal.

The recommended corrective actions include:

RECOMMENDED CORRECTIVE ACTION 1

Clarify the definition of the bottom of the Subbasin in areas not defined by the occurrence of bedrock.

RECOMMENDED CORRECTIVE ACTION 2

Provide a schedule to address data gaps related to the identification of interconnected surface water including confirmation of areas considered to be likely interconnected with groundwater. Similarly, future periodic evaluations of the Plan should include further assessment to confirm or refine various Plan elements related to the identification of interconnected surface water (e.g., the use of spring 2020 water levels, the depth-to-water measurement of 30 feet bgs, and possibly additional analysis of perched groundwater in the Ione formation) as more information is gathered.

RECOMMENDED CORRECTIVE ACTION 3

Provide additional information and discussion to support the definition of undesirable results for degraded water quality (particularly for the *public water supply* well group), including describing potential impacts to beneficial uses and users and what would be considered significant and unreasonable effects.

RECOMMENDED CORRECTIVE ACTION 4

Establish sustainable management criteria for land subsidence for the Subbasin utilizing a monitoring network that directly measures land elevation change such as remote sensing data, survey monuments, or global positioning system stations.

RECOMMENDED CORRECTIVE ACTION 5

Department staff understand that estimating the location, quantity, and timing of stream depletion due to ongoing, Subbasin-wide pumping is a complex task and that developing suitable tools may take additional time; however, it is critical for the Department's ongoing and future evaluations of whether GSP implementation is on track to achieve sustainable groundwater management. The Department plans to provide guidance on methods and approaches to evaluate the rate, timing, and volume of depletions of interconnected surface water and support for establishing specific sustainable management criteria in the near future. This guidance is intended to assist GSAs to sustainably manage depletions of interconnected surface water.

In addition, the GSAs should work to address the following items by the first periodic evaluation of the Plan:

a. Consider utilizing the interconnected surface water guidance, as appropriate, when issued by the Department to establish quantifiable minimum thresholds, measurable objectives, and management actions.

b. Continue to fill data gaps, collect additional monitoring data, and implement the current strategy to manage depletions of interconnected surface water and define segments of interconnectivity and timing.

c. Prioritize collaborating and coordinating with local, state, and federal regulatory agencies as well as interested parties to better understand the full suite of beneficial uses and users that may be impacted by pumping induced surface water depletion within the GSAs' jurisdictional area.

RECOMMENDED CORRECTIVE ACTION 6

Define the monitoring site type and data collection frequency in tabular format for all representative monitoring sites in the chronic lowering of groundwater levels, degraded water quality, and depletion of interconnected surface water monitoring networks ensuring internal consistency between information provided in different sections of the GSP and the SGMA Portal's Monitoring Network Module.