CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE
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February 27, 2025

Eric Thornburn
Oakdale Irrigation District
1205 East F. Street
Oakdale, CA, 95361
ethorburn@oakdaleirrigation.com

RE: Approved Determination of the 2024 Groundwater Sustainability Plan Submitted for the San Joaquin Valley - Modesto Subbasin

Dear Eric Thorburn,

The Department of Water Resources (Department) has evaluated the revised 2024 groundwater sustainability plan (GSP) for the San Joaquin Valley - Modesto Subbasin in response to the Department's Incomplete Determination on January 18, 2024, 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 San Joaquin Valley - Modesto Subbasin GSP has taken sufficient action to correct deficiencies identified by the Department, 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 GSAs are required to submit their periodic evaluation of the San Joaquin Valley - Modesto Subbasin GSP no later than January 31, 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 Determination of Approval of the San Joaquin Valley - Modesto Subbasin 2024 Groundwater Sustainability Plan

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

STATEMENT OF FINDINGS REGARDING THE APPROVAL OF THE SAN JOAQUIN VALLEY – MODESTO SUBBASIN 2024 GROUNDWATER SUSTAINABILITY PLAN

Under the Sustainable Groundwater Management Act (SGMA or Act), 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 SGMA, 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.[1] The Department is directed to issue an assessment of the Plan within two years of its submission.[2] If a Plan is determined to be Incomplete, the Department must identify deficiencies that preclude approval of the Plan and identify corrective actions required to make the Plan substantially compliant with SGMA and the GSP Regulations. The Groundwater Sustainability Agency (GSA or Agency) has up to 180 days from the date the Department issues its assessment to make the necessary corrections and submit a revised Plan.[3] When evaluating a revised GSP that was determined to be incomplete, the Department reviews the materials provided by the GSA (e.g., revised or amended GSP) to address the deficiencies by the submission deadline. Part of the Department's review focuses on how the Agency addressed the deficiencies that precluded approval of the Plan. The Department shall find a Plan previously determined to be incomplete to be either:

1. Approved, if the Department determines the Agency has sufficiently addressed those deficiencies, the Department may evaluate other components of the Plan, particularly to assess whether and, if so, how revisions to address deficiencies may have affected other components of a Plan or its likelihood of achieving sustainable groundwater management.

2. Inadequate if, after consultation with the State Water Resources Control Board, the Agency has not taken sufficient action to correct the deficiencies previously identified by the Department.

This Statement of Findings explains the Department's determination regarding the revised Plan for the San Joaquin Valley – Modesto Subbasin (Basin No. 5-022.02) by the Stanislaus and Tuolumne Rivers Groundwater Basin Association GSA and the County of

[1] Water Code § 10733.
[2] Water Code § 10733.4.
[3] 23 CCR § 355.2(e)(2).

Tuolumne GSA (GSAs or Agencies) submitted on July 12, 2024 (referred to as the 2024 GSP or 2024 Plan).

Department management have discussed the 2024 Plan with Department staff and have reviewed the written assessment titled Sustainable Groundwater Management Program Assessment of Incomplete Groundwater Sustainability Plan 2025 Staff Report (Staff Report), attached as Exhibit A, which recommends approval of the 2024 GSP. Department management are satisfied that staff have conducted a thorough evaluation and assessment of the 2024 Plan and concur with staff's recommendations and all the recommended corrective actions. The Department therefore **APPROVES** the 2024 Plan and makes the following findings:

A. On January 31, 2022, the GSAs submitted a GSP (referred to as the 2022 GSP or 2022 Plan) for the Department's evaluation.

B. On January 18, 2024, the Department issued a Staff Report (referred to as the 2024 Incomplete Determination) and Findings determining the 2022 GSP to be incomplete, because the 2022 GSP did not satisfy the requirements of SGMA, nor did it substantially comply with the GSP Regulations. The Department's 2024 Incomplete Determination identified the following deficiencies that precluded approval and provided the GSAs with corrective actions that were intended to address the deficiencies.

    1. Deficiency 1. The 2022 GSP did not establish sustainable management criteria for chronic lowering of groundwater levels in a manner substantially compliant with the GPS regulations.

    2. Deficiency 2: The 2022 GSP did not include a reasonable assessment of overdraft conditions and reasonable means to mitigate overdraft.

    The Department provided the Agencies with 180 days to address the deficiencies.[4]

C. On July 12, 2024, the GSAs submitted a revised Plan (the 2024 GSP) to the Department. After staff's thorough evaluation of the 2024 Plan, the Department finds:

    1. The Agencies have taken sufficient actions to correct Deficiency 1, such that, at this time, the Department no longer finds this deficiency to preclude approval. The 2024 GSP has sufficiently identified the impacts to beneficial uses and users that would occur at minimum thresholds and lower interim milestones through a well impacts analysis that details the anticipated number of wells that could be impacted and the development of a well mitigation program in 2026 to address impacts from declining

[4] 23 CCR § 355.2(e)(2).

groundwater water levels. The 2024 GSP also includes an analysis showing the lower interim milestones are not anticipated to cause undesirable results for other sustainability indicators.

2. The Agencies have taken sufficient actions to correct Deficiency 2, such that, at this time, the Department no longer finds this deficiency to preclude approval. The 2024 GSP has provided details for planned demand reductions strategies and a pumping management framework which include groundwater allocation, extraction fees, and a credit trading program.

The 2024 Plan satisfies the required conditions as outlined in § 355.4(a) of the GSP Regulations[5]:

1. 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.[6]

2. The Plan, either on its own or in coordination with other Plans, appears to cover the entire Basin sufficient to warrant a thorough evaluation.[7]

D. 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.[8] 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

[5] 23 CCR § 350 et seq.
[6] 23 CCR § 355.4(a)(2).
[7] 23 CCR § 355.4(a)(3).
[8] Water Code § 10733.

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[9]; 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.[10] 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 basin under review.

E. 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.[11]

F. 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 the Plan's goal to ensure a reliable, accessible, and high-quality groundwater supply that supports municipal, domestic, agricultural, industrial, and environmental beneficial uses, especially during drought are sufficiently justified and explained. The Plan relies on credible information and science with a thorough analysis 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.[12]

    2. The Plan has identified reasonable measures and schedules to eliminate data gaps such as installing additional monitoring wells in the Western Lower Principal Aquifer and the eastern portion of the Subbasin, and

[9] Water Code § 113.
[10] Water Code § 10720.1(h).
[11] Water Code §§ 10721(r); 10727.2(b); 10733(a); 10733.8.
[12] 23 CCR § 355.4(b)(1).

obtaining water level data from landowners to refine the understanding of the Subbasin setting and improve monitoring networks.[13]

3. The projects and management actions proposed are designed to not only halt the current rates of overdraft occurring in the Subbasin, but also raise groundwater levels after reaching interim milestone lows. The projects and management actions 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.[14]

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 domestic well owners, would be impacted by the chosen minimum thresholds.[15]

5. The Plan's projects and management actions appear feasible at this time and capable of preventing undesirable results and ensuring that the Subbasin is operated 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.[16]

6. The Plan includes a reasonable assessment of overdraft conditions and includes reasonable means to mitigate overdraft, if present.[17]

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 through a series of coordination meetings with adjacent subbasin representatives and review of draft and completed GSPs, the minimum thresholds in the adjacent subbasins were considered together and are not expected to either cause undesirable results or adversely impact GSP implementation in adjacent subbasins.[18]

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[13] 23 CCR § 355.4(b)(2).
[14] 23 CCR § 355.4(b)(3).
[15] 23 CCR § 355.4(b)(4).
[16] 23 CCR § 355.4(b)(5).
[17] 23 CCR § 355.4(b)(6).
[18] 23 CCR § 355.4(b)(7).

8. Because a single plan was submitted for the Subbasin, a coordination agreement was not required.[19]

9. The GSAs' 8 member agencies, City of Modesto, City of Modesto, City of Oakdale, City of Riverbank, City of Waterford, Modesto Irrigation District, Oakdale Irrigation District, Stanislaus County, and Tuolumne County, have historically been responsible for coordinating, planning, and management of the shared groundwater resources in the Modesto Subbasin. The GSAs' member agencies and their history of groundwater management provide a reasonable level of confidence that the GSAs has the legal authority and financial resources necessary to implement the Plan.[20]

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.[21]

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

1. The Department developed its GSP Regulations consistent with and intending to further the State's human right to water 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.[22]

2. The Plan acknowledges and identifies interconnected surface waters within the Subbasin. The GSAs propose 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

[19] 23 CCR § 355.4(b)(8).
[20] 23 CCR § 355.4(b)(9).
[21] 23 CCR § 355.4(b)(10).
[22] Water Code § 106.3; 23 CCR § 350.4(g).

amendments to the Plan should aim to improve the initial sustainable management criteria as more information and improved methodology becomes available.

3. Projections of future Subbasin extractions are likely to stay within current and historic ranges, at least until the next periodic evaluation by the GSAs and the Department. Subbasin groundwater levels and other SGMA sustainability indicators appear unlikely to substantially deteriorate while the GSAs implement the Department's recommended corrective actions.

4. The California Environmental Quality Act[23] does not apply to the Department's evaluation and assessment of the Plan.

[23] Public Resources Code § 21000 *et seq*.

Accordingly, the 2024 GSP submitted by the Agencies for the San Joaquin Valley – Modesto 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 in the next Periodic Evaluation, which is set to be submitted by January 31, 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: February 27, 2025

Exhibit A: Groundwater Sustainability Plan Assessment Staff Report – San Joaquin Valley – Modesto Subbasin

State of California
Department of Water Resources
Sustainable Groundwater Management Program
Reassessment of Incomplete
Groundwater Sustainability Plan
2025 Staff Report

Groundwater Basin Name:	San Joaquin Valley – Modesto Subbasin (No. 5-022.02)
Submitting Agency:	Stanislaus and Tuolumne Rivers Groundwater Basin Association Groundwater Sustainability Agency and County of Tuolumne Groundwater Sustainability Agency
Submittal Type:	Revised Plan in Response to Incomplete Determination
Submittal Date:	July 12, 2024
Recommendation:	Approve
Date:	February 27, 2025

On July 12, 2024, the Stanislaus and Tuolumne Rivers Groundwater Basin Association Groundwater Sustainability Agency (GSA) and the County of Tuolumne GSA (collectively referred to as the GSAs or Agencies) resubmitted the Modesto Subbasin Groundwater Sustainability Plan (2024 GSP or 2024 Plan) for Modesto Subbasin (Subbasin) to the Department of Water Resources (Department or DWR) for evaluation and assessment as required by the Sustainable Groundwater Management Act (SGMA)[1] and GSP Regulations.[2] This was in response to the Department's Incomplete Determination of the initial GSP (2022 GSP or 2022 Plan) on January 18, 2024.[3]

After evaluation and assessment, Department staff conclude the GSAs have taken sufficient actions to correct deficiencies identified by the Department; however, Department staff have provided additional corrective actions which will be required to be addressed by the Plan's periodic evaluation.

Overall, Department staff believe the 2024 Plan contains 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 2024 Plan, and proposes a set of projects and management actions that, if successfully implemented, are likely to achieve the sustainability goal defined for the

[1] Water Code § 10720 *et seq*.
[2] 23 CCR § 350 *et seq*.
[3] Water Code § 10733.4(b); 23 CCR § 355.4(a)(4); https://sgma.water.ca.gov/portal/gsp/assessments/110.

Subbasin.[4] 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.

- ***Based on the evaluation of the 2024 Plan, Department staff recommend the Plan be approved.***

This assessment includes six sections:

- **Section 1 – Summary:** Overview of the Department staff's assessment and recommendation.
- **Section 2 – Evaluation Criteria:** Describes the legislative requirements and the Department's evaluation criteria.
- **Section 3 – Required Conditions:** Describes the submission requirements of an incomplete resubmittal to be evaluated by the Department.
- **Section 4 – Deficiency Evaluation:** Provides an assessment of whether and how the contents included in the GSP resubmittal addressed the deficiencies identified by the Department in the initial incomplete determination.
- **Section 5 – Plan Evaluation:** Provides a detailed assessment of the contents included in the GSP organized by each Subarticle outlined in the GSP Regulations.
- **Section 6 – Staff Recommendation:** Includes the staff recommendation for the 2024 Plan.

[4] 23 CCR § 354.24.

1 SUMMARY

Department staff recommend **approval** of the 2024 Modesto GSP and have recommended corrective actions designed to address shortcomings of the 2024 Plan described in this Staff Report. In Section 4 of this report, Department staff reviewed how the 2022 Plan was updated in the 2024 Plan by comparing content from each plan in order to determine if sufficient action was taken in response to deficiencies identified in the 2022 Plan. In Section 5, Department staff reviewed content in the GSP for its substantial compliance with GSP Regulations, and have provided recommended corrective actions for components of the plan that need improvement to support substantial compliance with GSP Regulations and for Subbasin sustainability.

The GSAs have made substantial improvements to its 2024 Plan since the 2022 GSP was determined to be incomplete. The GSAs provide more information to support the proposed temporarily lowering of groundwater levels below minimum thresholds between 2022 and 2032 including providing an analysis which shows it will not cause undesirable results for other sustainability indicators. The GSAs also discuss how this approach was done with consideration of beneficial uses and users by committing to implement a well mitigation program in the near-term for users impacted by the temporary declines. Lastly, the GSAs have added to the suite of projects and management actions and appear to have multiple pathways to allow water levels to recover above minimum thresholds and manage the Subbasin sustainably.

While the GSAs have made substantial progress, diligent plan implementation will be critical to stem declines by 2027, recover water levels to minimum threshold levels by 2032, and manage the Subbasin to avoid undesirable results into the future. Department staff have identified multiple recommended corrective actions that the GSAs should consider for the first periodic evaluation of the Plan (see Staff Recommendation). Addressing these recommended corrective actions will be important to demonstrate, on an ongoing basis, that implementation of the Plan is likely to achieve the sustainability goal.

The recommended corrective actions generally focus on the following:

1) Refining the assessment of how established sustainable management criteria affects beneficial uses and users of groundwater,
2) Providing information in future annual reports and the periodic evaluation of the Plan to describe whether projects and management actions are being implemented as anticipated,
3) Providing supporting information related to the hydrogeologic conceptual model,
4) Revising the definition of undesirable results for degraded water quality,

5) Estimating the location, quantity, and timing of stream depletions, and
6) Providing supporting information for the degraded water quality monitoring network.

2 EVALUATION CRITERIA

The Department evaluates whether a Plan conforms to the statutory requirements of SGMA[5] and is likely to achieve the basin's sustainability goal,[6] whether evaluating a basin's first Plan,[7] a Plan previously determined incomplete,[8] an amended Plan,[9] or a GSA's periodic evaluation to an approved Plan.[10] To achieve the sustainability goal, each version of the Plan must demonstrate that implementation 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.[11] The Department is also required to evaluate, on an ongoing basis, whether the Plan will adversely affect the ability of an adjacent basin to implement its groundwater sustainability program or achieve its sustainability goal.[12]

The Plan evaluated in this Staff Report was previously determined to be incomplete. An incomplete Plan is one which had one or more deficiencies that precluded its initial approval, may not have had supporting information that was sufficiently detailed or analyses that were sufficiently thorough and reasonable, or Department staff determined it was unlikely the GSAs in the basin could achieve the sustainability goal. After a GSA has been afforded up to 180 days to address the deficiencies and based on the GSA's efforts, the Department can either approve[13] the Plan or determine the Plan inadequate.[14]

The Department's evaluation and assessment of a Plan previously determined to be incomplete, as presented in this Staff Report, continues to follow Article 6 of the GSP Regulations[15] to determine whether the Plan, with revisions or additions prepared by the GSA, complies with SGMA and substantially complies with the GSP Regulations.[16] As stated in the GSP Regulations, "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."[17]

[5] Water Code §§ 10727.2, 10727.4, 10727.6.
[6] Water Code § 10733; 23 CCR § 354.24.
[7] Water Code § 10720.7.
[8] 23 CCR § 355.2(e)(2).
[9] 23 CCR § 355.10.
[10] 23 CCR § 355.6.
[11] Water Code § 10721(v).
[12] Water Code § 10733(c).
[13] 23 CCR §§ 355.2(e)(1).
[14] 23 CCR §§ 355.2(e)(3).
[15] 23 CCR § 355 *et seq*.
[16] 23 CCR § 350 *et seq*.
[17] 23 CCR § 355.4(b).

The recommendation to approve a Plan previously determined to be incomplete does not signify that Department staff, were they to exercise the professional judgment required to develop a Plan for the basin, would make the same assumptions and interpretations as those contained in the revised Plan, but simply that Department staff have determined that the modified assumptions and interpretations relied upon by the submitting GSA(s) are supported by adequate, credible evidence, and are scientifically reasonable. The assessment of a Plan previously determined to be incomplete may involve the review of new information presented by the GSAs, including models and assumptions, and an evaluation of that information based on scientific reasonableness. In conducting its assessment, Department staff does not recalculate or reevaluate technical information or perform its own geologic or engineering analysis of that information.

The recommendation to not approve a Plan previously determined to be incomplete and instead determine it to be inadequate signifies that the resubmitted Plan contains significant deficiencies based on one or more of the criteria identified in 23 CCR § 355.4(b), or the GSAs in the basin have not taken sufficient actions to correct the deficiencies previously identified by the Department when it found the Plan incomplete. The Department engages in consultation with the State Water Resources Control Board before finding a Plan inadequate. A Plan determined to be inadequate is subject to the state intervention provisions contained in Chapter 11 of SGMA.[18]

[18] Water Code § 10735 *et seq*.

3 REQUIRED CONDITIONS

For a Plan that the Department previously determined to be incomplete, the Department provided required corrective actions that address minor or potentially significant deficiencies that the Department identified in the initially submitted Plan. The GSAs in a basin, whether developing a single GSP covering the basin or multiple GSPs, must attempt to sufficiently address those required corrective actions within the time provided, not to exceed 180 days, for the Plan to be reevaluated by the Department and potentially approved.

3.1 INCOMPLETE RESUBMITTAL

GSP Regulations specify that the Department shall evaluate a resubmitted GSP in which the GSA has taken corrective actions within 180 days from the date the Department issued an incomplete determination to address deficiencies.[19]

The Department issued the incomplete determination on January 18, 2024. The GSAs resubmitted the GSP to the Department on July 12, 2024, in compliance with the 180-day deadline.

The GSAs have provided a redline/strikeout version of the resubmitted GSP. The redline/strikeout version highlights the changes made from the initial 2022 submission to the 2024 submission.[20]

[19] 23 CCR § 355.4(a)(4).
[20] https://sgma.water.ca.gov/portal/service/gspdocument/download/10201.

4 DEFICIENCY 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.

In its initial incomplete determination, the Department identified deficiencies in the Plan which precluded the Plan's approval on January 18, 2024.[21] The GSAs were given 180 days to take corrective actions to remedy the identified deficiencies. Consistent with the GSP Regulations, Department staff are providing an evaluation of the resubmitted Plan to determine if the GSAs have taken sufficient actions to correct the deficiencies identified in the 2022 Plan. For each deficiency, the corrective actions are repeated, the 2022 Plan content is summarized, the 2024 Plan is then described, followed by Department staff's evaluation.

4.1 DEFICIENCY 1. THE GSP DOES NOT PROVIDE SUFFICIENT INFORMATION TO SUPPORT THE SELECTION OF CHRONIC LOWERING OF GROUNDWATER LEVELS SUSTAINABLE MANAGEMENT CRITERIA.

4.1.1 Corrective Action 1

In the Department's Incomplete Determination, the Department identified that the GSAs must provide more detailed explanation and justification regarding the selection for the sustainable management criteria for the chronic lowering of groundwater sustainability indicator. Department staff recommended the GSAs consider and address the following:

a) The GSAs should revise the GSP to include a complete and thorough discussion of how the interests of beneficial uses and users of groundwater in the Subbasin have been considered. Department staff recommend that additional assessment be conducted to understand the impacts to beneficial uses and users from continued overdraft, including what impacts may result if groundwater levels reach the established interim milestones in 2027. The GSP should also include a well impact analysis identifying the anticipated number and location of wells that may go dry during the 20-year implementation period based on the proposed interim milestones, for how long they may go dry, and the impacts to land uses and property interests, among others. Additionally, the GSP should include a

[21] https://sgma.water.ca.gov/portal/gsp/assessments/85.

discussion of how its approach to groundwater management may affect all identified beneficial uses and users in the Subbasin, including environmental users.

b) The GSAs should revise the GSP to describe how impacts to wells experienced at interim milestone levels below minimum thresholds will be managed or mitigated. If the GSAs plan to implement a well mitigation program to avoid causing significant and unreasonable effects to beneficial uses and users, details such as the number of wells anticipated to be eligible for the program, estimated costs, funding sources, and an implementation schedule should be included in the GSP.

c) The GSAs should revise the GSP to include an analysis describing whether or how managing the Subbasin to allow groundwater levels to drop to interim milestone levels that are below the established minimum thresholds will avoid causing undesirable results for other sustainability indicators.

4.1.2 Evaluation of Resubmitted Plan

4.1.2.1 Corrective Action 1a – Interests of Beneficial Uses and Users

In response to the incomplete determination, the GSAs provided a well impact analysis evaluating potential impacts to beneficial uses and users at minimum threshold and 2027 interim milestone groundwater elevations.

The 2022 Plan proposed minimum thresholds at historical low groundwater levels experienced in the Subbasin between water years (WY) 1991 to WY 2020,[22] with 2027 interim milestones in the eastern portions of the Subbasin (i.e., the area overlaying the Eastern Principal Aquifer) exceeding minimum thresholds for a period of 10 years until projects and management actions are implemented to raise groundwater levels back to the higher minimum thresholds.[23] While the 2022 Plan provided a description of adverse effects to wells during recent historical lows (i.e., the 2014-2017 drought period),[24] it had not provided an analysis of potential impacts to beneficial uses and users, land uses and property interests at all proposed minimum threshold or the lower 2027 interim milestone groundwater levels that would exceed minimum thresholds for an extended duration. Department staff believed that significant and unreasonable effects may occur in the Subbasin at 2027 interim milestones, particularly in the eastern portion of the Subbasin where declining groundwater levels have been more pronounced[25], the majority of adverse impacts to wells have been reported[26] and at vulnerable areas along the Tuolumne River and Stanislaus River.[27] Information provided in the 2022 Annual Report indicated that groundwater levels had already exceeded minimum thresholds in 11 of the

[22] 2022 Modesto Subbasin GSP, Section 6.3.2, p. 334.
[23] 2022 Modesto Subbasin GSP, Section 6.9, p. 387.
[24] 2022 Modesto Subbasin GSP, Table 6-2, p. 329.
[25] 2022 Modesto Subbasin GSP, Figures 3-21 to 3-25, pp. 186-190.
[26] 2022 Modesto Subbasin GSP, Section 3.2.2, p. 138; Figures 2-14 to 2-15, pp. 113-114.
[27] 2022 Modesto Subbasin GSP, Section 6.3.1.1, p. 330.

50 representative monitoring sites,[28] and over 15 additional dry wells had been reported in the Subbasin since the 2022 Plan was submitted.[29] Therefore, the Department's Incomplete Determination asked the GSAs to provide a complete and thorough discussion of potential impacts to all beneficial uses and users, land users, environmental users and property interests including the number and location of wells that may be negatively impacted from continued overdraft in the Subbasin and if groundwater levels reach the established interim milestones in 2027.[30]

The 2024 Plan includes a comprehensive well impact analysis to support the selection of minimum thresholds and interim milestones. Specifically, the well impact analysis assesses potential impacts to all water supply wells with construction information in the Subbasin at established minimum thresholds and the lower 2027 interim milestone groundwater elevations.[31] The well impact analysis includes records from 4,563 wells including municipal, industrial, domestic and agricultural water supply wells compiled from the GSP data management system (DMS), wells added to the Turlock-Modesto Water Resources Model (C2VSimTM) model since the 2022 GSP was submitted in January 2022, and the Department's Online System of Well Completion Reports (OSWCR).[32] The 2024 Plan explains that water supply wells used in the well impact analysis were mapped and grouped according to the nearest representative monitoring well in the same principal aquifer unit.[33] Minimum thresholds and the lower 2027 interim milestone groundwater elevations at each representative monitoring well were compared to the depth of grouped water supply wells.[34] Water supply wells were considered to go dry at minimum threshold groundwater elevations if the depth of the well was above the minimum threshold level. Similarly, water supply wells with total depths above the 2027 interim milestone groundwater elevations were considered to be dry.[35]

The 2024 Plan states that results of the well impact analysis indicate that a total of 126 water supply wells (2.8 percent of wells analyzed) could potentially go dry at minimum threshold groundwater elevations in wells predominately located in the Eastern Principal Aquifer, with one impacted well located in the Western Upper Principal Aquifer and no dry wells reported at the Western Lower Principal Aquifer.[36] At 2027 interim milestones, the well impact analysis indicates that 29 additional wells (0.6 percent of the wells analyzed) could go dry in the Eastern Principal Aquifer—representative of impacts to areas where groundwater decline would be allowed to exceed minimum thresholds for an extended duration.[37] The 2024 Plan discusses that, consistent with adverse impacts to water supply

[28] Modesto Subbasin Annual Report WY 2022 Table 3-4, pp. 33-35.
[29] "Dry Well Reporting System." *Mydrywellsupply.water.ca.gov,* Accessed 21, November, 2023.
[30] https://sgma.water.ca.gov/portal/gsp/assessments/85
[31] 2024 Modesto Subbasin GSP, Section 6.3.3.1, p. 337.
[32] 2024 Modesto Subbasin GSP, Section 6.3.3.1. p. 337-338.
[33] 2024 Modesto Subbasin GSP, Section 6.3.3.1. p. 338.
[34] 2024 Modesto Subbasin GSP, Section 6.3.3.1. p. 338.
[35] 2024 Modesto Subbasin GSP, Section 6.3.3.1. p. 338.
[36] 2024 Modesto Subbasin GSP, Section 6.3.3.1. p. 338; Figure 6-5, p. 396.
[37] 2024 Modesto Subbasin GSP, Section 6.3.3.1. p. 338-339.

wells during the 2014-2017 drought, wells impacted at the 2024 GSP's minimum thresholds and 2027 interim milestones are generally older and shallower than the average age and depth of water supply wells in the Subbasin.[38] By providing the well impact analysis, the 2024 Plan took steps to address the deficiency by disclosing the anticipated number and location of wells that may go dry during the 20-year implementation period based on the proposed interim milestones.

The 2024 Plan also describes limitations of the well impact analysis. Wells without construction information are excluded from the well impact analysis and wells with construction information commonly lacked screen interval depths; therefore, groundwater levels were compared with the total well depth.[39] Furthermore, there is uncertainty in the location of wells because many well locations are reported by public land survey system section centers, which may impact the grouping of water supply wells.[40] Considering these limitations, Department staff believe that the number of wells determined to be potentially impacted at minimum thresholds and 2027 interim milestones groundwater elevations may be conservative and does not consider potential impacts to wells prior to groundwater decline reaching the total well depth and excludes wells that may be impacted during these groundwater conditions. The 2024 Plan also describes that well records do not indicate well status, and all wells were considered as active water supply wells in this analysis.[41] Department staff note that the well inventory used in the well impact analysis (4,563 wells) exceeds the total number of wells in the OSCWR database (approximately 2,000 domestic, 620 irrigation, and 190 public supply wells) and that the majority of the wells in the analysis (3,330 of the 4,563 total wells in this Subbasin) are located in the eastern portion of the Subbasin, where the 2027 interim milestones are set below minimum thresholds. Therefore, the 2024 GSP well inventory is not overly exclusionary and represents an effort to use the best available information to establish reasonable sustainable management criteria. Department staff recommended the dry well impact analysis be improved to more clearly disclose impacts to beneficial uses and users and assist with well mitigation efforts by further defining impacts by well type such as domestic, public water supply, irrigation, and others as necessary (see Recommended Corrective Action 1a). Despite limitations, the approach seems rational, uses the best available data, and provides a reasonable assessment of potential impacts to water supply wells in the Subbasin during minimum thresholds and 2027 interim milestones groundwater elevations.

The Department's Incomplete Determination also directed the GSAs that the 2022 Plan should be revised to include a discussion of how the approach to groundwater management, which sets the 2027 interim milestones below its minimum thresholds, may affect all identified beneficial uses and users in the Subbasin, including environmental

[38] 2024 Modesto Subbasin GSP, Section 6.3.3.1. p. 339.
[39] 2024 Modesto Subbasin GSP, Section 6.3.3.1.1, p. 340.
[40] 2024 Modesto Subbasin GSP, Section 6.3.3.1.1, p. 340.
[41] 2024 Modesto Subbasin GSP, Section 6.3.3.1.1, p. 340.

users such as groundwater dependent ecosystems.[42] The 2024 Plan does not include a discussion of potential effects on environmental users from the lowering of groundwater levels below minimum thresholds. Department staff understand that the GSAs' efforts to consider beneficial uses and users have focused on impacts to water supply wells. The 2024 GSP identifies groundwater dependent ecosystems and interconnected surface water habitats as potential beneficial uses of groundwater in the Subbasin,[43] thus potential impacts to these environmental users from declining groundwater levels below minimum thresholds should also be considered in the discussion of impacts to beneficial uses and users in the Subbasin. Therefore, Department staff reiterate the recommendation of providing a discussion of potential effects on environmental users from the temporary lowering of groundwater levels below minimum thresholds via the proposed interim milestones (see Recommended Corrective Action 1b).

Department staff conclude that the GSAs have sufficiently responded to component 1a of Deficiency 1 in the resubmitted 2024 Plan by including a detailed dry well impact analysis of potential impacts to water supply wells in the Subbasin at proposed minimum thresholds and 2027 interim milestones, which provides the number and location of wells that may be negatively affected during groundwater level decline, provides a thorough description of the analysis performed, and presents the results of the analysis while describing the limitations of the analysis. Consequently, the analysis appears to follow valid scientific methods, ensuring that the results are unbiased and transparent regarding the anticipated impact on wells. Furthermore, the 2024 Plan commits to developing and implementing a well mitigation plan (also referred to as a dry well mitigation plan in the 2024 Plan) to mitigate potential impacts to water supply wells.[44] Department staff believe that implementation of the dry well mitigation plan will help address uncertainties identified in the well impact analysis and will assist in mitigating adverse effects to wells that may occur during lowering of groundwater levels to 2027 interim milestones. Details of the dry well mitigation program are discussed further in Section 4.1.2.2 below.

4.1.2.2 Corrective Action 1b – Mitigation of Impacts to Beneficial Uses and Users

In response to the incomplete determination, the 2024 Plan details the GSAs' commitment to developing and implementing a dry well mitigation program, along with key details of the program.

The 2022 Plan proposed 2027 interim milestones for wells with observed groundwater level declines over the past seven years that would allow exceedances of minimum thresholds for a period of 10 years until projects and management actions are implemented,[45] but did not provide a discussion of how lasting impacts that may occur even if groundwater levels improve after years of being below minimum threshold levels would be mitigated. Department staff noted that significant and lasting impacts, such as

[42] https://sgma.water.ca.gov/portal/gsp/assessments/85.
[43] 2024 Modesto Subbasin GSP, Section 3.2.8, p. 156-157; Section 6.8.1.2, p. 381.
[44] 2024 Modesto Subbasin GSP, Section 6.3.3.1, p. 340.
[45] 2022 Modesto Subbasin GSP, Section 6.9, p. 388.

depletion of water supply for prolonged periods due to dry wells, inelastic land subsidence caused by declining groundwater levels, or degraded water quality resulting from the migration of plumes, will not recover in the same manner as groundwater levels. These lasting impacts have the potential to substantially impact conditions in the Subbasin such as permanent changes in land use practices (e.g., farmland fallowed, converted, or sold), decreased property values and population changes associated with years of inadequate or unreliable groundwater supplies (because below existing well or pump depths), and impacts or damage to, or abandonment of, domestic or agricultural wells whose productivity decreases or ceases at groundwater levels below minimum thresholds. The Department's Incomplete Determination asked that the GSAs describe how impacts to wells experienced at interim milestone levels below minimum thresholds will be managed or mitigated, and, if the GSAs propose to implement a well mitigation program, then the GSAs should provide details such as the number of wells anticipated to be eligible for the program, estimated costs, funding sources, and an implementation schedule.

The 2024 Plan includes a commitment to implementing a dry well mitigation program with a Resolution[46] which was adopted by the Stanislaus and Tuolumne Rivers Groundwater Basin Association Groundwater Sustainability Agency on July 10, 2024, and the County of Tuolumne Groundwater Sustainability Agency on June 18, 2024.[47] The Resolution states the commitment to develop and implement a well mitigation program no later than January 31, 2026, with procurement of baseline finding amounting to $300,000.[48] Department staff note that the source of funding for this project has not been secured, and the Resolution states that a fee structure and/or sources of funding for this and other management actions will be secured no later than January 31, 2026 and may include GSA fees and assessments, landowner groundwater pumping fees and penalties, agency funds and grant funding.[49] Department staff conclude that the information provided in the 2024 Plan regarding funding for the well mitigation program is sufficient at this time, considering that many of these details will require additional local coordination and implementation efforts. Department staff will continue to track implementation of the well mitigation program and ask that the GSAs provide updates regarding funding of the dry well mitigation program and reporting of dry through annual reports and in the next periodic evaluation. The 2024 Plan explains that the dry well mitigation program will mitigate impacts from groundwater level decline to domestic wells and will cover eligible mitigation claims accrued after the adoption of the original 2022 GSP on January 31, 2022.[50]

The 2024 Plan states that the dry well mitigation program will involve mitigation for domestic well failures or diminished well yields and continue into perpetuity unless

[46] 2024 Modesto Subbasin GSP, Appendix C, pp. 607-646.
[47] 2024 Modesto Subbasin GSP, Appendix C, p. 607.
[48] 2024 Modesto Subbasin GSP, Appendix C, p. 607.
[49] 2024 Modesto Subbasin GSP, Appendix C, p. 607.
[49] 2024 Modesto Subbasin GSP, Appendix C, p. 607.
[50] 2024 Modesto Subbasin GSP, Section 8.1.3, p. 446.

otherwise directed by the Stanislaus and Tuolumne Rivers Groundwater Basin Association Groundwater Sustainability Agency.[51] Development of the dry well mitigation program will consist of five potential elements: 1) establishment of a well mitigation committee, 2) a well mitigation fund, 3) public outreach and application assistance, 4) eligibility criteria, and 5) application process.[52] The 2024 Plan explains that details of the program will be circulated for public comment prior to being finalized. Staff encourage the GSAs to conduct a robust, public process in development and implementation of the dry well mitigation program. This outreach effort may include coordination with trusted local community and local partners alongside monitoring and reporting of impacted wells.

The 2024 Plan describes that the dry well mitigation program would provide short-term and long-term mitigation measures for domestic water supply wells including provisions for temporary water supply, well modifications, connection to public water supply, and Subbasin management to reduce groundwater demand and increase aquifer recharge.[53] Furthermore, expected benefits from this program are anticipated to include direct mitigation of domestic wells particularly for disadvantaged communities who rely on the reliability of groundwater supply wells. Department staff believe the GSAs have demonstrated initiative to implement well mitigation measures to avoid causing significant and unreasonable effects to beneficial uses and users in a timely manner. This commitment to implementation is supported by the GSAs' resolution detailing that the dry well mitigation program would begin implementation no later than January 31, 2026.[54]

Based on review of the information provided in the 2024 Plan, Department staff believe that the GSAs have sufficiently addressed component 1b of Deficiency 1. The 2024 Plan's dry well mitigation program provides details requested in the Department's Incomplete Determination pertaining to eligibility criteria and selection through the proposed well mitigation committee, commitment to future funding actions to be taken, and an implementation schedule. The 2024 GSP also includes and relies on swift development and implementation of a well mitigation program to support and achieve sustainable groundwater management in the Subbasin. Department staff agree and encourage the GSAs to complete this important aspect of the 2024 GSP on the timeline indicated and Department staff will closely monitor achievement of implementation milestones. To that end, the GSAs should ensure that implementation information and milestones are reported in the next annual report for the Subbasin, due in April 2025. The GSAs may provide implementation updates at any time and Department staff may request updates from the GSAs between annual or periodic reporting periods. These details should be made available to the public and provided in annual reports and in more detail in the next periodic evaluation. Thus, although the GSAs have provided sufficient details of the proposed well mitigation program, at this time implementation is in the early stages and

[51] 2024 Modesto Subbasin GSP, Section 8.1.3, p. 446.
[52] 2024 Modesto Subbasin GSP, Section 8.1.3, p. 446-447.
[53] 2024 Modesto Subbasin GSP, Section 8.1.3, p. 446.
[54] 2024 Modesto Subbasin GSP, Section 8.1.3.4, p. 447; Appendix C, p. 610.

Department staff will not be able to fully evaluate the program until further details are determined.

4.1.2.3 Corrective Action 1c – Undesirable Results Avoidance for Sustainability Indicators

In response to the incomplete determination, the 2024 Plan presents the results of analyses to evaluate potential impacts to the degraded water quality, land subsidence, and depletions of interconnected surface water sustainability indicators from groundwater levels dropping below minimum thresholds to 2027 interim milestones[55] which are the lowest proposed management thresholds. Details of the analysis provided for each applicable sustainability indicator are discussed in the subsections below.

The 2022 Plan described how minimum thresholds for chronic lowering of groundwater levels would avoid undesirable results for other sustainability indicators,[56] but it did not evaluate potential impacts to other sustainability indicators that may occur by allowing groundwater levels to decline below minimum thresholds to the lower 2027 interim milestones. Establishing 2027 interim milestones below minimum thresholds has the potential of causing lasting or irreversible undesirable results related to degraded water quality, land subsidence, and depletions of interconnected surface water in the Subbasin even if groundwater levels recover above the minimum thresholds after 10 years of Plan implementation. The Department's Incomplete Determination asked the GSAs to provide an evaluation of how allowing groundwater levels to drop below the minimum thresholds via 2027 interim milestones would avoid causing undesirable results for other sustainability indicators.

Degraded Water Quality

The 2024 Plan states that the results of the analysis showed no apparent relationship between constituents of concern concentrations and declining groundwater levels and concludes that the "absence of a relationship, especially between declining groundwater levels and COC [constituent of concern] concentrations, suggests that lowering groundwater levels from the MTs [minimum thresholds] to the 2027 IMs [interim milestones], where the 2027 IMs are below the MTs, should not affect the degradation of water quality sustainability indicator."[57]

The 2024 Plan establishes minimum thresholds for degraded water quality for each of the seven constituents of concern (i.e., nitrate, arsenic, uranium, total dissolved solids (TDS), dibromochloropropane (DBCP), tetrachloroethene (PCE) and 1,2,3-trichloropropane (TCP)) at California primary or secondary maximum contaminant level concentrations in representative monitoring wells.[58] The 2024 Plan explains that to assess the correlation between changes in groundwater elevations in representative monitoring wells and

[55] 2024 Modesto Subbasin GSP, Section 6.3.3.2, p. 340.
[56] 2022 Modesto Subbasin GSP, Section 6.3.2.2, pp. 337-339.
[57] 2024 Modesto Subbasin GSP, Section 6.3.3.2.1, pp. 342-343.
[58] 2024 Modesto Subbasin GSP, Section 6.6.2, p. 360.

constituent of concern concentrations in the Subbasin, groundwater levels at each representative monitoring well were compared to constituent of concern concentrations in the nearest five groundwater ambient monitoring and assessment (GAMA) wells with known construction information and sufficient historical data of at least one constituent of concern. [59] Similarities between well screen intervals and distance between the representative monitoring well and GAMA wells were considered in this assessment. The 2024 Plan explains that hydrographs of groundwater levels over time for each representative monitoring well were compared to time-concentration plots of the constituents of concern at the five closest GAMA wells.[60]

Several limitations in this assessment were identified in the 2024 Plan. According to the GSAs, the ability to compare water quality to groundwater levels was limited due to the minimal availability of data in areas of the Subbasin including the Western Lower Principal Aquifer, GAMA wells being largely concentrated near municipalities, and having many of the representative monitoring wells with the low 2027 interim milestones not being located near GAMA wells.[61] The 2024 Plan provides a figure presenting the locations of the GAMA wells and representative monitoring wells referenced in this assessment [62], which shows greater than four miles between GAMA wells at four of the fourteen representative monitoring wells predicted with 2027 interim milestones exceeding minimum threshold groundwater elevations. The distance between these wells is concerning because Department staff question whether GAMA wells greater than four miles apart are representative of water quality impacts that may be occurring at these representative monitoring wells.

Department staff understand that there are limitations with availability of historical water quality of data and the spatial distribution of GAMA wells in the Subbasin but are concerned that this assessment may be lacking the evaluation necessary to assess the correlation between changes in groundwater elevations in representative monitoring wells and constituents of concern concentrations in the Subbasin. The 2024 Plan does not provide maps of plumes or isocontour contour maps showing zones within principal aquifers where constituent of concern concentrations are high enough to potentially impact water supplies, especially where groundwater levels are expected to exceed minimum thresholds. The 2024 Plan does acknowledge that groundwater level decline can cause increased nitrate concentrations at depth by intensifying the downward migration of nitrate-rich shallow groundwater,[63] but the 2024 Plan does not consider the vertical or lateral migration of plumes when analyzing the effect of declining groundwater levels beyond minimum thresholds on water quality. Furthermore, in the discussion of undesirable results, the 2024 Plan notes that hydraulic gradients and local groundwater flow directions could be altered from groundwater extractions, causing lateral migration

[59] 2024 Modesto Subbasin GSP, Section 6.3.3.2.1, p. 341.
[60] 2024 Modesto Subbasin GSP, Section 6.3.3.2.1, p. 341.
[61] 2024 Modesto Subbasin GSP, Section 6.3.3.2.1, p. 341.
[62] 2024 Modesto Subbasin GSP, Figure 6-7, p. 398.
[63] 2024 Modesto Subbasin GSP, Section 6.3.3.2.1, p. 342.

of degraded water quality into unimpacted areas,[64] but the 2024 Plan does not provide a discussion of how decreases of groundwater levels below minimum thresholds may affect groundwater gradients and flow directions. Based on information provided in the 2024 Plan, nitrate concentrations have historically impacted Subbasin water supplies by exceeding minimum contaminant levels, resulting in the discontinuance of supply wells due to elevated nitrate concentration.[65]

Given the above reasons, Department staff believe that the assessment to correlate changes between groundwater elevations in representative monitoring wells and constituent of concern concentrations in the Subbasin may be lacking; however, at this time, the analysis represents the use of best available data to conclude that the 2027 interim milestones should not affect the degradation of water quality sustainability indicator, as stated in the 2024 GSP.[66] The GSAs have the authority to regulate groundwater pumping, which affects hydraulic gradients and groundwater flow. The GSAs can monitor for and influence the migration of groundwater and have the responsibility to prevent unimpacted areas from becoming significantly and unreasonably impacted by constituents of concern.[67] Department staff understand that the GSAs are not responsible for improving degraded water quality conditions that existed before SGMA was enacted. However, the GSAs are required to manage the Subbasin to not exacerbate existing degraded water quality conditions. Department staff recommend the GSAs closely track the degradation of water quality during the implementation of the 2024 GSP, provide detailed reporting of groundwater conditions and undesirable results resulting from degraded water quality in annual reports, and proactively supplement the 2024 Plan as needed if conditions do not progress as expected.

Land Subsidence

The 2024 Plan includes an analysis to evaluate whether undesirable results would occur from the land subsidence sustainability indicator if groundwater levels are allowed to decline below minimum thresholds to the proposed 2027 interim milestones.[68] The 2024 Plan states that no impacts from inelastic land subsidence or significant rates of land subsidence are occurring in the Modesto Subbasin,[69] but small amounts of displacement exist within the central and eastern Subbasin and within the Corcoran Clay at the northwestern corner of the Subbasin.[70] The 2024 Plan explains that the western portion of the Subbasin is considered to be the most susceptible area for future land subsidence due to presence of the Corcoran Clay, whereas subsidence is less likely in the eastern portion of the Subbasin due to the absence of clay zones.[71]

[64] 2024 Modesto Subbasin GSP, Section 6.6.1.1, p. 356.
[65] 2024 Modesto Subbasin GSP, Section 3.2.5.3, pp. 137-138.
[66] 2024 Modesto Subbasin GSP, Section 6.3.3.2.1, pp. 342-343.
[67] 23 CCR 354.28(c)(4).
[68] 2024 Modesto Subbasin GSP, Section 6.3.3.2.2, p. 343.
[69] 2024 Modesto Subbasin GSP, Section 6.3.3.2.2, p. 343.
[70] 2024 Modesto Subbasin GSP, Section 6.3.3.2.2, p. 343.
[71] 2024 Modesto Subbasin GSP, Section 6.3.3.2.2, p. 343.

The 2024 Plan presents a strategy for minimizing subsidence in the western principal aquifers by maintaining groundwater levels at or above the minimum thresholds in representative monitoring wells at areas underlain by Corcoran Clay.[72] The 2024 Plan explains that representative monitoring wells proposed to exceed minimum thresholds at 2027 interim milestones are all located in the Eastern Principal aquifer, outside of the Corcoran Clay boundary and in an area less susceptible to subsidence.[73] The 2024 Plan states that, because representative monitoring wells proposed to exceed minimum thresholds are outside the boundary of the Corcoran Clay, "lowering groundwater elevations to the 2027 IMs [interim milestones] will not result in groundwater elevations declining to below the top of the Corcoran Clay."[74]

Although maintaining groundwater elevation above minimum thresholds in areas underlain by Corcoran Clay would likely reduce the likelihood of subsidence in the Subbasin, the 2024 Plan does not provide supporting analysis of how undesirable results will be avoided in the eastern portion of the Subbasin in areas with proposed lower 2027 interim milestones. Specifically, the 2024 Plan lacks an evidence-based discussion utilizing available data such as land subsidence data, technical studies, or site-specific data to support the assertion that subsidence is unlikely to occur due to proposed 2027 interim milestones other than being located outside the Corcoran Clay boundary. Though this premise may be plausible, Department staff note land subsidence has been documented in areas of the San Joaquin Valley with declining groundwater levels in areas without Corcoran Clay. For example, the 2024 Plan includes a map depicting the highest rates of subsidence in the Subbasin have occurred in the eastern parts, outside the area underlain by the Corcoran Clay—though staff acknowledge the reported rates are relatively minimal (i.e., up to -0.2 feet of cumulative subsidence over a period of approximately 5 years from June 2015 to October 2020). However, at this time, the analysis represents the use of best available data to conclude that the 2027 interim milestones should not affect the land subsidence sustainability indicator, as stated in the 2024 GSP. Department staff recommend the GSAs closely track the rate and extent of land subsidence during the implementation of the 2024 GSP, provide detailed reporting of groundwater conditions and any undesirable results resulting from land subsidence in annual reports, and proactively supplement the 2024 Plan as needed if conditions do not progress as expected.

Interconnected Surface Waters

The 2024 Plan presents an analysis evaluating if significant effects to the depletion of interconnected surface water would occur from lowering groundwater levels below minimum thresholds during the proposed 2027 interim milestones.[75] The 2024 Plan explains that interactions between groundwater and surface water at the base elevations

[72] 2024 Modesto Subbasin GSP, Section 6.3.3.2.2, p. 343.
[73] 2024 Modesto Subbasin GSP, Section 6.3.3.2.2, p. 343.
[74] 2024 Modesto Subbasin GSP, Section 6.3.3.2.2, p. 343.
[75] 2024 Modesto Subbasin GSP, Section 6.3.3.2.3, p. 343.

of the Stanislaus River, Tuolumne River and San Joaquin River occur in the Subbasin.[76] Although C2VSimTM results indicate that the groundwater system and river system remain connected throughout the 50-year implementation horizon, the 2024 Plan states that groundwater depletion exceeding the model predictions could result in disconnection between surface water and groundwater.[77]

The 2024 Plan presents an analysis to evaluate potential impacts to depletions of interconnected surface water from declining groundwater levels to the proposed 2027 interim milestones.[78] This analysis focused on representative monitoring wells for interconnected surface water anticipated to exceed minimum thresholds via lower 2027 interim milestones. In total, five representative monitoring wells were included in the analysis; three along the Stanislaus River (Allen OID-01, Birnbaum OID-03, and Marquis OID-10) and two along the Tuolumne River (Quesenberry 223 and MW-9).[79] There are no representative monitoring points along the San Joaquin River predicted to exceed minimum thresholds via lower 2027 interim milestones; therefore the San Joaquin River was not considered in the analysis. The 2024 Plan explained that the analysis included comparison of minimum thresholds and 2027 interim milestone elevations at each representative monitoring well to the elevation of the nearest stream node invert elevation representative of the base of the stream channel generated from the C2VSim TM model.[80]

The 2024 GSP concludes that the analysis indicates that it is “unlikely that lowering groundwater levels from the MT [minimum thresholds] to the 2027 IM [interim milestones] will result in groundwater levels declining from above the base of the river channel to below the base of the river channel.”[81] The inference seems to be that since 2027 interim milestones do not have the capacity to alter the interconnected stream from a gaining to a losing stream in comparison to minimum thresholds, the impact to depletions would be minimal. Department staff note that two representative monitoring wells (Allen OID-01 and Birnbaum OID-03) located within 7,200 feet from the Stanislaus River have both minimum thresholds and 2027 interim milestones established below the nearest stream node invert, or below the base of the river channel. Therefore, an analysis based on a change in groundwater elevations from above to below the stream channel would not be applicable. The 2024 Plan notes that there are data gaps currently being addressed for interconnected surface water in the Subbasin, and it is uncertain whether groundwater elevation in these representative monitoring wells will significantly increase streamflow depletion.[82]

[76] 2024 Modesto Subbasin GSP, Section 6.3.3.2.3, p. 344.
[77] 2024 Modesto Subbasin GSP, Section 6.3.3.2.3, p. 344.
[78] 2024 Modesto Subbasin GSP, Section 6.3.3.2.3, p. 344.
[79] 2024 Modesto Subbasin GSP, Section 6.3.3.2.3, p. 344.
[80] 2024 Modesto Subbasin GSP, Section 6.3.3.2.3, p. 344.
[81] 2024 Modesto Subbasin GSP, Section 6.3.3.2.3, p. 344.
[82] 2024 Modesto Subbasin GSP, Section 6.3.3.2.3, p. 345.

The 2024 Plan does not directly state whether lowering groundwater level elevation in a representative monitoring well to below the nearest stream node invert elevation would be considered an undesirable result for stream depletion. The 2024 Plan's definition of undesirable results for either the Tuolumne River or Stanislaus River is defined as "when 33% of representative monitoring wells for that river exceed the MT [minimum threshold] in three consecutive Fall monitoring events," where 33% minimum threshold exceedances along the Stanislaus River would equal three wells for this undesirable results definition. As discussed in further detail in Section 5.3.2.6, minimum thresholds are established using 2015 groundwater levels as a proxy.[83] The 2024 Plan does not describe how this analysis relates to the undesirable results definition for interconnected surface waters; however, at this time, the analysis represents the use of best available data to conclude that the 2027 interim milestones should not affect the depletion of interconnected surface water sustainability indicator, as stated in the 2024 GSP.[84] Department staff recommend the GSAs closely track effects on interconnected surface water during the implementation of the 2024 GSP, provide detailed reporting of groundwater conditions and any undesirable results resulting from depletions of interconnected surface water in annual reports, and proactively supplement the 2024 Plan as needed if conditions do not progress as expected.

4.1.3 Conclusion

Despite the recommended correction action provided, Department staff believe that the GSAs have sufficiently addressed Deficiency 1. The 2024 Plan included a well impact analysis by principal aquifer which considers all water supply wells with construction data in the Subbasin that may go dry at minimum thresholds and 2027 interim milestones that were set below minimum thresholds and discussed limitations of the analysis. Additionally, the 2024 Plan provides details demonstrating commitment to the implementation of a dry well mitigation program. Finally, the 2024 Plan provides analysis of potential effects of temporary lowering of groundwater level elevations below minimum thresholds on degraded water quality, land subsidence, and depletions of interconnected surface water sustainability indicators. Although Department staff consider information in the 2024 Plan sufficient to address Deficiency 1 at this time, the GSAs should address Department staff recommendations in future annual reports and by the next periodic evaluation of the Plan.

[83] 2024 Modesto Subbasin GSP, Section 6.8.1.3, p. 382-383.
[84] 2024 Modesto Subbasin GSP, Section 6.3.3.2.3, p. 344.

4.2 DEFICIENCY 2. THE GSP DOES NOT INCLUDE SUFFICIENT DETAILS OF PROJECTS AND MANAGEMENT ACTIONS TO MITIGATE OVERDRAFT IN THE SUBBASIN OR PROVIDE A FEASIBLE PATH TO ACHIEVE SUSTAINABILITY.

4.2.1 Corrective Action 2

In the Department's Incomplete Determination, the Department identified that the GSAs should revise the GSP to provide specific details of feasible projects and management actions that will be implemented to mitigate overdraft and that will raise groundwater levels from interim milestones towards the minimum thresholds and measurable objectives to achieve sustainability in the Subbasin. Specifically, the Plan must be amended as follows:

a) The GSAs should revise the GSP to include a reasonable means to arrest groundwater level declines and stop the overdraft that is continuing to occur in the Subbasin. Specifically, the GSAs should describe feasible, effective proposed projects and management actions that are commensurate with the level of understanding of groundwater conditions in the Subbasin and provide sufficient details for Department staff to be able to clearly evaluate how the Plan's projects and management actions will ensure achieving the sustainability goal in the Subbasin.

b) The GSAs should revise the GSP to include a feasible collection of projects and management actions to raise groundwater levels to avoid undesirable results that would occur as a result of groundwater levels dropping below minimum thresholds towards the proposed interim milestones levels.

4.2.2 Evaluation of Resubmitted Plan

4.2.2.1 Corrective Action 2a & 2b – Projects and Management Actions to Mitigate Overdraft

In response to the incomplete determination, the 2024 Plan provided additional details of proposed projects and management actions. Due to the similarity of content provided by the 2024 Plan for projects and management actions pertaining to Corrective Actions 2a and 2b, Department staff have provided evaluation of Corrective Actions 2a and 2b together.

The Department's Incomplete Determination concluded that the 2022 Plan did not appear to provide a suite of projects and management actions sufficient to offset overdraft and prevent undesirable results (such as dry wells) from occurring in the Subbasin, necessary efforts to achieve long-term sustainability.[85] The 2022 Plan projected baseline overdraft in the Subbasin to be 11,000 acre-feet per year,[86] which was significantly less than the

[85] https://sgma.water.ca.gov/portal/gsp/assessments/85.
[86] 2022 Modesto Subbasin GSP, Table 5-15, p. 314.

reported negative change in groundwater storage reported in recent annual reports for WY 2021 (132,500 acre-feet) and 2022 (172,300 acre-feet),[87] and, therefore, the 2022 GSP's plan to mitigate overdraft which included implementation of seven projects and no management actions seemed insufficient to offset even the recent overdraft observed in the Subbasin. Additionally, the 2022 Plan lacked sufficient detail, commitment, and clear definitions for triggers for the adaptive management process and asserted that sustainability goals could be met without implementing demand management strategies or other management actions, which were presented as frameworks only. Therefore, 2022 Plan had failed to provide specific details on how reducing groundwater pumping would be achieved to attain sustainability within the Subbasin. The Department's Incomplete Determination directed the GSAs that the 2022 Plan should be revised to include a suite of projects and management actions sufficient to not only arrest current groundwater level declines, but also to raise groundwater levels to offset and mitigate the temporary removal of groundwater in storage that would occur during the implementation period when groundwater levels were below the minimum threshold levels via lower proposed 2027 interim milestones.

The Department's Incomplete Determination requested that the GSAs disclose how projects and management actions implemented in the Subbasin would provide a feasible path to not only halt current overdraft, but also to raise groundwater levels from proposed 2027 interim milestones to established minimum threshold groundwater elevations. The 2024 Plan acknowledges that implementation of projects and management actions are necessary to achieve and maintain sustainable groundwater conditions in the Subbasin and plans to implement those projects and management actions using an adaptive management approach.[88] The below sections detail the information provided in the 2024 Plan regarding projects and management actions.

Projects

The 2024 Plan identified the same 13 projects proposed in the 2022 Plan, which focused on direct and in-lieu recharge, water recycling and improvements to metering infrastructure, divided into groups based on implementation priority.[89] Department staff's review of the 2024 Plan's projects is focused on projects with noted improvement from the 2022 Plan and projects that are being implemented or are in the development phase. Thus, staff's review does not include projects "identified for consideration" that have a great deal of uncertainty due to limited information. In particular, the 2024 Plan provides significant improvements to the in-lieu and direct recharge projects discussed below. Relevant project and management action details pertaining to actions taken by the GSAs to address Deficiency 2 are discussed below; further details are provided in Section 5.5 of this Staff Report.

[87] Department of Water Resources, SGMA Portal, Annual Report Module, WY 2021 and WY 2022 Data, Reported Overdraft, Modesto Subbasin.
[88] 2024 Modesto Subbasin GSP, Section 8.0, p. 425.
[89] 2024 Modesto Subbasin GSP, Table 8.2, p. 450.

The 2024 Plan provided significant progress updates to the Modesto Irrigation District In-Lieu and Direct Recharge Project by the Modesto Irrigation Board of Director's approval to implement this project on January 23, 2024.[90] Furthermore, the 2024 Plan explained that an Addendum to the Modesto Irrigation District Comprehensive Water Resources Management Plan Final Programmatic Environmental Impact Report was adopted by the Modesto Irrigation District that incorporated the Long-term Groundwater Replenishment Program with implementation of project activities, such as surface water deliveries to the Subbasin to begin in 2024.[91] This project helps mitigate overdraft in the Subbasin by providing in-lieu and direct recharge during the agricultural growing season by diversion of surface water from the Tuolumne River to the non-district east area of the Subbasin using Modesto Irrigation District's existing, and newly installed private irrigation conveyance infrastructure. The project involves delivery of approximately 60,000 acre-feet of surface water in Wet and Above normal years;[92] based on Wet and Above Normal WYs historically (1972-2020) occurring approximately 45% of the time, average direct and in-lieu recharge to the Subbasin across all years is estimated at 28,800 acre-feet per year.[93] The 2024 Plan explains that the volume of surface water for this project equates to 4% to 10% of the available water supply available to existing customer demands from the Tuolumne River during Wet and Above Normal WYs,[94] suggesting that there is adequate surface water availability for this project. The 2024 Plan explains that multiple public meetings and workshops were held to promote the program and additional public and/or inter-agency noticing may be facilitated through Stanislaus and Tuolumne Rivers Groundwater Basin Association Groundwater Sustainability Agency during project implementation.[95]

The 2024 Plan also provides significant progress updates to the Oakdale Irrigation District In-Lieu and Direct Recharge Project.[96] Similar to the Modesto Irrigation District In-Lieu and Direct Recharge Project, the Oakdale Irrigation District In-Lieu and Direct Recharge Project is another surface water diversion project, but between the Oakdale Irrigation District and the non-district east landowners. This project will divert surface water from the Stanislaus River using several existing and new points of diversions during all WYs except Critically Dry WYs, or at the discretion of the Oakdale Irrigation District.[97] Water supply benefits are provided to non-district east landowners between March 1st and September 31st providing additional irrigation water supply and in-lieu and direct recharge with additional direct recharge as canal or reservoir seepage to the Subbasin.[98] The 2024 Plan states that based on historical critically dry years occurring 72% of the time, on

[90] 2024 Modesto Subbasin GSP, Section 8.3.1.2.5, p. 467.
[91] 2024 Modesto Subbasin GSP, Section 8.3.1.2.5, p. 467.
[92] 2024 Modesto Subbasin GSP, Section 8.3.2.1.1, p. 465.
[93] 2024 Modesto Subbasin GSP, Section 8.3.2.1.4, p. 467.
[94] 2024 Modesto Subbasin GSP, Section 8.3.2.1.1, p. 465.
[95] 2024 Modesto Subbasin GSP, Section 8.3.2.1.2, p. 465.
[96] 2024 Modesto Subbasin GSP, Section 8.3.2.2, p. 469.
[97] 2024 Modesto Subbasin GSP, Section 8.3.2.2.1, p. 469.
[98] 2024 Modesto Subbasin GSP, Section 8.3.2.2.1, p. 469.

average across all years this project is expected to provide approximately 14,400 acre-feet per year of recharge benefit to the Subbasin.[99]

Further significant updates to the Oakdale Irrigation District In-Lieu and Direct Recharge Project in the 2024 Plan include adoption of a 10-year out-of-District Water Sales Program (10-year program) in 2023, requiring participating landowners within 4,882 of irrigated acres in the non-district east area of the Subbasin to purchase a minimum of 1.5 acre-feet per irrigated acre during each year when surplus surface water is available from Oakdale Irrigation District.[100] The 10-year program also provides landowners the opportunity to purchase and use additional surplus surface water throughout the irrigation season, if available.[101] The 2024 Plan states that under this program, a minimum of 7,300 acre-feet will be purchased each year when out-of-District water is available.[102] It appears to Department staff that use of this surface water supply would help off-set the demand for groundwater at the non-district east area during this time.

The 2024 Plan also provides improvements to the Oakdale Irrigation District In-Lieu and Direct Recharge Project by approval of the Paulsell Lateral Expansion (Paulsell Expansion) that will work in tandem with the 10-year program for the Oakdale Irrigation District to rehabilitate, automate, and expand the Paulsell Lateral for delivery of up to 20,000 acre-feet per year of available surface water for in-lieu and direct recharge to the Subbasin.[103] The Paulsell Expansion will also improve irrigation service to in-District lands served by the Oakdale Irrigation District and consequently will off-set groundwater demand in the non-district east area. The Paulsell Expansion is partially funded with the $14.4 million of SGMA Implementation Grant funding that was awarded to the Oakdale Irrigation District in October 2023, and revenue from voluntary water transfer with water users outside of the Oakdale Irrigation District.[104] Review and approval of the 10-year program and the Paulsell Expansion was accomplished through public outreach by the Oakdale Irrigation District Board of Directors through meetings, workshops and venues.[105]

Department staff are encouraged by the GSAs' progress to implement in-lieu and direct recharge projects in the non-district east area of the Subbasin. Implementation of recharge projects at the eastern portion of the Subbasin will help mitigate overdraft in the Eastern Principal Aquifer where more significant groundwater decline is occurring. Based on the information provided in the 2024 Plan, implementation of the in-lieu and direct recharge projects will provide an estimated 43,200 acre-feet per year of direct and in-lieu recharge to the Subbasin; however, according to details provided in the 2024 GSP, these surface water supplies are variable based on climatic conditions, surface water availability

[99] 2024 Modesto Subbasin GSP, Section 8.3.2.2.4, p. 472.
[100] 2024 Modesto Subbasin GSP, Section 8.3.2.2.1, p. 469.
[101] 2024 Modesto Subbasin GSP, Section 8.3.2.2.1, p. 469.
[102] 2024 Modesto Subbasin GSP, Section 8.3.2.2.1, p. 469-470.
[103] 2024 Modesto Subbasin GSP, Section 8.3.2.2.1, p. 470.
[104] 2024 Modesto Subbasin GSP, Section 8.3.2.2.1, p. 470.
[105] 2024 Modesto Subbasin GSP, Section 8.3.2.2.2, p. 470.

and landowner participation in the 10-year out-of-District Water Sales Program. Additionally, the Department has received public comment expressing concern regarding implementation progress of surface water delivery to the Non-District East management area. While the program may provide up to 60,000 acre-feet of supplemental surface water to the eastern portion of the Subbasin where groundwater is the primary source, as of May 2024 only four farmers have applied for a total of 1,500 acre-feet of water and no actual deliveries have been made. This is disconcerting given the ongoing declines in this portion of Subbasin. Department staff recommend the GSAs provide more information in future annual reports and the periodic evaluation of the Plan regarding water deliveries or demand reduction efforts in the Non-District East management area (see Recommended Corrective Action 2a).

Furthermore, the changes in groundwater in storage reported for WY 2021 of -132,500 acre-feet and -172,300 acre-feet for WY 2022,[106] are much greater than GSAs' overdraft estimates of 11,000 acre-feet per year[107] and indicate significantly greater losses in groundwater storage than what could potentially be gained annually from the recharge projects currently implemented in the Subbasin. Data from the 2023 Annual Report reports an increase of 77,800 acre-feet in groundwater storage during the wet year of 2023, which is encouraging; but the gain in groundwater storage occurred at the western portion of the Subbasin while the non-district area of the Subbasin showed continued loss of storage.[108] The Department's Incomplete Determination noted concern that the suite of projects considered in the 2022 Plan modeled scenario may be insufficient or ineffective to offset the recent overdraft observed in the Subbasin and, though progress has been reported in the 2024 Plan, the same suite of projects and estimated volumes of recharge remain unchanged in the 2024 Plan. Furthermore, the 2024 Plan did not provide an implementation schedule for two flood mitigation projects that contribute a significant volume of recharge in the modeled scenario to reduce groundwater pumping of 44,000 acre-feet per year to reach sustainability in the Subbasin.[109] Department staff recommend the GSAs provide these details along with progress updates regarding the implementation of planned projects in annual reports, assess the effectiveness of the projects in periodic evaluations, and revise the 2024 Plan accordingly.

Management Actions

The 2024 Plan was updated to include a Resolution signed by the Stanislaus and Tuolumne Rivers Groundwater Basin Association Groundwater Sustainability Agency on July 10, 2024, and by Tuolumne County GSA on June 18, 2024, demonstrating the GSAs' commitment to develop management actions inclusive of a fee structure and/or identified sources of funding by January 31, 2026, and implementation of management actions by

[106] Department of Water Resources, SGMA Portal, Annual Report Module, WY 2021 and WY 2022 Data, Reported Overdraft, Modesto Subbasin.
[107] 2024 Modesto Subbasin GSP, Table 5-8, p. 257.
[108] Modesto Subbasin Annual Report WY 2023, Section 7.2.1, p. 55; Section 7.3.1, p. 55.
[109] 2024 Modesto Subbasin GSP, Table 8-12, p. 495, Section 8.5.1, p. 496.

January 31, 2027.[110] This is in contrast to the 2022 Plan which asserted that demand management strategies were not required to reach sustainability and only provided a framework of management actions; though, the management actions are still in the early, preliminary stages of development. The 2024 Plan now includes seven management actions with the addition of a dry well mitigation plan.[111] Management actions are organized in the 2024 Plan in two categories; 1) Pumping Management Framework that provides a suite of administrative procedures, programs, and policies that describe how the GSAs will manage and monitor during groundwater extraction, and 2) Demand Reduction Strategies that provide a broad and strategic set of actions intended to reduce water demand.[112] The 2024 Plan provides details for the dry well mitigation program which is discussed in detail in Section 4.1.2.2 above. The 2024 Plan generally discusses triggers to implement management actions include approaching undesirable results, exceedance of minimum thresholds and poor project performance.[113] The 2024 plan commits developing the full scope of management actions including program descriptions, triggering criteria, GSA authorities, costs and funding, management of water sources, monitoring processes, and applicable areas by January 31, 2026, in accordance with the Resolution.[114] Department staff's review of the 2024 Plan's two categories of management actions is primarily focused on management actions with additional information or improvements presented in the 2024 Plan.

Pumping Management Framework

The 2024 Plan includes four management actions under the pumping management framework category including: 1) a Groundwater Allocation and Pumping Management Program, 2) Groundwater Extraction and Surface Water Program, 3) Groundwater Extraction Fee, and 4) a Groundwater Pumping Credit Marking and Trading Program.[115]

The 2024 Plan provides additional information to the framework and implementation schedule for the Groundwater Allocation and Pumping Management Program proposed for the Subbasin. The 2024 plan now includes the framework that will be used to develop pumping allocation in the Subbasin based on the magnitude of projected overdraft[116] and provides a description of a robust public outreach program that would be implemented during the development phase through finalization of this project.[117] The 2024 Plan also provides additional detail regarding the benefits of this program, and now includes a commitment to development of this program by January 31, 2026, and implementation by January 31, 2027, in accordance with the Resolution.[118] Although improvements and commitments to this management action are provided in the 2024 Plan, this project

[110] 2024 Modesto Subbasin GSP, Section 8.0, p, 425 and Appendix C, 607.
[111] 2024 Modesto Subbasin GSP, Table 8-1, p. 428.
[112] 2024 Modesto Subbasin GSP, Section 8.1, p. 426.
[113] 2024 Modesto Subbasin GSP, Section 8.1, p. 427.
[114] 2024 Modesto Subbasin GSP, Section 8.1, p. 427.
[115] 2024 Modesto Subbasin GSP, Table 8.1, p. 428.
[116] 2024 Modesto Subbasin GSP, Section 8.1.1.1.1, p. 429.
[117] 2024 Modesto Subbasin GSP, Section 8.1.1.1.2, p. 430.
[118] 2024 Modesto Subbasin GSP, Appendix C, 607.

remains in the preliminary stages of development and estimation of project costs, procurement of funding and estimation of volumetric benefits to the Subbasin have not been determined.

The remainder of management actions in this category remain preliminary and lack additional detail to the commitment for implementation, estimated costs for development and implementation, volumetric benefit to the Subbasin and discussion of funding sources in the 2024 Plan.[119] The 2024 Plan does provide additional detail to the framework and anticipated public outreach program for the Extraction and Surface Water Program, Groundwater Extraction Fee and Groundwater Pumping Credit Marking and Trading Program; however, due to the lack of detail provided for these programs an evaluation of the effectiveness of these programs cannot be conducted until additional data is provided (see Recommended Corrective Action 2b).

Demand Reduction Strategies

The 2024 Plan includes two management actions under the Demand Reduction Strategies category including: 1) a Voluntary Conservation and/or Land Fallowing, and 2) Conservation practices.[120] The 2024 Plan explains that Demand Reduction Strategies would be developed to manage agricultural and urban water demands in the Subbasin by adaptive implementation of voluntary water conservation and/or land fallowing.[121]

The 2024 Plan provides minimal updates to the Voluntary Conservation and/or Land Fallowing strategy. The 2024 Plan identifies potential funding sources for this strategy including mitigation or conservation banks, conservation easements, solar and grazing leases, conversion to low water intensity crops and potential federal and state funding.[122] The 2024 Plan states that implementation of this strategy is under possible consideration and updates to the implementation status for this project will be provided in future reports.[123] The 2024 Plan did not provide any further updates for this strategy.

The 2024 Plan provided additional detail to the Conservation Practices strategy including a discussion of the demand reduction and conservation efforts required by agricultural suppliers serving more than 25,000 irrigated acres by adoption of an Agricultural Water Management Plan (AWMP).[124] The 2024 Plan discusses that as part of this strategy the GSA's may choose to expand the existing AWMP and Urban Water Management Plan(UWMP) to expand conservation requirements, or implement similar conservation efforts in the Subbasin.[125] The 2024 Plan includes a discussion of the nexus between on-farm water and groundwater sustainability challenges that need to be addressed to move this strategy forward from the current preliminary phase and provides more detail to the

[119] 2024 Modesto Subbasin GSP, Sections 8.1.1.2, 8.1.1.3, 8.1.1.4 and pp. 432,434 and 438.
[120] 2024 Modesto Subbasin GSP, Table 8.1, p. 428.
[121] 2024 Modesto Subbasin GSP, Section 8.1.2, p. 440.
[122] 2024 Modesto Subbasin GSP, Section 8.1.2.1.8, p. 442.
[123] 2024 Modesto Subbasin GSP, Sections 8.1.2.1.1, 8.1.2.1.4 and 8.1.2.1.5 pp. 440 and 441.
[124] 2024 Modesto Subbasin GSP, Section 8.1.2.2.1, p. 443.
[125] 2024 Modesto Subbasin GSP, Section 8.1.2.2.1, p. 443.

public outreach activities necessary for development and implementation for this strategy.[126] The 2024 Plan stated that a timeline to implement this plan has not been determined and future changes in implementation of this strategy will be documented in Annual Reports and five-year updates.[127]

The 2024 Plan provided additional detail to the framework for the Demand Reduction Strategies in the Subbasin, but neglected to provide any updates to the commitment, triggers for implementation and volumetric estimates of in-lieu or direct groundwater recharge from these strategies. Department staff understand that the 2024 Plan is in the early stages of implementation but encourage the GSAs to report on these key details in annual reports, assess progress in periodic evaluations, and incorporate them into the next periodic evaluation of the plan.

Department staff believe the GSAs demonstrated progress in implementing projects and committing to management actions are a substantial improvement from the 2022 Plan and have thus sufficiently addressed Deficiency 2. However, it will take a diligent effort to implement these various strategies to successfully stem declines in the Subbasin by 2027 and raise water levels above minimum thresholds by 2032. Department staff believe that implementation of a pumping management framework along with demand management strategies will be important tools for the GSAs to complement projects to mitigate overdraft and help raise groundwater levels. However, at this time, much of the information presented pertaining to management actions has not yet been developed. Failure to stem water level declines by 2027, as indicated by the 2027 and 2032 interim milestones, will be an indication that the 2024 GSP is not on track to achieve its sustainability goal. Department staff will look to detailed updates in annual reports and the next periodic evaluation to continue to evaluate the effectiveness of the 2024 Plan's approach.

4.2.3 Conclusion

The 2022 Plan provided limited information on projects and no commitment to management actions. In contrast, the 2024 Plan documented substantial progress for two in-lieu and direct recharge projects in the Subbasin including the Modesto Irrigation District In-Lieu and Direct Recharge Project and Oakdale Irrigation District In-Lieu and Direct Recharge Project. Furthermore, the 2024 Plan demonstrates the GSAs' commitment to develop and implement management actions by adoption of a Resolution signed by the GSAs which includes a commitment to develop management actions and establish funding by January 31, 2026, and a commitment to implement management actions by January 31, 2027. Although many of the projects and management actions are still in conceptual and developmental phases and the adequacy of proposed projects to arrest groundwater decline in the Subbasin will need to be shown with reports of actual progress in annual reports. Department staff believe the 2024 Plan demonstrates progress by the GSAs' commitment to develop and implement projects and management

[126] 2024 Modesto Subbasin GSP, Section 8.1.2.2.2, p. 444.
[127] 2024 Modesto Subbasin GSP, Section 8.1.2.2.5, p. 445.

actions in the Subbasin to work towards arresting groundwater decline. Department staff consider this information sufficient to address Deficiency 2 at this time but will continue to track how the GSAs address Department staff recommendations.

5 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. Department staff consider the information presented in the Plan to satisfy the general requirements of the GSP Regulations.

5.1 ADMINISTRATIVE INFORMATION

The GSP Regulations require each Plan to include administrative information identifying the submitting Agency, its decision-making process, and its legal authority;[128] a description of the Plan area and identification of beneficial uses and users in the Plan area;[129] and a description of the ability of the submitting Agency to develop and implement a Plan for that area.[130]

The 2024 Plan describes the GSAs, discusses their decision-making process, and provides their legal authority;[131] a description of the Plan area, identification of beneficial uses and users in the Plan area;[132] and a description of the ability of the submitting Agencies to develop and implement a Plan for that area.[133]

The Subbasin GSAs include the Stanislaus and Tuolumne Rivers Groundwater Basin Association Groundwater Sustainability Agency (STRGBA GSA) and the County of Tuolumne Groundwater Sustainability Agency (Tuolumne GSA).[134] The STRGBA GSA is an exclusive agency formed in 2017 through a Memorandum of Understanding (MOU) that includes seven local agencies: City of Modesto, City of Oakdale, City of Riverbank, City of Waterford, Modesto Irrigation District (MID), Oakdale Irrigation District (OID) and Stanislaus County.[135] The Tuolumne GSA is an exclusive agency formed on May 16, 2017, by adoption of County of Tuolumne Resolution No.63-17.[136] Representatives of the

[128] 23 CCR § 354.6 *et seq*.
[129] 23 CCR § 354.8 *et seq*.
[130] 23 CCR § 354.6(e).
[131] 2024 Modesto Subbasin GSP, Section 1, pp. 48-53.
[132] 2024 Modesto Subbasin GSP, Section 2, pp. 54-109.
[133] 2024 Modesto Subbasin GSP, Section 1.3, pp. 50-52.
[134] 2024 Modesto Subbasin GSP, Section 1.1, p. 48.
[135] 2024 Modesto Subbasin GSP, Section 1.1.1, pp. 48-49; Appendix B, pp. 534-559.
[136] 2024 Modesto Subbasin GSP, Section 1.1.2, p. 49; Appendix B, pp. 560-568.

STRGBA GSA member agencies formed a Technical Advisory Committee (TAC) that serves as an advisory group for the Subbasin providing assistance with GSP preparation, oversight and direction of technical consulting teams, assists with Plan preparation and facilitates periodic monthly meetings with local stakeholders and the public and promotes coordination with SGMA activities in adjacent basins.[137]

The 2024 Plan describes the organization and management structure for GSAs in the Subbasin. Preparation and implementation of the Subbasin GSP is performed jointly by the STRGBA GSA and the Tuolumne GSA in accordance with the Cooperation Agreement between the Counties of Stanislaus and Tuolumne dated, May 8, 2018.[138] A Plan Manager was appointed for the Subbasin authorized as the point of contact between the GSAs and the Department of Water Resources (Department) and as the delegated authority for Plan submittal to the Department.[139] The 2024 Plan presents the rights, responsibilities, decision making, and cost-sharing agreement between the GSAs as defined in the Cooperation Agreement.[140]

The 2024 Plan states that the GSAs will incur costs for GSP implementation activities including implementation of the GSP and GSP-related projects and management actions, operation and administration of the GSAs and developing annual reports and five-year evaluation reports.[141] The total estimated annual budget for operation of the GSAs and GSP implementation is estimated between $250,000 and $350,000, and estimated costs for proposed projects is approximately between $237,610,600 and $268,440,000.[142] Estimated project costs were prepared under the assumption that anticipated grant funding will offset project related costs and additional projects and management actions may be developed in the future contingent on Subbasin needs.[143] The GSAs' operation costs are funded through contributions of GSAs member agencies through customer fees or other public funds.[144] The STRGBA GSA member agencies intend to pursue grants, loans and additional funding from multiple GSA member agencies or Non-District East landowners to help pay for projects costs.[145]

The 2024 Plan includes a description of the plan area for the Subbasin. The Subbasin is designated as a high-priority basin and covers 245,253 acres of the larger San Joaquin Valley Groundwater Basin.[146] The Subbasin is located in Stanislaus and Tuolumne counties and is bound by the Stanislaus River on the north, the Tuolumne River on the south, the San Joaquin River on the west, and the crystalline basement rocks of the Sierra

[137] 2024 Modesto Subbasin GSP, Section 1.2, pp. 49-50.
[138] 2024 Modesto Subbasin GSP, Section 1.3, p. 50; Appendix A, p. 562.
[139] 2024 Modesto Subbasin GSP, Section 1.2, p. 50.
[140] 2024 Modesto Subbasin GSP, Appendix A, p. 562.
[141] 2024 Modesto Subbasin GSP, Section 1.3.1, p. 51.
[142] 2024 Modesto Subbasin GSP, Section 1.3.1, p. 51.
[143] 2024 Modesto Subbasin GSP, Section 1.3.1, p. 51.
[144] 2024 Modesto Subbasin GSP, Section 1.3.2, p. 50.
[145] 2024 Modesto Subbasin GSP, Section 1.3.2, pp. 50-51.
[146] 2024 Modesto Subbasin GSP, Section 2.0, p. 54.

Nevada Foothills on the east.[147] The Subbasin is hydraulically connected along shared river boundaries to adjacent basins including the Turlock Subbasin to the south, the Delta-Mendota Subbasin to the west, and the Eastern San Joaquin Subbasin to the north.[148] Of these subbasins, the Delta-Mendota and Eastern San Joaquin are listed in critical overdraft by the Department. Jurisdictions in the Subbasin include irrigation districts, municipalities, California Department of Fish and Wildlife (CDFW) lands and easements, federal lands, California Conservation Easements, and portions of two counties.[149] A map of the Subbasin location, boundary, and adjacent Subbasins is shown in Figure 1 below.

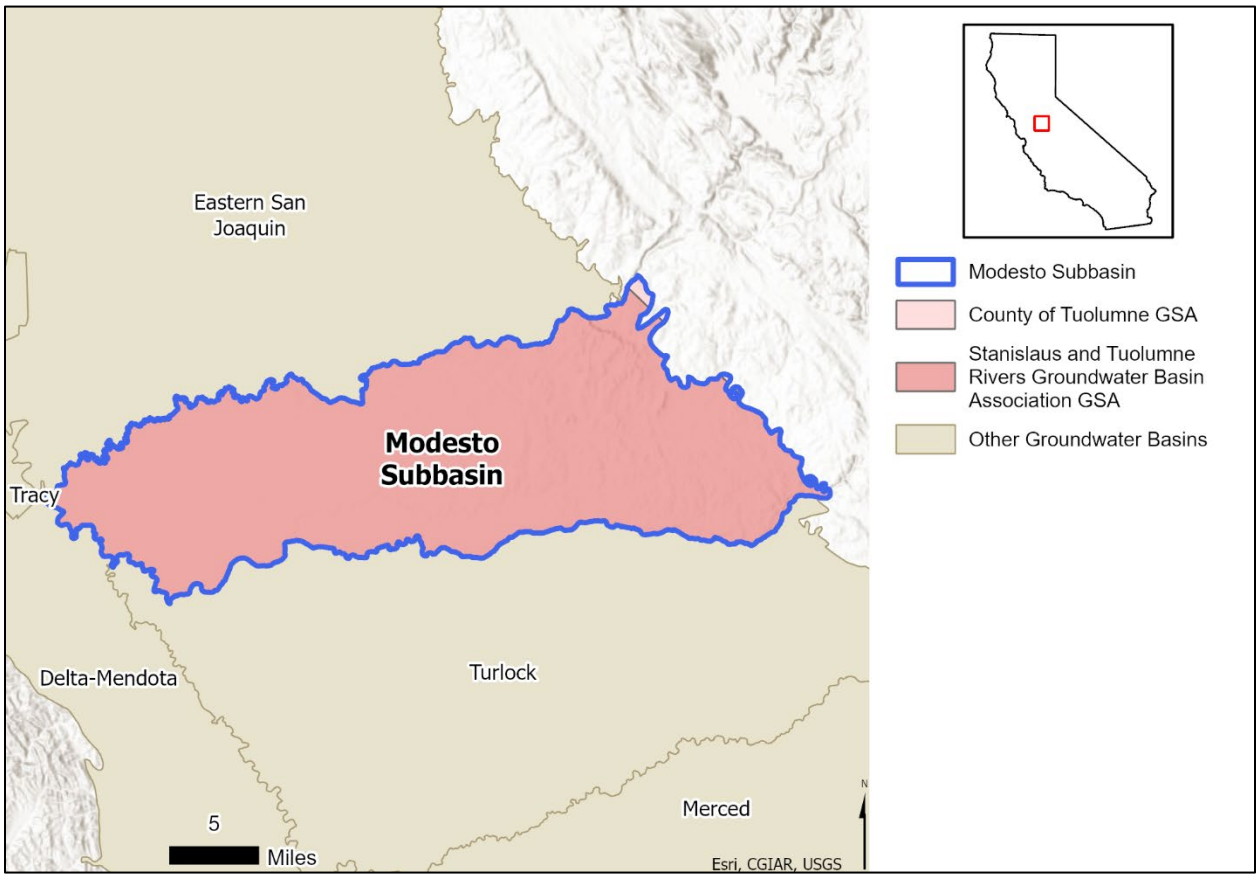

Figure 1: Modesto Subbasin Location Map

Land use in the Subbasin is primarily irrigated agriculture (64%), followed by urban use (13%) and to a lesser extent a combination of non-agriculture, non-irrigated agriculture (e.g., rangeland) and undeveloped land and surface water (23%).[150] The 2024 Plan notes that that many land use planning agencies in the Subbasin prioritize preservation of land for agricultural use and from 1996 to 2017, 18.7 percent (45,965 acres) of the Subbasin was converted from pasture land to irrigated crops predominately in the eastern portion

[147] 2024 Modesto Subbasin GSP, Section 2.0, p. 54.
[148] 2024 Modesto Subbasin GSP, Section 2.0, p. 54.
[149] 2024 Modesto Subbasin GSP, Section 2.1, pp. 54-55.
[150] 2024 Modesto Subbasin GSP, Section 2.2, pp. 55-56.

of the Subbasin where groundwater is the primary source of water supply.[151] Land use general plans provided in the 2024 Plan for Stanislaus County and the cities of Modesto, Oakdale, Riverbank and Waterford accommodate planned population growth in the Subbasin with intent to preserve other beneficial uses of water from agriculture and the environment through various land use restriction and groundwater ordinances.[152]

The 2024 Plan identifies beneficial uses and users in the Subbasin as municipal users, public water systems, local land use planning agencies, U.S. Fish and Wildlife Service, surface water users, domestic drinking water, industrial and agricultural supply and environmental users.[153] The 2024 Plan states that groundwater and surface water from the Stanislaus River and Tuolumne River are the primary sources of water in the Subbasin.[154] During WY 2015, groundwater was extracted primarily for agricultural irrigation (77%), municipal (20,1%) and domestic water supply (2.6%).[155] The western portion of the Subbasin has the highest density of production wells but groundwater pumping is offset by availability of surface water used to augment irrigation and municipal water supply; however, increased groundwater pumping occurs during drought periods when surface water is insufficient to meet demands.[156] Surface water supplies are generally unavailable in the eastern portion of the Subbasin where groundwater is the primary source for irrigation of agricultural lands.[157] There are about 4,000 production wells (including water supply, irrigation, public, municipal and industrial wells) and approximately 3,190 domestic wells in the Subbasin.[158] The 2024 Plan includes well density maps for each well type.[159]

The GSAs subdivided the Subbasin into four management areas to prioritize areas for GSP project implementation.[160] Management areas include the Modesto Irrigation District Management Area, Oakdale Irrigation District Management Area, Non-District East Management Area, and Non-District West Management Area. The management areas are representative of areas with similar water supplies, water management, and hydrological conditions.[161] The 2024 Plan includes a figure illustrating the extent of the management areas in the Subbasin.[162]

The administrative information provided in the 2024 Plan is substantially compliant with the requirements outlined in the GSP Regulations. Department staff consider the

[151] 2024 Modesto Subbasin GSP, Section 2.2, p. 56.
[152] 2024 Modesto Subbasin GSP, Sections 2.6.1.1 - 2.6.1.8, pp. 73-89.
[153] 2024 Modesto Subbasin GSP, Table 4-1, p. 229.
[154] 2024 Modesto Subbasin GSP, Section 2.3, pp. 57.
[155] 2024 Modesto Subbasin GSP, Section 2.3.2, p. 58.
[156] 2024 Modesto Subbasin GSP, Section 2.3.2, p. 58.
[157] 2024 Modesto Subbasin GSP, Section 2.3.2, p. 58.
[158] 2024 Modesto Subbasin GSP, Sections 2.3.2 and 2.3.3, pp. 59-62.
[159] 2024 Modesto Subbasin GSP, Figures 2-11 - 2-14, pp. 102-105.
[160] 2024 Modesto Subbasin GSP, Section 6.2.3, p. 317.
[161] 2024 Modesto Subbasin GSP, Section 6.2.3, p. 317.
[162] 2024 Modesto Subbasin GSP, Figure 6.2, p. 393.

information presented in the 2024 Plan to satisfy the general requirements of the GSP Regulations for administrative information.[163]

5.2 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.[164]

5.2.1 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.[165] The GSP Regulations require a descriptive hydrogeologic conceptual model that includes a written description of geologic conditions, supported by cross sections and maps,[166] and includes a description of basin boundaries and the bottom of the basin,[167] principal aquifers and aquitards,[168] and data gaps.[169]

The 2024 Plan describes the structural setting of the Subbasin as a large northwest-trending structural trough in the southern Central Valley with Cenozoic age continental sediments up to six miles thick.[170] Formations in the Subbasin consist of Miocene age consolidated and fluvial sediments, younger aged alluvial deposits and the Corcoran Clay at the western area of the Subbasin representative of a regional aquitard in the upper part of the Turlock Lake Formation.[171] Normal faults are present in the Subbasin from the down-dropped portion of the western Sierran block that offset formations in the Subbasin. The 2024 Plan does not discuss whether faulting disrupts the flow of groundwater in the Subbasin. The 2024 Plan provides figures presenting the surficial geology[172] and locations of wells and stratigraphic and structural features in the Subbasin in two east-

[163] 23 CCR §§ 354.2 *et seq.*
[164] 23 CCR § 354.12 *et seq*.
[165] 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.
[166] 23 CCR §§ 354.14(a), 354.14(c).
[167] 23 CCR §§ 354.14(b)(2-3).
[168] 23 CCR § 354.14(b)(4) *et seq.*
[169] 23 CCR § 354.14(b)(5).
[170] 2024 Modesto Subbasin GSP, Section 3.1.1, p. 111.
[171] 2024 Modesto Subbasin GSP, Section 3.1.1, pp. 111-112.
[172] 2024 Modesto Subbasin GSP, Figure 3-1, p. 158.

west and three north-south trending cross sections transecting the Subbasin.[173] The 2024 Plan also provides descriptions and maps of precipitation and average hydrologic conditions,[174] topography,[175] and soil characteristics[176] considered in development of the Subbasin hydrogeologic conceptual model.

The 2024 Plan identifies three principal aquifers in the Subbasin: the Western Upper Principal Aquifer, the Western Lower Principal Aquifer, and the Eastern Principal Aquifer.[177] The Western Upper Principal Aquifer and Western Lower Principal Aquifer are located at the western portion of the Subbasin separated by the Corcoran Clay aquitard. The Western Upper Principal Aquifer is an unconfined aquifer above the Corcoran Clay, whereas the Western Lower Principal Aquifer is a confined aquifer below the Corcoran Clay.[178] The Corcoran Clay does not extend into the eastern portion of the Subbasin. The Eastern Principal Aquifer is the primary aquifer at the eastern portion of the Subbasin with unconfined conditions in the shallower and younger alluvial deposits, and semi-confined conditions at depth from discontinuous clay layers in older more consolidated formations.[179]

The Western Upper Principal Aquifer and Eastern Principal Aquifer include overlapping terrace and alluvial deposits of the Modesto Formation, Riverbank Formation, and Turlock Lake Formation that yield moderate amounts of groundwater.[180] The Western Lower Principal Aquifer and deeper portions of the Eastern Principal Aquifer include the Laguna Formation and Mehrten Formation that represent more consolidated deposits generally with lower hydraulic conductivity and transmissivity than the overlying younger alluvial deposits; with the exception of localized deposits of black sands in the Mehrten Formation that are well-sorted with relatively high permeability in the eastern portion of the Subbasin.[181] The degree of hydraulic connection between the Laguna Formation and the Mehrten Formation to the overlying younger alluvial deposits is poorly understood.[182]

The 2024 Plan discusses the vertical and lateral extents of principal aquifers in the Subbasin. The GSAs state that the boundaries of the Stanislaus River, Tuolumne River, and San Joaquin River do not represent the lateral extent of the Subbasin aquifers but only provide institutional boundaries and authorities for groundwater management.[183] The lateral boundary of the eastern Subbasin generally follows the contact between the Subbasin sedimentary deposits and crystalline basement rocks of the Sierra Nevada but

[173] 2024 Modesto Subbasin GSP, Figures 3-11 - 3-18, pp.168-175.
[174] 2024 Modesto Subbasin GSP, Figure 3-2 – 3-3, pp. 159-160.
[175] 2024 Modesto Subbasin GSP, Figure 3-4 – 3-5, pp. 161-162.
[176] 2024 Modesto Subbasin GSP, Figure 3-6, p. 163.
[177] 2024 Modesto Subbasin GSP, Section 3.1.4, p. 118.
[178] 2024 Modesto Subbasin GSP, Section 3.1.4, p. 118.
[179] 2024 Modesto Subbasin GSP, Section 3.1.4, p. 118.
[180] 2024 Modesto Subbasin GSP, Section 3.1.4, pp. 125-127.
[181] 2024 Modesto Subbasin GSP, Section 3.1.4.3, p. 126; Section 3.1.1, pp. 111-112.
[182] 2024 Modesto Subbasin GSP, Section 3.1.4, pp. 126-127.
[183] 2024 Modesto Subbasin GSP, Section 3.1.3.1, p. 116.

the extent of this boundary is likely limited by increasing salinity at depth from older underlying deposits.[184]

The 2024 Plan explains that due to increasing salinity at depth the base of fresh water in the Subbasin is defined as an operational bottom for GSP management based on data from the Department's California Central Valley Groundwater-Surface Water Simulation Model (C2VSim) and the United States Geological Survey (USGS) specific conductance mapping of 3,000 micromhos per centimeter.[185] The base of fresh water in the Subbasin is defined by the GSAs as an undulating surface ranging in depth from -600 feet mean sea level (msl) along the eastern Subbasin boundary, dipping to an elevation of approximately -1,000 feet msl in the central Subbasin and rising to an elevation of approximately -700 feet msl along the western Subbasin boundary.[186] The 2024 GSP provides base to freshwater contour maps illustrating the limits of fresh water modeled in the Subbasin.[187] Both the Western Lower Principal Aquifer and Eastern Principal Aquifer extend vertically to the base of fresh water, whereas the base of the Western Upper Principal Aquifer is defined by the top of Corcoran Clay.[188] The 2024 Plan explains that the top of the Corcoran Clay was refined in the Subbasin model using data from USGS hydrogeologic characterization, data from USGS mapping of the Corcoran Clay, and USGS MERSTAN model data.[189]

While the 2024 GSP identifies and describes the beneficial uses and users of groundwater in the Subbasin (see Administrative Information), it does not provide a discussion of primary uses of each principal aquifer as required by the GSP Regulations.[190] This type of information is required in a GSP to fully describe the basin setting and serves as the basis for defining and assessing reasonable sustainable management criteria and projects and management actions. Therefore, Department staff recommend that a discussion of primary uses of each principal aquifer in the Subbasin, along with data gaps if they exist and the relative level of uncertainty, be provided in future annual reports and periodic evaluations of the plan (see Recommended Corrective Action 3a).

The 2024 Plan identifies three hydrogeologic data gaps in the Subbasin that affect implementation of the Plan: 1) there are a sparse number of wells east and northeast of the Modesto Reservoir providing uncertainty in evaluating the Eastern Principal Aquifer, 2) the top of the Mehrten Formation at the central and western portion of the Subbasin is poorly understood affecting the understanding of aquifer properties and geometry, and 3) there is uncertainty to the exact base of fresh water that may affect estimates in

[184] 2024 Modesto Subbasin GSP, Section 3.1.3.1, p. 116.
[185] 2024 Modesto Subbasin GSP, Section 3.1.3.2, pp. 116-117.
[186] 2024 Modesto Subbasin GSP, Section 3.1.3.2, p.117.
[187] 2024 Modesto Subbasin GSP, Figure 3-7, p. 164.
[188] 2024 Modesto Subbasin GSP, Section 3.1.4.2, p. 126.
[189] 2024 Modesto Subbasin GSP, Section 3.1.4, p. 120.
[190] 23 CCR § 354.14(b)(4)(E).

groundwater storage and groundwater quality at depth.[191] The GSAs provide a summary of planned actions to address the data gaps and state that an implementation schedule will be developed but do not provide a timeframe for when this will occur.[192] Department staff recommend the GSAs provide a discussion of when identified data gaps will be addressed in annual reports and periodic evaluations of the Plan (see Recommended Corrective Action 3b).

The hydrogeologic conceptual model section included in the 2024 Plan substantially complies with the requirements outlined in the GSP Regulations at this time. Department staff have provided recommended corrective actions for this section which the GSAs should consider and address by the next periodic evaluation.

5.2.2 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,[193] a graph depicting change in groundwater storage,[194] maps and cross-sections of the seawater intrusion front,[195] maps of groundwater contamination sites and plumes,[196] maps depicting total subsidence,[197] identification of interconnected surface water systems and an estimate of the quantity and timing of depletions of those systems,[198] and identification of groundwater dependent ecosystems.[199]

The 2024 Plan includes an evaluation of groundwater levels and trends in the Subbasin utilizing data from 450 wells and numerous sources including local water agencies, municipalities, urban communities and databases maintained by the Department and the USGS.[200] The 2024 Plan includes a map[201] showing the spatial distribution of wells with water level data in the Subbasin. As illustrated in the map, a majority of groundwater data is collected from the western and central areas of the Subbasin where a higher density of wells are present, thus limiting available groundwater data in the eastern portion of the Subbasin where greater groundwater decline is occurring. The poor spatial distribution of wells at the eastern portion of the Subbasin is identified as a data gap in the hydrogeologic conceptual model discussed above in Section 5.2.1.

[191] 2024 Modesto Subbasin GSP, Table 3-1, p. 127.
[192] 2024 Modesto Subbasin GSP, Table 3-1, p. 127; Section 3.1.6, p. 127.
[193] 23 CCR §§ 354.16(a)(1-2).
[194] 23 CCR § 354.16(b).
[195] 23 CCR § 354.16(c).
[196] 23 CCR § 354.16(d).
[197] 23 CCR § 354.16(e).
[198] 23 CCR § 354.16(f).
[199] 23 CCR § 354.16(g).
[200] 2024 Modesto Subbasin GSP, Section 3.2.1 and 3.2.2, p. 128.
[201] 2024 Modesto Subbasin GSP, Figure 3-19, p. 176.

Groundwater data is summarized for 21 hydrographs depicting long-term trends in groundwater elevation from 1990 to 2018 in each of the three principal aquifers.[202] The GSAs note that groundwater data from the Western Upper Principal Aquifer indicate that groundwater levels are generally shallow (generally within 10 feet from ground surface), tend to fluctuate more at the central areas of the Subbasin coincident with increased distance from rivers, are relatively stable with the exception of drought periods followed by notable recovery and there is a general increase in groundwater elevation in pumping wells since the City of Modesto began receiving supplemental water from the Modesto Regional Water Treatment Plant in 1995.[203] Similar observations are noted by the GSAs in the Western Lower Principal Aquifer but with more pronounced groundwater level fluctuations during seasonal pumping typical of pumping from a confined aquifer.[204] Historical groundwater trends in the Eastern Principal Aquifer indicate a deeper water table in the eastern portion of the Subbasin, with more pronounced groundwater decline and lesser recharge following drought periods.[205] Department staff note that a general decline is occurring in the majority of the easternmost wells in the Subbasin with some wells exceeding 20 to 40 feet of general decline since the mid-2000s.[206] The GSAs state that long-term rates of decline in the eastern Subbasin are up to about 2.7 feet/year and up to 6 feet/year during drought periods.[207] The 2024 GSP also includes hydrographs for wells comprising the chronic lowering of groundwater levels, reduction of groundwater storage, land subsidence, and interconnected surface water representative monitoring networks.[208]

The 2024 Plan includes groundwater contour maps for years 1998 (wet year), 2015 (dry year), and 2017 (most recent year of data, wet year) for the unconfined Western Upper Principal Aquifer and Eastern Principal Aquifer.[209] The 2024 GSP does not provide contour maps for the confined Western Lower Principal Aquifer due to limited data and cross screening of wells between the Western Upper and Lower Principal Aquifers, but does provide groundwater elevation maps for the same years.[210] Simulated groundwater elevation contours are provided for all 3 principal aquifers for 2015. Groundwater contour maps for unconfined aquifers in the Subbasin indicate a southwesterly groundwater flow direction with a southerly flow component towards the Tuolumne River, a steeper hydraulic gradient at the eastern portion of the Subbasin and localized areas of intermittent groundwater depressions due to variability in groundwater pumping over time.[211] Simulated groundwater flow in the Western Lower Principal Aquifer indicate a

[202] 2024 Modesto Subbasin GSP, Figures 3-20 – 3-25, pp. 177-182.
[203] 2024 Modesto Subbasin GSP, Section 3.2.2, p. 129.
[204] 2024 Modesto Subbasin GSP, Section 3.2.2, p. 129.
[205] 2024 Modesto Subbasin GSP, Section 3.2.2, p. 130.
[206] 2024 Modesto Subbasin GSP, Figure 3-25, p. 182.
[207] 2024 Modesto Subbasin GSP, Section 3.2.2, p. 130.
[208] 2024 Modesto Subbasin GSP, Appendix G, pp. 898-981.
[209] 2024 Modesto Subbasin GSP, Figures 3-26 - 3-28, pp. 183-186.
[210] 2024 Modesto Subbasin GSP, Figures 3-29 - 3-31, pp. 187-190.
[211] 2024 Modesto Subbasin GSP, Section 3.2.3.1, pp. 130-131.

northeastern groundwater flow direction,[212] but Department staff note the observations are based on limited available data for the unconfined aquifer. The 2024 Plan explains that that vertical groundwater flow in the Subbasin is downward based on analysis of data from a USGS well cluster and nearby wells in the Subbasin screened above and below the Corcoran Clay.[213] GSP Regulations require groundwater contour maps depicting the potentiometric surface for the current seasonal high and current seasonal low for each principal aquifer[214] which is inconsistent with what was provided in the 2024 Plan. Department staff recommend that the GSAs continue to provide groundwater contour maps for the current seasonal high and low potentiometric surface for each principal aquifer in the Subbasin in annual reports.

The 2024 Plan presents the annual and cumulative changes in groundwater in storage averaged over a 25-year period from WY 1991-2015.[215] The storage changes are estimated using the Subbasin C2VSimTM model, a fully integrated surface and groundwater flow model developed and refined with a focus for both the Modesto and Turlock Subbasins.[216] The 2024 Plan describes that the change in storage during the 25-year historical study period equates to an annual depletion of groundwater of about 43,000 acre-feet per year, and a cumulative depletion of approximately 1.07 million acre-feet.[217] The remaining groundwater in storage is estimated at about 13 million acre-feet.[218] The 2024 Plan states that over the 50-year planning horizon the Subbasin is projected to experience approximately 11,000 acre-feet per year of storage decline under projected conditions, leading to a cumulative reduction of 530,000 acre-feet.[219] As discussed in the Department's Incomplete Determination (see Section 4.2), the projected storage decline of 11,000 acre-feet per year is significantly less than the reported loss of groundwater in storage reported in recent annual reports for WY 2021 (132,500 acre-feet) and WY 2022 (172,300 acre-feet). The 2024 Plan includes a graphical representation of the annual and cumulative groundwater storage.[220] Department staff note that the graphical representations of change in groundwater in storage in the 2024 Plan do not include water year type as required by GSP Regulations, though this information is provided alongside the discussion of annual precipitation in the Subbasin.[221] Department staff recommend that the GSAs include the water year type in future graphical representations of the annual and cumulative change in groundwater in storage for the Subbasin.

[212] 2024 Modesto Subbasin GSP, Section 3.2.3.1, p. 132; Figure 3-30b, p. 189.
[213] 2024 Modesto Subbasin GSP, Section 3.2.3.2, p. 133.
[214] 23 CCR § 354.16(a)(1).
[215] 2024 Modesto Subbasin GSP, Section 3.2.4, p. 135.
[216] 2024 Modesto Subbasin GSP, Section 3.2.4, p. 134; Section 5.1.2, p. 245.
[217] 2024 Modesto Subbasin GSP, Section 3.2.4, p. 135.
[218] 2024 Modesto Subbasin GSP, Section 3.2.4, p. 135.
[219] 2024 Modesto Subbasin GSP, Section 5.1.4.3, p. 277.
[220] 2024 Modesto Subbasin GSP, Figure 5-20, p. 268; Figure 5-40, p. 284.
[221] 23 CCR § 354.16(b); 2024 Modesto Subbasin GSP, Figure 3-2, p. 159.

The 2024 Plan explains that the Subbasin is located far from coastal areas and seawater intrusion is not a relevant sustainability indicator for the Subbasin.[222] Department staff agree with the GSAs' assessment.

The 2024 Plan describes an analysis performed by the Subbasin technical team to evaluate the occurrence and extent of groundwater quality issues in the Subbasin. The analysis included evaluation of groundwater quality data for all well types from publicly available groundwater quality sources including STRGBA GSA member agencies, Eastern San Joaquin Water Quality Coalition, Central Valley Salinity Alternatives for Long-term Sustainability (CV-SALTS), and the California State Water Resources Control Board GeoTracker-GAMA and GAMA database.[223] Results from the analysis was used to establish the list of nine potential constituents of concern for the Subbasin including nitrate as N, TDS, arsenic, boron, uranium, gross alpha 1,2-, DBCP, PCE, and TCP.[224] The 2024 Plan explains that the groundwater quality analysis included over 118,203 groundwater quality records from 1,339 wells over a 25-year study period between WY 1995 to 2019.[225] Constituents of concern were selected based on their elevated concentrations over a relatively widespread area of the Subbasin, constituents most likely to affect the Subbasin based on land use (predominately agricultural and human point sources), and natural geogenic sources.[226] The 2024 Plan presents a statistical summary of constituents of concern in the Subbasin to establish temporal trends and occurrence of each constituents of concern by principal aquifer.[227] Results from the statistical analysis indicate that groundwater quality is similar above and below the Corcoran Clay, the highest TDS concentrations are generally reported in the Western Upper Principal Aquifer and average arsenic concentrations in the Western Upper Principal Aquifer and Western Lower Principal Aquifer are more than double the average concentration than in the Eastern Principal Aquifer.[228] The 2024 Plan explains that statistical tests were also conducted by the GSAs to evaluate if constituents of concern concentrations in the Subbasin are statistically similar or different between historical (WY 1995 to 2014) and present (2015 to 2019) time periods, and to identify processes that may affect the temporal trends in the Subbasin.[229] The 2024 Plan explains that results from these tests indicate that TCP, radionuclides (gross alpha and uranium), TDS, and nitrate concentrations are increasing over time in the Subbasin, while DBCP and arsenic concentrations are decreasing over time in the Subbasin.[230] The 2024 Plan includes figures depicting the spatial distribution of average and maximum constituents of concern

[222] 2024 Modesto Subbasin GSP, Section 6.2.1, p. 315.
[223] 2024 Modesto Subbasin GSP, Section 3.2.5.2, p. 136.
[224] 2024 Modesto Subbasin GSP, Table 3-2, p. 137.
[225] 2024 Modesto Subbasin GSP, Section 3.2.5.2, p. 136.
[226] 2024 Modesto Subbasin GSP, Section 3.2.5.2, p. 137.
[227] 2024 Modesto Subbasin GSP, Tables 3-3 - 3-6, pp. 139-142.
[228] 2024 Modesto Subbasin GSP, Section 3.2.5.3, pp.136-144; Tables 3-3 – 3-6, pp. 139-142.
[229] 2024 Modesto Subbasin GSP, Section 3.2.5.4, p.149.
[230] 2024 Modesto Subbasin GSP, Section 3.2.5.4, p.150.

in the Subbasin between years 1995-2019[231] and a figure identifying the locations of known groundwater contamination sites in the Subbasin.[232]

The 2024 GSP states that land subsidence has not been a significant issue for the Subbasin based on various studies and use of Interferometric Synthetic Aperture Radar (InSAR).[233] A figure is provided in the 2024 Plan presenting the results of InSAR data from June 2015 to October 2020,[234] supporting the assessment that subsidence has not occurred in the majority of the Subbasin with subsidence generally ranging between 0 and 0.05 feet, equating to a subsidence rate of approximately 0.12 inches per year over the five year period. The 2024 Plan identifies areas of minor subsidence in the central, eastern and northwest corner and along the western portion of the Stanislaus River in the Subbasin.[235] Additionally, the 2024 Plan identifies two small localized areas in the eastern portion of the Subbasin where a larger rate of subsidence of 0.15 feet has occurred.[236] Rather than groundwater extraction, the GSAs attribute land subsidence to the presence of abundant clay surficial soils and disruption of restrictive layers potentially by agricultural operations.[237] The 2024 Plan explains that a study was performed by the GSAs to verify the accuracy of InSAR measurements by comparison of InSAR data to continuously operating global positioning system (CGPS) base station data which indicate a high degree of correlation (absolute difference of 8.86 mm) between data sets.[238] Furthermore, data from four GPS stations in the Subbasin indicate zero to low rates (0.048 feet) of vertical displacement in the Subbasin.[239]

The 2024 Plan identifies surface water interconnectivity with the Tuolumne River, Stanislaus River, and San Joaquin River that provide critical water supply to the Subbasin.[240] The San Joaquin River is characterized as a gaining stream, whereas interconnectivity with Tuolumne and Stanislaus river systems is considered dynamic with recharge varying along segments of the rivers both seasonally and over time.[241] The 2024 Plan presents the water budget for inflow and outflow of stream systems in the Subbasin simulated by the C2VSimTM model.[242] Model estimates indicate that during the historical study period (1991-2015) combined inflow into the Subbasin from the rivers is approximately 2.5 million acre-feet.[243] Subbasin outflow to the San Joaquin River is estimated at approximately 2.8 million acre-feet during the historical study period.[244] The

[231] 2024 Modesto Subbasin GSP, Figures 3-35 - 3-52, pp.194-211.
[232] 2024 Modesto Subbasin GSP, Figure 3-57, p. 216.
[233] 2024 Modesto Subbasin GSP, Section 3.2.6, pp.151-153.
[234] 2024 Modesto Subbasin GSP, Figure 3-60, p. 219.
[235] 2024 Modesto Subbasin GSP, Section 3.2.6, p. 152.
[236] 2024 Modesto Subbasin GSP, Figure 3-60, p. 219.
[237] 2024 Modesto Subbasin GSP, Section 3.2.6, p.152; Figure 3-6, p.163.
[238] 2024 Modesto Subbasin GSP, Section 3.2.6, p.153.
[239] 2024 Modesto Subbasin GSP, Section 3.2.6, p.153.
[240] 2024 Modesto Subbasin GSP, Section 3.2.7, p. 153.
[241] 2024 Modesto Subbasin GSP, Section 3.2.7, p. 153.
[242] 2024 Modesto Subbasin GSP, Table 5-2, p. 251.
[243] 2024 Modesto Subbasin GSP, Section 3.2.7, p. 153.
[244] 2024 Modesto Subbasin GSP, Section 3.2.7, p. 153.

2024 Plan explains that during the historical study period the Tuolumne River, Stanislaus River, and San Joaquin River were all net gaining rivers; however, 50-year model predictions indicate that portions of the Tuolumne River and Stanislaus River could transition to overall net losing rivers with average net losses of 11,000 and 24,000 acre-feet per year, respectively if groundwater decline is not arrested.[245] The 2024 Plan provides a figure illustrating the portions of the rivers where losing conditions may to occur if overdraft increases in the Subbasin.[246]

The 2024 Plan includes details of an assessment to identify whether groundwater dependent ecosystems (GDEs) exist in the Subbasin.[247] The assessment included the compilation of vegetation, wetlands, springs, and seep data from publicly available State and federal agency datasets. Additionally, a depth to water analysis was conducted to evaluate the occurrence of groundwater within the upper 30 feet below ground surface (where depth to water exceeds rooting depths) during a wet year (spring 1998) and a critically dry year (fall 2015). From this assessment potential GDEs were identified along all three river boundaries and along the downstream portions of Dry Creek in the western portion of the Subbasin.[248] The 2024 Plan provides a figure illustrating the locations of potential groundwater dependent ecosystems in the Subbasin.[249] The GSAs commit to further investigate the potential GDEs in the Subbasin during implementation of the 2024 Plan, and as an initial step the GSAs plan to seek technical consultants with expertise to assist in developing a plan for additional GDE analyses.[250] The GSAs should provide progress and schedule updates for further investigations to evaluate potential groundwater dependent ecosystems in annual reports and next periodic evaluation of the plan.

The groundwater conditions section included in the 2024 Plan substantially complies with the requirements outlined in the GSP Regulations, at this time.

5.2.3 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,[251] and the sustainable yield.[252]

The 2024 Plan estimates historical, current, and projected water budgets using the C2VSimTM model.[253] The C2VSimTM is based on the California Central Valley Groundwater-Surface Water Simulation Model (C2VSimFG Beta2) and includes

[245] 2024 Modesto Subbasin GSP, Section 3.2.7, pp. 153-154.
[246] 2024 Modesto Subbasin GSP, Figure 3-61, p. 220.
[247] 2024 Modesto Subbasin GSP, Section 3.2.8, p. 155.
[248] 2024 Modesto Subbasin GSP, Section 3.2.8, pp. 156-157.
[249] 2024 Modesto Subbasin GSP, Figure 3-67, p. 226.
[250] 2024 Modesto Subbasin GSP, Section 9.5.2, p. 518.
[251] 23 CCR §§ 354.18(a), 354.18(c) *et seq*.
[252] 23 CCR § 354.18(b)(7).
[253] 2024 Modesto Subbasin GSP, Section 5.1.2, p. 245.

refinements specific to land use, water use and surface stream parameters in the Modesto and Turlock Subbasins.[254] The 2024 Plan explains that the C2VSimTM includes monthly data for water year 1969 through water year 2018, but is only calibrated for water year 1991 through 2015.[255]

The 2024 Plan presents a historical water budget representative of a 25-year period spanning 1991-2015, a current water budget based on water year 2010 (representative of the last normal water prior to the 2012-2015 drought) and a projected water budget based on projected future land and water use conditions considering the 50-year hydrologic period of water years 1969-2018.[256] Water budgets are presented in the 2024 Plan as stream systems in the Subbasin,[257] land surface systems for the Subbasin and the four Management Areas,[258] and groundwater systems for the Subbasin.[259] The 2024 Plan provides water budget information in tabular and graphical form and presents total inflow and outflow to the Subbasin by water source type for surface water and groundwater systems.

During the historical period (1991-2015), the model-estimated average annual inflow into the Subbasin was 440,000 acre-feet, outflow from the Subbasin was 483,000 acre-feet, and change in groundwater storage was an overdraft of 43,000 acre-feet per year.[260] Groundwater decline is heavily weighted to the end of the historical study period due to increased stresses relating increased agricultural water demand,[261] local hydrology and drought conditions occurring at the end of this period. The 2024 Plan states that this simulation period was selected “because it provides a period of representative hydrology while capturing recent operations within the Subbasin”[262]; however, the Plan does not explain why data from water years 2016-2018 fail to meet these conditions. Furthermore, the historical period excludes data from potentially critical years during the later part of the 2014-2017 drought when significant and unreasonable conditions were experienced in the Subbasin. Department staff recommend the GSAs consider data from water years 2016-2018 in historical period simulations and explain how the choice of historical period may impact their assessment of actual historical conditions experienced in the Subbasin.

For the current period (2010), the 2024 Plan states the model-estimated average inflow into the Subbasin was 434,000 acre-feet, and outflow from the Subbasin was 559,000 acre-feet, with a reduction in groundwater storage of 125,000 acre-feet for that year.[263] The 2024 Plan states that the decline in groundwater in storage is due to increased

[254] 2024 Modesto Subbasin GSP, Section 5.1.2, p. 245.
[255] 2024 Modesto Subbasin GSP, Appendix D, p. 703.
[256] 2024 Modesto Subbasin GSP, Section 5.1.3.3, p. 247.
[257] 2024 Modesto Subbasin GSP, Table 5-2, p. 251.
[258] 2024 Modesto Subbasin GSP, Tables 5-3 – 5-7, pp. 252-256.
[259] 2024 Modesto Subbasin GSP, Table 5-8, p. 257.
[260] 2024 Modesto Subbasin GSP, Section 5.1.4.1, p. 257
[261] 2024 Modesto Subbasin GSP, Figure 5-7, p. 260.
[262] 2024 Modesto Subbasin GSP, Section 5.1.3.1 p. 246.
[263] 2024 Modesto Subbasin GSP, Figure 5-8, p. 257.

stresses relating to expanding increased agricultural water demand and local hydrology and lesser surface water diversions relative to the historical water budget period.

Projected water budget conditions in the Subbasin include an average annual outflow into the Subbasin of 428,000 acre-feet, and an outflow from the Subbasin of 438,000 acre-feet, with an overdraft in groundwater storage of 11,000 acre-feet per year.[264] Projected conditions anticipate increases in irrigation practices and growing population and water demand in urban areas. Under projected conditions and unless groundwater decline is arrested, model results indicate that portions of the Tuolumne River and Stanislaus River may transition from net gaining streams to net losing streams resulting in recharge to the Subbasin by reduction in the net loss of groundwater to rivers.[265] As a result, the average groundwater storage decline of 11,000 acre-feet per year is significantly less than the historical depletion of 43,000 acre-feet per year due to buffering by a net gain of 86,000 acre-feet per year of seepage from the river systems.[266] The 2024 Plan states that this would affect groundwater sustainability of the Subbasin and is considered significant and unreasonable. As discussed in Section 4.2.2.1 above, Department staff are concerned that the 2024 Plan's projected overdraft estimate of 11,000 acre-feet per year may be conservative based on observations in recent years when much greater overdraft was documented in annual reports and will continue to track changes in groundwater storage reported in future annual reports and periodic evaluations of the plan to evaluate the likelihood of the 2024 Plan achieving the sustainability goal of the Subbasin.

To offset overdraft and meet sustainability goals for the Subbasin, the 2024 Plan proposes projects and management actions to provide additional recharge to the Subbasin as discussed in Section 5.5 below. The 2024 Plan presents two scenarios (Scenario 1 and Scenario 2) and estimated benefits from project and management action implementation using the C2VSimTM model. Scenario 1 considers projected baseline conditions and implementation of three urban and municipal projects estimated to benefit the Subbasin by a reduction of 13,700 acre-feet per year in groundwater pumping and net savings in groundwater storage of 1,500 acre-feet per year over the 50-year simulation period.[267] In Scenario 2 the GSAs considered the same benefits as Scenario 1, with the addition of implementation of in-lieu and direct recharge projects.[268] Under Scenario 2, estimated benefits to the Subbasin are a reduction of 44,000 acre-feet per year in groundwater pumping and net savings in groundwater in storage of 12,400 acre-feet per year in the Subbasin over the 50-year simulation period.[269] The 2024 Plan states that the Scenario 2 simulated conditions meet the sustainability metrics for the Subbasin in the long-term.[270]

[264] 2024 Modesto Subbasin GSP, Figure 5-8, p. 257.
[265] 2024 Modesto Subbasin GSP, Section 5.1.4.3 p. 273.
[266] 2024 Modesto Subbasin GSP, Section 5.1.4.3 p. 276.
[267] 2024 Modesto Subbasin GSP, Table 8-11, p. 494.
[268] 2024 Modesto Subbasin GSP, Section 8.5.1 pp. 494-495.
[269] 2024 Modesto Subbasin GSP, Table 8-12, p. 495.
[270] 2024 Modesto Subbasin GSP, Section 8.5.1 p. 496.

As discussed in Section 4.2.2.1 above, in response to the Department's Incomplete Determination the GSAs demonstrated substantial progress for projects and commitment toward development and implementation of management actions in the Subbasin. Department staff believe that implementation of pumping management framework along with demand management strategies is an important tool to halt mitigate overdraft in the Subbasin, and GSAs should develop and implement the Pumping Management Framework and Demand Reduction Strategies, which are still in the development phase in the 2024 Plan.

The 2024 Plan quantifies a sustainable yield for the Subbasin of approximately 267,000 acre-feet per year.[271] The sustainable yield was developed using a C2VSimTM scenario based on baseline projected conditions where groundwater pumping from "net groundwater extractors" is reduced to not reach groundwater levels that would result in undesirable results in the Subbasin in the long-term.[272]

The 2024 Plan provides the required historical, current, and future accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the Subbasin including an estimate of the sustainable yield of the Subbasin. The water budget described in the 2024 Plan generally complies with the GSP Regulations and appears to be developed using the best available science.

5.2.4 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.[273]

The 2024 Plan identifies four management areas[274]:

1) Modesto Irrigation District (ID) Management Area (101,914 acres),
2) Oakdale ID Management Area (49,893 acres),
3) Non-District East Management Area (77,218 acres), and
4) Non-District West Management Area (15,777 acres).

The 2024 Plan presents a map illustrating the boundaries of management areas in the Subbasin.[275] Management areas are defined in the Subbasin to facilitate implementation of projects, particularly in the Non-District East Management Area where declining water levels are most pronounced and projects to arrest groundwater decline are focused.[276]

[271] 2024 Modesto Subbasin GSP, Section 5.3.1, p. 310.
[272] 2024 Modesto Subbasin GSP, Section 5.3.1, pp. 309-310.
[273] 23 CCR § 354.20.
[274] 2024 Modesto Subbasin GSP, Section 6.2.3, p. 317.
[275] 2024 Modesto Subbasin GSP, Figure 6-2, p. 393.
[276] 2024 Modesto Subbasin GSP, Section 6.2.3, p. 318.

Department staff note that sustainability management criteria established for sustainability indicators in the Subbasin are the same across all management areas.

The 2024 Plan explains that management areas have similar water supplies and ongoing water management activities. Delineations of the Modesto ID and Oakdale ID management areas are coincident with current Modesto Irrigation District and Oakdale Irrigation District service areas.[277] The Non-District East and Non-District West management areas are located outside of the two large irrigation district boundaries and management of these management areas is currently coordinated through Stanislaus County.[278]

The 2024 Plan's description and use of management areas in the Subbasin are supported with sufficient information and justification and substantially complies with the GSP Regulations.

5.3 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.[279]

5.3.1 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 and should include an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation.[280]

The 2024 Plan states that the sustainability goal for the Subbasin is to "provide a sustainable groundwater supply for the local community and for the economic vitality of the region".[281] The sustainability goal was developed by the Subbasin technical team and the TAC Planning Group. Groundwater levels, storage volume, and quality will be actively managed by the STRGBA GSA to:

- "Operate the Subbasin within its sustainable yield to support beneficial uses including municipal, domestic, agricultural, industrial, and environmental;

[277] 2024 Modesto Subbasin GSP, Section 6.2.3, pp. 317-318.
[278] 2024 Modesto Subbasin GSP, Section 6.2.3, p. 318.
[279] 23 CCR § 354.22 *et seq*.
[280] 23 CCR § 354.24.
[281] 2024 Modesto Subbasin GSP, Section 6.1, p. 312.

- Maintain a reliable, accessible, and high-quality groundwater supply, especially during droughts;
- Manage groundwater levels such that beneficial uses of interconnected surface water are not adversely impacted by groundwater extractions;
- Optimize conjunctive management of local surface water and groundwater resources;
- Avoid adverse impacts from future potential land subsidence associated with groundwater level declines; and
- Cooperate and coordinate with GSAs in neighboring subbasins to avoid undesirable results along the shared Subbasin boundaries."[282]

The 2024 Plan states that the sustainability goal will be achieved in the 20-year implementation period and maintained throughout the planning horizon by implementation of a robust monitoring program and a series of projects and management actions that involve groundwater recharge, in lieu surface water use, conservation, stormwater management, and other strategies to be developed and modified over time through adaptive management.[283]

Staff conclude that the sustainability goal section included in the 2024 Plan is substantially compliant with the requirements outlined in the GSP Regulations.[284]

5.3.2 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.[285] 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[286] – 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.

[282] 2024 Modesto Subbasin GSP, Section 6.1, pp. 312-313.
[283] 2024 Modesto Subbasin GSP, Section 6.1, p. 313.
[284] 23 CCR § 354.16 et seq.
[285] 23 CCR § 351(ah).
[286] Water Code § 10721(x).

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.[287] GSP Regulations also require GSPs provide the criteria used to define when and where the effects of the groundwater conditions cause 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.[288]

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.[289] GSAs are required to describe how conditions at minimum thresholds may affect beneficial uses and users,[290] 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.[291]

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.[292] 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.[293]

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.[294]

5.3.2.1 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

[287] 23 CCR §§ 354.26(a), 354.26 (b)(c).
[288] 23 CCR § 354.26(b)(2).
[289] 23 CCR § 354.28(b)(1).
[290] 23 CCR § 354.28(b)(4).
[291] 23 CCR § 354.28(b)(2).
[292] 23 CCR § 354.30(a).
[293] 23 CCR § 354.30(b).
[294] 23 CCR § 354.26(d).

about groundwater elevation conditions and potential effects on other sustainability indicators.[295]

The 2024 Plan identifies the 2014-2017 drought period as a period of historic groundwater level decline resulting in significant and unreasonable conditions demonstrated by adverse impacts experienced in more than 150 water supply wells in the Subbasin. These impacts occurred predominately in the eastern half of the Subbasin where more pronounced groundwater decline occurred.[296] The 2024 Plan notes that most domestic wells affected during the 2014-2017 drought have been replaced.[297]

The 2024 Plan defines undesirable results as "significant and unreasonable groundwater level declines – either due to multi-year droughts or due to chronic declines where groundwater is the sole supply – such that water supply wells are adversely impacted in a manner that cannot be readily managed or mitigated."[298] The 2024 Plan states that the cause of groundwater level decline in the Subbasin is a combination of over-pumping and multi-year drought conditions.[299] The quantitative definition for undesirable results is defined by the GSAs as "when at least 33% of representative monitoring wells exceed the MT [minimum threshold] for a principal aquifer in 3 consecutive Fall monitoring events."[300] The GSAs' justification for the three consecutive fall measurement period is to focus on long-term trends versus seasonal fluctuations and based on data where three critically dry years (WY 2013 – WY 2015) led to previous undesirable results in the Subbasin.[301] The 2024 Plan does not explain why the 33% exceedance criteria would constitute an undesirable result in the Subbasin. The justification for choosing the 33% exceedance criteria in the quantitative definition for undesirable results should be explained by the GSAs in the next periodic evaluation.

The 2024 Plan establishes minimum thresholds for all principal aquifers in the Subbasin as "the historic low groundwater elevation observed or estimated during WY 1991 - WY 2020 at each representative monitoring location, based on available data".[302] The 2024 Plan provides a summary table presenting the minimum threshold value at each representative monitoring well[303] and includes hydrographs for wells with relatively long water level records across the Subbasin,[304] and hydrographs showing long-term groundwater elevation trends with sustainable management criteria in Appendix G.[305]

[295] 23 CCR § 354.28(c)(1) *et seq*.
[296] 2024 Modesto Subbasin GSP, Section 6.3.1.1, pp. 321-322.
[297] 2024 Modesto Subbasin GSP, Section 6.3.1.2, p. 323.
[298] 2024 Modesto Subbasin GSP, Table 6-3, p. 325.
[299] 2024 Modesto Subbasin GSP, Section 6.3.1.1, p. 321.
[300] 2024 Modesto Subbasin GSP, Table 6-3, p. 325.
[301] 2024 Modesto Subbasin GSP, Section 6.3.1.3, p. 326.
[302] 2024 Modesto Subbasin GSP, Table 6-4, p. 327.
[303] 2024 Modesto Subbasin GSP, Table 7-1, p. 401.
[304] 2024 Modesto Subbasin GSP, Figures 3-21 – 3-25, pp. 178-182.
[305] 2024 Modesto Subbasin GSP, Appendix G, p. 898.

Minimum thresholds were established for the Subbasin to avoid similar undesirable results experienced during the 2015-2017 drought. The 2024 Plan describes that minimum thresholds were established for the Western Upper Principal Aquifer and Western Lower Principal Aquifer according to 2015 and 1991 historic low groundwater elevations based on relatively stable groundwater levels throughout the study period and recovery to near pre-drought conditions in nearly all wells partly due to the accessibility of surface water supply used to supplement the City's drinking water supply.[306] Wells in the Eastern Principal Aquifer show a greater decline in groundwater elevation (about 40-feet of long-term groundwater decline since the mid-2000's) due to increasing demands from irrigated agriculture and inaccessibility of surface water supply to supplement water demands at this of the Subbasin.[307] Minimum threshold groundwater elevations were set in the majority of eastern Subbasin wells according to fall 2020 groundwater elevations.[308] Department staff note that groundwater levels in fall 2020 are lower than groundwater levels in 2015; however, undesirable results were not identified during the fall 2020 period likely due to replacement of shallower wells following the 2014-2017 drought.[309]

The 2024 Plan explains that minimum thresholds will avoid causing undesirable results in adjacent subbasins and significant inter-basin coordination continues among GSAs and member agencies across subbasins.[310] The 2024 Plan provides a brief description of established sustainable management criteria for each adjacent subbasin, highlighting the similar method of using historical groundwater levels to establish thresholds.[311]

The 2024 Plan establishes measurable objectives as "the midpoint between the historical high groundwater elevation and the MT [minimum threshold] at each representative monitoring location" for all principal aquifers.[312]

The 2024 Plan explains that long-term groundwater decline is occurring in the eastern portion of the Subbasin, specifically in the Non-District East Management Area which has propagated westward into the Oakdale ID Management Area.[313] To plan for a "worst-case scenario" for continued groundwater decline until projects and management actions are implemented, the 2024 Plan's path to achieving groundwater sustainability include setting 2027 interim milestones in the eastern portion of the Subbasin representative monitoring wells below minimum thresholds, allowing for groundwater levels to exceed minimum thresholds for a period of up to ten years.[314] In the Department's Incomplete Determination of the 2022 Plan, Department staff identified a deficiency with this

[306] 2024 Modesto Subbasin GSP, Section 6.3.2.1, pp. 328-329.
[307] 2024 Modesto Subbasin GSP, Section 6.3.2.1, p. 328.
[308] 2024 Modesto Subbasin GSP, Section 6.3.2.1, p. 329.
[309] 2024 Modesto Subbasin GSP, Section 2.3.3, pp. 62-63.
[310] 2024 Modesto Subbasin GSP, Section 6.3.2.3, p. 332.
[311] 2024 Modesto Subbasin GSP, Section 6.3.2.3, pp. 332-333.
[312] 2024 Modesto Subbasin GSP, Table 6-10, p. 346.
[313] 2024 Modesto Subbasin GSP, Section 6.3.3, p. 336.
[314] 2024 Modesto Subbasin GSP, Section 6.3.3, p. 337.

approach and provided recommended corrective actions.[315] The GSAs' response to the identified deficiency is discussed in Section 4.1.

The sustainable management criteria for chronic lowering of groundwater levels sustainability indicator included in the 2024 Plan substantially complies with the requirements outlined in the GSP Regulations, at this time. Department staff have provided recommended corrective actions for this sustainability indicator in Section 4.1 above which the GSA should consider and address by the next periodic evaluation.

5.3.2.2 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.[316]

The 2024 Plan presents the qualitative definition of undesirable results for the reduction of groundwater storage as "a significant and unreasonable reduction of groundwater in storage that would occur if the volume of groundwater supply is at risk of depletion and is not accessible for beneficial use, or if the Subbasin remains in a condition of long-term overdraft based on projected water use and average hydrologic conditions."[317] The cause of the reduction of groundwater storage in the Subbasin is identified in the 2024 Plan as the result of chronic lowering of groundwater levels from over-pumping primarily in the Non-District Eastern Management Area where surface water is generally not available and groundwater is the primary source of water.[318] The GSAs describe the close relationship between groundwater levels and groundwater storage in the Subbasin and use sustainable management criteria developed for the chronic lowering of groundwater levels as a proxy for the reduction of groundwater storage sustainability indicator (i.e., undesirable results, minimum thresholds, and measurable objectives).[319] Department staff generally agree with this approach. Furthermore, the 2024 Plan defers to the same description of impacts to other sustainability indicators, adjacent Subbasins, and potential impacts to beneficial uses and users as defined in the chronic decline in groundwater level sustainability indicator.

The 2024 Plan acknowledges the requirement in the GSP Regulations to select a volume as the required metric for the reduction of groundwater storage indicator.[320] The GSAs refer to an analysis using C2VSimTM model that demonstrates correlation of established

[315] https://sgma.water.ca.gov/portal/gsp/assessments/85.
[316] 23 CCR § 354.28(c)(2).
[317] 2024 Modesto Subbasin GSP, Table 6-11, p. 349.
[318] 2024 Modesto Subbasin GSP, Section 6.4.1.1, p. 348.
[319] 2024 Modesto Subbasin GSP, Section 6.4, p. 347; Tables 6-11, 6-12 and 6-13, pp. 349, 351 and 354.
[320] 23 CCR § 354.28(c)(2).

minimum threshold groundwater levels for the reduction in groundwater in storage to the Subbasin's estimated sustainable yield of 267,000 acre-feet per year.[321]

Overall, Department staff believe that the use of groundwater levels as a proxy for the reduction of groundwater storage sustainability indicator to be appropriate, as the potential impacts related to reductions of groundwater storage are similar to those described for chronic lowering of groundwater levels.

5.3.2.3 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.[322]

The 2024 Plan explains that the Subbasin aquifers are separated from the Pacific Ocean by the bedrock units of the Coast Ranges and are more than 10 miles upgradient from the edge of the Sacramento-San Joaquin Delta; therefore, it was determined that the Subbasin is not susceptible to seawater intrusion.[323]

Furthermore, the technical team conducted a public presentation to the technical advisory committee in January 2021, and prepared a technical memorandum on March 23, 2021, to assess the applicability of the seawater intrusion sustainability indicator to the Subbasin. At the public meeting the GSAs made the determination by Resolution 2021-1 "that seawater intrusion does not exist and is not likely to occur in the future, and therefore a seawater intrusion sustainability indicator is not applicable in the Modesto Subbasin."[324]

Department staff agree with the GSA's rationale for not setting sustainable management criteria for seawater intrusion in the Subbasin.

5.3.2.4 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. In setting minimum thresholds for degraded water quality, the Agency shall consider local, state, and federal water quality standards applicable to the basin.[325]

[321] 2024 Modesto Subbasin GSP, Section 6.4.2, pp. 350-351.
[322] 23 CCR § 354.28(c)(3).
[323] 2024 Modesto Subbasin GSP, Section 6.5, p. 355.
[324] 2024 Modesto Subbasin GSP, Section 6.5, p. 355.
[325] 23 CCR § 354.28(c)(4).

As discussed in Section 5.2.2, seven primary constituents of concern are identified for the Subbasin including nitrate as N, TDS, arsenic, boron, uranium, gross alpha 1,2-, DBCP, PCE, and TCP. The 2024 Plan defines significant and unreasonable effects of degraded water quality as "indicated by a new (first-time) exceedance of, or further exceedance from, an MCL for a constituent of concern that is caused by GSA projects, management actions, or management of groundwater levels or extractions such that beneficial uses are affected and well owners experience an increase in operational costs."[326] The GSAs identify potential causes of undesirable results from degraded water quality to include impacts to water supply wells and un-impacted aquifers from migration of deeper poor quality water and mobilization of degraded water from drought, implementation of GSP-related projects and management actions, and changes in groundwater pumping affecting horizontal and vertical gradients in the Subbasin.[327]

The 2024 Plan defines the quantitative criteria for when and where undesirable results occur as "when a Subbasin potable water supply well in the defined monitoring network reports a new (first-time) exceedance of an MT [minimum threshold] or an increase in concentration above the MT for a Modesto Subbasin constituent of concern that results in increased operational costs and is caused by GSA management activities".[328] To determine if a new (first-time) exceedance is due to GSP groundwater management, the GSAs explain that an analysis will be conducted considering historical water quality compared to GSA activities (i.e. groundwater levels, extractions, or projects/management actions), coordination will be pursued between local public agencies and member agencies of the GSAs and results of the analysis will be summarized in annual reports.[329] If undesirable results are identified the "GSAs will coordinate with regulatory agencies on options and mitigation measures for water quality impacts."[330]

Potential effects to beneficial uses and users from degraded water quality are described in the 2024 Plan to include impairment of water supply and create considerable operational costs or constraints on public water suppliers.[331] Additionally, there are potential adverse effects to public health and safety if constituents of concern above regulatory levels impact water supply in the Subbasin, and adverse impacts can also occur to agricultural, industrial, and environmental beneficial uses including reduction in crop yields and impacts to groundwater dependent ecosystems.[332]

Department staff note that the GSAs' definition of undesirable results for degraded water quality, which solely focuses on water quality impacts caused directly by the GSAs implementing an action, is incorrect. SGMA includes in its definition of undesirable results the "significant and unreasonable degraded water quality, including the migration of

[326] 2024 Modesto Subbasin GSP, Table 6-14, p. 359.
[327] 2024 Modesto Subbasin GSP, Section 6.6.1.1, pp. 356-358.
[328] 2024 Modesto Subbasin GSP, Table 6-14, p. 359.
[329] 2024 Modesto Subbasin GSP, Section 6.6.1.3, pp. 359-360.
[330] 2024 Modesto Subbasin GSP, Section 6.6.1.3, pp. 359-360.
[331] 2024 Modesto Subbasin GSP, Section 6.6.1.2, p. 358.
[332] 2024 Modesto Subbasin GSP, Section 6.6.1.2, p. 358.

contaminant plumes that impair water supplies."[333] SGMA specifies that the significant and unreasonable effects are those "caused by groundwater conditions occurring throughout the basin," but does not limit them to impacts caused by basin management under a GSP. As currently defined, if for instance, a minimum threshold exceedance occurs because of mobilization of naturally occurring constituents or migration of a contaminant plume to supply wells caused by groundwater pumping, but the GSAs have not implemented any management activities, the GSAs would not identify this as an undesirable result. Department staff consider this to be inconsistent with the intent of SGMA, which requires GSAs to ensure management of groundwater conditions in the Subbasin, including any action taken by the GSAs, will not significantly and unreasonably degrade water quality. Therefore, degraded water quality caused by groundwater pumping, whether the GSAs have implemented management activities or not, should be considered in the assessment of undesirable results in the Subbasin. Department staff recommend the GSAs revise the definition of undesirable results such that groundwater pumping, whether due to action or inaction of the GSAs with respect to Subbasin management, is considered in the undesirable result definition, or the GSAs should explain why it excludes minimum threshold exceedances that may result from unregulated groundwater pumping in the Subbasin in the definition of undesirable results (see Recommended Corrective Action 4a).

The 2024 Plan presents minimum thresholds for each of the seven constituents of concern in the Subbasin consistent with state and federal standards and the Water Quality Control Plan for the Sacramento and San Joaquin River Basins.[334] As discussed in Section 5.2.2, the seven constituents of concern established for the Subbasin were selected based on elevated concentrations over a relatively widespread area of the Subbasin, constituents most likely to affect the Subbasin based on land use, and constituents of concern identified as the most difficult to manage for public water suppliers.[335]

The 2024 Plan explains that since minimum thresholds are set consistent with regulatory levels and minimum thresholds for other applicable sustainability indicators are focused on maintaining groundwater levels at or above the historic low water levels preventing migration of constituents of concern at depth, significant and undesirable results from degraded water quality sustainability management criteria is unlikely to impact other sustainability indicators and adjacent subbasins.[336] Department staff note that this conclusion by the GSAs does not consider Subbasin conditions when groundwater levels at the eastern portion of the Subbasin will be allowed to decline below minimum thresholds for an extended duration during 2027 interim milestones.[337] In response to the Department's Incomplete Determination and as discussed in Section 4.1.2.3, the 2024

[333] Water Code § 10721(x).
[334] 2024 Modesto Subbasin GSP, Table 6-15, p. 360.
[335] 2024 Modesto Subbasin GSP, Section 6.6.2.2, p. 364.
[336] 2024 Modesto Subbasin GSP, Section 6.6.2.2, pp. 364-365.
[337] 2024 Modesto Subbasin GSP, Section 6.3.3, p. 337.

Plan provided additional analysis to evaluate potential impacts to other sustainability indicators including degraded water quality during declining groundwater levels at, and below minimum thresholds.

The 2024 Plan defines measurable objectives in the Subbasin as "the historical maximum concentration of each constituent of concern at each representative monitoring location."[338] The 2024 GSP explains that this target would avoid exacerbation of the nature and extent of current groundwater quality by limiting further degradation of water quality.

The 2024 Plan includes a data set from GeoTracker[339] as an example water quality monitoring network to monitor degraded water quality. The data set provides a summary of information that will be provided in the water quality network table (i.e. well location and type, well ID, which of the seven groundwater quality constituents of concern the well is tracking, and well construction data); however, neither the table nor other parts of the 2024 Plan clearly identify a baseline number of exceedances for each constituent of concern in the Subbasin from which new exceedances can be tracked. Department staff note that all seven constituents of concern have already exceeded MCLs in the Subbasin. Additionally, the 2024 Plan does not provide a discussion comparing their chosen baseline to groundwater quality conditions of January 1, 2015, to identify if undesirable results (defined as any new exceedances) have occurred. While GSAs are not required to address undesirable results that occurred prior to January 1, 2015, GSAs are required to address undesirable results that occur after January 1, 2015. Department staff recommend the GSAs provide the baseline from which the 2024 GSP will be tracking additional exceedances and a rationale for establishing the minimum thresholds for degraded water quality based on those concentrations if the groundwater conditions differ from 2015 data (see Recommended Corrective Action 4b).

Department staff consider the 2024 Plan's sustainable management criteria for degraded water quality to be reasonable and consistent with the GSP Regulations, at this time. Department staff have provided recommended corrective actions for this section which the GSAs should consider and address by the next periodic evaluation.

5.3.2.5 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.[340] 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

[338] 2024 Modesto Subbasin GSP, Table 6-16, p. 369.
[339] 2024 Modesto Subbasin GSP, Appendix H, pp. 982-990.
[340] 23 CCR § 354.28(c)(5).

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.[341]

The GSAs state that there have been no known impacts from inelastic land subsidence in the Subbasin, but the potential for subsidence in the Subbasin exists mainly due to the presence of Corcoran Clay.[342] As discussed in Section 5.2.2 above, only minor subsidence (generally between 0 and 0.15 feet) has been detected by InSAR data in localized areas of the Subbasin outside of the Corcoran Clay which the GSAs attribute to compaction of abundant clay surficial soils and disruption of restrictive layers by agricultural operations. The Corcoran Clay is localized to the western portion of the Subbasin and is defined by the GSAs to be the most susceptible area for subsidence in the Subbasin.[343] The GSAs cite the various causes for land subsidence to occur and state that the 2024 Plan only focuses on land subsidence related to groundwater extraction.[344] The 2024 Plan includes figures illustrating vertical displacement in the San Joaquin Valley between years 2009-2010, and the Subbasin between years 2015-2020.[345]

The 2024 Plan defines significant and unreasonable effects from inelastic land subsidence as "caused by groundwater extraction and associated water level declines, that adversely affects land use or reduces the viability of the use of critical infrastructure" in all principal aquifers.[346] The 2024 Plan explains that sustainable management criteria for chronic lowering of groundwater levels is used as a proxy for the land subsidence sustainability indicator since minimum thresholds were established to arrest groundwater level declines in the Subbasin, and groundwater decline is identified as the cause for undesirable results for land subsidence.[347] The GSAs state the potential cause of land subsidence in the Subbasin is from groundwater decline causing dewatering, depressurization, and compaction of thick and compressible layers such as Corcoran Clay and discuss the potential adverse effects to infrastructure should subsidence occur.[348] The quantitative criteria defining when and where groundwater conditions may cause undesirable results to occur is defined as "when 33 percent of representative monitoring wells exceed the MT [minimum threshold] in three consecutive Fall monitoring events."[349]

Minimum thresholds and measurable objectives are set for land subsidence in the Subbasin consistent with the chronic lowering of groundwater levels sustainability indicator.[350] The 2024 Plan explains that subsidence will be monitored in the Subbasin

[341] 23 CCR §§ 354.28(c)(5)(A-B).
[342] 2024 Modesto Subbasin GSP, Section 6.7, p. 369.
[343] 2024 Modesto Subbasin GSP, Section 6.7.1.1, p. 370.
[344] 2024 Modesto Subbasin GSP, Section 6.7.1, p. 370.
[345] 2024 Modesto Subbasin GSP, Figures 3-59 and 3-60, pp. 218-219.
[346] 2024 Modesto Subbasin GSP, Table 6-17, p. 373.
[347] 2024 Modesto Subbasin GSP, Section 6.7.2.1, p. 374.
[348] 2024 Modesto Subbasin GSP, Section 6.7.1.1, pp. 373-374.
[349] 2024 Modesto Subbasin GSP, Table 6-17, p. 373.
[350] 2024 Modesto Subbasin GSP, Table 6-18, p. 374; Table 6-19, p. 379.

by annual screening of InSAR data and measurement of groundwater levels.[351] The 2024 Plan explains that that if increasing rates of subsidence is indicated by InSAR data, the network will be bolstered by additional monitoring including the installation of GPS stations in targeted areas of the Subbasin and the criteria could also be adjusted to be more protective.[352] Department staff are unclear how the GSAs would adjust sustainable management criteria to be more protective should increasing rates of subsidence be detected in the Subbasin, and recommend the GSAs specify how such criteria may be adjusted in the next periodic evaluation.

Since minimum thresholds for chronic lowering of groundwater levels are being used as a proxy, the potential effect of the established minimum thresholds on other sustainability indicators and adjacent subbasins from land subsidence are the same as those identified for the chronic lowering of groundwater levels sustainability indicator.

The GSP Regulations state that minimum thresholds and measurable objectives for groundwater elevation may be used for multiple sustainable indicators, where an agency can demonstrate that the representative value is a reasonable proxy.[353] While the minimum thresholds for the chronic lowering of groundwater levels were established to arrest groundwater level declines in the Subbasin and groundwater level decline is identified as the cause for land subsidence, the 2024 Plan does not provide an explicit analysis that demonstrates a relationship between groundwater levels and subsidence rates. The 2024 Plan does state that InSAR data would be used for screening purposes to track the rate and extent of land subsidence and that if significant rates of subsidence occur, additional monitoring such as global positioning system stations will be installed. Additionally, the 2024 GSP provides and analysis indicating that the 2027 interim milestones are not expected to contribute to additional subsidence (see Section 4.1.2.3).

Department staff conclude that this section of the 2024 Plan substantially complies with the requirements outlined in the GSP Regulations, at this time.

5.3.2.6 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.[354] 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.[355] 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

[351] 2024 Modesto Subbasin GSP, Section 6.7.1.3, p. 373.
[352] 2024 Modesto Subbasin GSP, Section 6.7.1.3, p. 373.
[353] 23 CCR §§ 354.28(d); 354.30(d)
[354] Water Code § 10721(x)(6).
[355] 23 CCR § 354.16(f).

adversely impact beneficial uses of the surface water and may lead to undesirable results.[356]

The 2024 Plan states that the Tuolumne River, Stanislaus River, and San Joaquin River are all interconnected surface water in the Subbasin.[357] Supplemental surface water supply is received by the Subbasin via diversion from the Tuolumne River and Stanislaus River. Surface water is primarily used to supplement water supply at the western portion of the Subbasin for use as municipal drinking water (City of Modesto), non-potable municipal use, and agricultural operations.[358] The location, timing, and rate of potential depletions of interconnected rivers and the definition of segments of interconnectivity in the Subbasin was evaluated using the integrated surface water-groundwater model C2VSimTM under historical, current, and projected future water conditions.[359]

The 2024 Plan explains that modeling results indicate that continued groundwater decline in the Subbasin is associated with increased streamflow depletion along the Subbasin boundaries and a reduction in Subbasin groundwater in storage. If future groundwater decline is not arrested, projected model simulations indicate that undesirable results may occur in the Subbasin by transitioning the Tuolumne River and Stanislaus River from net gaining to net losing streams, thereby decreasing groundwater flow to streams and increasing recharge to the Subbasin.[360] Additionally, groundwater extraction in the Non-District East Management Area has already intercepted groundwater that would have naturally flowed toward the river boundaries.[361]

The 2024 Plan does not quantify the rate or volume of depletions due to groundwater pumping as the sustainable management criteria for depletions of interconnected surface water. Rather, the 2024 Plan uses groundwater levels as a proxy for the depletions of interconnected surface water. The 2024 Plan states that groundwater level minimum thresholds are used as a proxy for monitoring depletions of interconnected surface water since projections of future streamflow depletion are attributed to declining groundwater levels.[362]

The 2024 Plan defines undesirable results for depletions of interconnected surface water as “significant and unreasonable adverse impacts to the beneficial uses of surface water caused by groundwater extraction.”[363] The potential causes of undesirable results is defined as groundwater extraction in the Non-District Eastern Management Area causing

[356] 23 CCR § 354.28 (c)(6).
[357] 2024 Modesto Subbasin GSP, Section 6.8, p. 379.
[358] 2024 Modesto Subbasin GSP, Section 6.8, p. 379.
[359] 2024 Modesto Subbasin GSP, Section 6.8, p. 379.
[360] 2024 Modesto Subbasin GSP, Section 6.8.1.1, pp. 380-381.
[361] 2024 Modesto Subbasin GSP, Section 6.8.1, p. 380.
[362] 2024 Modesto Subbasin GSP, Section 6.8.2, p. 383.
[363] 2024 Modesto Subbasin GSP, Table 6-20, p. 382.

depletion of baseflow groundwater to the rivers, and groundwater extraction in other parts of the Subbasin and along rivers contributing to streamflow depletion.[364]

The 2024 Plan presents two quantitative definitions for undesirable results in the Subbasin specific to the rivers bordering the Subbasin. The first definition for undesirable results would "occur on either the Tuolumne River or Stanislaus River when 33% of representative monitoring wells for that river exceed the MT [minimum threshold] in three consecutive Fall monitoring events"; and the second definition for undesirable results would "occur on the San Joaquin River when 50% of representative monitoring wells for that river exceed the MT [minimum threshold] in three consecutive Fall monitoring events." [365] Currently, the number of wells and number of minimum threshold exceedances that would trigger an undesirable result are stated in the 2024 Plan as 10 wells (33% - 3 wells) for the Tuolumne River, 8 wells (33% - 3 wells) for the Stanislaus River and 2 wells (50% - 1 well) for the San Joaquin River.[366] The 2024 Plan presents a map showing the location of representative monitoring points for the interconnected water sustainability in the Subbasin.[367] The 2024 GSP acknowledges that an exceedance in only one well may not lead to undesirable results so incorporating additional wells is a priority to improve the monitoring network and is part of projects planned in the Subbasin.[368] Department staff note that the 2024 Plan does not relate depletions of interconnected surface water quantitative undesirable results criteria to the beneficial uses of surface water and recommend that the GSAs provide an analysis to support their definition (see Recommended Corrective Action 5a).

The 2024 Plan briefly describes potential effects to beneficial users, uses, and interests including municipal, agricultural, and/or industrial supply; recreation; freshwater habitat, migration, and spawning; wildlife habitat; and riparian corridors that rely on surface water. Additionally, the GSAs explain that increased release of water during future droughts to meet current downstream flow requirements could reduce the availability of surface water supply to municipal and agricultural beneficial uses.[369]

The 2024 Plan establishes minimum thresholds for the Western Upper Principal Aquifer and the Eastern Principal Aquifer "as the low groundwater elevation observed in Fall 2015 at each representative monitoring location."[370] The 2024 Plan explains that based on model results, 2015 groundwater levels are representative of sustainable yield conditions in the Subbasin when the net losing condition is eliminated and the overall surface water system returns is maintained at a gaining condition.[371]

[364] 2024 Modesto Subbasin GSP, Section 6.8.1.1, pp. 380-381.
[365] 2024 Modesto Subbasin GSP, Table 6-20, p. 382.
[366] 2024 Modesto Subbasin GSP, Section 6.8.1.3, p. 383.
[367] 2024 Modesto Subbasin GSP, Figure 7-5, p. 424.
[368] 2024 Modesto Subbasin GSP, Section 6.8.1.3, p. 383.
[369] 2024 Modesto Subbasin GSP, Section 6.8.1.2, pp. 381-382.
[370] 2024 Modesto Subbasin GSP, Table 6-21, p. 384.
[371] 2024 Modesto Subbasin GSP, Section 6.8.2.1, p. 386.

Measurable objectives are established "at the midpoint between the MT [minimum threshold] and the historical high groundwater elevation at each representative monitoring site" for all principal aquifers.[372]

The 2024 Plan does not identify any adverse effects to other sustainability indicators or adjacent subbasins considering the interconnected surface water sustainability criteria.

The sustainable management criteria for interconnected surface water in the 2024 Plan generally complies with the requirements outlined in 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. Department staff further advise that at this stage in SGMA implementation it is appropriate to approve Plans with recommended corrective actions to address deficiencies related to interconnected surface water depletion where GSAs are still working to fill data gaps related to interconnected surface water and where these data will be used to inform plan components that will be subject to future review. Accordingly, Department staff believe 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 evaluations to the GSP (see Recommended Corrective Action 5b). 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 5c). 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 5d).

[372] 2024 Modesto Subbasin GSP, Table 6-23, p. 390.

5.4 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.[373] Specifically, a monitoring network must be able to monitor impacts to beneficial uses and users,[374] monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds,[375] capture seasonal low and high conditions,[376] include required information such as location and well construction and include maps and tables clearly showing the monitoring site type, location, and frequency.[377] Department staff encourage GSAs to collect monitoring data as specified in the GSP, follow SGMA data and reporting standards,[378] fill data gaps identified in the GSP prior to the first periodic evaluation,[379] update monitoring network information as needed, follow monitoring best management practices,[380] 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 2024 Plan includes monitoring networks for chronic lowering of groundwater levels, reduction of groundwater storage, degraded water quality, land subsidence, and depletions of interconnected surface water sustainability indicators. The monitoring network in the Subbasin consists of CASGEM wells, City of Modesto monitoring wells, USGS monitoring wells and monitoring wells constructed in 2021 with Proposition 68 grant funding from the Department.[381] The 2024 Plan proposes to use the chronic lowering of groundwater levels monitoring network as a proxy for the reduction of groundwater storage and land subsidence sustainability indicator. The 2024 Plan also proposes to use groundwater levels as a proxy to monitor the depletions of interconnected surface water sustainability indicator.

The 2024 Plan explains that the chronic lowering of groundwater levels sustainability indicator will be monitored by a dedicated groundwater level monitoring network

[373] 23 CCR § 354.32.
[374] 23 CCR § 354.34(b)(2).
[375] 23 CCR § 354.34(b)(3).
[376] 23 CCR § 354.34(c)(1)(B).
[377] 23 CCR §§ 354.34(g-h).
[378] 23 CCR § 352.4 *et seq*.
[379] 23 CCR § 354.38(d).
[380] Department of Water Resources, 2016, Best Management Practices and Guidance Documents.
[381] 2024 Modesto Subbasin GSP, Section 7.1, p. 399.

consisting of 61 representative monitoring wells across the three principal aquifers in the Subbasin.[382] The 2024 Plan describes that of the 61 wells, seventeen wells are located in the Western Upper Principal Aquifer, five wells are located in the Western Lower Principal Aquifer, and thirty-nine wells are located in the Eastern Principal Aquifer.[383] Additionally, the GSAs will measure groundwater elevations from 40 SGMA designated wells not associated with a minimum threshold or measurable objective to monitor overall groundwater conditions and support any resultant analyses.[384] The 2024 Plan provides a figure illustrating the spatial distribution of representative wells in each principal aquifer[385] and summary tables for the representative monitoring wells[386] and SGMA wells[387] used to monitor the chronic lowering of groundwater levels sustainability indicator. Based on review of the representative monitoring well summary table and the calculated areal coverage of respective aquifers in the Subbasin, the proposed density of groundwater level monitoring wells exceeds the range (0.2 – 10 wells per 100 square miles) provided by the Department's Best Management Practices.[388]

Representative monitoring wells were chosen based on the availability of well construction data (specifically known screen intervals), spatial distribution, availability of historical data and accessibility. The 2024 Plan states that representative monitoring wells in the Western Upper Principal Aquifer and Western Lower Principal Aquifer and the Eastern Principal Aquifer will be monitored twice a year to assess seasonal high and low groundwater conditions.[389] Additionally, SGMA wells will be measured in a semi-annual basis to monitor overall groundwater conditions in the Eastern Principal Aquifer.[390]

The 2024 Plan recognizes data gaps in the chronic lowering of ground levels monitoring network including an insufficient number of wells to fully evaluate the Eastern Principal Aquifer and Western Lower Principal Aquifer.[391] To address these data gaps, the GSAs committed to a comprehensive assessment of the monitoring network as part of the next periodic evaluation and plan to install additional wells pending funding.[392] Department staff recommend that the GSAs include a description of associated costs, available funding and schedule for monitoring well installation as part of the monitoring well comprehensive assessment in annual reports and the next periodic evaluation. Furthermore, the comprehensive assessment performed by the GSAs should include the

[382] 2024 Modesto Subbasin GSP, Section 7.1.1, pp. 405-410.
[383] 2024 Modesto Subbasin GSP, Sections 7.1.1.1, 7.1.1.2 and 7.1.1.3, pp. 405-410.
[384] 2024 Modesto Subbasin GSP, Section 7.1, p. 405.
[385] 2024 Modesto Subbasin GSP, Figures 7-1 – 7-3, p. 420-422.
[386] 2024 Modesto Subbasin GSP, Figures 7-1, pp. 401-403.
[387] 2024 Modesto Subbasin GSP, Table 7-3, pp. 406-407.
[388] 2024 Modesto Subbasin GSP, Section 7.1.1, p. 405.
[389] 2024 Modesto Subbasin GSP, Section 7.1.1.1–7.1.1.3, pp. 408-410.
[390] 2024 Modesto Subbasin GSP, Section 7.1.1.3, p. 410.
[391] 2024 Modesto Subbasin GSP, Table 3-7, p. 157.
[392] 2024 Modesto Subbasin GSP, 9.5.1, p. 516.

proposed locations and the purpose of proposed monitoring wells consistent with the GSP Regulations.[393]

Since the sustainable management criteria for chronic lowering of groundwater levels will be used as a proxy for the reduction of groundwater in storage sustainability indicator, the same monitoring network will be used which Department staff consider reasonable.[394] The 2024 Plan recognizes that GSP regulations require the GSAs to provide an annual estimation of the change in groundwater in storage.[395] As such, the GSAs provide an estimate of the historical reduction of groundwater in storage at about 43,000 acre-feet per year and commit to provide both the change in groundwater in storage and corresponding water levels in the Subbasin in annual reports.[396]

The 2024 Plan states that seawater intrusion is not applicable to this Subbasin; therefore, no monitoring network is proposed for this sustainability indicator. Department staff agree the sustainability indicator for seawater intrusion is not present in this Subbasin and does not require a monitoring network at this time.

The 2024 Plan states that groundwater quality is assessed in the Subbasin through numerous on-going regulated groundwater quality monitoring programs. The 2024 Plan does not define a definitive monitoring network for degraded water quality the Subbasin, rather provides an explanation that the monitoring network will incorporate hundreds of monitoring sites (i.e., drinking water supply wells, monitoring wells at regulated facilities, and monitoring sites associated with other regulatory water quality programs) utilized in the various groundwater quality monitoring programs for the Subbasin.[397] The 2024 Plan provides an example water quality monitoring network that will be populated for degraded water quality network in future reporting[398] and provides a figure depicting the current distribution of water quality monitoring sites in the Subbasin.[399] The 2024 Plan states that the monitoring network will vary from year-to-year based on regulatory requirements for water quality programs in the Subbasin.[400]

Although the 2024 Plan's approach to use existing monitoring sites to monitor degraded water quality is reasonable, Department staff have concerns with the current distribution of water quality monitoring points in the Subbasin and how the GSAs will evaluate whether the monitoring network is adequate to monitor groundwater quality in the Subbasin, especially when the monitoring well network is proposed to vary annually. Most monitoring points utilized in the existing monitoring programs are associated with municipal drinking water systems which are clustered around the municipalities with poor spatial distribution of monitoring points at the central, eastern and western margin of the

[393] 23 CCR § 354.38(d).
[394] 2024 Modesto Subbasin GSP, Section 7.1.2, p. 411.
[395] 23 CCR § 354.34(c)(2).
[396] 2024 Modesto Subbasin GSP, Section 7.1.2, p 411.
[397] 2024 Modesto Subbasin GSP, Section 7.1.4, p. 411-412.
[398] 2024 Modesto Subbasin GSP, Appendix H, p. 982.
[399] 2024 Modesto Subbasin GSP, Figure 7-4, p. 423.
[400] 2024 Modesto Subbasin GSP, Section 7.1.4, pp. 411-412.

Subbasin.[401] Although this well distribution may be adequate for on-going groundwater quality monitoring programs, the current well distribution may be insufficiently coordinated to assess groundwater quality sustainable management criteria in the Subbasin during Plan implementation.[402] Department staff recommend the GSAs provide an explanation of how the monitoring network with an adequate spatial density of monitoring points for degraded water quality will be developed and implemented to adequately monitor temporal changes in degraded water quality in each principal aquifer consistent with GSP Regulations [403] to assess if undesirable results are occurring (see Recommended Corrective Action 6).

The 2024 Plan identifies groundwater decline as the cause for significant and undesirable results for land subsidence in the Subbasin, thus the 2024 Plan proposes to use groundwater levels as a proxy to monitor land subsidence using the same monitoring network as the chronic lowering of water level sustainability indicator.[404] Static depth to water will be measured twice a year in the monitoring network wells to represent seasonal high and seasonal low groundwater conditions. Additionally, vertical displacement in the Subbasin will be measured annually utilizing InSAR data in conjunction with groundwater level monitoring.[405] The 2024 Plan states that evaluation of InSAR data and groundwater monitoring for land subsidence will be included in annual reports.[406]

The 2024 Plan identifies a dedicated monitoring network of 20 wells to monitor the interconnection of surface water and groundwater along the San Joaquin River, Tuolumne River, and Stanislaus River.[407] Wells in the interconnected surface water monitoring network were chosen based on their proximity to rivers (ranging approximately 0.75 to 2.0 miles away from the river), having known well construction details, monitoring the unconfined water level surface adjacent to the river boundaries and being accessible for future monitoring.[408] Of the 20 wells, two wells are located along the San Joaquin River, eight wells are located along the San Joaquin River and six wells are located along the Tuolumne River.[409] The 2024 Plan provides a map showing the distribution of the monitoring well network for interconnected surface water.[410]

Data collected from the interconnected surface water well network will be supplemented by stream gauge and flow data from the USGS and local entities regarding flows along

[401] 2024 Modesto Subbasin GSP, Figure 7-4, p. 423.
[402] 23 CCR § 354.34(a), 23 CCR § 354.34(f).
[403] 23 CCR § 354.34(c)(4), 23 CCR § 354.36(c); 23 CCR § 354.34(f).
[404] 2024 Modesto Subbasin GSP, Section 7.1.5, p. 412; Figures 7-1 – 7-3, pp. 420-422.
[405] 2024 Modesto Subbasin GSP, Section 7.1.5, p. 413.
[406] 2024 Modesto Subbasin GSP, Section 7.1.5, p. 413.
[407] 2024 Modesto Subbasin GSP, Section 7.1.6, p. 413.
[408] 2024 Modesto Subbasin GSP, Section 7.1.6, p. 413.
[409] 2024 Modesto Subbasin GSP, Sections 7.1.6.1, 7.1.6.2, and 7.1.6.3, pp. 413-415.
[410] 2024 Modesto Subbasin GSP, Figure 7-5, p. 424.

the Stanislaus River and Tuolumne River. Groundwater levels will be measured twice a year (spring and fall) to represent seasonal high and low groundwater conditions.[411]

The 2024 Plan identifies data gaps in the interconnected surface water well network including lack of data along the upstream and downstream portions of the San Joaquin River, upstream and downstream portions of the Stanislaus River, and upstream reach of the Tuolumne River.[412] The GSAs have completed an analysis to identify potential locations of new monitoring wells along the rivers and may seek future grant opportunities to provide funding for the additional well installation[413] and the GSAs will also coordinate with neighboring Subbasin GSAs planning to add additional wells along the shared river boundaries to site and install wells that are capable of generating useful data for shared surface water resources.[414] The 2024 Plan states that until improvements to monitoring network are performed, groundwater monitoring for the interconnected surface water sustainability indictor will be accomplished using representative monitoring wells located relatively close to rivers coupled with stream gage data and ongoing modeling.[415]

Department staff note that although the GSA's have identified potential locations for new monitoring wells to address data gaps for interconnected surface water along rivers, the commitment to addressing these data gaps is currently contingent on availability of future grant opportunities and potential coordinated actions with neighboring Subbasins. Department staff recommend that the GSAs provide the steps that will be taken to fill data gaps before the next five-year assessment[416] and recommend that the GSAs provide an update to demonstrate progress to fill the data gaps for interconnected surface water by the next periodic evaluation.

Department staff note that in the table summarizing the monitoring well network for interconnected surface water there are several wells (Riverbank OID-13, Langdon Merle 241, Jones WID 228, Prop 68, etcetera) that are screened at deep intervals in excess of 200 feet below ground surface.[417] The 2024 GSP does not explain or provide rationale regarding the applicability of data collected from wells screened in deeper zones (exceeding 200 feet below ground surface) to evaluate the interaction between depletions of surface water and groundwater. Department staff recommend that the GSAs provide the rationale how data from wells screened in deeper groundwater zones is applicable to evaluate the interaction between interconnected surface water and groundwater.

The 2024 Plan's descriptions of monitoring networks for the sustainability indicators are supported by the best available information and comply with the requirements outlined in the GSP Regulations; however, Department staff note some items that warrant

[411] 2024 Modesto Subbasin GSP, Sections 7.1.6.1, 7.1.6.2, and 7.1.6.3, pp. 413-415.
[412] 2024 Modesto Subbasin GSP, Sections 7.1.6.1, 7.1.6.2, and 7.1.6.3, pp. 413-415.
[413] 2024 Modesto Subbasin GSP, Section 9.5.1.3, p., 517.
[414] 2024 Modesto Subbasin GSP, Section 9.5.1.3, p., 517.
[415] 2024 Modesto Subbasin GSP, Section 6.8.1, p. 380.
[416] 23 CCR § 354.38 (d).
[417] 2024 Modesto Subbasin GSP, Table 7-2, p. 404.

recommended corrective action. Department staff recommend that the GSAs address the recommended corrective action by the next periodic evaluation.

5.5 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.[418] 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.[419]

The 2024 Plan states that to achieve Subbasin sustainability implementation of projects and management actions are necessary to arrest groundwater decline and maintain sustainable groundwater conditions. The GSAs propose thirteen projects and seven management actions to be considered or implemented using an adaptive management approach.[420] The 2024 Plan provides a description and prioritization of the proposed projects and management actions,[421] details regarding the implementation process, expected benefits and an estimated implementation schedule.[422] As discussed above in Section 4.2, as part of the GSAs' response to the Department's Incomplete Determination the GSAs have made substantial progress to direct and in-lieu recharge projects in the Subbasin and commit to develop and implement management actions in accordance with a signed Resolution.[423]

The thirteen projects in the 2024 Plan are categorized into Groups 1-3 based on project status. Group 1 projects focus on four urban and municipal projects. Three of the four Group 1 projects are currently in place with plans for expansion that provide the Subbasin with in-lieu recharge from increased surface water purchase from expansion of the Modesto Regional Water Treatment Plant,[424] installation of smart meters to support water reduction goals,[425] and capture and increase infiltration of stormwater to the Subbasin.[426] The fourth Group 1 project is still in conceptual phase, and is anticipated to provide additional in-lieu recharge to the Subbasin by increasing surface water use from connection and upgrades to the City of Waterford's water supply system to Modesto Irrigation Districts water treatment plant and potable surface water supply system.[427]

[418] 23 CCR § 354.44 (a).
[419] 23 CCR § 354.44 (b) *et seq.*
[420] 2024 Modesto Subbasin GSP, Section 8.0, p. 425.
[421] 2024 Modesto Subbasin GSP, Section 8.0, p. 425, Tables 8-1 and 8-2 pp. 428 and 450.
[422] 2024 Modesto Subbasin GSP, Figure 9-1, p. 507.
[423] 2024 Modesto Subbasin GSP, Appendix C, p. 607.
[424] 2024 Modesto Subbasin GSP, Section 8.3.1.1, pp. 452-455.
[425] 2024 Modesto Subbasin GSP, Section 8.3.1.2, pp. 455-457.
[426] 2024 Modesto Subbasin GSP, Section 8.3.1.3, pp. 457-461.
[427] 2024 Modesto Subbasin GSP, Section 8.3.1.4.1, p. 461.

Group 2 projects include two in-lieu and direct recharge projects in early implementation phase that will provide recharge to the Subbasin during the growing season, and two flood mitigation projects in conceptual phase anticipated to provide direct recharge to the Subbasin during the non-growing season. These projects are discussed above in Section 4.2.2.1.

Group 3 projects include five supplemental projects in the early conceptual or planning stages and the GSAs will continue assessing their feasibility to support local goals for the Subbasin.[428] Due to the great deal of uncertainty and limited information for these projects Department staff is not able review these projects at this time.

The 2024 Plan presents seven management actions organized into two categories including Pumping Management Framework and Demand Reduction Strategies and a Dry Well Mitigation Plan.[429] Details are discussed above in in Section 4.1.2.2 and Section 4.2.2.1 above.

Overall, the 2024 Plan presents a reasonable discussion of how projects and management actions are anticipated to mitigate overdraft and ultimately achieve and maintain Subbasin sustainability in a manner that complies with the GSP Regulations. Although the GSAs have demonstrated progress to projects and management actions in the Subbasin, Department staff note that many projects and management actions are still in conceptual and developmental phases and the effectiveness of proposed projects and management actions to arrest groundwater decline in the Subbasin will need to be supported by quantitative data demonstrating progress toward Subbasin sustainability goals. Department staff will look to detailed updates in annual reports and periodic evaluations to continue to evaluate the effectiveness of the 2024 Plan's approach.

5.6 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."[430] 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.[431]

The Subbasin has three adjacent Subbasins including the Turlock Subbasin south of the Tuolumne River, the Delta-Mendota Subbasin west of the San Joaquin River, and the Eastern San Joaquin Subbasin north of the Stanislaus River.[432] Of these subbasins, the Delta-Mendota and Eastern San Joaquin Subbasins are listed by the Department as being critically overdrafted, and the Turlock Subbasin is designated as a high priority

[428] 2024 Modesto Subbasin GSP, Section 8.2, p. 449.
[429] 2024 Modesto Subbasin GSP, Table 8-1, p. 428.
[430] Water Code § 10733(c).
[431] 23 CCR § 354.28(b)(3).
[432] 2024 Modesto Subbasin GSP, Figure 2-1, p. 92.

Subbasin. The 2024 Plan discusses a cross-basin relationship between some STRGBA GSA members that also provide water to adjacent Subbasins and serve GSAs outside the Subbasin. The GSAs explain that this facilitates a cooperative and coordinated approach to GSP development and implementation through meetings and shared analysis in the northern San Joaquin Valley.[433] The Subbasin is hydraulically connected with the adjacent subbasins along shared boundaries of the Stanislaus River, Tuolumne River and San Joaquin River.[434] Hydrologic flows between the Subbasin and adjacent subbasins were considered in water budget and sustainable yield estimates in the 2024 Plan.[435]

The 2024 Plan evaluates potential impacts from sustainable management criteria established for sustainability indicators in the Subbasin to adjacent subbasins. The GSAs explain that because of technical similarities between the subbasins including delineation of similar principal aquifers, establishment of minimum thresholds in a similar manner, shared interconnected surface water along rivers, and multiple GSA member agencies that overlap the Subbasin and adjacent subbasins, sustainable management criteria in the Subbasin is not expected to either cause undesirable results or adversely impact GSP implementation in adjacent subbasins.[436]

As part of the Modesto Subbasin Communication and Engagement Plan the 2024 Plan discusses inter- and intra-Basin Coordination with neighboring Subbasins.[437] The 2024 Plan commits to hosting at least one semi-annual inter-basin coordination meeting with the Eastern San Joaquin Subbasin and Delta-Mendota Subbasin to discuss inter-basin boundary flows and other regional issues of concern. Furthermore, the Subbasin commits to continuing inter-basin coordination meetings with the Turlock Subbasin GSAs to ensure consistent analyses along the shared Tuolumne River boundary and intend to continue coordinate outreach efforts to stakeholders near the Modesto-Turlock Subbasins boundary.

Department staff conclude that based on the information provided by the 2024 Plan, it is unlikely that Plan implementation in the Subbasin will adversely affect adjacent subbasin sustainability or their ability to implement their respective GSP to achieve their sustainability goals.

5.7 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.[438]

[433] 2024 Modesto Subbasin GSP, Section 1.1.1, p. 49.
[434] 2024 Modesto Subbasin GSP, Section 2.0, p. 54.
[435] 2024 Modesto Subbasin GSP, Section 5.1.4, p. 249.
[436] 2024 Modesto Subbasin GSP, Section 6.3.2.3, p. 333.
[437] 2024 Modesto Subbasin GSP, Appendix F, p. 881.
[438] 23 CCR § 354.18.

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

6 STAFF RECOMMENDATION

Department staff believe sufficient action has been taken by the GSAs to address the deficiencies identified. Department staff recommend **APPROVAL** of the Plan with the required and recommended corrective actions listed below. The Plan conforms with Water Code Sections 10727.2 and 10727.4 of SGMA and substantially complies with the GSP Regulations. Implementation of the Plan will likely achieve the sustainability goal for the Modesto Subbasin. The GSAs have identified several areas for improvement of its 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 GSA for the first periodic evaluation of its 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

Department staff recommend the GSAs address the following recommendations related to the chronic lowering of groundwater levels sustainability indicator:

a) Refine the well impact analysis with a detailed assessment of impacts to water well types such as domestic, public water supply, irrigation, and others as necessary in continued consideration of groundwater beneficial uses and users.[439]

b) Revise the GSP to include a discussion of potential effects on environmental users from the temporary lowering of groundwater levels below minimum thresholds. In the assessment, the GSAs also need to consider effects on groundwater dependent ecosystems.

RECOMMENDED CORRECTIVE ACTION 2

Department staff recommend the GSAs provide sufficiently detailed supporting information so that it will be evident to Department staff that the GSAs' implementation of projects and management actions continues to be feasible and likely to prevent undesirable results.[440] In annual reports and in the next periodic evaluation, the GSAs should report the progress and challenges on projects and management actions. The GSAs should describe whether projects and management actions are being implemented as anticipated and if additional efforts or measures will be necessary. Specifically, the GSAs should:

[439] 23 CCR §§ 355.4(b)(4).
[440] 23 CCR § 355.4(b)(5).

a) Provide more information in future annual reports and the periodic evaluation of the Plan regarding water deliveries or demand reduction efforts in the Non-District East management area.

b) Develop, implement, and provide updates on the Pumping Management Framework and Demand Reduction Strategies to mitigate overdraft and quantify the benefits of their efforts in the Subbasin to mitigate overdraft.[441]

RECOMMENDED CORRECTIVE ACTION 3

Department staff recommend the GSAs address the following related to the hydrogeologic conceptual model:

a) Identify the primary use of each principal aquifer in the Subbasin using best available data, along with a discussion of uncertainty as required.[442]

b) Provide a discussion and implementation schedule of how and when data gaps will be addressed in the Subbasin hydrogeologic conceptual model to further evaluate hydrological properties of the Eastern Principal Aquifer, characterize the top of the Mehrten Formation in deeper portions of the Western Lower Principal Aquifer, and confirm the base of fresh water in the Subbasin.[443]

RECOMMENDED CORRECTIVE ACTION 4

Department staff recommend the GSAs address the following related to the degraded water quality sustainability indicator:

a) Revise the definition of undesirable results for degraded water quality so that exceedances of minimum thresholds caused by groundwater extraction, whether due to action or inaction of the GSAs with respect to Subbasin management, are considered in the undesirable result definition; or the GSAs should explain why they exclude minimum threshold exceedances that may result from unmanaged groundwater pumping in the Subbasin, in the definition of undesirable results.

b) Provide an explanation to clearly identify a baseline number of exceedances for each constituent of concern in the Subbasin from which new exceedances can be tracked and the rationale for establishing the minimum thresholds for degraded water quality based on those concentrations if the conditions differ from 2015 data.

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

[441] 23 CCR § 354.44(b)(2).
[442] 23 CCR § 354.14(b)(4)(E).
[443] 23 CCR § 354.14(b)(5).

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:

a) Provide details that relate depletions of interconnected surface waters undesirable results quantitative criteria to beneficial uses of surface water. This may include an analysis of impacts to surface water beneficial uses from the proposed depletions of interconnected surface water undesirable results criteria.

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

c) 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.

d) 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

Provide the location and monitoring frequency of each monitoring site, intended principal aquifer to be monitored by each monitoring site, a discussion of the adequacy of monitoring in areas of the Subbasin where there are currently a poor distribution of wells (i.e., the central, eastern and western margin of the Subbasin), and constituents of concern to be targeted for each degraded groundwater quality monitoring well.[444] If the monitoring network will vary from year-to-year as proposed in the 2024 Plan, the GSAs should provide the above information in annual reports and periodic evaluations, along with the rationale why annual changes were made to the monitoring well network.

[444] 23 CCR § 354.34(c)(4), 23 CCR § 354.36(c); 23 CCR § 354.34(f).