Appendix 1.A. DWR Recommended Corrective Actions and Corresponding Revisions to Plan Elements (§356.4(i))

Appendix 1.A.1. DWR 2023 Revised Plan Approval Letter: Approved Determination of the Revised Groundwater Sustainability Plans Submitted for the San Joaquin Valley – Madera Subbasin

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

December 21, 2023

John Davids
Madera Point of Contact
1772 Picasso Avenue, Suite A
Davis, CA 95618
john@davidsengineering.com

RE: Approved Determination of the Revised Groundwater Sustainability Plans Submitted for the San Joaquin Valley – Madera Subbasin

Dear John Davids,

The Department of Water Resources (Department) has evaluated the four groundwater sustainability plans (GSPs) submitted for the San Joaquin Valley – Madera Subbasin (Subbasin), as well as the materials considered to be part of the required coordination agreement. Collectively, the four GSPs and the coordination agreement are referred to as the Plan for the Subbasin. The Department has evaluated the resubmitted Plan for the Madera Subbasin in response to the Department's incomplete determination on September 22, 2022, and has determined the Plan 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 Plan has taken sufficient action to correct deficiencies identified by the Department and satisfies the objectives of the Sustainable Groundwater Management Act (SGMA) and substantially complies with the GSP Regulations. The Staff Report also proposes recommended corrective actions that the Department believes will enhance the GSP and facilitate future evaluation by the Department. The Department strongly encourages the recommended corrective actions be given due consideration and suggests incorporating all resulting changes to the GSP in future updates.

Recognizing SGMA sets a long-term horizon for groundwater sustainability agencies (GSAs) to achieve their basin sustainability goals, monitoring progress is fundamental for successful implementation. GSAs are required to evaluate their GSPs at least every five years and whenever the Plan is amended, and to provide a written assessment to the Department. Accordingly, the Department will evaluate approved GSPs and issue an assessment at least every five years. The Department will initiate the first periodic review of the Plan no later than January 31, 2025.

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 – Madera Subbasin Groundwater Sustainability Plans (December 21, 2023)

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

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

The Department of Water Resources (Department) is required to evaluate whether a submitted groundwater sustainability plan (GSP or Plan) conforms to specific requirements of the Sustainable Groundwater Management Act (SGMA or Act), is likely to achieve the sustainability goal for the basin covered by the Plan, and whether the Plan adversely affects the ability of an adjacent basin to implement its GSP or impedes achievement of sustainability goals in an adjacent basin. (Water Code § 10733.) The Department is directed to issue an assessment of the Plan within two years of its submission. (Water Code § 10733.4.) If a Plan is determined to be Incomplete, the Department identifies deficiencies that preclude approval of the Plan and identifies corrective actions required to make the Plan compliant with SGMA and the GSP Regulations. The groundwater sustainability agency (GSA) has up to 180 days from the date the Department issues its assessment to make the necessary corrections and submit a revised Plan. (23 CCR § 355.2(e)(2)). This Statement of Findings explains the Department's decision regarding the revised Plan submitted by the City of Madera GSA, Madera County GSA, Madera Irrigation District GSA, Madera Water District GSA, Gravelly Ford Water District GSA, New Stone Water District GSA, and Root Creek Water District GSA (GSAs or Agencies) for the San Joaquin Valley – Madera Subbasin (No. 5-022.06) (Subbasin) on March 21, 2023 (2023 Plan).

Department management has discussed the 2023 Plan with staff and has reviewed the Department Staff Report, entitled Sustainable Groundwater Management Program Groundwater Sustainability Plan Assessment Staff Report, attached as Exhibit A, recommending approval of the 2023 Plan. Department management is satisfied that staff have conducted a thorough evaluation and assessment of the 2023 Plan and concurs with staff's recommendation and all the recommended corrective actions. The Department therefore **APPROVES** the 2023 Plan and makes the following findings:

A. The initial Plan for the basin submitted by the GSAs for the Department's evaluation on January 31, 2020 (2020 GSP or 2020 Plan) was determined by Department staff to satisfy the preliminary requirements for Plan review as outlined in § 355.4(a) of the GSP Regulations (23 CCR § 350 et seq.), and Department Staff therefore evaluated the initial Plan.

B. On September 22, 2022, the Department issued a Staff Report and Findings determining the initial 2020 GSP submitted by the Agencies for the basin to be incomplete because the 2020 Plan did not satisfy the requirements of

SGMA, nor did it substantially comply with the GSP Regulations. At that time, the Department provided corrective actions in the Staff Report that were intended to address the deficiencies that precluded approval. Consistent with the GSP Regulations, the Department provided the Agencies with up to 180 days to address the deficiencies detailed in the Staff Report. On March 21, 2023, within the 180 days provided to remedy the deficiencies identified in the Staff Report related to the Department's initial incomplete determination, the Agencies resubmitted a revised Plan to the Department for evaluation.

When evaluating a revised Plan that was initially determined to be incomplete, the Department reviews the materials (e.g., revised or amended Plan) that were submitted within the 180-day deadline and does not review or rely on materials that were submitted to the Department by the GSAs after the resubmission deadline. Part of the Department's review focuses on how the Agencies have addressed the previously identified deficiencies that precluded approval of the initially submitted Plan. The Department shall find a Plan previously determined to be incomplete to be inadequate if, after consultation with the State Water Resources Control Board, the Agencies have not taken sufficient actions to correct the deficiencies previously identified by the Department. (23 CCR § 355.2(e)(3)(C).) If the Department determines the Agencies have 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.

C. The Department's initial Staff Report identified the deficiencies that precluded approval of the initially submitted 2020 Plan. After staff's thorough evaluation of the revised 2023 Plan, the Department makes the following findings regarding the sufficiency of the actions taken by the Agencies to address those deficiencies:

   1. Deficiency 1: The corrective action advised the Agencies to modify several aspects of their respective GSPs to substantially comply with the GSP Regulations in a coordinated manner. The Department found that the initial GSPs did not sufficiently coordinate on data and methodologies, including coordination of the sustainability goal, water budget and sustainable yield, and undesirable results as required by SGMA and the GSP Regulations. The Department also determined that the 2020 Plan's definition of an undesirable result for the chronic lowering of groundwater levels was not consistent with the requirements of SGMA.

The 2023 Staff Report indicates that the Agencies have taken sufficient actions to correct this deficiency, and it should no longer materially affect the ability of the Agencies to achieve sustainability and the ability of the Department to evaluate the likelihood of the 2023 Plan to achieve sustainability.

2. Deficiency 2: The corrective action advised the Agencies to address several aspects of the 2020 Plan's disclosure, discussion, and analyses of groundwater level sustainable management criteria and potential impacts to groundwater users and uses. The initial 2020 Plan did not establish undesirable results and minimum thresholds for chronic lowering of groundwater levels in a manner substantially compliant with the GSP Regulations. Additionally, the Department found that the Plan did not present sufficient analysis of the effects of minimum thresholds on beneficial uses and users of groundwater in the Subbasin.

   The 2023 Staff Report indicates that the Agencies have taken sufficient actions to correct this deficiency, and it should no longer materially affect the ability of the Agencies to achieve sustainability and the ability of the Department to evaluate the likelihood of the 2023 Plan to achieve sustainability.

3. Deficiency 3: The corrective action advised the Agencies to address several aspects of the 2020 Plan's disclosure, discussion, and analyses of land subsidence sustainable management criteria and potential impacts to groundwater users and uses. The initial Plan did not establish sustainable management criteria for subsidence. The Department determined that the GSAs did not sufficiently demonstrate that undesirable results related to land subsidence are not present and are not likely to occur in the Subbasin.

   The 2023 Staff Report indicates that the Agencies have taken sufficient actions to correct this deficiency, and it should no longer materially affect the ability of the Agencies to achieve sustainability and the ability of the Department to evaluate the likelihood of the 2023 Plan to achieve sustainability.

4. Deficiency 4: The corrective action advised the Agencies to address several aspects of the 2020 Plan's disclosure, discussion, and analyses of interconnected surface water sustainable management criteria and potential impacts to groundwater users and uses. The initial 2020 Plan did not establish sustainable management criteria for interconnected surface water. The Department determined that the GSAs do not sufficiently demonstrate that interconnected surface

water or undesirable results related to depletions of interconnected surface water are not present and are not likely to occur in the Subbasin.

The 2023 Staff Report indicates that the Agencies have taken sufficient actions to correct this deficiency, and it should no longer materially affect the ability of the Agencies to achieve sustainability and the ability of the Department to evaluate the likelihood of the 2023 Plan to achieve sustainability.

D. The 2023 Plan satisfies the required conditions as outlined in § 355.4(a) of the GSP Regulations (23 CCR § 350 et seq.):

1. The 2020 Plan was submitted within the statutory deadline of January 31, 2022 (Water Code § 10720.7(a); 23 CCR § 355.4(a)(1)), and the 2023 Plan was submitted within 180 days of the Department's Incomplete determination (23 CCR § 355.2(e)(2)).

2. The 2023 Plan is complete, meaning it generally appeared to include the information required by the Act and the GSP Regulations sufficient to warrant a thorough evaluation and issuance of an assessment by the Department. (23 CCR § 355.4(a)(2).)

3. The 2023 Plan, either on its own or in coordination with other Plans, covers the entire Subbasin. (23 CCR § 355.4(a)(3).)

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

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

F. In making these findings and Plan determination, the Department also recognized that: (1) it 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 with 20 years of implementation to achieve the sustainability goal in a Subbasin (with the possibility that the Department may grant GSAs an additional five years upon request if the GSA has made satisfactory progress toward sustainability); and, (4) local agencies acting as GSAs are authorized, but not required, to address undesirable results that occurred prior to enactment of SGMA. (Water Code §§ 10721(r); 10727.2(b); 10733(a); 10733.8.)

G. The 2023 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 2023 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 2023 Plan's goal to implement a package of projects and management actions that will, by 2040, balance long-term groundwater system inflows and outflows based on a 50-year period representative of average historical hydrologic conditions are sufficiently justified and explained. The 2023 Plan relies on credible information and science to quantify the groundwater conditions that the Plan seeks to avoid and provides an objective way to determine whether the Subbasin is being managed sustainably in accordance with SGMA. (23 CCR § 355.4(b)(1).)

2. The 2023 Plan demonstrates an understanding of where data gaps exist and has identified areas for improvement of its Plan, including addressing data gaps related to land subsidence and interconnected surface water, refining water budgets, incorporating new information

into the numerical model, and expanding monitoring networks. (23 CCR § 355.4(b)(2).)

3. The projects and management actions proposed are designed to meet interim milestones and bring groundwater levels back up to minimum thresholds, mitigate overdraft, and operate the Subbasin sustainably. 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. (23 CCR § 355.4(b)(3).)

4. The 2023 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 wells, would be impacted by the chosen minimum thresholds. (23 CCR § 355.4(b)(4).)

5. The 2023 Plan's projects and management actions appear feasible at this time and appear likely to prevent undesirable results and ensure 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. (23 CCR § 355.4(b)(5).)

6. The 2023 Plan includes a reasonable assessment of overdraft conditions and includes reasonable means to mitigate overdraft. (23 CCR § 355.4(b)(6).)

7. At this time, it does not appear that the 2023 Plan will adversely affect the ability of an adjacent basin to implement its GSP or impede achievement of sustainability goals in an adjacent basin. The Plan states that the Subbasin's GSAs have met with GSAs in adjacent basins to share data and information to ensure that the implementation of the GSPs will not interfere with neighboring basins. The Plan also qualitatively describes how minimum thresholds and measurable objectives may affect an adjacent basin, concluding that the Madera Subbasin Plan will not hinder the ability of an adjacent basin to be sustainable; however, the evaluation is provided without specifics. (23 CCR § 355.4(b)(7).)

8. A satisfactory coordination agreement has been adopted by all relevant parties. (23 CCR § 355.4(b)(8).)

9. The City of Madera GSA, Madera County GSA, Madera Irrigation District GSA, Madera Water District GSA, Gravelly Ford Water District GSA, New Stone Water District GSA, and Root Creek Water District GSA have historically had a role in water planning and management in the Subbasin. The seven GSAs' history of groundwater management provide a reasonable level of confidence that the GSAs have the legal authority and financial resources necessary to implement the 2023 Plan. (23 CCR § 355.4(b)(9).)

10. Through review of the 2023 Plan and consideration of public comments, the Department determines that the GSAs adequately responded to comments that raised credible technical or policy issues with the Plan, sufficient to warrant approval of the Plan at this time. The Department also notes that the recommended corrective actions included in the Staff Report are important to addressing certain technical or policy issues that were raised and, if not addressed before future, subsequent plan evaluations, may preclude approval of the Plan in those future evaluations. (23 CCR § 355.4(b)(10).)

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

1. The 2023 Plan provides an analysis that documents the expected location and quantity of domestic wells that will experience undesirable results during the GSP implementation period based on future modeled groundwater conditions. Additionally, the Plan describes a domestic well mitigation program that the GSAs will implement to provide assistance to domestic and municipal wells adversely impacted by declining groundwater levels that have occurred since 2015. The Plan describes that the cost of mitigating domestic wells due to lowering groundwater levels is shown to be economically preferable to the costs associated with immediately stabilizing groundwater levels and the resulting impact to the local economy. The Plan's compliance with the requirements of SGMA and substantial compliance with the GSP Regulations supports the state policy regarding the human right to water (Water Code § 106.3). The Department developed its GSP Regulations consistent with and intending to further the policy through implementation of SGMA and the Regulations, primarily by achieving sustainable groundwater management in a basin. By ensuring substantial compliance with the GSP Regulations, the Department has considered the state policy

regarding the human right to water in its evaluation of the Plan. (23 CCR § 350.4(g).)

2. The 2023 Plan acknowledges and identifies interconnected surface waters within the Subbasin. The GSAs propose interim 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 updates to the Plan should aim to improve the initial sustainable management criteria as more information and improved methodology becomes available.

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

Accordingly, the revised 2023 Plan submitted by the Agencies for the San Joaquin Valley – Madera Subbasin is hereby **APPROVED.** The recommended corrective actions identified in the Staff Report will assist the Department's future review of the Plan's implementation for consistency with SGMA and the Department therefore recommends the Agencies address them by the time of the Department's periodic review, which is set to begin on January 31, 2025, 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: December 21, 2023

Exhibit A: Groundwater Sustainability Plan Assessment Staff Report – San Joaquin Valley – Madera Subbasin (December 21, 2023)

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

Groundwater Basin Name:	San Joaquin Valley - Madera Subbasin (No. 5-022.06)
Number of GSPs:	4 (see list below)
Number of GSAs:	7 (see list below)
Submittal Type:	Revised Plan in response to Incomplete Determination
Submittal Date:	March 21, 2023
Recommendation:	Approve
Date:	December 21, 2023

On March 21, 2023, multiple groundwater sustainability agencies (GSAs) resubmitted multiple groundwater sustainability plans (GSPs) for the entire Madera Subbasin (Subbasin), which are coordinated pursuant to a required coordination agreement, to the Department of Water Resources (Department) in response to the Department's incomplete determination on September 22, 2022[1] for evaluation and assessment as required by the Sustainable Groundwater Management Act (SGMA) [2] and GSP Regulations.[3] In total, four GSPs have been revised and implemented by seven GSAs. Collectively, all GSPs and the Coordination Agreement are, for evaluation and assessment purposes, treated and referred to as the Plan for the Subbasin. Individually, the GSPs include the following:

- *Gravelly Ford Water District Groundwater Sustainability Plan (Gravelly Ford GSP)* – prepared by the Gravelly Ford Water District GSA.
- *Joint Groundwater Sustainability Plan (Joint GSP)* – prepared jointly by the City of Madera GSA, Madera County GSA, Madera Irrigation District GSA, and Madera Water District GSA.
- *New Stone Water District Groundwater Sustainability Agency Groundwater Sustainability Plan (New Stone GSP)* – prepared by the New Stone Water District GSA.

[1] Water Code § 10733.4(b); 23 CCR § 355.4(a)(4). https://sgma.water.ca.gov/portal/service/gspdocument/download/9363; Water Code § 10733.4(b); 23 CCR § 355.4(a)(4).
[2] Water Code § 10720 *et seq*.
[3] 23 CCR § 350 *et seq*.

- *Root Creek Water District Groundwater Sustainability Agency Groundwater Sustainability Plan (Root Creek GSP)* – prepared by the Root Creek Water District GSA.

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 recommended corrective actions which will be required to be addressed by the Plan's next periodic evaluation.

Overall, Department staff believe the 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 Plan, and proposes a set of projects and management actions that, if successfully implemented, are likely achieve the sustainability goal defined for the Subbasin.[4] Department staff will continue to monitor and evaluate the Subbasin's progress toward achieving the sustainability goal through Annual Reports and future Periodic Evaluations of the GSP and its implementation.

Based on the reevaluation of the Plan, Department staff recommend the Plan be approved.

This assessment includes six sections:

- **Section 1 – Summary:** Provides an overview of the Department Staff's assessment and recommendations.
- **Section 2 – Evaluation Criteria:** Describes the legislative requirements and the Department's evaluation criteria.
- **Section 3 – Required Conditions:** Describes the submission requirements of a response to an incomplete determination to be evaluated by the Department.
- **Section 4 – Deficiency Evaluation:** Provides an assessment of whether and how the contents included in the GSP submittal 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 Plan and any recommended corrective actions.

[4] 23 CCR § 354.24.

1 SUMMARY

Department staff recommend approval of the Plan for the Madera Subbasin and have recommended corrective actions designed to address shortcomings of the Plan described in this Staff Report. In the evaluation of the Plan, Department staff concluded that sufficient action was taken to correct the deficiencies; however, Department staff have provided recommended corrective actions which will be required to be address by the Plan's next periodic evaluation.

The GSA has identified areas for improvement of its Plan (e.g., addressing data gaps related to land subsidence and interconnected surface water, refining water budgets, incorporating new information into the numerical model, and expanding monitoring networks). Department staff concur that those items are important and recommend the GSA address them as soon as possible. As mentioned, Department staff have also identified additional recommended corrective actions that the GSA should consider for the next periodic evaluation of the Plan or sooner (see Section 6). 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. Providing a detailed explanation specifically discussing and identifying Madera Irrigation District GSA's legal, contractual, or other authorities or arrangements to implement its obligations under the Joint GSP in the next periodic evaluation.
2. Continuing efforts to further coordinate the GSPs and groundwater management.
3. Sufficiently describing the effect of chronic lowering of groundwater level interim milestones on other sustainability indicators.
4. Reevaluating the quantitative metrics that constitute undesirable results due to land subsidence and sufficiently describing the effect and extent of land subsidence interim milestones that allow continued subsidence during the GSP implementation period.
5. Describing data gaps in the hydrogeologic conceptual model.
6. Sufficiently detailing the degraded water quality undesirable results and explaining the rationale to allow potential further degradation.

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 update 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 is a revision of the 2020 Plan, which was evaluated by the Department and found to be incomplete. An incomplete Plan is one which Department staff identify as containing one or more deficiencies that preclude its initial approval. Deficiencies may result from supporting information that is insufficiently detailed or analyses that are insufficiently thorough or unreasonable, or where Department staff determine it is unlikely the GSAs in the basin could achieve the sustainability goal under the proposed Plan. 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 revised or amended Plan, subsequent to the initial Plan being found 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

[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*.

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]

The recommendation to approve a Plan previously determined to be incomplete is based on a determination that the GSAs have taken sufficient actions (e.g., amended or revised the Plan) to correct the deficiencies previously identified by the Department that precluded earlier approval.

3 REQUIRED CONDITIONS

For a Plan that the Department determines to be incomplete, the Department identifies corrective actions to address those deficiencies that preclude approval of the Plan as initially submitted. The GSAs in a basin, whether developing a single GSP covering the basin or multiple GSPs, must attempt to address those corrective actions within the time provided, not to exceed 180 days, for the Plan to be evaluated by the Department.

3.1 INCOMPLETE RESUBMITTAL

GSP Regulations specify that the Department shall evaluate a resubmitted GSP in which the GSAs have taken corrective actions within 180 days from the date the Department issued an incomplete determination to address deficiencies.[18]

The Department issued the incomplete determination on September 22, 2022. The GSAs resubmitted their individual GSPs and the Coordination Agreement on March 21, 2023 in compliance with the 180 day deadline. However, the Madera Irrigation District GSA (MID GSA) did not adopt a resolution approving and/or adopting the Revised Joint GSP, which was prepared jointly by MID GSA, the City of Madera GSA, Madera County GSA, and Madera Water District GSA. However, MID GSA did approve the related Coordination Agreement.

MID GSA's failure to adopt the Revised Joint GSP concerned Department staff. Accordingly, on April 6, 2023, the Sustainable Groundwater Management Office sent a letter seeking clarification from MID GSA regarding its failure to adopt the Revised Joint GSP. The MID GSA responded by letter dated April 21, 2023, confirming that "the MID GSA has not and does not intend to adopt the Revised Joint GSP," stating that "MID GSA has determined the Revised Joint GSP is inadequate," and explaining that "the MID GSA cannot adopt the Revised Joint GSP without substantial revision." At the same time, the letter indicated that "[t]he lack of action on the Revised Joint GSP was not due to any intention on the part of MID GSA to avoid its implementation of the Revised Joint GSP," and vowed that "MID GSA will continue to fully implement its own obligations under the Revised Joint GSP."

[17] 23 CCR § 355.4(b).
[18] 23 CCR § 355.4(a)(4).

MID GSA's refusal to adopt the Revised Joint GSP, but its apparent intent to implement its obligations under the Revised Joint GSP, creates a level of inconsistency and uncertainty regarding Plan implementation that continues to concern staff. SGMA provides that a GSA may exercise any of the powers granted by SGMA if the GSA adopts and submits a Plan to the Department. Because of MID GSA's failure to adopt the Revised Joint GSP, it is unclear whether MID GSA has the necessary powers and authorities to implement its obligations under the Revised Joint GSP. In its previous letter, MID GSA claimed it would implement the Plan, but did not provide specific references to existing, non-SGMA authorities granting it the powers to implement the Revised Joint GSP or otherwise explaining how it retained SGMA authorities to do so, or identifying other agreements or entities that had the power and would implement those aspects of the Revised Joint GSP. Without an understanding of these issues, Department staff remain concerned that overall SGMA implementation in the Subbasin may be infeasible or delayed as a result of MID GSA's failure to adopt the Revised Joint GSP. However, Department staff do not believe this issue precludes an approval recommendation at this time, because various components of the overall Subbasin Plan have been and continue to be implemented and staff is not aware of any existing impediment or delay in implementation caused by these circumstances.

Nevertheless, MID GSA is the only GSA of which Department staff are aware that has refused to adopt a GSP that it intends to implement. This novel circumstance continues to be a concern to Department staff. To alleviate those concerns, Department staff provide a recommended corrective action requiring identification and listing of the specific projects and management actions that MID GSA will or may be responsible for implementing under the Revised Joint GSP and a parallel listing and detailed identification and discussion of the legal, contractual, or other authorities or arrangements that MID GSA is relying or will rely upon in adequately implementing the Plan including those projects or management actions to clearly demonstrate the feasibility of all projects and management actions (see Recommended Corrective Action 1) Department staff will closely monitor Plan implementation and may change its recommendation if MID GSA does not provide a satisfactory response addressing these issues in the next periodic evaluation or if it appears that MID GSA's failure to adopt the Revised Joint GSP is preventing or delaying Plan implementation or otherwise impacting the likelihood of the Subbasin to achieve sustainability consistent with SGMA timelines.

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 in September 2022.[19] In September 2022 the GSAs were given 180 days to take corrective actions to remedy the identified deficiencies. Consistent with the GSP Regulations, Department staff have evaluated the revised 2022 Plan to determine if the GSAs have taken sufficient actions to correct the deficiencies.

4.1 Deficiency 1. The GSPs have not sufficiently coordinated on data and methodologies including coordination of sustainability goal, water budget and sustainable yield, and undesirable results as required by SGMA and the GSP Regulations.

4.1.1 Corrective Action 1

As described in the Department's GSP Assessment Staff Report released on September 22, 2022, Department staff determined that the Subbasin's definition of an undesirable result for the chronic lowering of groundwater levels was not consistent with the requirements of SGMA. The Department provided the following corrective actions for the Subbasin to consider and address:

> *The Plan does not provide sufficient explanation to confirm that the GSPs have been developed using the same data and methodologies and that elements of the GSPs have been based upon consistent interpretations of the Subbasin's setting. The GSAs in the Subbasin should modify each of their respective GSPs, as well as any applicable coordination materials, to substantially comply with the GSP Regulations and define sustainable yield and undesirable results, and develop water budgets in a manner that addresses groundwater conditions occurring throughout the Subbasin, not for only the portion of the Subbasin represented by the respective GSPs.*

[19] *Incomplete Determination of the 2020 Groundwater Sustainability Plan for the San Joaquin Valley – Madera Subbasin*, Department of Water Resources, September 22, 2022. https://sgma.water.ca.gov/portal/service/gspdocument/download/9363

4.1.2 Evaluation

To address the identified deficiencies, the GSAs have supplemented portions of each Plan to use consistent data and methodologies. Specifically, the descriptions supporting the sustainability goal, water budgets, and undesirable results have been further detailed or revised. Most of the supplemented material is provided in the Joint GSP and Coordination Agreement and referenced by the other GSPs.

The Department's Incomplete Determination notified the GSAs that the Plan did not present a coordinated sustainability goal in the Coordination Agreement applicable to the entire Subbasin. Instead, each GSP described related, but varied sustainability goals. In response, the GSAs amended the Coordination Agreement to include a sustainability goal that all parties agree to as presented below:

> *The sustainability goal for the Madera Subbasin is to implement a package of projects and management actions that will, by 2040, balance long-term groundwater system inflows and outflows based on a 50-year period representative of average historical hydrologic conditions.*[20]

The Gravelly Ford GSP,[21] New Stone GSP,[22] and Root Creek GSP[23] still contain the varied language describing the sustainability goal that was present in the initial Plan submission; however, the language does not conflict with the overarching sustainability goal definition found in the Coordination Agreement. A detailed assessment of the sustainability goal is provided in Section 5.3.1.

The Department's Incomplete Determination also notified the GSAs that the water budgets presented in each GSP were unclear, used different data, and were difficult to assess. Additionally, the water budget along with an estimate of sustainable yield was not included in the Coordination Agreement as required. In response, the GSAs have amended the GSPs and the Coordination Agreement to include agreed upon water budgets and estimates of sustainable yield. Specifically, the GSPs now all reference historical, current, and projected water budgets[24] developed in February 2018 for the entire Madera Subbasin and developed for the seven subregions representing each GSA. This water budget information was part of the initial Joint GSP submission in 2020 but was not clearly recognized in the other GSPs at the time. A detailed assessment of the water budget is provided in Section 5.2.3.

The GSPs acknowledge that there are still refinements needed to remove discrepancies and further improve the accuracy of the water budgets. The New Stone and Root Creek resubmitted GSPs note that the availability of more specific information and knowledge on the regional scale (i.e., geography, geology, water management practices, familiarity,

[20] Madera Subbasin Coordination Agreement, p. 34.
[21] Gravelly Ford GSP (Redlined), Section 3.1, p. 53.
[22] New Stone GSP (Redlined), Section 4.1, pp. 129-130.
[23] Root Creek GSP (Redlined), Section 4.1, pp. 184-185.
[24] Joint GSP (Resubmitted), Appendix 2.F, pp. 1322-1620; Appendix 6.D, pp. 2012-3335.

and understanding)[25] have been discussed amongst the GSAs and updates to the model will occur during the 2025 evaluation cycle.[26] Department staff encourage these efforts and also recommend the GSAs continue productive coordination and refinement of each GSP to be a cohesive Plan for sustainable groundwater management in the Subbasin (see Recommended Corrective Action 2).

4.1.3 Conclusion

Overall, Department staff believe the GSAs have taken sufficient action to address the identified deficiencies. Staff conclude that the enhanced coordination and addition of a coordinated sustainability goal and water budget with agreed upon estimates of sustainable yield for the Subbasin allows the GSAs to manage the Subbasin as intended by SGMA. However, as highlighted in the recommended corrective actions, the GSP should continue efforts to increase cooperative coordination and alignment of each GSP by the next periodic evaluation. The Plan also provides an agreed upon definition of undesirable results occurring in the Subbasin, which is discussed in Section 4.2.2.1.

4.2 Deficiency 2. The Plan does not establish minimum thresholds for chronic lowering of groundwater levels in a manner substantially compliant with the GSP Regulations.

4.2.1 Corrective Action 2

As described in the Department's GSP Assessment Staff Report released on September 22, 2022, Department staff determined that the GSAs must provide more detailed explanation and justification regarding the selection of the sustainable management criteria for groundwater levels, particularly the undesirable results, the minimum thresholds, and the effects of those criteria on the interests of beneficial uses and users of groundwater. The Department provided the following corrective actions for the Subbasin to consider and address:

1. The GSAs should describe the specific undesirable results they aim to avoid through implementing the Plan. If, for example, significant and unreasonable impacts to domestic wells are a primary management concern for the Subbasin, then the GSAs should sufficiently explain why that effect was selected and what level of impact(s) to those wells the GSAs consider to be significant and unreasonable. In support of its explanation, the GSPs should also clearly discuss and disclose the anticipated impact of operating the Subbasin at conditions protective against those effects on users of domestic wells and all other beneficial uses and users of groundwater in the Subbasin. The discussion should be supported using best available information, such as using State or county information on well completion reports and dry well reports, to analyze the

[25] New Stone GSP (Redlined), Section 3.3, p. 106; Root Creek GSP (Redlined), Section 3.3.3, p. 180.
[26] New Stone GSP (Redlined), Section 3.3.1, p. 107.

locations and quantities of domestic wells and other types of well infrastructure that could be impacted by groundwater management when implementing the Plan.

2. The GSAs should either explain how the existing minimum threshold groundwater levels are consistent with avoiding undesirable results or they should establish minimum thresholds at the representative monitoring wells that account for the specific undesirable results the GSAs aim to avoid. The Plan should include a detailed description of the factors and information considered and the analytic route and rationale the GSAs employed to reach conclusions regarding significant and unreasonable effects constituting undesirable results for groundwater levels and other applicable sustainability indicators.
3. The GSAs need to provide a description of the relationship between established minimum thresholds for all applicable sustainability indicators including how conditions at minimum thresholds avoid undesirable results for each applicable indicator.

4.2.2 Evaluation

To address the identified deficiencies, the GSAs have supplemented portions of the Plan related to the sustainable management criteria for chronic lowering of groundwater levels. Specifically, descriptions supporting the undesirable result, minimum thresholds, measurable objectives, interim milestones, and a domestic well mitigation program have been further detailed or revised. Most of the supplemented material is provided in the Joint GSP and referenced by the other GSPs.

4.2.2.1 Describing Undesirable Results and Potential Effects (1)

The Department's Incomplete Determination notified the GSAs that the Plan incorrectly established undesirable results which were applicable only within each GSP area—without agreement between GSPs—and some of the information provided in each GSP was insufficiently detailed.

In response to the corrective action, the GSAs coordinated to develop agreed-upon undesirable results applicable to the entire Subbasin. The GSPs reference information in the Joint GSP as a basis for developing undesirable results, particularly coordinating on defining when an undesirable result will occur (i.e., the quantitative description of minimum threshold exceedances that cause significant and unreasonable effects). In describing undesirable results, each GSP provides a different level of detail. For example, the Joint GSP describes an undesirable result as "those conditions that: 1) Cause significant financial burden to local agricultural interests or other beneficial uses and users who rely on the Subbasin's groundwater resources, 2) Cause groundwater level conditions at private domestic wells that cannot be mitigated, and 3) Interfere with other sustainability indicators." [27] The Gravelly Ford GSP refers to this information but also, alongside the New Stone GSP and the Root Creek GSP, provides additional description

[27] Joint GSP (Redlined), Section 3.4.1, p. 323.

such as: “Chronic lowering of groundwater levels in the Plan area cause significant and unreasonable declines if they are sufficient in magnitude to lower the rate of production of pre-existing groundwater wells below that necessary to meet the minimum required to support overlying beneficial use where alternative means of obtaining sufficient groundwater resources are not technically or financially feasible.” [28] The varied descriptions presented in each GSP do not conflict and appear to be generally coordinated. All GSPs refer to a domestic well mitigation framework which provides more specific information describing effects on beneficial uses and users.[29]

The Plan states that an undesirable result would occur when “… more than 30 percent of RMS in the Subbasin (including RMS in all four GSP plan areas) [are] exceeding their [minimum thresholds] for the same two consecutive Fall readings.”[30] The Plan further describes that “…implementation of the GSP is designed to avoid undesirable results during the sustainability period (i.e., the “planning and implementation horizon,” per CWC §10721(v)), after 2040.”[31]

As mentioned, the Plan describes details for a domestic well mitigation program,[32] which the GSAs will implement to provide assistance to domestic and municipal wells adversely impacted by declining groundwater levels that have occurred since 2015.[33] The Plan includes supporting information for the mitigation program which document the expected location and quantity of domestic wells that will experience undesirable results during the GSP implementation period. Staff believe the details provided for this framework effectively describe the specific undesirable results the GSAs are trying to avoid. Based on an analysis of 4,822 wells, the GSP documents that up to 1,294 wells,[34] located primarily in the central and eastern portion of the Subbasin,[35] would be impacted due to future modeled groundwater conditions. The total cost to assist impacted wells is estimated to be approximately $39,000,000; however, the Plan describes that the cost of mitigating domestic wells due to lowering groundwater levels is shown to be economically preferable to the costs associated with immediately stabilizing groundwater levels and the resulting impact to the local economy.[36] The GSAs have provided a commitment to this program including a schedule, timeline, and have reported progress in recent Annual Reports. The GSAs expect that the program would be implemented during the GSP

[28] Gravelly Ford GSP (Redlined), Section 3.4.1, p. 60; New Stone GSP (Redlined), Section 4.2.1.1, p. 131; Root Creek GSP (Redlined), Section 4.2.1, p. 186.
[29] Joint GSP (Redlined), Section 3.3.1.1, pp. 294-295; Gravelly Ford GSP (Redlined), Section 3.4.1, p. 60; New Stone GSP (Redlined), Section 4.2.1.2, pp. 132-133; Root Creek GSP (Redlined), Section 4.2.1.1, pp. 187-188.
[30] Joint GSP (Redlined), Section 3.4.1, p. 323.
[31] Joint GSP (Redlined), Section 3.4.1, p. 323.
[32] Joint GSP (Resubmitted), Appendix 3.E, pp. 1904-1918, Appendix 2.G, pp. 1733-1813.
[33] Joint GSP (Redlined), Section 3.3.1.1, p. 294.
[34] Joint GSP (Resubmitted), Appendix 2.G, p. 1762.
[35] Joint GSP (Resubmitted), Appendix 2.G, pp. 1783-1787.
[36] Joint GSP (Resubmitted), Appendix 3.D, p. 1902.

implementation period, no later than 2025; as of March 2023, the GSP states, the GSAs are continuing to develop the program's eligibility criteria and terms.[37]

In addition to the domestic well mitigation program, the Plan includes a suite of over 25 projects and management actions (e.g., demand management, increased recharge, increased surface water supply) which will be utilized to meet interim milestones and bring groundwater levels back up to minimum thresholds, mitigate overdraft, and operate the Subbasin sustainably. At full implementation, by 2040, the projects and actions will provide 215,840 acre-feet per year of annual gross benefit. The estimated capital cost of the projects is over $260,000,000, with an estimated annual operating cost of over $70,000,000; Department staff note that the GSAs have included an estimated economic cost from reduced crop production resulting from demand management in the estimated annual operating cost, which is approximately $54,000,000 per year or over 75% of the total annual cost provided.[38] The implementation schedule and expected benefit of each project was also considered in the modeling scenario used to develop interim milestones.[39] A review of the Annual Reports submitted to the Department shows progress on many of the projects.[40] For example, the GSAs report a cumulative total benefit of over 63,000 acre--feet from projects and management actions to date, with a benefit of 7,300 acre-feet for the latest reported water year.[41] With reporting of active progress toward project implementation, Department staff have increased confidence in the likelihood of the Plan to achieve the sustainability goal of the Subbasin.

Based on the information provided, Department staff think the Plan provides a reasonable description of the potential effects of undesirable results due to lowering of groundwater levels to domestic wells, generally the shallowest wells, and encourage the GSAs to continue development of the domestic well mitigation program and provide progress updates in Annual Reports. The GSAs should continue to progress projects and provide updates of observed benefits to the Department in Annual Reports. Department staff conclude that defining agreed upon undesirable results for the Subbasin and describing the potential effects of planned undesirable results that are likely to occur has sufficiently addressed component 1 of the corrective action.

4.2.2.2 Establishing Minimum Thresholds, Measurable Objectives, and Interim Milestones (2)

The Department's Incomplete Determination notified the GSAs that each Plan's varied descriptions and methods to establish minimum thresholds for chronic lowering of groundwater levels were not provided with sufficient supporting information to allow Department staff to evaluate whether the criteria were reasonable or whether operating

[37] Joint GSP (Redlined), Section 3.3.1.1, p. 295.
[38] Joint GSP (Redlined), Table 4-3, p. 366; Section 4.4.4.5, p. 409.
[39] Joint GSP (Redlined), Section 3.2.1.2, p. 270; Joint GSP, Appendix 6.D, pp. 2323-2326.
[40] Madera Subbasin Annual Reports, https://sgma.water.ca.gov/portal/gspar/submitted.
[41] Joint GSP Water Year 2022 Annual Report, pp. 57-58.

the Subbasin to avoid those thresholds is consistent with avoiding undesirable results—in part due to undesirable results being insufficiently defined in the Plan.

In response to the corrective action, the GSAs revised the chronic lowering of groundwater levels minimum thresholds to be set at the fall 2015 groundwater level measurement recorded at each representative monitoring site.[42] The Plan explains that the groundwater level minimum thresholds based on fall 2015 groundwater levels are consistent with the avoidance of significant and unreasonable impacts to other sustainability indicators.[43] The Plan states that the minimum thresholds will keep groundwater elevations generally above levels that have been experienced in the past, and that impacts to shallow well users and other beneficial users of groundwater will generally not exceed what has historically been experienced in the Subbasin.[44] Furthermore, the Plan explains that minimum thresholds established at fall 2015 groundwater levels are consistent with the avoidance of significant and unreasonable impacts for subsidence, water quality, and depletions of interconnected surface water.[45] The measurable objectives were revised to the fall 2010 groundwater levels which represents Subbasin conditions prior to the 2012 to 2015 drought period.[46]

Department staff believe that establishing minimum thresholds at the fall 2015 groundwater level is a reasonable approach. However, the GSAs intend to allow continued groundwater level declines during the 20-year implementation period based on the GSP's proposed interim milestones. The process to establish interim milestones is described as a "review and evaluation of measured groundwater level data and future projected fluctuations in groundwater levels during the GSP implementation period utilizing the numerical groundwater flow model, which simulated implementation of projects and management actions."[47] As a result, interim milestones were set to levels below minimum thresholds in years 2025, 2030, and 2035, prior to recovering by 2040 due to the implementation of projects and management actions.[48] Interim milestones for 2030 are the lowest groundwater elevations expected to occur during the GSP implementation period. When examining the hydrographs provided, Department staff note the 2030 milestones are frequently below historical lows.[49]

To successfully implement such a management program, GSAs are required to fully and thoroughly describe undesirable results that may occur prior to achieving sustainability, implement necessary projects and management actions to eliminate those undesirable results, and show measurable progress in annual reporting. The GSP provides information detailing how the proposed management of lowering groundwater levels

[42] Joint GSP (Redlined), Section 3.3.1, p. 293.
[43] Joint GSP (Redlined), Section 3.3.1.4, pp. 301-303.
[44] Joint GSP (Redlined), Section 3.3.1, pp. 293-294.
[45] Joint GSP (Redlined), Section 3.3.1.4, pp. 302-303.
[46] Joint GSP (Redlined), Section 3.2.1.1, pp. 269-270.
[47] Joint GSP (Redlined), Section 3.2.1.2, p. 270.
[48] Joint GSP (Redlined), Section 3.2.1.3, p. 271.
[49] Joint GSP (Resubmitted), Appendix 2.E.b, pp. 1243-1380; Gravelly Ford GSP (Redlined), Appendix G, pp. 218-224.

below minimum thresholds for an extended period will affect the interests of beneficial uses and users of groundwater in the Subbasin. As discussed above, during the period when interim milestones exceed minimum thresholds, the GSAs plan to implement a domestic well mitigation program to assist impacted users that effectively manages the effects of the undesirable results that are expected to occur; also, the Plan includes a suite of over 25 projects and management actions which the GSAs have reported progress on implementing in recent Annual Reports.

Based on a review of the information found in the resubmitted Plan and Annual Reports, Department staff conclude that at this time the GSAs have sufficiently addressed component 2 of the corrective action.

4.2.2.3 Describing How Minimum Thresholds Avoid Undesirable Results For Other Sustainability Indicators (3)

The Department's Incomplete Determination notified the GSAs that the GSPs require a description of how conditions at minimum thresholds avoid undesirable results for each applicable indicator.

In response to the corrective action, the GSAs revised the GSPs to include a discussion of the relationship between established minimum thresholds and undesirable results for other sustainability indicators. However, the GSP Regulations require the Department to evaluate whether the minimum thresholds and interim milestones are reasonable[50] and established in a manner to avoid undesirable results for each of the other sustainability indicators.[51] Department staff believe the lower interim milestones have the potential to cause undesirable results related to land subsidence, water quality, and interconnected surface water in the Subbasin. For example, the highest annual rate of subsidence was recorded between December 2012 and July 2014, when groundwater levels were declining to historical lows.[52] The GSAs should consider and disclose their understanding of the correlation between the declining groundwater levels and the maximum historical rate of subsidence while also describing the relationships between groundwater levels and the other applicable sustainability indicators. Department staff are concerned that impacts on other indicators (such as subsidence and water quality) may not recover in the same manner that groundwater levels may. Therefore, the GSAs should analyze how the groundwater levels at interim milestones will avoid causing undesirable results for other sustainability indicators (see Recommended Corrective Action 3).

Based on a review of the information found in the resubmitted Plan, Department staff conclude that the GSAs have taken sufficient action to address component 3 of the corrective action.

[50] 23 CCR § 355.4(b)(1).
[51] 23 CCR § 354.28(b)(2).
[52] New Stone GSP (Redlined), Section 3.2.6.1, p. 99.

4.2.3 Conclusion

At this time, Department staff believe the GSAs have taken sufficient action to address the deficiency identified. Department staff believe that having all the GSPs coordinated and establishing minimum thresholds at 2015 groundwater levels – in conjunction with the implementation of a well mitigation program and the projects and managements actions outlined in the Plan – to be a reasonable means of mitigating overdraft to achieve sustainability by 2040. However, Department staff note the GSAs intend to continue overdraft before 2040 based on the revised interim milestones, which after examining the hydrographs provided, are frequently below historical lows.[53] While SGMA and the GSP Regulations do not preclude undesirable results from occurring during Plan implementation, undesirable results cannot remain or continue after 20 years of Plan implementation. Department staff encourage the GSAs to continue with planning and implementation of the domestic well mitigation program to assist those users and uses of groundwater and other sustainability indicators (e.g., land subsidence, water quality, or interconnected surface water) that may be affected by lowering groundwater levels. The recommended corrective actions should also be considered by the next Periodic Evaluation for further advancement of the sustainable groundwater management in the Subbasin.

4.3 Deficiency 3. The Plan does not develop sustainable management criteria for land subsidence based on best available information and science.

4.3.1 Corrective Action 3

As described in the Department's GSP Assessment Staff Report released on September 22, 2022, Department staff determined that the GSAs do not sufficiently demonstrate that undesirable results related to land subsidence are not present and are not likely to occur in the Subbasin. The Department provided the following corrective actions for the Subbasin to consider and address the following:

1. Clarify and address the currently conflicting information in the Plan regarding what is known, qualified by the level of associated uncertainty, about the existence and impact of land subsidence.
2. The GSP should develop sustainable management criteria based on information in the basin setting and establish a monitoring network to adequately monitor conditions.[54] The basin setting should sufficiently detail the physical setting and characteristics of the Subbasin including descriptions of principal aquifers. the definable bottom of the Subbasin and identify data gaps and uncertainty within the

[53] Joint GSP (Resubmitted), Appendix 2.E.b, pp. 1243-1380; Gravelly Ford GSP (Redlined), Appendix G, pp. 218-224, New Stone GSP (Redlined), Figures 4-2 through 4-7, pp. 145-150; Root Creek GSP (Redlined), Figures 4-2 through 4-7, pp. 196-201.
[54] 23 CCR § 354.26.

hydrogeologic conceptual model. If applicable, data gaps monitoring and steps to fill data gaps before the next periodic assessment should be described.

4.3.2 Evaluation

To address the identified deficiency, the GSAs have supplemented portions of each Plan to develop sustainable management criteria and monitoring for land subsidence. Most of the supplemented material is provided in the Joint GSP and referenced by the other GSPs.

4.3.2.1 Clarifying Conflicting Information in the Plan (1)

The Department's Incomplete Determination notified the GSAs that the GSPs provided conflicting information related to whether significant and unreasonable land subsidence has occurred or will occur in the Subbasin.

In response to the corrective action, the GSPs acknowledge that significant and unreasonable land subsidence has historically occurred during periods with groundwater pumping in excess of the sustainable yield in areas where critical infrastructure exists and in the western areas that overlay the Lower Aquifer, where the Corcoran Clay exists.[55] Additionally, loss of groundwater storage and associated reduction in pore pressures in clay layers in the Lower Aquifer (indicated by lowering groundwater levels) is understood by all parties to lead to conditions that cause or exacerbate land subsidence.[56] Between 1926 and 1972, subsidence resulted in up to 4.0 feet of elevation change within the western portion of the Subbasin.[57] The highest rate of subsidence, also in western portion of the Subbasin, was 0.60 feet per year from December 2012 through July 2014.[58] The Plan also provides various maps documenting the location and extent of subsidence in the Subbasin.[59]

The Plan provides information about infrastructure that is susceptible to subsidence. Specifically, the Joint GSP provides an infrastructure sensitivity assessment of critical infrastructure including roads, railroads, highways, waterways, surface water conveyance structures, agricultural wells, domestic wells, public supply wells, and wastewater infrastructure. The assessment discusses impacts or interference with surface land uses and includes details such as proximity, orientation, and relative vulnerability to adverse effects of land subsidence.[60] Generally, the assessment states that the critical infrastructure were not anticipated to be impacted by future subsidence rates. For example, the GSP identifies the Chowchilla Bypass and the Eastside Bypass as critical infrastructure overlaying the Corcoran Clay, near an area of past documented subsidence; based on annual average subsidence rates from 2011 to 2017, the design profile and freeboard of the bypass will not be impacted by residual subsidence through

[55] Joint GSP (Redlined), Section 3.4.3, p. 325.
[56] Joint GSP (Redlined), Section 3.3.3.7, p. 313.
[57] Gravelly Ford GSP (Redlined), Section 2.2.2, p. 41.
[58] New Stone GSP (Redlined), Section 3.2.6.1, p. 99.
[59] New Stone GSP (Redlined), Figures 3-23 and 3-24, pp. 101-102.
[60] Joint GSP (Resubmitted), Appendix 3.G, pp. 1921-1953.

2026.[61] Additionally, for impacted wells, such as domestic wells, well owners are to be assisted by the domestic well mitigation program.[62] The GSP also states the GSAs are analyzing the potential to couple implementation efforts with the Subsidence Control Measures Agreement that is currently in effect in parts of the Chowchilla Subbasin near the Subbasin boundary.[63]

Based on a review of the information found in the resubmitted Plan, Department staff conclude that the GSAs have addressed component 1 of the corrective action.

4.3.2.2 Developing Sustainable Management Criteria and Monitoring Network (2)

The Department's Incomplete Determination notified the GSAs that the GSPs do not sufficiently demonstrate that undesirable results related to land subsidence are not present and are not likely to occur in the Subbasin.

In response to the corrective action, the GSPs establish revised, coordinated sustainable management criteria for the Subbasin to not allow subsidence once sustainability is achieved in 2040. With that the GSPs amended the minimum thresholds to 0 feet per year (ft/yr).[64] The Plan also identifies a total uncertainty of subsidence to be -0.16 ft/yr, meaning any amount of subsidence less than -0.16 ft/yr would be considered within the uncertainty of measurement and considered 0 ft/yr.[65] The Plan states that this minimum threshold is consistent with the sustainable management criteria for groundwater levels which seeks to keep levels above 2015 conditions by 2040.[66] The GSAs also revised the measurable objective rate to 0 ft/yr.[67] The Plan allows for minimum threshold exceedances throughout the duration of the implementation phase with the proposed interim milestones, which were revised based on two areas: areas of subsidence monitoring and areas of greater subsidence concern.[68] For areas of monitoring, interim milestones are established at -0.20 ft/yr by 2025, -0.13 ft/yr by 2030, -0.07 ft/yr by 2035, and 0 ft/yr by 2040 which are monitored by three survey benchmarks and one continuous GPS station. For areas of concern, interim milestones are established at -0.60 ft/yr by 2025, -0.40 ft/yr by 2030, -0.20 ft/yr by 2035, and 0 ft/yr by 2040 and monitored at three survey benchmarks. The established interim milestones are based on observed data with the highest rates (i.e., milestones to 2025) being slightly higher than actual subsidence rates experienced in the Subbasin between 2011 and 2016.[69] The Plan defines an undesirable result as occurring when "… the average subsidence across 75 percent or

[61] Joint GSP (Resubmitted), Appendix 3.G, p. 1932.
[62] Joint GSP (Resubmitted), Appendix 3.G, p. 1935.
[63] Joint GSP (Resubmitted), Appendix 3.G, p. 1933; Joint GSP (Redlined) Section 3.3.3.7, p. 312.
[64] Joint GSP (Redlined), Section 3.3.3, pp. 310-314.
[65] Joint GSP (Redlined), Section 3.3.3.1, p. 311.
[66] Joint GSP (Redlined), Section 3.3.1.4, p. 301.
[67] Joint GSP (Redlined), Section 3.2.3.1, p. 279.
[68] Joint GSP (Redlined), Section 3.2.3.2, pp. 279-280.
[69] Joint GSP (Redlined), Section 3.2.3.2, p. 280.

more RMS in the Subbasin (including RMS in all four GSP plan areas) exceeds the minimum threshold for two consecutive years."[70]

Department staff have identified areas for improvement in the GSAs' defined undesirable results. Specifically, the quantification of conditions that likely would cause undesirable results as when more than 75 percent of the representative monitoring sites in the Subbasin exceed threshold levels for two consecutive years is unsatisfactory, because the Plan does not explain how this threshold would avoid effects the GSAs have determined to be significant and unreasonable. On the contrary, the values and timing of exceedances appear to be arbitrary. Subsidence is prominent and likely to occur in western portions of the Subbasin in correlation with the presence of the Corcoran Clay. Two of the seven representative monitoring sites are located in that area of the Subbasin; using the current definition, localized subsidence could occur indefinitely without meeting the quantitative criteria for an undesirable result. Furthermore, when considering land subsidence, compacted sediments may not rebound alongside rising groundwater levels due to irreversible changes in the subsurface. Additionally, the Plan establishes two subsidence areas, as mentioned above, which the GSAs do not consider when establishing the quantitative metrics for an undesirable result (i.e., Department staff would expect more stringent metrics in the areas of greater subsidence concern as compared to the subsidence monitoring areas). These criteria should be considered when defining when and where undesirable results occur (see Recommended Corrective Action 4a)

While Department staff are encouraged by the updated sustainable management criteria, the Plan still does not identify a total (i.e., cumulative) amount of subsidence which would be considered significant and unreasonable. The interim milestones established using annual rates would allow for up to 6.5 feet of total subsidence by 2040. This appears inconsistent with the legislative intent of SGMA to avoid or minimize subsidence, and no adequate justification for allowing this amount of additional subsidence is provided in the GSP.[71] Considering the Subbasin has recently experienced subsidence and contains infrastructure that the GSP identifies as susceptible to subsidence, the GSAs should identify and disclose the cumulative amount of subsidence that can occur without causing significant and unreasonable impacts to the beneficial uses and users of groundwater, surface land uses, and property interests, all of which must be clearly defined. In establishing the cumulative amount of potential subsidence that could occur during GSP implementation, the GSAs should consider the conditions necessary to minimize or halt subsidence during GSP implementation and maintain those conditions once sustainability has been achieved on or before 2040. Based on the amount of subsidence anticipated between now and 2025, Department staff believe this does not preclude approval at this time. However, given that the Plan projects minimum threshold exceedances during implementation, which may likely result in undesirable results related to water levels, and the Plan intends for subsidence to be 0 ft/yr only by and after 2040, Department staff

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[70] Joint GSP (Redlined), Section 3.4.3, p. 325.
[71] Water Code § 10720.1 (e).

recommend identifying and including a quantitative value for cumulative subsidence for minimum thresholds and other sustainability criteria related to subsidence by the first Periodic Evaluation (see Recommended Corrective Action 4b).

SGMA and the GSP Regulations indicate that for a basin to be sustainably managed, the basin must experience no undesirable results within 20 years of plan implementation and then throughout the planning and implementation horizon. Unlike other indicators, the legislature specifically indicated its intent that SGMA implementation avoid or minimize subsidence.[72] Unlike groundwater levels that may fall and then rise in a basin, subsidence can often be inelastic and permanent. This means that undesirable results from subsidence during plan implementation will likely still exist and persist to 2040 and beyond. For instance, subsidence that occurs during early Plan implementation that causes lasting impacts to infrastructure, like flood control structures, that substantially interferes with the infrastructure's operations and utility in 2040 and beyond, constitutes an undesirable result under SGMA. Department staff believe that the Plan's continued allowance of minimum threshold exceedances during the first 20 years of plan implementation (i.e., allowing further subsidence as a result of water level declines below historic lows at the interim milestones) and potential permanent impacts to surface infrastructure and uses is not consistent with the intent of SGMA to achieve sustainability and to avoid or minimize subsidence. The Plan should consider and provide details describing the current and potentially lasting impacts of subsidence on land uses and groundwater beneficial uses and users as described above in Recommended Corrective Action 4b.

The GSP Regulations require the Department to evaluate whether the minimum thresholds and interim milestones are reasonable[73] and established in a manner to avoid undesirable results for each of the other sustainability indicators.[74] Department staff believe the interim milestones below the minimum threshold have the potential to cause undesirable results related to other sustainability indicators which the GSAs also have a responsibility to avoid. For example, the Plan does not provide a discussion of how the subsidence milestones, that allow for continued subsidence and associated irreversible compaction of aquifer materials, relate to the reduction of groundwater storage or the degradation of water quality sustainability indicators. The GSAs should consider and disclose their understanding of this and other relationships between sustainability indicators. The GSAs should analyze whether or how the land subsidence rates at interim milestones will avoid causing undesirable results for other sustainability indicators (see Recommend Corrective Action 4c).

In the establishment of the minimum thresholds for land subsidence, the Plan describes the application of a level of uncertainty to measurements, claiming that the survey measurements have a vertical accuracy of plus or minus 2.5 centimeters. The Plan

[72] Water Code § 10720.1(e).
[73] 23 CCR § 355.4(b)(1).
[74] 23 CCR § 354.28(b)(2).

proposes adding these uncertainty values so that when two measurements are taken the Agencies consider the total uncertainty in subsidence to be 5 centimeters, which equals approximately -0.16 ft/yr. By this rationale, the Plan assumes that subsidence values less than 0.16 ft/yr are within the uncertainty of measurement and considered to be compliant with the minimum threshold of 0 ft/yr.[75] However, although there may be some uncertainty in subsidence measurements, the uncertainty does not necessarily mean that small measurements of subsidence within that range of uncertainty (or accuracy) should be ignored or mean that no subsidence is occurring. Department staff believe this approach of always rounding any annual subsidence measurements within the range of error to zero every year is inconsistent with standard practices. When multiple measurements are taken at the same location, they are compared to the same baseline measurement and, in turn, have the same single level of uncertainty. While it’s understandable to build in an allowance for some level of uncertainty, it appears the Plan allows for the continued subsidence if the measured rate is equal to or less than 0.16 ft/yr. Department staff recommend the Plan revise its application of the level of uncertainty as it relates to subsidence measurements according to standard professional practices (see Recommended Corrective Action 4d).

The Plan acknowledges there are data gaps in assessing subsidence in the Subbasin and provides a workplan[76] which aims to provide sufficient data and analysis to fill data gaps, including enhancing monitoring and understanding relationships between land subsidence and groundwater levels at different depths within the western part of the Subbasin, improving quantification of groundwater pumping within Upper Aquifer and Lower Aquifer, and assessing the adequacy of the sustainable management criteria. Considering the Department provides quarterly updates for monthly InSAR subsidence data covering much of the Subbasin, the GSP should address or explain why the GSAs have decided to not utilize this reliable data source to assess whether management is causing significant and unreasonable effects to surface land uses. Department staff encourage these efforts and also recommend the GSAs take steps to address the recommended corrective actions by the next Periodic Evaluation of the Plan.

Based on a review of the information found in the resubmitted Plan, Department staff conclude that the GSAs have addressed component 2 of the corrective action.

4.3.3 Conclusion

Overall, Department staff believe the GSAs have taken sufficient action to address the deficiency identified. Staff conclude that the zero tolerance for land subsidence minimum thresholds and measurable objectives at the end of the implementation period in 2040 is commensurate with the understanding of SGMA. However, Department staff are concerned with the amount of subsidence that may occur during the implementation period and the potential undesirable results that may cause as a result of permanent impacts to infrastructure and surface land uses. The recommended corrective actions

[75] Joint GSP (Redlined), Section 3.3.3.1, p. 311.
[76] Joint GSP (Resubmitted), Appendix 3.H, pp. 1954-1968.

should be considered by the next Periodic Evaluation to more align with the intent of SGMA to avoid or minimize subsidence.

4.4 Deficiency 4. The Plan does not develop sustainable management criteria for the depletions of interconnected surface water based on best available information and science.

4.4.1 Corrective Action 4

As described in the Department's GSP Assessment Staff Report released on September 22, 2022, Department staff determined that the GSAs do not sufficiently demonstrate that interconnected surface water or undesirable results related to depletions of interconnected surface water are not present and are not likely to occur in the Subbasin. The Department provided the following corrective actions for the Subbasin to consider and address the following:

1. Clarify and address the currently conflicting information in the Plan regarding what is known, qualified by the level of associated uncertainty, about the presence and degree of interconnected surface water and, if applicable, the depletion of that interconnected surface water by groundwater use, including quantities, timing, and locations.[77]

2. If the GSAs cannot provide a sufficient, evidence-based justification for the absence of interconnected surface water, then they should develop sustainable management criteria, as required in the GSP Regulations[78] based on best available information and science. Evaluate and disclose, sufficiently and thoroughly, the potential effects of the Plan's sustainable management criteria for depletion of interconnected surface water on beneficial uses of the interconnected surface water and on groundwater uses and users. Additionally, development of sustainable management criteria must be supported by information in the basin setting and the GSAs must develop a monitoring network capable of collecting sufficient data to support analysis of the quantified spatial and temporal exchanges between surface water and groundwater that can be associated with groundwater pumping.

4.4.2 Evaluation

To address the identified deficiency, the GSAs have supplemented portions of the Plan to describe the basin setting, develop sustainable management criteria and monitoring for depletions of interconnected surface water.

4.4.2.1 Clarifying Conflicting Information in the Plan (1)

The Department's Incomplete Determination notified the GSAs that the GSPs provided conflicting information related to identifying the presence of interconnected surface water in the Subbasin.

[77] 23 CCR §§ 354.28(c)(6)(A-B).
[78] 23 CCR §§ 354.26, 354.28, 354.30.

In response to the corrective action, the GSPs revised the descriptions of groundwater—surface water interactions in the Subbasin, acknowledging that data indicates that the San Joaquin River appears to be in connection with groundwater during some periods and there is at least some potential for regional groundwater pumping to impact groundwater dependent ecosystems (GDEs) with roots extending down 20 to 30 feet along the San Joaquin River.[79]

The method the GSP used to determine the connectivity was to compare the historical regional aquifer groundwater elevations to stream thalweg (deepest portion of stream channel) elevations and assess stream seepage. The comparison of the groundwater levels and stream thalweg suggest the San Joaquin River was likely connected with groundwater from 1958 through 1984, but groundwater was about 10 to 50 feet below the thalweg from 1989 through 2016.[80] While this approach is sufficient to confirm the presence of a hydraulic connection, Department staff note groundwater levels dropping below the thalweg of the San Joaquin River would not be sufficient to prove surface water and groundwater are disconnected. This is because water from the river is still recharging the aquifer and may do so at a rate that would cause mounding in the local water table surrounding the river. The mounding in the water table may enable the river and aquifer to maintain a saturated hydraulic connection when groundwater levels drop well below the bottom of the river. Additionally, stream seepage indicates that during above normal and wet years, such as 2017 and 2019, groundwater is discharged to streams.[81] The GSP states that there are data gaps, and provides a workplan[82] which aims to provide sufficient data and analysis to fill data gaps, including making a more informed determination of whether or not interconnected surface water is present along the San Joaquin River, improving understanding of the relationship between streamflow and regional groundwater pumping, and providing an improved basis for setting sustainable management criteria if it is determined that interconnected surface water conditions exist.[83] At this time, Department staff conclude sufficient action has been taken on this deficiency and believe the GSAs can work with the Department to further efforts on interconnected surface water.

Based on a review of the information found in the resubmitted Plan, Department staff conclude that the GSAs have addressed component 1 of the corrective action.

4.4.2.2 Sustainable Management Criteria and Monitoring Network (2)

The Department's Incomplete Determination notified the GSAs that the GSPs do not sufficiently demonstrate that undesirable results related to depletions of interconnected surface water are not present and are not likely to occur in the Subbasin. Therefore, if the GSAs cannot provide a sufficient, evidence-based justification for the absence of

[79] Joint GSP (Redlined), Section 2.2.2.5, p. 120.
[80] Joint GSP (Redlined), Section 2.2.2.4, p. 118.
[81] Joint GSP (Resubmitted), Figure 2-76, p. 310.
[82] Joint GSP (Resubmitted), Appendix 3.I, pp. 1969-1981
[83] Joint GSP (Resubmitted), Appendix 3.I, p. 1971.

interconnected surface water, then they should develop sustainable management criteria, as required in the GSP Regulations.

In response to the corrective action, the GSPs established interim sustainable management criteria for depletions of interconnected surface water along the San Joaquin River. Specifically, the GSAs define an undesirable result occurring when greater than 30 percent of representative monitoring wells exceed their minimum thresholds for two consecutive five-year rolling averages.[84] Minimum thresholds are defined as the percent of time surface water and groundwater was connected over the historical period of 1989 to 2015. Measurable objectives and interim milestones are the same as minimum thresholds. Monitoring will be conducted annually using three monitoring sites.

The GSAs used a metric called “percent of time connected” to develop the interim sustainable management criteria for depletion of interconnected surface water.[85] In reviewing the information provided in the GSP, Department staff conclude that while developing sustainable management criteria for interconnected surface water is a substantial step forward in addressing the deficiency, the development of sustainable management criteria in the Plan is not consistent with the GSP Regulations. Reporting the percent of time connected does not provide adequate information to describe or evaluate the quantity and timing of depletions of interconnected surface water due to groundwater use, as required by the GSP Regulations.[86] As mentioned in Section 4.4.2.1, the GSAs prepared a work plan outlining an approach to fill these data gaps.[87] The work plan states the GSAs intend to compile and review pertinent existing data and reports, construct and install new monitoring facilities, collect additional field data, and conduct additional technical analysis. The purpose is to make a more informed determination of whether interconnected surface water is present along the San Joaquin River, to improve understanding of the relationships between streamflow, shallow groundwater levels, and regional groundwater pumping.[88] While the work plan states that the GSAs will potentially refine or modify the interim sustainable management criteria, it also indicates that the GSAs will continue using the metric of “percent of time connected” for sustainable management criteria[89] – a metric Department staff conclude is not appropriate in estimating timing and volume of interconnected surface water depletion and evaluating potential impacts to beneficial uses and users. The GSAs proposed to complete most of the tasks in the work plan by 2024 with the intent of including the early results in the first Periodic Evaluation.[90] Department staff are encouraged by the GSA’s intent to increase data collection and fieldwork. At this time, Department staff conclude sufficient action has

[84] Joint GSP (Redlined), Section 3.4.5, p. 327.
[85] Joint GSP (Redlined), Section 3.2.5.1, p. 291, Section 3.3.5.1, p. 319.
[86] 23 CCR §§ 354.28(c)(6)(A), 354.28(c)(6)(B).
[87] Joint GSP (Resubmitted), Appendix 3.I, pp. 1969-1981.
[88] Joint GSP (Resubmitted), Appendix 3.I, pp. 1970-1971.
[89] Joint GSP (Resubmitted), Appendix 3.I, p. 1979.
[90] Joint GSP (Resubmitted), Appendix 3.I, p. 1980.

been taken on this deficiency and believe the GSAs can work with the Department to further efforts on interconnected surface water.

Based on a review of the information found in the resubmitted Plan, Department staff conclude that the GSAs have addressed component 2 of the corrective action.

4.4.3 Conclusion

Overall, Department staff believe the GSAs have taken sufficient action to address the deficiency identified.

Department staff understand that quantifying depletions of interconnected 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 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 GSAs 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 and establish sustainable management criteria based on timing, volume, and depletion as required by the GSP Regulations.

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, GSAs, where applicable, should consider incorporating appropriate guidance approaches into their future periodic updates to the GSP. 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. 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.

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 Basin 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, describing the plan area, and demonstrating the legal authority and ability of the submitting Agency to develop and implement a Plan for that area.[91]

The Madera Subbasin is bound by the San Joaquin River and Kings Subbasin in the south, Delta-Mendota Subbasin in the west, Chowchilla Subbasin in the north, and the foothills of Sierra Nevada in the east.[92] No adjudicated areas are shown on the maps provided in the GSP.[93] The Subbasin does not have any considerable federal lands or state-owned lands.[94]

The Subbasin is managed by seven groundwater sustainability agencies. Four of those seven groundwater sustainability agencies have developed the Madera Joint Groundwater Sustainability Plan, and the other three groundwater sustainability agencies developed individual groundwater sustainability plans.[95] The four GSPs that cover the entire Madera Subbasin are:

- Madera Joint Groundwater Sustainability Plan (Joint GSP)
- Gravelly Ford Water District Groundwater Sustainability Plan (Gravelly Ford GSP)
- New Stone Water District Groundwater Sustainability Plan (New Stone GSP)

[91] 23 CCR § 354.2 *et seq*.
[92] Joint GSP, Section 2.1, p. 63.
[93] Joint GSP, Section 2.1.1, p. 63, Figure 2-1, p. 64.
[94] Joint GSP, Section 2.1.1, p. 63. Note: Federal land includes primarily rights of way along canals conveying USBR Central Valley Project water. State land includes primarily California Department of Parks and Recreation land along San Joaquin River near Friant, California.
[95] Joint GSP, Table 1-4, p. 56.

- Root Creek Water District Groundwater Sustainability Plan (Root Creek GSP)

The four groundwater sustainability agencies that developed the Joint GSP collectively are:

- Madera County Groundwater Sustainability Agency
- City of Madera Groundwater Sustainability Agency
- Madera Irrigation District Groundwater Sustainability Agency
- Madera Water District Groundwater Sustainability Agency

The Joint GSP plan area represents 94% of the Madera Subbasin.[96] The Joint GSP provides information that is encompassing-of, relevant-to, and reiterated-in the other three groundwater sustainability plans and is often cited by Department staff when referencing information relevant to the entire Subbasin. Collectively, unless otherwise specified, the four GSPs are referred to as the Plan for the Subbasin.

The Gravelly Ford GSP boundaries are contiguous with the Gravelly Ford Water District and contain approximately 8,500 acres comprised of grape vineyards, tree groves, and rural residences.[97] The New Stone GSP boundaries are coterminous with the New Stone Water District boundaries, encompassing approximately 4,200 acres in the northwestern area of the Madera Subbasin. The New Stone Water District consists primarily of agriculture and two landowners.[98] The Root Creek GSP boundaries are the same as the Root Creek Water District boundaries and is located in the southeastern portion of the Madera subbasin—bounded on the south by San Joaquin River—with the majority of the land being used as agriculture.[99]

A map showing the Subbasin and adjacent subbasins is shown in Figure 1 below.

[96] Joint GSP, Table 1-2, p. 42.
[97] Gravelly Ford GSP, Section 1.1.1, p. 6.
[98] New Stone GSP, Executive Summary, p. 12.
[99] Root Creek GSP, Executive Summary, p. 13, Figure 2-5, p. 43.

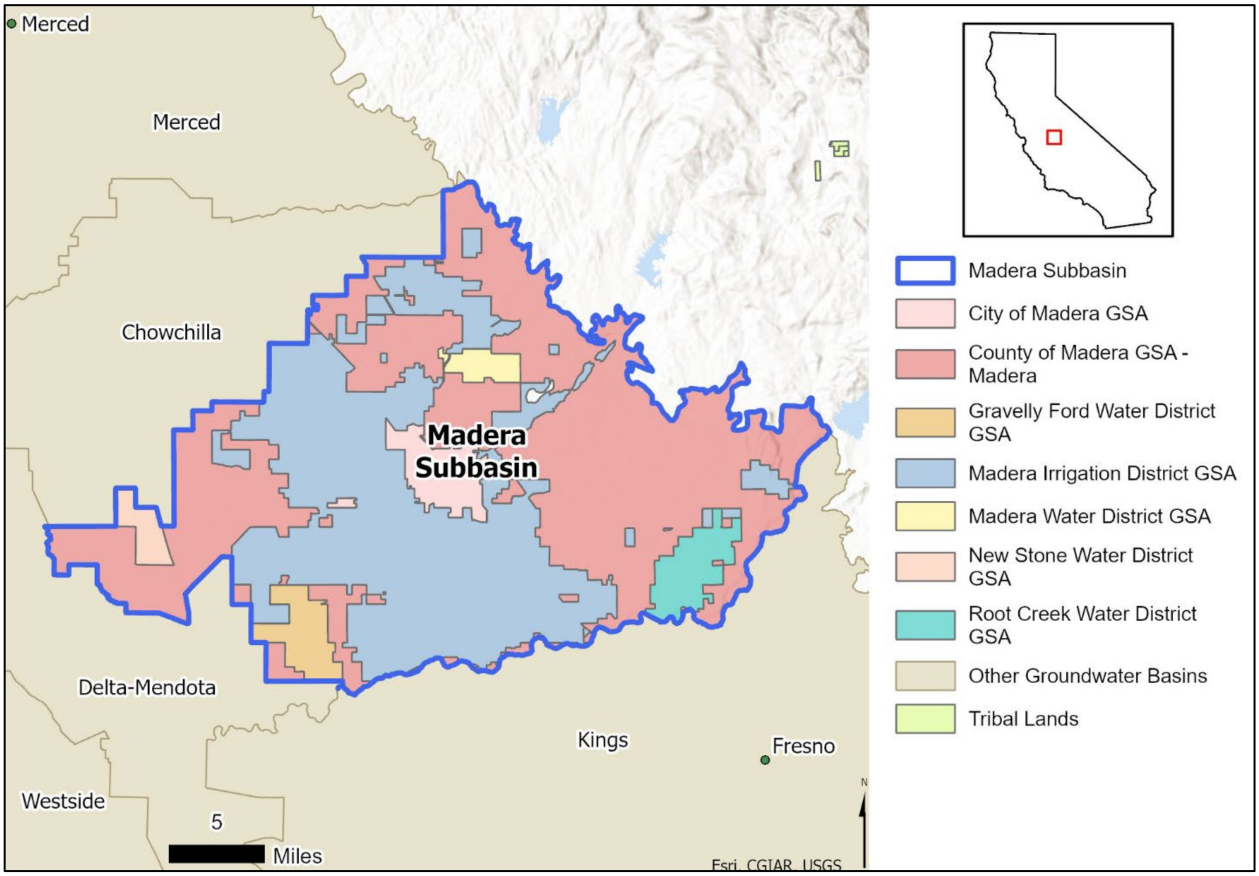

Figure 1. Madera Subbasin Location Map[100]

The land use areas in the Subbasin are broadly classified across three sectors: agricultural (including dairies), urban, and native vegetation.[101] The Plan includes a summary of land use stating irrigated agriculture is the most prominent land use in the Subbasin, covering approximately 213,000 acres.[102] For example, the New Stone GSP states that 100% of land use in the GSP is agricultural.[103] Native vegetation and water surfaces collectively were reported to cover the second highest acreage approximately 100,000 acres.[104] Urban area that includes cities, residential, and semi-agricultural cover approximately 36,000 acres.[105]

The water use source type was not independently presented for the entire Subbasin. For example, the Gravelly Ford GSP states an unquantified, small amount of groundwater pumping occurs for domestic use.[106] Instead, it is reported that the water source type is

[100] Joint GSP, Figure 2-1, p. 64.
[101] Joint GSP, Section 2.1.1, p. 65, Figure 2-2, p. 66.
[102] Joint GSP, Table 2-1, p. 68.
[103] New Stone GSP, Section 2.5.1, p. 38.
[104] Joint GSP, Table 2-1, p. 68.
[105] Joint GSP, Table 2-1, p. 68.
[106] Gravelly Ford GSP, Section 2.1.5, p. 21.

both groundwater and local surface water supplies, but groundwater appears to be the primary water source in the Subbasin.[107]

The Plan includes maps that depict the density of wells (domestic, agricultural, and public supply) by township range and section in Figure 2-5, Figure 2-6, and Figure 2-7 of the Joint GSP prepared from the Department's Well Completion Report Map Application.[108] The highest concentrations of reported domestic wells are centered primarily around the City of Madera and Bonadelle Ranchos-Madera Ranchos in the eastern portion of the Subbasin.[109] Reported irrigation wells are generally less concentrated and more evenly distributed across the Subbasin, though slightly higher concentrations are found in some areas within rural Madera County, Madera Irrigation District, and Root Creek Water District.[110]

The Plan describes existing water resource management programs operating in the Subbasin. The Joint GSP states the local agencies that have formed each of the Subbasin's groundwater sustainability agencies have prepared and adopted several water planning documents in the past, including Madera Integrated Regional Water Management Plan and Madera Regional Groundwater Management Plan. The Subbasin's other local water management plans, federal, state, and regional groundwater and surface water programs were discussed.[111] The Joint GSP states the existing water resource monitoring and management programs constitute a well-developed and broadly distributed system that provides representative data throughout the Subbasin that have been, and will be, incorporated into the Plan as appropriate.[112]

The Plan provides a list of public meetings where the Plan was discussed, including GSA board meetings, Coordination Committee meetings, stakeholder advisory committee meetings, and public workshops.[113] The GSPs include stakeholder communication and engagement plans to assist Subbasin groundwater sustainability agencies in their efforts to develop general and strategic communications to engage stakeholders in groundwater management activities.[114]

The Plan identifies beneficial uses and users of groundwater in the Subbasin. The various stakeholders identified are the general public, private water users, urban and agricultural water users, industrial water users, environmental and ecosystem water uses, tribes, federal lands and integrated regional water management groups.[115] The Plan describes the beneficial uses of groundwater in the Subbasin, which includes irrigation and drinking

[107] Joint GSP, Figure 2-2, p. 66.
[108] Joint GSP, Figures 2-5 through 2-7, pp. 171-173.
[109] Joint GSP, Section 2.1.1, p. 70.
[110] Joint GSP, Section 2.1.1, p. 70.
[111] Joint GSP, Section 2.1.2, pp. 70-77.
[112] Joint GSP, Section 2.1.2, pp. 70-77.
[113] Joint GSP, Section 2.1.5, pp. 83-90, Table A6.C-2, pp. 1768-1779.
[114] Joint GSP, Appendix 2.C.a, pp. 586-638; Gravely Ford GSP, Section 2.1.5, p. 22, New Stone GSP, Section 2.5.3 and 2.5.4, pp.39-40, Root Creek GSP, Section 2.5.3 to 2.5.4, pp. 73-75.
[115] Joint GSP, Table 2-5, pp. 85-86, Table A2.C.a-1, pp. 592-593.

water supply (i.e., municipal, urban, and rural).[116] According to the Joint GSP, each of the seven groundwater sustainable agencies in the Subbasin held regular public meetings, coordination committee meetings, and subbasin wide technical meetings.[117] For example, according to the Root Creek GSP,[118] engagement with the groundwater users occurred at the time of formation of GSAs, development of the draft GSP, finalization of the GSP and engagement will continue for the implementation of the GSP.[119]

Overall, Department staff believe the GSAs have thoroughly described Agency information, plan area, and notice and communication process, in substantial compliance with the GSP Regulations.

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.[120]

5.2.1 Hydrogeologic Conceptual Model

The GSP Regulations require a descriptive hydrogeologic conceptual model of the basin that includes a written description supported by cross sections and maps.[121] 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 GSA'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.[122]

The Plan provides a description of the hydrogeologic conceptual model documented in a 2017 technical memoranda[123] and qualified maps.[124] The Gravelly Ford GSP provided additional descriptions to the hydrogeological conceptual model using a 2018 report titled *Hydrogeologic Conceptual Model and Groundwater Conditions for the Gravelly Ford Water District GSP*,[125] which describes the physical components in the Gravelly Ford

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116 Joint GSP, Section 1, p. 40.
117 Joint GSP, Section 2.1.5.3, p. 86.
118 Root Creek GSP, Appendix 2-C, pp. 245-246.
119 Root Creek GSP, Section 2.5.1, pp. 72-73.
120 23 CCR § 354.12 *et seq*.
121 23 CCR § 354.12 *et seq*.
122 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.
123 Joint GSP, Section 2.2.1, pp. 90-96.
124 Joint GSP, Figures 2-5 through Figure 2-46, pp. 171-211, Appendix 2.D, pp. 1078-1090.
125 Gravelly Ford GSP, Appendix B, pp. 89-124.

GSP area, including, but not limited to, the principal aquifers,[126] surface water bodies,[127] and primary users of groundwater[128] in the Gravelly Ford GSP area.

The surface geology of the Subbasin is described predominantly as younger and older alluvium with subsurface deposits, from the surface to the bottom of the Subbasin, consisting of alluvium and unconsolidated continental deposits.[129] The Subbasin is depicted to be underlain by crystalline basement complex rocks of the Sierra Nevada.[130]

The lateral boundaries of the Subbasin are described as the hydrogeologic boundary created by the bedrock of the Sierra Nevada to the east; and the political boundaries of the Kings Subbasin to the south, Chowchilla Subbasin to the north, and Delta-Mendota Subbasin to the west.[131]

The Plan describes that the bottom of the Subbasin, throughout most of the Subbasin, is defined by the depth to the base of fresh water (groundwater with conductivity up to 3,000 micromhos per centimeter), except in the eastern portion where it is defined by the depth to basement rock.[132] However, the Plan states that there are wells screened below the defined base of fresh water while explaining these wells will likely have hydraulic connection with the overlying freshwater zone, so they are considered to be part of the Subbasin.[133] For example, cross-sections provided by the Joint GSP depict wells that extend below the bottom of the Subbasin.[134]

The Plan does not explicitly use the term principal aquifers to describe aquifers within the Subbasin, instead the Plan provides a description of aquifer systems present in the Subbasin. The Plan states that the Corcoran Clay underlies the western one-third of the Subbasin[135] and acts as a confining layer separating the upper unconfined aquifer from the lower confined aquifer.[136] The top of Corcoran Clay lies between 200 to 350 feet beneath the New Stone GSP area.[137] The Plan describes that the area outside of the Corcoran Clay, located in the central and eastern portions of the Subbasin, contains discontinuous clay layers interspersed with permeable coarse-grained units and is generally considered to be semi-confined. The semi-confined aquifer is further described as an upper semi-confined aquifer and a lower semi-confined aquifer (at an estimated depth ranging from 200 to 400 feet which generally correlates to the depth of the Corcoran Clay).[138] The Plan states the Subbasin contains areas of perched water. For example,

[126] Gravelly Ford GSP, Appendix B, p. 102.
[127] Gravelly Ford GSP, Appendix B, pp. 96-99.
[128] Gravelly Ford GSP, Appendix B, p. 107.
[129] Joint GSP, Section 2.2.1.1, p. 91.
[130] Joint GSP, Section 2.2.1.1, p. 91, Figure 2-19, p. 184.
[131] Joint GSP, Section 2.2.1.2, p. 91, Figure 2-17, p. 182.
[132] Joint GSP. Section 2.2.1.2. pp. 91-92, Figures 2-24 through 2-34, pp. 189-199.
[133] Joint GSP, Section 2.2.1.2, p. 92.
[134] Joint GSP, Figures 2-24 to 2-34, pp. 189-199.
[135] Joint GSP, Section 2.2.1.3, p. 93.
[136] New Stone GSP, Section 3.1.8, p. 60.
[137] New Stone GSP, Section 3.1.8, p. 60.
[138] Joint GSP, Section 2.2.1.3, pp. 93-94.

the Joint GSP states that the approximate location of the perched aquifers are six miles southeast of the City of Madera and ten miles northwest of the City of Madera; depths range from 3 to 27 feet southeast of the City of Madera, 100 feet within the City of Madera, and 105 to 130 feet northeast of Madera. Other sites with perched groundwater are believed to exist, but locations and depths are uncertain due to limited data.[139]

Department staff find that the Plan introduces uncertainty in the hydrogeologic conceptual model by identifying several aquifers in the Subbasin, but not directly defining any of these aquifers as principal aquifer(s). Additional details are provided below.

- The Plan identifies formations (i.e., Modesto, Riverbank, and Turlock Lake Formation - which contains the Corcoran Clay)[140] of the Subbasin but does not associate them with principal aquifer(s).
- The Plan describes the lateral and vertical boundaries of the Subbasin[141] but does not provide details that describe the lateral and vertical boundaries by principal aquifer. Also, the GSP does not provide sufficient details to support that east of the Corcoran Clay, the upper regional aquifer is semi-confined, instead of unconfined.
- The Plan does not provide a map depicting the source and point of delivery for imported waters.
- The Plan provides a description of water quality for total dissolved solids, nitrate, and arsenic along with maps of concentrations within the Subbasin.[142] None of the water quality data is identified by principal aquifer, although some of the data is identified by different aquifer descriptions such as upper, lower, shallow wells and deep wells.[143]

The Plan provides cross-sections that provide sufficient information to depict the major stratigraphic and structural features in the Subbasin. Physical characteristics of the Subbasin are depicted on various maps and figures. The cross-sections depict the base of freshwater, top of crystalline basement complex of the Sierra Nevada along the eastern portion of the Subbasin. Also shown is the upper aquifer and lower aquifer separated by the Corcoran Clay. Additionally, the GSP describes that east of the Corcoran Clay extent, the aquifer system is considered to consist of an upper semi-confined aquifer and a lower semi-confined aquifer;[144] however, the cross-sections show unconfined groundwater levels in the areas identified in the GSP as semiconfined.

The Plan does not explicitly identify data gaps and uncertainty concerning the hydrogeologic conceptual model as required by the GSP Regulations.[145] Department staff believe that a discussion regarding data gaps and uncertainty in the hydrogeologic

[139] Joint GSP, Section 2.2.2.1, p. 98.
[140] Joint GSP, Section 2.2.1.1, p. 91; Root Creek GSP, Section 3.1.2, p. 76.
[141] Joint GSP, Section 2.2.1.2, p. 91.
[142] Joint GSP, Section 2.2.2.3, pp. 102-104.
[143] Joint GSP, Appendix 2.E., pp. 1267-1321.
[144] Joint GSP, Section 2.2.1.1, p. 95.
[145] 23 CCR § 354.14(b)(5).

conceptual model, and plans to address data gaps is necessary, as lack of data and understanding of the physical characteristics of the subbasin may limit sustainable groundwater management (see Recommended Corrective Action 5).

5.2.2 Groundwater Conditions

The GSP Regulations require a written description of historical and current groundwater conditions for each of the six sustainability indicators and groundwater dependent ecosystems.[146]

Groundwater levels are currently declining across much of the Subbasin in both the unconfined and lower aquifer zones.[147] The current conditions are a continuation of historical trends of declining groundwater levels across much of the Subbasin that have been observed for at least the past 30 years.[148] In total, more than 500 hydrographs are included in the Plan covering varying timelines over the last 100 years. Hydrographs included in the Plan show two measurements per year over the well's entire period of record with the timeline beginning in 1945 or 1920.[149]

The Subbasin is also losing groundwater storage and has been since at least 1988 based on information provided in the Plan.[150] The Joint GSP includes a summary of various studies which utilized different specific yield values to estimate the total volume of groundwater storage loss ranging between 1,891,308 acre-feet to 3,073,376 acre-feet for the period 1988 to 2014 and 2,809,149 acre-feet to 4,564,868 acre-feet for the period 1988 to 2016.[151] This equates to an annual storage loss of 73,000 to 163,000 acre-feet per year since 1988.[152] The range in change in groundwater storage conditions result from five different specific yield estimates that vary from 5% to 12% for the Subbasin. The Joint GSP includes a summary table (Table 2-8) showing the total change of storage over two time periods: 1988 to 2014 and 1988 to 2016 based on five different specific yield values.[153]

The Plan identifies nitrate, total dissolved solid (TDS), and arsenic as the current key water quality constituents in the Subbasin. These three constituents were highlighted because they "have greater potential for presenting broader regional groundwater quality concerns extending beyond localized or site-specific contamination cases and are likely to reflect a range of potential contamination sources."[154] The New Stone GSP also states that salinity, chloride, specific conductance, and pesticides are constituents being detected in areas in the district; however, data available within and near the district indicates that levels of these constituents are generally below respective maximum

[146] 23 CCR § 354.16 (a-f).
[147] Joint GSP, Section 2.2.2.1, pp. 97-100.
[148] Joint GSP, Figures 2-56 and 2-57, pp. 221-222.
[149] Joint GSP, Appendix 2.E.b, pp. 1129-1266.
[150] Joint GSP, Section 2.2.2.2, p. 101.
[151] Joint GSP, Section 2.2.2.2, pp. 101-102, Table 2-8, p. 102.
[152] Joint GSP, Section 2.2.2.2, pp. 101-102, Table 2-8, p. 102.
[153] Joint GSP, Table 2-8, p. 102.
[154] Joint GSP, Section 2.2.2.3, p. 102.

contaminant limits (MCLs) for drinking water. [155] The Root Creek GSP also included an evaluation of other constituents historically present in the GSP area, and states that the evaluation of historical results indicate that the area generally has acceptable groundwater quality for agricultural use and drinking water.[156] The Plan includes more than 50 maps displaying chemical concentrations for the key water quality constituents and other chemicals.[157]

Land subsidence has occurred and continues to occur in the Subbasin. The Joint GSP includes a written description detailing land subsidence over three time periods: 1926 to 1970, 2007-2011, and 2015-2017. [158] The discussion in the GSP focuses on the northwestern portion of the Subbasin where 1 to 2 feet of land subsidence occurred between 1926 and 1970, 0.5 to 1.0 feet occurred between 2007 and 2011, and 1.0 to 1.5 feet between 2015 and 2017.[159] The New Stone GSP states the subsiding area near El Nido is approximately 25 miles in diameter and its outer reach extends to the Plan area and the western area of the Subbasin.[160] United States Bureau of Reclamation monitoring point 1007R located on the western boundary of Plan area has indicated an annual subsidence rate ranging from 0.09 to 0.60 feet per year since December 2011 with the highest annual rate occurring from December 2012 through July 2014. [161] The Plan includes maps displaying both historical and current land subsidence.[162] Department staff provide information relevant to this in Section 4.3.

Interconnected surface water potentially exists in localized areas along the San Joaquin River within the Subbasin based on an analysis of comparing groundwater levels to the stream thalweg.[163] Based on this analysis, there were also additional portions of the San Joaquin River that were connected with groundwater historically (from 1958 to 1984) but may no longer be connected due to declining groundwater levels.[164] The Joint GSP states characterization of hydrogeologic conditions related to the potential for interconnected surface water is currently based on very limited data and, therefore, additional data collection and analyses are needed to update and refine the understanding of how surface water and GDEs may (or may not) be connected to the regional aquifers where groundwater pumping occurs.[165] Department staff provide information relevant to this in Section 4.4.

[155] New Stone GSP, Section 3.2.5, pp. 77-79.
[156] Root Creek GSP, Section 3.2.6, pp. 120-125.
[157] Joint GSP, Appendix 2.E, pp. 1268-1321; Root Creek GSP, Figures 3-27 through 3-29, pp. 121-123.
[158] Joint GSP, Section 2.2.2.4, p. 105.
[159] Joint GSP, Section 2.2.2.4, p. 105, Figures 2-67 through 2-70, pp. 232-235.
[160] New Stone GSP, Section 3.2.6.1, p. 82.
[161] New Stone GSP, Section 3.2.6.1, p. 82.
[162] New Stone GSP, Figures 3-23 and 3-24, pp. 84-85.
[163] Joint GSP (Redline), Section 2.2.2.5, p. 118.
[164] Joint GSP, Section 2.2.2.5, p. 105.
[165] Joint GSP (Redline), Section 2.2.2.5, p. 121.

The Plan identifies four areas within the Subbasin as "Potential GDE Units".[166] The Joint GSP includes a technical memorandum that provides additional information about each of the four Potential GDE Areas including a series of maps, identification of potential GDE species, and a description of GDE conditions in the Subbasin.[167]

Overall, the Plan sufficiently describes the historical and current groundwater conditions throughout the Subbasin and the information included in the Plan substantially complies with the requirements outlined in the GSP Regulations.

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, and the change in the volume of water stored, as applicable.

The seven GSAs in the Subbasin use the data and analysis provided in the Technical Memorandum: Data Collection and Analysis (Davids engineering and Luhdorff & Scalmanini Consulting Engineers, July 2017) and the Draft Preliminary Basin Boundary Water Budget (Davids engineering and Luhdorff & Scalmanini Consulting Engineers, February 2018).[168] These documents were used to develop the Subbasin's water budget.[169] The water budget described in the Joint GSP presents a water budget for the entire Plan area, including annual water budget information for Gravelly Ford GSP, New Stone GSP, and Root Creek GSP; the Gravelly Ford GSP, New Stone GSP, and Root Creek GSP also reference the water budget information in the Joint GSP.[170] Detailed information is provided for all seven GSAs in Appendix 6.D of the Joint GSP.[171] An assessment of the information is provided below.

The water budgets contain a surface water system and a groundwater system (referred to as accounting centers) for the entire Subbasin. The Plan clearly lists the inflow, outflow, and change in storage components for each accounting center.[172] This framework is applied to the current, historical, and projected budgets.

The period 1989-2014 is used as the base period for both the historical and current water budget and represents average hydrologic conditions based on cumulative departure from mean precipitation.[173] The average annual change in storage is calculated as -34,200 acre-feet per year[174] for the historical budget. The overdraft estimate for the current water budget is -93,276 acre-feet, calculated using an average of historical

[166] Joint GSP, Section 2.2.2.6, p. 107.
[167] Joint GSP, Appendix 2.B, pp. 518-584.
[168] Madera Subbasin Coordination Agreement, p. 12.
[169] Joint GSP, Section 2.2.3.1, p. 114.
[170] Joint GSP, Appendix 2.F, pp. 1322-1620.
[171] Joint GSP, Appendix 6.D, pp. 2012-2175.
[172] Joint GSP, Table 2-10, p. 117.
[173] Joint GSP, Section 2.2.3.2, pp. 122-123, Figures 2-81 and 2-82, p. 124.
[174] Joint GSP, Table 2-26, p. 159.

hydrologic conditions from 1989-2014 with 2015 land use data.[175] The information presented indicates that change in storage is positive only during wet years at a volume of 122,900 acre-feet. All other years indicate decreases in storage ranging from -82,700 to -230,400 acre-feet.[176]

Sustainable yield is calculated for the historical and projected water budgets.[177] As reported in the Plan, the historical sustainable yield for the Subbasin is 437,300 acre-feet per year.[178] The projected sustainable yield for the Subbasin is 439,300 acre-feet per year with a lower bound of 329,500 acre-feet per year and upper bound of 549,100 acre-feet per year.[179] The projected sustainable yield was calculated only for the sustainability period 2040-2090 with the reasoning that ongoing projects and demand management during the implementation period (2020-2039) will continually shift sustainable yield as project efficacy is evaluated.[180] The similarity of historical and projected sustainable yields suggests the sustainable yield during the implementation period would not differ appreciably from these estimates.

Department staff conclude the historical, current, and projected water budgets included in the Plan substantially comply with the requirements outlined in the GSP Regulations. The GSP 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 and projected future water demands.

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.[181]

No management areas were designated per the information provided in the Plan.

5.3 Sustainable Management Criteria

The 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

[175] Joint GSP, Table 2-30, p. 163.
[176] Joint GSP, Table 2-33, p. 165.
[177] Joint GSP, Section 2.2.3.4, pp. 166-167.
[178] Joint GSP, Table 2-34, p. 167.
[179] Joint GSP, Table 2-35, p. 168.
[180] Joint GSP, Section 2.2.3.4, p. 167.
[181] 23 CCR § 345.20.

characterizes undesirable results and establishes minimum thresholds and measurable objectives for each applicable sustainability indicator.[182]

5.3.1 Sustainability Goal

The GSAs establish a sustainability goal for the Subbasin in the Coordination Agreement which is to "…implement a package of projects and management actions that will, by 2040, balance long-term groundwater system inflows and outflows based on a 50-year period representative of average historical hydrologic conditions."[183] The Joint GSP explains that during the 20-year implementation period a combination of recharge projects, replacing groundwater use with surface water, and demand reduction management actions are planned. These efforts will "increase groundwater inflows and decrease groundwater outflows to bring the groundwater system into balance by 2040 and will allow its operation to remain sustainable over a 50-year period representing average hydrologic conditions."[184]

Each GSP also provides additional specific information describing the goal for each GSP area. For example, the Gravelly Ford GSP describes the sustainability goal for the Subbasin as "…to minimize the listed undesirable results throughout the Subbasin by providing a Gravelly Ford GSP water supply that supports current cultivated acreage in the Plan area by developing an expanded surface water irrigation and recharge program, and groundwater monitoring and land elevation measurement program."[185] The New Stone GSP states that "[t]he goal for the GSP is to provide a tool for managing groundwater, basin-wide, on a long-term basis and to meet measurable objectives for each indicator by maintaining a sustainable yield, thus avoiding undesirable results."[186] The Root Creek GSP explains that the sustainability goal is to work collectively with the other GSAs within the Subbasin to "sustainably manage the groundwater resources of the basin while maintaining openness to the public and stakeholders such that local citizenry has a voice in the outcome."[187] Additionally, the goal of the Root Creek GSP is to "immediately reduce and eventually eliminate systematic overdraft within the [GSP] area.[188] While, specifying how each GSP will support the Subbasin sustainability goal within its' GSP area is an appropriate level of detail for each GSP, Department staff recommend the GSAs continue to coordinate and align this portion of each GSP to provide a more cohesive definition between the specific GSP goal and the sustainability goal for the Subbasin (see Recommended Corrective Action 2).

[182] 23 CCR § 354.22 *et seq*.
[183] Madera Subbasin Coordination Agreement, p. 34.
[184] Joint GSP, Section 3.1.2, p. 244.
[185] Gravelly Ford GSP, Section 3.1, p. 48.
[186] New Stone GSP, Section 4.1, p. 110.
[187] Root Creek GSP, Section 4.1, p. 157.
[188] Root Creek GSP, Section 1.2, p. 17.

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.[189] 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[190] – 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.

The following subsections 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 basin, as quantified through the establishment of minimum thresholds, are addressed for each sustainability indicator. However, a GSA is not required to establish criteria for undesirable results that the GSA can demonstrate are not present and are not likely to occur in a basin.[191]

5.3.2.1 Chronic Lowering of Groundwater Levels

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.[192]

In the September 2022 Incomplete Determination, the Department identified deficiencies related to the sustainable management criteria for the chronic lowering of groundwater levels. The GSAs revised this portion of the Plan, and Department staff evaluate this sustainability indicator in Section 4.2 of this Staff Report. As presented above, Department staff concluded that the GSAs took sufficient action to correct this deficiency to warrant approving the Plan, but staff also provided recommended corrective actions based on the changes the Agencies have made to the sustainable management criteria for this sustainability indicator to further improve management during Plan implementation.

[189] 23 CCR § 351(ah).
[190] Water Code § 10721(x).
[191] 23 CCR § 354.26(d).
[192] 23 CCR § 354.28(c)(1).

5.3.2.2 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 basin's sustainable yield, calculated based on the basin's historical trends, water year type, and projected water use.[193]

The Plan states groundwater levels act as a proxy for the groundwater storage sustainability indicator and the sustainable management criteria for reduction in groundwater storage are the same as those established for chronic lowering of groundwater levels.[194] Department staff will evaluate and compare the groundwater level conditions and reduction of storage in Annual Reports submitted to the Department. Department staff expect the information will be reported on a per aquifer basis given the groundwater level monitoring network identifies which aquifer the representative monitoring site is monitoring.

5.3.2.3 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.[195]

As stated in the Plan, seawater intrusion sustainability criteria are not applicable to the Subbasin, because it is located more than 70 miles inland and hydraulically disconnected from the ocean.[196]

5.3.2.4 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 thresholds 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.[197]

The GSP states that "an undesirable result for degraded groundwater quality occurs when groundwater quality exceeds an established MCL and minimum threshold for arsenic, nitrate, or TDS [total dissolved solids] for a significant duration of time and at a significant number of representative monitoring sites and is the direct result of projects or management actions undertaken as part of the GSP implementation."[198] More

[193] 23 CCR § 354.28(c)(2).
[194] Joint GSP, Section 3.4.2, pp. 277-278.
[195] 23 CCR § 354.28(c)(3).
[196] Joint GSP, Section 3.2.6, p. 259.
[197] 23 CCR § 354.28(c)(4).
[198] Joint GSP, Section 3.4.4, p. 279.

specifically, a “significant duration of time” is defined as “a three-year monitoring period” and a “significant number of representative monitoring sites” is defined as “greater than 10 percent of representative groundwater quality monitoring wells exceeding a minimum threshold for a given constituent.”[199] This definition is overly narrow. SGMA specifies that the significant and unreasonable effects are those “caused by groundwater conditions occurring throughout the basin” not just from groundwater management activities. By solely focusing on water quality impacts caused directly by the GSAs implementing an action, the GSP does not define undesirable results for degraded water quality in accordance with the SGMA. SGMA’s definition of undesirable results includes “significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.”[200] As currently defined in the Plan, 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 in the Subbasin, but the GSAs have not determined this to be a result of a project or management action, the GSAs would not identify this as an undesirable result. 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, changes in groundwater levels, changes in the direction of groundwater flow, or changes in horizontal or vertical movement of groundwater within the Subbasin should be considered in the assessment of undesirable results in the Subbasin. Department staff recommend the GSAs revise the definition of their overly-narrow definition of undesirable results such that groundwater pumping and other factors, whether due to action or inaction of the GSAs with respect to Subbasin management, is considered and not excluded in the undesirable result definition (see Recommended Corrective Action 6a).[201]

Significant and unreasonable degradation of water quality is defined as “when beneficial uses for groundwater are adversely impacted by constituent concentrations increasing to levels above the drinking water MCLs for one of the key constituents of interest …due to implementation of a GSP project or management action.”[202] Though the definition provided appears to consider specific effects of degradation of groundwater quality, the GSP does not provide details that explain how the GSAs determined what “adversely impacted by constituent concentrations” means. Additionally, the GSP does not provide descriptions, supported by analysis, of the potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results. The GSAs should update the definition of undesirable results to include specific scenarios the GSAs are trying to avoid (e.g., additional cost to domestic well users for well treatment, decrease in water available

[199] Joint GSP, Section 3.4.4, p. 279.
[200] Water Code § 10721(x).
[201] 23 CCR § 354.26 (b)(2).
[202] Joint GSP, Section 3.4.4, p. 279.

for certain beneficial uses, etc.). Department staff recommend that the GSAs refine the definition to better describe the specific significant and unreasonable effects related to degraded water quality the GSAs are managing to avoid (see Recommended Corrective Action 6b).

The GSP provides a description of potential causes of an undesirable result, limited to direct effects of GSP projects or management actions, such as localized pumping clusters (which would particularly affect areas prone to elevated arsenic concentrations occurring at greater pumping water level depths)[203] and groundwater recharge which particularly affect areas of actively or formerly cultivated lands where high residual concentrations of nutrients, especially nitrogen, may exist.[204]

The GSP establishes the minimum thresholds for degraded water quality at the "[maximum contaminant level (MCLs)] for drinking water for identified key constituents (10 mg/L for nitrate as nitrogen; 500 mg/L for TDS; 10 ug/L for arsenic) or when existing or historical concentrations for the key constituents already exceed the MCL, the minimum threshold is set at the recent concentration plus 20 percent."[205] Measurable objectives are set at current constituent concentrations.[206] However, the GSP does not identify which wells have had exceedances in the past or provide the current constituent concentrations in the Plan. The GSP also states "significant and unreasonable degradation of water quality occurs when beneficial uses for groundwater are adversely impacted by constituent concentrations increasing to levels above the drinking water MCLs,"[207] but the GSP does not explain or justify setting minimum thresholds at 20 percent above MCLs, or demonstrate that these increased levels would not adversely impact beneficial uses and users of water. Department staff are not aware of specific concerns regarding degraded water quality that warrant immediate action based on what is provided in the Plan; however, staff believe the GSAs should identify the exact minimum threshold values what will be used and justify how establishing minimum thresholds at the higher of either MCLs or existing concentrations plus 20 percent does not constitute significant and unreasonable effects as defined by the GSP (i.e., "when beneficial uses for groundwater are adversely impacted by constituent concentrations) (see Recommended Corrective Action 6c).

5.3.2.5 Land Subsidence

SGMA defines the undesirable result for subsidence to be significant and unreasonable land subsidence that substantially interferes with surface land uses, caused by groundwater conditions occurring throughout the basin.[208] The GSP Regulations require the minimum threshold for land subsidence to be the rate and extent of subsidence that

[203] Joint GSP, Section 3.4.4, pp. 279-280.
[204] Joint GSP, Section 3.4.4, p. 280.
[205] Joint GSP, Section 3.3.4, p. 271.
[206] Joint GSP, Section 3.4.2.1, p. 253.
[207] Joint GSP, Section 3.4.4, p. 271.
[208] Water Code § 10721(x)(5).

substantially interferes with surface land uses and may lead to undesirable results.[209] Minimum thresholds for subsidence shall be supported by the identification of land uses and property interests that have been affected or are likely to be affected by land subsidence in the basin, including an explanation of how the Agency has determined and considered those uses and interests, and the Agency's rationale for establishing minimum thresholds in light of those effects and maps and graphs showing the extent and rate of land subsidence in the basin that defines the minimum threshold and measurable objectives.[210]

In the September 2022 Incomplete Determination, the Department identified deficiencies related to the sustainable management criteria for land subsidence. The GSAs revised this portion of the Plan and Department staff provide evaluation for this sustainability indicator in Section 4.3 of this Staff Report. As presented above, Department staff concluded the GSAs had taken sufficient actions to correct the deficiencies and provided additional recommended corrective actions based on the changes the Agencies have made to the sustainable management criteria for this sustainability indicator to further improve basin management as the Plan is implemented.

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.[211] 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.[212] The GSP Regulations further require that minimum thresholds be set based on the rate or volume of surface water depletions caused by groundwater use, supported by information including the location, quantity, and timing of depletions, that adversely impact beneficial uses of the surface water and may lead to undesirable results.[213]

In the September 2022 Incomplete Determination, the Department identified deficiencies related to the sustainable management criteria of depletions of interconnected surface water. The GSAs revised this portion of the Plan and Department staff provide evaluation for this sustainability indicator in Section 4.4 of this Staff Report. As presented above, Department staff concluded the GSAs had taken sufficient actions to correct the deficiencies and provided additional recommended corrective actions based on the changes the Agencies have made to the sustainable management criteria for this sustainability indicator.

[209] 23 CCR § 354.28(c)(5).
[210] 23 CCR §§ 354.28(c)(5)(A-B).
[211] Water Code § 10721(x)(6).
[212] 23 CCR § 354.16(f).
[213] 23 CCR § 354.28(c)(6).

5.4 Monitoring Network

The GSP Regulations describe the monitoring network that must be developed for each basin including monitoring objectives, monitoring protocols, and data reporting requirements. Collecting monitoring data of 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.[214] Specifically, a monitoring network must be able to monitor impacts to beneficial uses and users,[215] monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds,[216] capture seasonal low and high conditions,[217] include required information such as location and well construction, and include maps and tables clearly showing the monitoring site type, location and frequency.[218] Department staff encourage GSAs to collect monitoring data as specified in the GSP, fill data gaps identified in the GSP prior to the first 5 year update,[219] update monitoring network information as needed, follow monitoring best management practices,[220] 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. 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.

Each GSP identifies a distinct monitoring network that measures groundwater elevations for assessment of chronic lowering of groundwater levels. The Joint GSP identifies 37 monitoring wells with 11 wells in the Upper Aquifer, 22 wells in the Lower Aquifer, and four composite wells screened in both aquifers.[221] The Joint GSP acknowledges the spatial coverage of the monitoring network for the Upper Aquifer is limited to the southwestern portion of the GSP area.[222] The Gravelly Ford GSP states that two different groups of wells are currently being used for monitoring chronic lowering of groundwater levels; one with a network of 24 wells and another network of four wells from outside the GSP area to compare future measurements.[223] However, the Gravelly Ford GSP does not specify which aquifer the wells are monitoring. The New Stone GSP monitoring network includes six monitoring wells comprised of three California Groundwater Elevation Monitoring Program (CASGEM) monitoring sites and three district wells that will

[214] 23 CCR § 354.32.
[215] 23 CCR § 354.34(b)(2).
[216] 23 CCR § 354.34(b)(3).
[217] 23 CCR § 354.34(c)(1)(B).
[218] 23 CCR §§ 354.34(g)-(h).
[219] 23 CCR § 354.38(d).
[220] Department of Water Resources, 2016, Best Management Practices and Guidance Documents.
[221] Joint GSP, Section 3.5.1, p. 281.
[222] Joint GSP, Section 3.5.1, p. 282.
[223] Gravelly Ford GSP, Section 3.5.1, pp. 57-58.

be monitoring the unconfined aquifer and confined aquifer respectively.[224] The Root Creek GSP states that the GSA will use the five wells in the monitoring network within the single aquifer that underlies the GSP area.[225]

The Plan proposes to use groundwater levels and the groundwater level monitoring network as a proxy for the loss of groundwater in storage monitoring network because changes in groundwater storage are directly dependent on changes in groundwater levels.[226]

The groundwater quality monitoring network in the Joint GSP consists of 12 monitoring sites selected from the GSP groundwater level monitoring network.[227] Of these wells, two are screened in the Upper Aquifer, eight in the Lower Aquifer, and two are composite wells screened in both.[228] Additionally, two domestic wells from the Irrigated Lands Regulatory Program, and thirteen public supply wells with ongoing monitoring conducted by other entities are also part of the representative monitoring sites but the GSP does not identify which aquifers the wells are completed in.[229] The Gravelly Ford GSP states groundwater quality samples will be collected from 24 wells throughout the district and the samples will be collected once a year.[230] The New Stone GSP states the GSA will use the three district wells that monitor the confined aquifer.[231] The Root Creek GSP states that degraded water quality will be monitored from 17 sites throughout the GSA's area of the Subbasin which includes municipal wells, monitoring wells associated with the Riverstone wastewater treatment plant, agricultural wells used in the GSP, and wells associated with CASGEM.[232] The Plan states that several agencies monitor and regulate water quality in the Subbasin and the GSAs will collect and review the data published by these agencies, which include the Regional Water Quality Control Board, Environmental Protection Agency, Department of Toxic Substance Control, Madera County, United States Geological Survey, and State Water Resources Control Board.[233]

The land subsidence monitoring network in the Joint GSP is comprised of six benchmark survey points monitored by the United States Bureau of Reclamation as part of the San Joaquin River Restoration Program (SJRRP) and one continuous GPS station monitored by UNAVCO as part of the Plate Boundary Observatory Project.[234] Two of the benchmark survey points are underlaid by the Corcoran Clay, where subsidence is of most concern. Representative monitoring site 1007R, a benchmark survey point which is located on the

[224] New Stone GSP, Section 5.2.1, pp. 133-134.
[225] Root Creek GSP, Section 5.2.1, p. 191.
[226] Joint GSP, Section 3.5.1.2, p. 286; Gravelly Ford GSP, Section 3.5, p. 59; New Stone GSP, Section 5.3.1, p. 138; Root Creek GSP, p. 196.
[227] Joint GSP, Section 3.5.1.4, p. 287.
[228] Joint GSP, Figure 3-2, p. 300.
[229] Joint GSP, Section 3.5.1.4, p. 287.
[230] Gravelly Ford GSP, Section 3.5.1, p. 58.
[231] New Stone GSP, Section 5.5.1, p. 139, Figure 5-1, p. 137.
[232] Root Creek GSP, Section 5.4.1, pp. 199-201.
[233] Root Creek GSP, Section 5.4.1, p. 199.
[234] Joint GSP (Redlined), Section 3.2.3.2, p. 279, Figure 3-10, p. 360.

western edge of the New Stone GSP area, has reported the most severe rate of recent subsidence in the Subbasin.[235] The Plan states that all SJRRP and UNAVCO sites will be used to monitor for subsidence in the area and monitoring stations outside the Subbasin will be used to provide regional context. The Root Creek GSP also provides a list of subsidence monitoring done by other agencies such as USGS, DWR, USACE which will be used to verify the Plan's monitoring network.[236] The Gravelly Ford GSP subsidence monitoring program will be expanded by the district to include observations on all the 24 monitoring sites in the GSP area, at a period of three to five years, with some wells observing the Lower Aquifer.[237] See Section 4.3.2 for further evaluation of the Plans sustainable management criteria and monitoring network for land subsidence.

Interconnected surface water is evaluated by monitoring groundwater levels at three wells[238] screened in the Upper Aquifer near the San Joaquin River. The Joint GSP explains the representative monitoring sites include a combination of irrigation and monitoring wells with data representing surface water-groundwater interconnection trends from 1989.[239] Streamflow data from gaging stations is also collected and will be used in future studies and evaluations of interconnected surface water, including generating data to better estimate groundwater basin conditions related to interconnected surface water[240] (also see Section 4.4.2).

The description of the monitoring in the Plan substantially complies with the requirements outlined in the GSP Regulations. Overall, the Plan describes in sufficient detail a monitoring network that promotes the collection of data of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the Subbasin and evaluate changing conditions that occur through Plan implementation. The GSP provides a good explanation for the conclusion that the monitoring network is supported by the best available information and data and is designed to ensure adequate coverage of sustainability indicators. The Plan also describes existing data gaps and the steps that will be taken to fill data gaps and improve the monitoring network. Department staff consider the information presented in the Plan as satisfying the general requirements of the GSP Regulations regarding monitoring networks, but also provide recommended corrective actions related to managing and monitoring land subsidence (see Recommended Corrective Action 4).

[235] New Stone GSP (Redlined), Section 3.2.6.1, p. 99, Figure 5-2, p. 185.
[236] Root Creek GSP (Redlined), Section 5.5.1, pp. 266-267, Section 5.5.3, p. 268.
[237] Gravelly Ford GSP (Redlined), Section 3.5.1, p. 76, Section 3.5.4.2, p. 77.
[238] Joint GSP (Redlined), Figure 3-4, p. 352, Section 3.5.1.5, p. 336.
[239] Joint GSP (Redlined), Section 3.5.1.5, p. 336, Section 3.2.5, p. 288.
[240] Joint GSP (Redlined), Section 3.5.1.5, p. 336.

5.5 PROJECTS AND MANAGEMENT ACTIONS

The GSP Regulations require a description of the projects and management actions the GSAs have determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin.[241]

The Plan lays out the projects which were selected by the GSAs to achieve the Subbasin sustainability goal by 2040.[242] Generally, the projects are supply augmentation (i.e., recharge or conveyance enhancement) projects which source water from flood releases, Section 215 water, bypass flows, or water purchases. While the total cost of project implementation is not provided, the estimated costs provided in each individual GSP total to over $270,000,000 in capital costs and over $70,000,000 in annual costs; Department staff note that the GSAs have also included an estimated economic cost from reduced crop production resulting from demand management in the estimated annual operating cost, which is approximately $54,000,000 per year or over 75% of the total.[243] Many of the projects are currently being implemented, having been initiated by past efforts, or will be implemented by 2040. The total expected benefit is 215,840 acre-feet per year[244] at full implementation with the majority of the benefit deriving from a demand management program led by the Madera County GSA which will conserve 90,000 acre-feet per year. Madera County determined that projects were unlikely to generate enough benefit to offset the estimated current and projected future overdraft conditions and decided to implement a management action to gradually reduce groundwater pumping over the GSP implementation period.[245] The demand management effort started in 2020 with 2% demand reduction per year until 2025. Starting in 2026, the demand reduction increases to a 6% reduction rate until 2040.[246]

Since the submission of the Plan in 2020, the GSAs have provided Annual Reports to the Department that provide updates on progress, a brief overview of these efforts from Water Year 2019 to Water Year 2022 is provided in each revised GSP. A review of the Annual Reports submitted shows progress on a majority of the projects and enhancements of monitoring networks, which now collect more land subsidence, water quality, and groundwater level data; the GSAs also report efforts being made to collect more interconnected surface water data.[247]

A review of the projects presented in each GSP is provided below.

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[241] 23 CCR § 354.44 et seq.
[242] Joint GSP (Redlined), Section 4, pp. 361-431; Gravelly Ford GSP (Redlined), Section 4, pp. 83-37; Root Creek GSP (Redlined), Section 6, pp. 309-327; New Stone GSP (Redlined), Section 6, pp. 189-199.
[243] Joint GSP, Table 4-3, p. 312, Section 4.4.4.5, p. 352.
[244] Joint GSP, Tables 4-1 and 4-2, pp. 310-311.
[245] Joint GSP, Section 4.4.4, p. 347.
[246] Joint GSP, Section 4.4.4.2, p. 348.
[247] Joint GSP Water Year 2022 Annual Report, Table 7-1, pp. 56-57; Gravelly Ford GSP Water Year 2022 Annual Report, Section 2.4.3, pp. 18-19; New Stone GSP Water Year 2022 Annual Report, Section 3.1.2, p. 10; Root Creek GSP Water Year 2022 Annual Report, p. 26.

The Joint GSP describes each project and management action proposed by Madera Water District GSA, Madera Irrigation District GSA, City of Madera GSA, and Madera County GSA.[248] They are:

Madera Water District GSA

1. Surface Water Purchase Program

Madera Irrigation District GSA

1. Groundwater Recharge Basins
2. On-Farm Recharge (Flood-MAR)
3. Madera Irrigation District System Improvements and Programs
4. Madera Ranch Annexation

The City of Madera GSA

1. Berry Basin for groundwater recharge
2. The City of Madera Metering and Volumetric Billing program.

Madera County GSA

1. Water Purchase for Direct or In-Lieu Recharge (starts in 2025)
2. Import and Recharge of Millerton Flood Releases (Flood-MAR) (starts in 2025)
3. Chowchilla Bypass Flood Water Recharge Basins (starts in 2025)
4. Chowchilla Bypass Flood Water Recharge Basins (starts in 2040)
5. Management Action: Demand Management (starts in 2020)

The Joint GSP provides an estimate for implementing projects and management actions, which totals approximately $193,460,000 in capital costs and $69,550,000 in annual operating costs.[249] As noted above, the GSAs have included an estimated economic cost from reduced crop production resulting from demand management of approximately $54,000,000 per year in the total annual cost.[250] Based on information provided in the Joint GSP resubmittal and the 2022 Annual Report,[251] the GSA reports that a cumulative total benefit of over 63,000 acre-feet from projects and management actions to date, with a benefit of 7,300 acre-feet for the latest reported water year for the GSP area.[252] Demand management is described to potentially utilize a range of options including allocations, a water trading program, or easements to reduce groundwater demand. In 2022, Madera County took steps to develop a demand management study that was intended to result

[248] Joint GSP (Redlined), Section 4, pp. 361-341.
[249] Joint GSP (Redlined), Table 4-3, p. 366.
[250] Joint GSP (Redlined), Section 4.4.4.5, p. 409.
[251] Joint GSP Water Year 2022 Annual Report, Section 7.1, pp. 53-69.
[252] Joint GSP Water Year 2022 Annual Report, Table 7-2, p. 58.

in an acreage-based rate for extraction of groundwater within the GSA area. However, following an injunction issued by the Madera County Superior Court in December 2022, the Madera County GSA was ordered to refrain from imposing or collecting any new fees, rates, or GSP Project Fees enacted under Madera County Resolution 2022-086 against landowners in the Madera Subbasin.[253] Nonetheless, Department staff encourage the GSAs to continue efforts to develop and implement a successful management strategy to reduce groundwater pumping in the Subbasin, since the reduction of groundwater demand, as detailed in the Plan, is an essential part of achieving the sustainability goal for the basin. Department staff will closely monitor and track the implementation of the demand management program; delays in implementation due to litigation or funding are insufficient to justify delays in implementing demand reduction strategies that are needed to sustainably manage the basin.

The Gravelly Ford GSP[254] provides details for two projects which the GSA is currently implementing:

1. Recharge Program: this project is the continuation of the recharge program established by the Gravelly Ford Water District in 1961.
2. Increased Measurement, Sampling and Monitoring: this project is to continue data collection efforts.

The Gravelly Ford GSP does not provide an estimate for projects and management actions; the cost of implementing the GSP is estimated to be $961,000.[255] Based on information in the 2022 Annual Report,[256] the GSA reports that a number of measurements (i.e., depth to groundwater) of private agricultural wells in the GSP area were made and the installation of measurement meters has started on those wells to increase data collection; but the GSAs were not able to discharge surface water into the existing recharge basins during the 2022 Water Year.

The New Stone GSP includes a brief description of one project that is “currently being considered by the [New Stone Water] District”[257] which is the:

1. Construct Chowchilla Bypass Turnout, New Canals, and Recharge Basins (Bypass Project)

The Bypass Project is in the “conceptual phase” and implementation will “depend on the availability of land for new recharge basins [which will also determine amount of recharge] and acquiring a source of funding”; the amount of recharge will depend on acres available for recharge facilities but the district has a 15,700 acre-feet appropriative water right.[258] The estimated cost over 20-years for implementing the project is $7,800,000 but no

[253] Joint GSP (Redlined), Section 4.10.5.4, p. 430.
[254] Gravelly Ford GSP, Section 4, pp. 64-66.
[255] Gravelly Ford GSP (Redlined), Section 5.3.1, p. 88.
[256] Gravelly Ford GSP Water Year 2022 Annual Report, Section 2.4.3, p. 18-19.
[257] New Stone GSP, Section 6.2, pp. 151-157.
[258] New Stone GSP, Section 6.2.1.2 through 6.2.1.6, pp. 152-153.

schedule is provided.[259] Management actions will be enacted "[i]f basin overdraft isn't mitigated"[260] and the GSP doesn't provide related cost of implementation or schedule estimates. Based on information in the 2022 Annual Report,[261] the GSA did not provide substantial updates on the project or management action progress for the 2022 Water Year—but the GSA did report three new wells were added to the monitoring network.

The Root Creek GSP[262] includes brief descriptions of three projects:

1. Expansion of the In-Lieu Pipeline (to fully utilize surface water allocations)
2. Intentional Recharge Projects
3. Agricultural Land Conversion (Development of Riverstone)
4. Monitoring Well Program – Interconnected Surface Water

The Root Creek GSP provides project cost estimates and projects 2 and 3 are currently being implemented. Additionally, though management actions are referenced,[263] no specific details are provided; the GSP references the continuation of programs that were enacted prior to SGMA related to the use and sustainable management of groundwater.[264] During 2022, the GSP states, a benefit of 4,500 acre-feet was realized from projects for the GSP area.[265]

The Plan adequately describes proposed projects and management actions in a manner that is generally consistent and substantially complies with the GSP Regulations.[266] The projects and management actions, which focus largely on recharge or conveyance projects and demand management, are directly related to the sustainable management criteria and present a generally feasible approach to achieving the sustainability goal of the Subbasin.

As projects and management actions are implemented, the Department expects that progress be included in Annual Reports and any addition or removal of project and management actions be documented in Periodic Evaluations.

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."[267] Furthermore, the GSP Regulations state that minimum thresholds defined in each GSP

[259] New Stone GSP, Table 7-3, p. 160.
[260] New Stone GSP, Section 6.3, p. 154.
[261] New Stone GSP Water Year 2022 Annual Report, Section 3.1, pp. 10-11.
[262] Root Creek GSP, Section 6.1 through 6.4, pp. 212-226.
[263] Root Creek GSP, Table 6-1, p. 213.
[264] Root Creek GSP, Section 6.5, p. 226.
[265] Root Creek GSP (Redlined), Section 6.7, pp. 326-327.
[266] 23 CCR §§ 354.44 (a), 354.44 (b), 354.44 (c), 354.44 (d).
[267] Water Code § 10733(c).

be designed to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.[268]

The Madera Subbasin has three adjacent basins; the Kings Subbasin, Delta-Mendota Subbasin, and the Chowchilla Subbasin, are all high-priority and required to be managed under a GSP. The Delta-Mendota Subbasin and Chowchilla Subbasins are critically overdrafted and currently have inadequate plans which the Department has referred to the State Water Resources Control Board under Chapter 11 of SGMA. The Kings Subbasin is to the south of the Madera Subbasin bordering the south bank of the San Joaquin River. The Kings Subbasin is designated critically overdrafted and the Kings Subbasin Plan has been approved by the Department.

The Plan states that the Madera Subbasin GSAs have met multiple times with GSAs in adjacent subbasins to ensure that implementation of the Madera Subbasin GSPs will not interfere with the ability of adjacent subbasins to also achieve sustainable groundwater management; however, further details are not provided in the Plan.[269] The Plan also qualitatively describes how minimum thresholds and measurable objectives may affect an adjacent basin, concluding that the Madera Subbasin Plan will not hinder the ability of an adjacent basin to be sustainable;[270] however, the evaluation is provided without specifics.

Based on information available at this time, Department staff have insufficient evidence to conclude that groundwater management in the Madera Subbasin will adversely affect the implementation of a plan or impede achievement of sustainability goals in an adjacent basin. Department staff encourage the GSAs to evaluate whether their 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. Department staff will continue to review periodic evaluations to the Plan and Annual Reports to assess whether implementation of the Madera Subbasin GSP is likely to impact adjacent basins.

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.[271]

Since the GSP was adopted and submitted, climate change conditions have advanced faster and more dramatically. It is anticipated that the hotter, dryer 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

[268] 23 CCR § 354.28(b)(3).
[269] Joint GSP (Redlined), Executive Summary, p. 25.
[270] Joint GSP (Redlined), Section 3.2.1.4, p. 277, Section 3.2.2.4, p. 278, Section 3.2.4.4, p. 285, Section 3.2.5.4, p. 291, Section 3.3.1.5, p. 304, Section 3.3.2.3, p. 309, Section 3.3.3.3, p. 312, Section 3.3.4.3, p. 318, Section 3.3.5.3, p. 319.
[271] 23 CCR § 354.18.

encourages the GSAs to explore how the proposed groundwater level thresholds have been established in consideration of groundwater level conditions in the Subbasin based on current and future drought conditions. The Department encourages the GSAs to also explore how groundwater level data from the existing monitoring network will be used to make progress towards sustainable management of the Subbasin given increasing aridification and effects of climate change, such as prolonged drought. Lastly, the Department encourages the GSAs to 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 [272] to evaluate how the GSAs' groundwater management strategy aligns with drought planning, response, and mitigation efforts within the Subbasin.

[272] Water Code § 10609.50.

6 STAFF RECOMMENDATION

Department staff believe sufficient action has been taken by the GSAs to 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 Madera 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 GSAs for the first periodic assessment 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

Considering MID GSA has yet to adopt the Plan, by the first periodic evaluation, MID GSA should identify and list the specific projects and management actions that MID GSA will or may be responsible for implementing under the Revised Joint GSP and provide a parallel listing and detailed identification and discussion of the legal, contractual, or other authorities or arrangements that MID GSA is relying or will rely upon in adequately implementing the Plan including those projects or management actions to clearly demonstrate the feasibility of MID GSA implementing all projects and management actions.

RECOMMENDED CORRECTIVE ACTION 2

While the GSAs have established a framework for coordination of multiple GSPs that could serve as a basis to achieve Subbasin sustainability, it is vital that the GSAs continue their efforts to improve coordination and eliminate any remaining areas of disagreement that could delay Plan implementation or affect the likelihood of achieving sustainability. For example, the GSA should come to a consensus regarding the data and methods utilized to develop refined future water budgets for the entire Subbasin, and agreement regarding the availability and use of more detailed data as it becomes available from each GSP area. These efforts should be done with the ultimate goal that the contents of each GSP should represent a component of a cohesive, unified Plan that will achieve the sustainability goal in the Subbasin consistent with SGMA timelines and not be an isolated document only for a specific GSP area.

RECOMMENDED CORRECTIVE ACTION 3

The GSAs should revise the GSPs to include a discussion of the relationship between the management criteria for chronic lowering of groundwater levels and the other sustainability indicators, including an explanation of how the criteria, including interim milestones, were established to avoid undesirable results for each of the other sustainability indicators.

Recommended Corrective Action 4

Department staff recommend the following as it relates to land subsidence:

a. The GSAs should refine the description of undesirable results to clearly describe the significant and unreasonable conditions the GSAs are managing the Subbasin to avoid, as it relates to land subsidence. More specifically, the GSAs should reevaluate the quantitative metrics that define an undesirable result for subsidence. The reevaluation should consider localized subsidence conditions and the irreversibility of continued inelastic subsidence, especially in the area deemed of "greater subsidence concern." This is to say that the current quantitative metrics (i.e., 75 percent of the representative monitoring sites in the Subbasin exceed threshold levels for two consecutive years across the entire Subbasin) would not minimize or avoid inelastic subsidence in the most susceptible areas of the Subbasin – predominantly in the north-northwestern portion of the Subbasin which are describe as the areas of greater subsidence concern.

b. The GSAs should identify the cumulative amount of subsidence that, if exceeded, would substantially interfere with groundwater and land surface beneficial uses and users in the Subbasin. The Plan should explain how the rate and extent of any future subsidence permitted in the Subbasin may interfere with surface land uses. The Plan should also include additional details describing measures that consider and disclose the current and potentially lasting impacts of subsidence on land uses and groundwater beneficial uses and users.

   Additionally, the GSAs should provide specific details and schedule for projects or management actions that will be implemented to minimize or eliminate subsidence. The projects or management actions must be supported by best available information and science[273] and consider the level of uncertainty associated with the Subbasin.[274]

c. The GSAs should revise the GSPs to include a discussion of the relationship between the management criteria for land subsidence and the other sustainability indicators, including an explanation of how criteria, including interim milestones, were established to avoid undesirable results for each of the other sustainability indicators.

d. The GSAs should reevaluate or eliminate the application of the level of uncertainty as it relates to subsidence measurements according to standard professional practices. Establishment of sustainable management criteria should not allow for

[273] 23 CCR § 354.44 (c).
[274] 23 CCR § 354.44 (d).

subsidence in perpetuity based on the error of measurement. The GSAs should also consider incorporation of remotely sensed subsidence data (i.e., InSAR data) made available by the Department on an ongoing basis to monitor for subsidence in conjunction with the representative monitoring sites. For reference, the statewide vertical displacement measurements provided via the InSAR data present an error of 0.1 foot.

RECOMMENDED CORRECTIVE ACTION 5

The GSA should provide a discussion of the uncertainty concerning the hydrogeologic conceptual model and a description of hydrogeologic conceptual model data gaps.[275] For example, the GSP should include revisions to identify how many wells are completed below the bottom of the Subbasin, the amount of water that is extracted from these wells, and a description of changes to groundwater storage calculations for the Subbasin based on best available information.

RECOMMENDED CORRECTIVE ACTION 6

The GSAs must provide more detailed explanation and justification regarding the selection of the sustainable management criteria for degradation of water quality. Department staff recommend the GSAs consider and address the following:

a. The GSAs should revise the definition of undesirable results so that exceedances of minimum thresholds caused by groundwater extraction are considered in the assessment of undesirable results in the Subbasin.

b. The GSAs should provide a clear definition of what the Plan considers an undesirable result for degraded water quality by describing conditions that it would consider to be significant or unreasonable. For example, the Plan should—in addition to qualitative descriptions—quantify the specific potential effects to beneficial users and uses from undesirable results using best available data and science. This definition should be supported by information described in the basin setting, and other data or models as appropriate, as required by the GSP Regulations.[276]

c. The GSAs should identify which minimum threshold values—either the MCL or existing concentration plus 20 percent—will be used at which representative monitoring sites. Also, the GSAs should justify how establishing minimum thresholds at the higher of either MCLs or existing concentrations plus 20 percent does not constitute significant and unreasonable effects as defined by the GSP (i.e., “when beneficial uses for groundwater are adversely impacted by constituent concentrations).

[275] 23 CCR § 354.14(b)(5).
[276] 23 CCR § 354.26 (b)(1).

Appendix 1.A. DWR Recommended Corrective Actions and Corresponding Revisions to Plan Elements (§356.4(i))

Appendix 1.A.2. Summary of Revisions to Address Recommended Corrective Actions – Joint GSP 2025 Plan Amendment

Topic	Recommended Corrective Action	Section(s) Where Recommended Corrective Action was Primarily Addressed in the Joint GSP	How Recommended Corrective Action was Addressed
1. GSP Adoption by All GSAs	Add language to the Joint GSP explaining that all Joint GSP GSAs have adopted the Joint GSP and are committed to implementing it consistent with SGMA.	Section 1 (Introduction) Appendix 1.H (Adoption Resolutions)	Text has been added to Section 1 of the Joint GSP 2025 Plan Amendment to describe the adoption of the Joint GSP (March 2023 Revisions) by all four Joint GSP GSAs and their commitment to implementing the Plan consistent with SGMA. The adoption resolutions for all Joint GSP GSAs have been included in Appendix 1.H of the Joint GSP 2025 Plan Amendment.
2. Continued Coordination	The GSAs must continue to coordinate to eliminate areas of disagreement.	Executive Summary (GSP Development, Coordination, and Outreach) Section 1.3.3 (Coordination Among the GSAs) Appendix 1.J (Coordination Agreement Amendment)	Despite multiple GSPs in the Subbasin, the GSAs have worked continuously over the last several years to seek consensus, striving to bring consistency across the four GSPs with the express goal of eliminating inconsistencies and embracing shared tools and resources, all while working towards a common Subbasin sustainability goal. The GSAs have continued coordination efforts through many efforts, including (but not limited to): • Engagement of facilitation support services to assist the GSAs in working through and eliminating any areas of disagreement. Specific areas of assistance include intra-basin and inter-basin coordination support, governance development, and other stakeholder outreach and engagement support efforts. • Ongoing recurring meetings between the technical teams for each GSA (or group of GSAs in the case of the Joint GSP) to discuss methodologies and preferred technical approaches for addressing DWR's recommended corrective actions. These technical team meetings have served as the basis for reaching consensus and ensuring consistent policies, procedures, and methodologies and ultimately, consistent groundwater management across the Subbasin. • Recurring meetings between the Joint GSP GSAs to coordinate GSP implementation. • Updates and refinements to the Madera-Chowchilla Groundwater-Surface Water Simulation Model (MCSim) through coordination between all GSAs. To date, all GSAs have embraced the use of MCSim as a consistent methodology for determining historical and projected conditions within the Subbasin. MCSim continues to be supported broadly by the GSAs in the Subbasin and serves as a uniform and consistent basis for development of GSA water budgets, future subsidence estimates, and establishment of SMC in the 2025 Plan Amendment. • Development of a Domestic Well Mitigation Program (DWMP) memorandum of understanding (MOU) by the GSAs, made possible through facilitation and related services between the GSAs, including a DWR grant for Senate Bill (SB) 552 compliance. For purposes of the 2025 Plan Amendment, it is assumed that the facilitation and related services associated with the DWMP as set-forth above will result in complete development of the DWMP such that implementation can begin in 2025 as set-forth and agreed upon in the MOU. • Signing a new coordination agreement. Ongoing coordination efforts since Fall 2023 (prior to DWR's approval of the 2023 Revised Plan on December 21, 2023) are summarized in the executive summary and in Section 1.3.3 of the Joint GSP 2025 Plan Amendment.

Topic	Recommended Corrective Action	Section(s) Where Recommended Corrective Action was Primarily Addressed in the Joint GSP	How Recommended Corrective Action was Addressed
3. Groundwater Level Sustainable Management Criteria (SMC)	The GSAs must revise the GSPs to include a discussion of the relationship between the SMC for chronic lowering of groundwater levels and the other sustainability indicators, including an explanation of how the SMC, including interim milestones (IMs), were established to avoid undesirable results (URs) for each of the other sustainability indicators.	Section 3.2.1 (Measurable Objectives and Interim Milestones) Section 3.3.1 (Minimum Thresholds) Section 3.4 (Undesirable Results) Appendix 6.D (MCSim Updates) Appendix 6.E (1D Subsidence Modeling)	The Joint GSP 2025 Plan Amendment includes an updated explanation of how the groundwater level SMC, including IMs, were established to avoid URs for each of the other sustainability indicators and an explanation of how groundwater levels and subsidence are separate sustainability indicators with different SMC, and that the most restrictive SMC governs. MCSim has also been updated to incorporate the Integrated Water Flow Model (IWFM) subsidence module that became available after initial development of MCSim for the Initial Joint GSP. These updates allow direct simulation of the relationship between groundwater levels and subsidence across the Subbasin, including evaluation of the relationship between the SMC for groundwater levels and subsidence. The updated MCSim has been embraced by all Subbasin GSAs as a uniform and consistent basis for development of GSA water budgets, future subsidence estimates, and establishment of SMC in the 2025 Plan Amendment. The GSAs have further completed additional 1D subsidence modeling to characterize the relationship between groundwater levels and subsidence at specific locations with data. The Subbasin GSAs also conducted interviews with critical infrastructure owners and operators (Section 3.4.3) to assess their subsidence concerns and issues, and have also continued to coordinate development of the DWMP (see Sections 3.3.1.1 and 4.9.5). Through these efforts, the Subbasin GSAs are proactively working to ensure that the groundwater level SMC are not negatively impacting beneficial uses and users and other sustainability indicators.
4. Land Subsidence Updates	*See specific items below.*	*See specific items below.*	*See specific items below.*

4.a	Refine the description of URs:
	• Clearly describe the significant and unreasonable conditions the GSAs are managing the Subbasin to avoid.
	• Reevaluate the quantitative metrics that define a UR, considering:
	  • Localized subsidence conditions and the irreversibility of continued inelastic subsidence, especially in an area deemed of "greater subsidence concern."
	  • The current quantitative metrics (i.e., 75 percent of RMS) would not minimize or avoid inelastic subsidence in the most susceptible areas of the Subbasin – predominantly in the north-northwestern portion of the Subbasin.
		Section 3.4.3 (Undesirable Results)
		
		Table 3-16 (Documentation of interviews conducted with critical infrastructure owners and operators to identify critical infrastructure, reported and possible subsidence impacts)
		
		Section 4 (Projects and Management Actions)
			The Subbasin GSAs addressed these recommended corrective actions through the following updates:
			• Documentation of interviews conducted with critical infrastructure owners and operators (in summer 2024) to confirm identification of their critical infrastructure, document observed and possible impacts attributable to land subsidence, and assess the potential future impacts of land subsidence.
			• Updates to describe the significant and unreasonable conditions the GSAs are managing the Subbasin to avoid, informed by input gathered from critical infrastructure owners and operators and members of the public.
			• Reviewing and refining the quantitative metrics that define URs for subsidence, including identifying and defining the cumulative amount of subsidence that, if exceeded, would substantially impact groundwater and land surface beneficial uses and users. Quantitative metrics were also informed by input gathered from critical infrastructure owners and operators.
			• Description of Projects and Management Actions (PMAs) that will be implemented to minimize or eliminate subsidence.

Topic	Recommended Corrective Action	Section(s) Where Recommended Corrective Action was Primarily Addressed in the Joint GSP	How Recommended Corrective Action was Addressed
4.b	Identify the cumulative amount of subsidence that, if exceeded, would substantially interfere with groundwater and land surface beneficial uses and users in the Subbasin. • Explain how the rate and extent of any future subsidence permitted in the Subbasin may interfere with surface land uses. • Describe the current and potentially lasting impacts of subsidence on land uses and groundwater beneficial uses and users.	Section 3.4.3 (Undesirable Results) Table 3-16 (Documentation of interviews conducted with critical infrastructure owners and operators to identify critical infrastructure, reported and possible subsidence impacts) Section 3.2.3 (Interim Milestones) Appendix 3.G (Infrastructure Sensitivity Assessment)	The Joint GSP GSAs conducted a detailed infrastructure sensitivity assessment (Appendix 3.G) and conducted interviews with critical infrastructure owners and operators (Section 3.4.3) to identify the cumulative amount of subsidence that, if exceeded, would substantially interfere with groundwater and land surface beneficial uses and users in the Subbasin. These efforts were documented in the Joint GSP 2025 Plan Amendment, and were used to re-evaluate critical infrastructure, the potential impacts of land subsidence, and the extent to which potential impacts are considered significant and unreasonable by the interviewed critical infrastructure owners and operators and members of the public. These discussions directly informed updates to quantitative metrics for tracking cumulative subsidence (i.e., IMs) to avoid interference with land uses and groundwater beneficial uses and users. Following the infrastructure sensitivity assessment and interviews, the Subbasin GSAs, with support from the agencies interviewed, are also proposing to establish a Subbasin Critical Infrastructure Operator Group. Although discussions are ongoing, the Critical Infrastructure Operator Group is planning to meet annually to provide updates on any potential critical infrastructure impacts related to subsidence, to coordinate ongoing PMA implementation, and to discuss any potential critical infrastructure mitigation concerns. These coordination efforts will help to identify cumulative subsidence concerns early and to spur action to avoid exceedances that would substantially interfere with groundwater and land surface beneficial uses and users in the Subbasin.
4.c	Revise the GSPs to include a discussion of the relationship between the SMC for land subsidence and the other sustainability indicators, including an explanation of how the SMC, including IMs, were established to avoid URs for each of the other sustainability indicators.	Section 3.2.3 (Measurable Objectives and Interim Milestones) Section 3.3.3 (Minimum Thresholds) Section 3.4 (Undesirable Results) Appendix 6.D (MCSim Updates) Appendix 6.E (1D Subsidence Modeling)	The Joint GSP 2025 Plan Amendment includes an updated explanation of how the subsidence SMC, including IMs, were established to avoid URs for each of the other sustainability indicators and an explanation of how groundwater levels and subsidence are separate sustainability indicators, and that the most restrictive SMC governs. MCSim has also been updated to incorporate the IWFM subsidence module that became available after initial development of MCSim for the Initial Joint GSP. These updates allow direct simulation of the relationship between groundwater levels and subsidence across the Subbasin, including evaluation of the relationship between the SMC for groundwater levels and subsidence. The updated MCSim has been embraced by all Subbasin GSAs as a uniform and consistent basis for development of GSA water budgets, future subsidence estimates, and establishment of SMC in the 2025 Plan Amendment. The GSAs have further completed additional 1D subsidence modeling to characterize the relationship between groundwater levels and subsidence at specific locations with data.
4.d	Reevaluate or eliminate the application of the level of uncertainty as it relates to subsidence measurements (i.e., clarify SMC so that subsidence can't continue into perpetuity).	Section 3.2.3 (Measurable Objectives) Section 3.4.3 (Undesirable Results) Section 4.9.5 and Appendix 3.H (Subsidence data gaps workplan)	Text has been added to clarify that the MO for subsidence of 0.00 feet/year was established with the goal of long-term avoidance of land subsidence, and that the consideration of uncertainty is not meant to allow for continued subsidence in the Subbasin. Rather, this is an acknowledgement that there may be instances where measurement uncertainty will indicate a rate of subsidence greater than the MO. The definition of undesirable results (as described in Section 3.4.3) will govern and, should an IM be exceeded or an undesirable result occur, a subsidence working group committee consisting of technical representatives of each Subbasin GSA as appointed by the Coordination Committee will be formed to define areas of the Subbasin subject to taking additional actions to eliminate subsidence. To address the need and interest in improving the understanding of subsidence in the Subbasin, the GSAs have also developed a workplan outlining future activities related to monitoring and understanding conditions relating to subsidence in the Subbasin. The subsidence workplan is described in Section 4.9.5 and included in Appendix 3.H of the Joint GSP 2025 Plan Amendment.

Topic	Recommended Corrective Action	Section(s) Where Recommended Corrective Action was Primarily Addressed in the Joint GSP	How Recommended Corrective Action was Addressed
4.e	Describe Projects and Management Actions (PMAs) that will be implemented to minimize or eliminate subsidence (with details/schedule).	Section 4 (Projects and Management Actions)	Additional text was added to indicate which specific PMAs will help to reduce the rate of active subsidence and/or minimize or prevent continuing subsidence.
5. Hydrogeologic Conceptual Model	Discuss the uncertainty concerning the Hydrogeologic Conceptual Model (HCM) and a description of the HCM data gaps.	Executive Summary (Approach to Achieving Sustainability) Section 2.2.2.7 (Uncertainty and Data Gaps in Hydrogeologic Conceptualization and Groundwater Conditions) Appendix 3.I (Subsidence and ISW Workplans)	Additional text was added to discuss the uncertainties related to the HCM, new information gathered about the HCM (e.g., additional description of principal aquifers, aquifer confinement, and updates related to new nested monitoring wells), and a description of HCM data gaps and how these have been or are being addressed. Certain data gaps and associated uncertainty are described in Section 2.2.2.7. Additional information about assessment of data gaps and related improvements to the monitoring network is provided in Section 3.5.4. The GSAs have also discussed, reviewed, and refined their subsidence and ISW Workplans to fill data gaps. Extensive work has also been completed during 2024 to update and refine MCSim, including refinements to the HCM that were informed by new monitoring well data and AEM data provided by DWR.
6. Water Quality	*See specific items below.*	*See specific items below.*	*See specific items below.*
6.a	Revise the definition of URs so that exceedances of minimum thresholds caused by groundwater extraction are considered in the assessment of undesirable results in the Subbasin.	Section 3.3.4 (Minimum Thresholds) Section 3.4.4 (Undesirable Results) Table ES-3 (SMC Summary)	Additional text was added to clarify the water quality undesirable results definition, with specific incorporation of overall Subbasin groundwater extraction (along with PMAs) as potential causes of groundwater quality degradation that the GSAs are responsible for. The definition recognizes “10 percent of RMS wells above the minimum threshold for the same constituent due to projects and/or management actions, or overall groundwater extraction, based on average of most recent three year period.”
6.b	Clearly define what the Plan considers an UR for degraded water quality by describing conditions that it would consider to be significant or unreasonable. • Quantify the specific potential effects to beneficial users and uses from undesirable results using best available data and science. • Definition should be supported by information described in the basin setting, and other data or models as appropriate	Section 3.3.4 (Minimum Thresholds) Section 3.4.4 (Undesirable Results)	The Subbasin GSAs addressed these recommended corrective actions through the following updates: • Updates to more clearly describe the significant and unreasonable conditions the GSAs are managing the Subbasin to avoid, including specific adverse impacts related to groundwater quality (e.g., causing domestic/municipal supply wells to exceed MCLs). • Reviewing and refining the quantitative metrics that define URs for water quality.
6.c	Identify which minimum threshold values—either the MCL or existing concentration plus 20 percent—will be used at which representative monitoring sites.	Section 3.3.4 (Minimum Thresholds) Section 3.4.4 (Undesirable Results)	Additional text has been added to document the approach used to establish the MT values, as well as studies and reports reviewed that recognize that it is reasonable and technically justifiable to set MTs with respect to existing concentrations near or above the MCL, recognizing the uncertainty in individual sample measurement accuracy (i.e., setting the MT for groundwater quality RMS at either the MCL, or at the baseline concentration + 20% at locations where the existing concentrations are near or above the MCL). All four GSPs in the Subbasin have agreed to adopt the same consistent MT approach for the same key constituents (arsenic, nitrate, and TDS).

Topic	Recommended Corrective Action	Section(s) Where Recommended Corrective Action was Primarily Addressed in the Joint GSP	How Recommended Corrective Action was Addressed
			The Joint GSP 2025 Plan Amendment has also been updated to include all available groundwater quality data collected for the groundwater quality RMS to date. This information is being evaluated as part of the Periodic Evaluation to develop appropriate baselines for all groundwater quality RMS.
6.d	Justify how establishing minimum thresholds at the higher of either MCLs or existing concentrations plus 20 percent does not constitute significant and unreasonable effects as defined by the GSP.	Section 3.3.4 (Minimum Thresholds) Section 3.4.4 (Undesirable Results)	Additional text has been added to document the approach used to establish the MT values, as well as studies and reports reviewed that recognize that it is reasonable and technically justifiable to set MTs with respect to existing concentrations near or above the MCL, recognizing the uncertainty in individual sample measurement accuracy (i.e., setting the MT for groundwater quality RMS at either the MCL, or at the baseline concentration + 20% at locations where the existing concentrations are near or above the MCL).
Additional Action 1.	Interconnected Surface Water (ISW) Updates.	Section 2.2.2.5 (Groundwater - Surface Water Interaction) Section 2.2.2.7.4 (ISW Uncertainty and Data Gaps) Section 4.9.5 (ISW Stakeholder Coordination) Appendix 3.I. (ISW Data Gaps Workplan, and ISW Coordination MOU).	Though not specifically requested by DWR, the GSAs have taken the initiative to engage in ISW coordination with applicable GSAs in the Kings Subbasin, the United States Bureau of Reclamation (USBR), the Friant Water Authority (FWA), and the San Joaquin River Restoration Program (SJRRP). Since late 2023, representatives from the Subbasin and Kings Subbasin (McMullin Area GSA and North Kings GSA) have been meeting monthly with representatives from the USBR and FWA to better understand their issues and concerns related to ISW along the San Joaquin River. These discussions have led to more detailed analyses by USBR and FWA of total diversions, uses, and losses along portions of the San Joaquin River, and more detailed analyses by USBR related to the Holding Contracts and the groundwater pumping allowances and limitations that will need to be factored into any allowable groundwater pumping within proximity to the San Joaquin River The Subbasin GSAs also coordinated and developed an ISW workplan for the Subbasin as part of prior GSP development. Certain refinements were made to the ISW workplan following coordination with applicable GSAs in the Kings Subbasin to draw greater consistency between the adjacent subbasins. These updates have been made in the January 2025 Plan Amendment. No amendments have been made to the ISW SMC in the 2025 Plan Amendment. It is anticipated that the ISW SMC may be refined following review of DWR's forthcoming guidance for managing ISW depletion (anticipated Winter 2024/2025).
Additional Action 2.	PMA Updates.	4.9 (Implementation of Projects and Management Actions Since Initial GSP Development)	The Joint GSP GSAs have also provided an update on PMA planning and implementation since the Initial Joint GSP was completed and submitted in January 2020.

Appendix 1.B. 2025 Periodic Evaluation GSP Attachments

Appendix 1.B.1. Joint GSP 2025 Periodic Evaluation Elements

Madera Subbasin Joint Groundwater Sustainability Plan

Periodic Evaluation

January 2025

PREPARED FOR

City of Madera GSA
County of Madera GSA - Madera Subbasin
Madera Irrigation District GSA
Madera Water District GSA

PREPARED BY

Davids Engineering, Inc.
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Table of Contents

List of Tables

List of Figures

List of Abbreviations

AFY	acre-feet per year
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CM GSA	City of Madera GSA
DWMP	Domestic Well Mitigation Program
DWR	California Department of Water Resources
EO	Executive Order
ETAW	evapotranspiration of applied groundwater
GFWD GSA	Gravelly Ford Water District GSA
GIS	geospatial information system
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
IRWM	Integrated Regional Water Management
ISW	Interconnected Surface Water
MC GSA	County of Madera GSA – Madera Subbasin
MID GSA	Madera Irrigation District GSA
MLRP	Multibenefit Land Repurposing Program
MOU	memorandum of understanding
MWD GSA	Madera Water District GSA
MWELO	Model Water Efficient Landscape Ordinance
NRCS	Natural Resources Conservation Service
NSWD GSA	New Stone Water District GSA
PMAs	projects and management actions
RCWD GSA	Root Creek Water District GSA
RMS	representative monitoring site
SB	Senate Bill
SCADA	supervisory control and data acquisition
SGMA	Sustainable Groundwater Management Act
USBR	United States Bureau of Reclamation
VLRP	Voluntary Land Repurposing Program
WY	water year

Executive Summary

The Madera Subbasin (Subbasin[1]) is a critically overdrafted subbasin subject to the requirements of the Sustainable Groundwater Management Act of 2014 (SGMA). The Subbasin is cooperatively managed by seven Groundwater Sustainability Agencies (GSAs) under four Groundwater Sustainability Plans (GSPs) and one Coordination Agreement. The four GSPs and Coordination Agreement are collectively referred to as the Plan for the Subbasin, and the seven GSAs are collectively referred to as the Subbasin GSAs.

Four GSAs have jointly developed one GSP that is referred to as the Joint GSP, including: City of Madera GSA (CM GSA), County of Madera GSA – Madera Subbasin (MC GSA), Madera Irrigation District GSA (MID GSA), and Madera Water District GSA (MWD GSA). These four GSAs are collectively referred to as the Joint GSP GSAs. The remaining three GSAs – Gravelly Ford Water District GSA (GFWD GSA), New Stone Water District GSA (NSWD GSA), and Root Creek Water District GSA (RCWD GSA) – have each developed their own GSPs.

The Subbasin GSAs have collaboratively developed one cohesive 2025 Periodic Evaluation for the Plan in alignment with the requirements of the GSP regulations, per the California Code of Regulations Title 23 (23 CCR) §356.4.

This document is the 2025 Periodic Evaluation GSP attachment for the Joint GSP, containing the 2025 Periodic Evaluation elements specific to the Joint GSP 2025 Plan Amendment and the Joint GSP GSAs. Other content related to the entire Subbasin and all four GSPs is contained in the Madera Subbasin 2025 Periodic Evaluation.

This document follows the same general structure as the Madera Subbasin 2025 Periodic Evaluation, with cross-referencing between documents as appropriate to capture all content pertinent to the Subbasin as a whole and to the Joint GSP 2025 Plan Amendment.

Content across the 2025 Periodic Evaluation includes the following, in alignment with 23 CCR §356.4:

- New Information Collected (§356.4(f))
- Groundwater Conditions Relative to Sustainable Management Criteria (§356.4(a))
- Status of Projects and Management Actions (§356.4(b))
- Basin Setting Evaluation Based on New Information or Changes in Water Use (§356.4(c)-(d))
- Monitoring Networks Evaluation (§356.4(e))
- GSA Authorities and Enforcement Actions (§356.4(g)-(h))
- Outreach, Engagement, and Coordination with other Agencies (§356.4(j))
- Other Information (§356.4(k))
- Summary of Proposed or Completed Revisions to Plan Elements (§356.4(i))

Please refer to the Madera Subbasin 2025 Periodic Evaluation for the Executive Summary overview of conditions in the Subbasin and Plan implementation activities by the Subbasin GSAs during the first Periodic Evaluation cycle from January 31, 2020 through January 31, 2025.

[1] Groundwater basin number 5-022.06, part of the San Joaquin Valley Groundwater Basin, as defined by DWR Bulletin 118 (DWR, 2003) and updated in 2016.

1 New Information Collected or Acquired (§356.4(f))

Please refer to the Madera Subbasin 2025 Periodic Evaluation for a summary of new information collected or acquired during this Periodic Evaluation cycle (per 23 CCR §356.4(f)). Updates are provided for the Subbasin as a whole.

2 Groundwater Conditions Relative to the Sustainable Management Criteria (§356.4(a))

Please refer to the Madera Subbasin 2025 Periodic Evaluation for a summary of groundwater conditions relative to the sustainable management criteria for the Subbasin during this Periodic Evaluation cycle (per 23 CCR §356.4(a)). Updates are provided for the Subbasin as a whole, with specific reference to groundwater conditions at representative monitoring sites (RMS) in the Joint GSP area for all applicable sustainability indicators.

3 Status of Projects and Management Actions (23 CCR §356.4(b))

The purpose of this section is to describe the Joint GSP GSAs' advancements in implementing projects and management actions (PMAs), and the benefits those PMAs have achieved for the Subbasin through the most recently completed Annual Report (WY 2023), including how those benefits are contributing to the Subbasin achieving its sustainability goal and operating within its sustainable yield. This Periodic Evaluation covers the first Periodic Evaluation cycle, during which Annual Reports have been completed for WY 2019 through WY 2023. Thus, PMA implementation efforts by the Joint GSP GSAs described in this section are focused on this period. Efforts by the other GSAs in the Subbasin are described in their respective Periodic Evaluation attachments.

The contents of this section are organized as follows:

- **Section 3.1** provides a summary and status update for the Joint GSP GSAs' PMA implementation efforts during this Periodic Evaluation cycle.
- **Section 3.2** provides a summary of the benefits and costs of PMAs during the first Periodic Evaluation cycle.
- **Section 3.3** provides a brief description of how the GSAs are tracking, administering, and reporting PMA implementation in the Subbasin.

3.1 Summary and Status of PMA Implementation

PMAs that are being planned, developed, or implemented by the Joint GSP GSAs are listed and summarized in **Table 3-1**. **Table 3-1** includes many PMAs that were included in the 2020 Initial Joint GSP, as well as other PMAs that have been added or refined during this Periodic Evaluation cycle. **Table 3-1** provides a brief description of each PMA, its implementation status as of WY 2023 (the most recently completed Annual Report during this Periodic Evaluation cycle), the anticipated schedule for implementation, and a brief discussion of the PMA status and related activities during this Periodic Evaluation cycle. The status of PMAs is generally defined as follows:

- **Implemented**: Active efforts to operate the PMA have begun, though benefits may or may not have been achieved to date (e.g., benefits may not have occurred if water has not been available for recharge since a PMA became operable).
- **In Progress**: Active efforts needed to initiate the PMA have begun (e.g., permitting), though development has not reached the point of operability.
- **Planned**: Early conceptual development is still in progress, though active efforts to initiate or operate the PMA have not begun.

Table 3-1 has been assembled from the Joint GSP Annual Reports prepared during this Periodic Evaluation cycle. Additional discussion of the status of PMAs for each Joint GSP is provided in **Sections 3.1.2** through **3.1.5**, and in the Joint GSP Annual Reports. Updates to these PMAs are also described in the Joint GSP 2025 Plan Amendment (Section 4.9). Updates will continue to be provided each year in the Joint GSP Annual Reports and in subsequent Periodic Evaluations and Plan Amendments, as necessary.

The GSAs have made significant progress in implementing PMAs, as evidenced by **Table 3-1**, the PMA summaries for each Joint GSP GSA (see **Sections 3.1.2 through 3.1.5**), and the benefits achieved thus far (see **Section 3.2**). Most PMAs proposed in the 2020 Initial Joint GSP are still applicable, and the Joint GSP GSAs have made considerable strides to implement those PMAs. The Joint GSP GSAs have also identified several new PMAs or made substantial refinements to planned PMAs during this Periodic Evaluation cycle. As of the WY 2023 Annual Report (the most recently completed Annual Report during this Periodic Evaluation cycle), updates were reported for nearly 30 PMAs developed by the Joint GSP GSAs. Benefits of PMA implementation are discussed in **Section 3.2**.

3.1.1 Adaptive Management Approach

The Joint GSP GSAs recognize that this Periodic Evaluation cycle included very wet conditions and substantial recharge in 2023. The Subbasin GSAs are planning PMAs and other GSP implementation efforts with the expectation that landmark wet years, such as 2023, will not occur again prior to 2040 (see Section 4.3.2 of the Madera Subbasin 2025 Periodic Evaluation). The Subbasin GSAs are committed **t**o adaptive management of groundwater resources through their suite of identified PMAs. As PMAs are implemented and monitored, the timelines of other PMAs and the volume of demand management necessary to achieve sustainability will be reviewed. If adjustments are needed to achieve the sustainability goal for the Subbasin, PMA implementation efforts will be evaluated and adjusted. Already, changes to PMA implementation have been informed by changing conditions and new understanding of the Subbasin. For instance, MC GSA has refined its demand reduction targets as part of its demand management program based on new understanding of overdraft in the MC GSA since the 2020 Initial Joint GSP was developed, increasing targets from 90,000 AFY to 113,000 AFY. MID GSA has also refined its PMAs, working to hasten recharge projects and incentives for surface water use to support groundwater sustainability, consistent with the Subbasin GSAs' adaptive management commitment. Each Annual Report represents an important milestone and recurrent opportunity for the GSAs to collectively review groundwater conditions in the Subbasin and report on the status of Joint GSP implementation efforts.

Table 3-1. Summary of PMA Implementation as of the Water Year 2023 Annual Report.

GSA	PMA Name	PMA Description	PMA in 2020 Joint GSP	PMA Status as of WY 2023	Planned Start Year *(Actual, if Earlier)*	Discussion of PMA Status and Implementation During this Periodic Evaluation Cycle as of the WY 2023 Annual Report
MWD	Expanded Surface Water Purchase	Expand ability to purchase additional surface water supply, including upgrades to conveyance infrastructure.	Yes	In Progress	2023	MWD GSA has continued work to implement the expanded surface water purchase project. A large component of this has been MWD's work on the Madera Lake Project, which will construct the infrastructure needed to allow additional surface water from MID or other sources to be brought into MWD through Madera Lake. In early 2022, MWD applied for and was awarded $3.7 million in Proposition 68 funding from DWR for development and construction of the Madera Lake Project. In 2022, MWD initiated various permitting processes and circulated CEQA documents for the Madera Lake Project. As of the end of WY 2023, MWD was continuing to pursue the required permits. MWD also purchased additional surface water in WY 2021-2023 (benefits of this additional surface water are quantified in WY 2023). MWD plans to purchase additional surface water when it is available.
MID	Rehab Recharge Basins	Rehabilitate and upgrade recharge facilities, including metering.	Yes	Implemented	2016	MID rehabilitated and expanded the capacity of its recharge basins. The capacity was expanded by approximately 130,000 cubic yards (approximately 83 AF) as of the end of WY 2023, resulting in higher recharge potential in wet years. Little to no recharge occurred in 2020-2022 due to drought conditions and limited surface water availability, although MID recharged nearly 3,700 AF of water in WY 2019 and nearly 5,300 AF of water in WY 2023.
MID/MC	Ellis Basin	Cooperatively operate Ellis Basin for recharge.	Yes	Implemented	2016	MID and MC continued to cooperatively operate Ellis Basin for recharge, but no recharge occurred in 2020-2022 due to drought conditions and limited surface water availability, or in 2023 due to maintenance. MC completed recharge basin improvements and maintenance in 2022, and CM conducted maintenance in 2023 to remove sediment and improve drainage.
MID/CM	Berry Basin	Cooperatively operate Berry Basin for recharge.	Yes	Implemented	2018	MID and CM continued to cooperatively operate Berry Basin for recharge. No recharge occurred in 2020-2022 due to drought conditions and limited surface water availability, while some recharge occurred in WY 2019 and WY 2023. MID and CM recharged more than 400 AF of water in 2023 (benefits are split between MID and CM).
MID	Allende Basin	Operate Allende Basin for recharge.	Yes	Implemented	2019	MID continued to operate Allende Basin for recharge, however little to no recharge occurred in 2020-2022 due to drought conditions and limited surface water availability. MID recharged more than 3,000 AF of water in 2019 and nearly 5,000 AF of water in 2023.
MID/CM	Additional Recharge Basins with City of Madera	Cooperatively operate additional basins for recharge, including Golf Course Basin and Airport Basin.	No (Added)	Implemented	2021	MID developed and operated additional recharge basins in coordination with CM beginning in 2021. MID and CM are jointly developing the Golf Course Basin. In 2021, MID facilities were connected to the Golf Course Basin in the CM for future groundwater recharge benefiting MID and CM. More than 1,200 AF of water was recharged in 2023 in basins jointly operated by MID and CM, including the Golf Course, Absire, Stadium, Mitchell, and Mosesian Basins (benefits are split between MID and CM).
MID	Additional Recharge Basins Phase 1	Construct and operate additional recharge basins.	Yes	Implemented	2030 *(Implemented beginning 2021)*	MID began developing additional recharge basins in 2021 that were successfully used for recharge in 2023. MID acquired three (3) parcels in 2021 (approximately 73 acres) and developed recharge basins on those parcels in 2022. More than 6,700 AF of water was recharged in those additional recharge basins in 2023.
MID	Additional Recharge Basins Phase 2	Construct and operate 260 acres of additional recharge basins.	Yes	In Progress	2040 *(In Progress as of 2023)*	MID is developing additional recharge basins ahead of schedule. MID acquired two parcels for new recharge basins in 2023, totaling approximately 45 acres.
MID	On-Farm Recharge	Deliver available flood water to agricultural or other suitable land for recharge.	Yes	Implemented	2015	MID has constructed infrastructure to redirect flood waters to suitable farmland for recharge. MID is also offering financial incentives to promote participation in recharge program. Approximately 3,000 AF of recharge occurred in 2019, although little to no on-farm recharge occurred in 2020-2022 due to drought conditions and limited surface water availability. Wet conditions in 2023 allowed MID to offer landowners on-farm recharge opportunities throughout the year. Water was available from $0/AF to $10/AF to promote on-farm recharge. Substantial volumes of on-farm recharge occurred in 2023, with estimates in excess of 38,000 AF (benefits are split between Phase 1 and 2).
MID	Phase 2 On-Farm Recharge	Expand delivery of available flood water to agricultural or other suitable land for recharge.	Yes	Implemented	2025 *(Implemented beginning 2023)*	MID has expanded the on-farm recharge program beginning in 2023. Many more MID landowners are taking advantage of this opportunity when it is available. MID has also partnered with the NRCS and U.S. Department of Interior's WaterSMART Initiative for funding of projects related to on-farm recharge and MID's Incentive Program (see below). $1.5 million was made available in 2022, and another $2.4 million was made available in fall 2023. Substantial volumes of on-farm recharge occurred in 2023 (benefits are split between Phase 1 and 2).
MID	MID Pipeline	Rehabilitate aging pipelines to reduce losses.	Yes	Implemented	2016	MID replaced 5,350 feet of pipeline in 2021, in addition to other rehabilitation prior to WY 2019. MID continues to see in-lieu recharge benefits from improvements made through this PMA.
MID	WaterSMART Pipeline	Rehabilitate additional pipelines to reduce losses and allow MID to deliver water later in the irrigation season.	Yes	Implemented	2019	MID continues to see in-lieu recharge benefits from improvements made through this PMA.

GSA	PMA Name	PMA Description	PMA in 2020 Joint GSP	PMA Status as of WY 2023	Planned Start Year *(Actual, if Earlier)*	Discussion of PMA Status and Implementation During this Periodic Evaluation Cycle as of the WY 2023 Annual Report
MID	WaterSMART SCADA	Expand SCADA to improve MID water management, reduce losses, and allow MID to deliver water later in the irrigation season.	Yes	Implemented	2019	MID received WaterSMART grant funding from the USBR in 2021 that is being used for installation of additional SCADA, automated gates, and new meters. Other improvements made since this PMA began in 2019 are still in use. MID continues to benefit from improvements made through this PMA.
MID	Water Supply Partnerships	Identify and purchase or exchange additional water supplies from partnering districts.	Yes	In Progress	2025 *(In Progress as of 2022)*	MID is working to establish water supply partnerships with local landowners to improve MID water management to reduce water loss and reduce groundwater pumping. MID is also working with other districts with Friant contracts to develop water supply partnerships.
MID	Incentive Program	Develop incentive structures to encourage more MID growers to utilize surface water supplies instead of groundwater.	Yes	Implemented	2022	MID is continuing various efforts to develop incentive structures to encourage more MID growers to utilize surface water supplies instead of groundwater. These include grant-funded efforts to educate and support local MID growers to facilitate irrigation using surface water rather than groundwater. MID also uses financial incentives to encourage landowners to participate in these programs and projects. In wet years, MID implements the Incentive Program as part of the On-Farm Recharge Program (above). Since 2021, MID has conducted public outreach to educate growers on the benefits of surface water use and to encourage landowners to use available surface water through existing turnouts or installation of new turnouts. Since 2022, MID has partnered with the NRCS and U.S. Department of Interior's WaterSMART Initiative and was selected as a pilot program area for investigating the benefits of implementing new recharge practices. Through this program, $1.5 million in funding was made available to MID landowners in 2022 and another $2.4 million was made available in fall 2023 for projects that conserve water and promote the use of surface water, such as on-farm recharge, recharge basins, or other supporting practices. MID has conducted public outreach and hosted workshops to promote the program and offered financial incentives to encourage landowner participation and surface water use. More than 25 parcels in MID have participated in recharge activities.
MID	Demand Reduction	Detach from MID or remove agricultural land from production.	No (Added)	Implemented	2019	MID has acquired more than 118 acres of irrigated parcels and took those out of production for conversion to recharge basins since adoption of the 2020 Initial Joint GSP. MID also detached 320 acres from MID GSA, with ongoing benefits to demand in MID GSA.
MID	Grazing Land Annexation	Annexation of grazing land to increase sustainable yield for the MID GSA.	No (Added)	Implemented	2020	MID annexed parcel APN 044-192-009 into the District area, increasing sustainable yield for the MID GSA. Grazing land is available for recharge, with ongoing benefits since WY 2020.
MID	Water User Software Platform (UI)	Software platform for MID landowners that provides information on current and historical water use	No (Added)	Implemented	2020	MID has continued implementing this PMA throughout this Periodic Evaluation cycle.
MID	Intensive Groundwater Use Policy	Policy related to intensive groundwater use for a purpose other than agriculture.	No (Added)	Implemented	2019	MID has continued implementing this PMA throughout this Periodic Evaluation cycle.
CM	Meters and Volumetric Pricing	Install water meters and implement a volumetric billing process for single-family users to promote water conservation.	Yes	Implemented	2015	CM is continuing efforts to identify and install water meters to reduce water use. The installation of water meters is greater than 97% complete. In 2022, CM identified 646 additional residential, industrial, commercial, and institutional locations to be metered. Plans, specifications, and estimates were prepared for meter installation, and CM proceeded with installation of 46 automatic meter reading (AMR) meters ranging from 3 to 10 inches in 2023. Additional meters are being installed in subsequent years.
CM/MID	Berry Basin	Cooperatively operate Berry Basin for recharge.	Yes	Implemented	2018	CM and MID continued to cooperatively operate Berry Basin for recharge. No recharge occurred in 2020-2022 due to drought conditions and limited surface water availability, while some recharge occurred in WY 2019 and WY 2023. MID and CM recharged more than 400 AF of water in 2023 (benefits are split between MID and CM).
CM/MID	Additional Recharge Basins	Cooperatively operate additional basins for recharge, including Golf Course Basin and Airport Basin.	No (Added)	Implemented	2021	MID developed and operated additional recharge basins in coordination with CM beginning in 2021. Updates to this PMA are described above.
MC/MID	Ellis Basin	Cooperatively operate Ellis Basin for recharge.	Yes	Implemented	2016	MID and MC continued to cooperatively operate Ellis Basin for recharge, but no recharge occurred in 2020-2022 due to drought conditions and limited surface water availability, or in 2023 due to maintenance. MC completed recharge basin improvements and maintenance in 2022, and CM conducted maintenance in 2023 to remove sediment and improve drainage.
MC	Water Imports Purchase	Develop partnerships and import additional water into Madera County for direct or in-lieu recharge.	Yes	In Progress	2025	MC requested a change in place of use in 2019 and has since had multiple meetings with USBR.
MC	Millerton Flood Release Imports	Request CVP Section 215 flood water when available for recharge	Yes	In Progress	2025	MC requested a change in place of use in 2019 and has since had multiple meetings with USBR. MC has written a separate letter requesting Section 215 water to be made available for use in MC.

GSA	PMA Name	PMA Description	PMA in 2020 Joint GSP	PMA Status as of WY 2023	Planned Start Year *(Actual, if Earlier)*	Discussion of PMA Status and Implementation During this Periodic Evaluation Cycle as of the WY 2023 Annual Report
MC	Chowchilla Bypass Flood Flow Recharge Phase 1	Construct and operate diversion and conveyance facilities and basins.	Yes	In Progress	2025	MC is continuing efforts to construct and operate infrastructure for recharge as part of the Chowchilla Bypass Flood Flow Recharge program. Phase 1 efforts during this Periodic Evaluation cycle have primarily been focused on identifying project funding and conducting surveying, design, and required permitting, CEQA, and regulatory processes. MC GSA applied for and was awarded grant funding from DWR in 2021 to fund Phase 1 project development. Grant funds are being used to support Phase 1 planning and design of infrastructure for diversions, deliveries, and recharge of flood water from Millerton Reservoir and purchased water. Surveying and 60% of designs were completed in 2022. Final designs, planning efforts, and permitting have continued, although delays in CEQA and permitting processes have created schedule challenges. MC GSA has continued moving forward with permitting and CEQA-related efforts, after which the MC GSA anticipates completion of design documents and initiation of the construction bid process. The MC GSA has also planned to submit a request for a grant agreement extension to support project completion. This project has been developed in close coordination with RCWD and participating landowners. Despite delays in CEQA and permitting, substantial recharge occurred under the provisions of EO N-4-23 in 2023, in excess of 42,000 AF in the Subbasin.
MC	Chowchilla Bypass Flood Flow Recharge Phase 2	Construct and operate additional diversion and conveyance facilities and basins.	Yes	In Progress	2040	MC is continuing efforts to construct and operate infrastructure for recharge as part of the Chowchilla Bypass Flood Flow Recharge program. As part of Phase 2, MC has begun creating designs for additional infrastructure for the Chowchilla Bypass. MC began early planning for Phase 2 in 2020-2021, resulting in refined costs and benefits that were considered as part of the MC GSA rate study. MC GSA applied for and was awarded grant funding from DWR in 2022. Grant funds are being used to support Phase 2 planning and design of infrastructure for diversions, deliveries, and recharge of flood water from the Chowchilla Bypass. Conceptual plans have been developed for a new project location that will include a recharge basin and infrastructure to support Flood-MAR. The MC GSA is proceeding with 30% and 60% designs, and initiating required permitting processes. This project has been developed in close coordination with participating landowners. MC is conducting additional planning and coordinating with a group of farmers and other agencies in western Subbasin that have applied for a water right on the Chowchilla Bypass.
MC	Demand Management	Reduce consumptive water use through actions such as water-stressing crops, shifting to lower water-using crops, reducing evaporation losses, and reducing irrigated acreage.	Yes	In Progress	2020	MC GSA has completed, developed, and/or begun implementing numerous actions to support implementation of its demand management program. Related efforts include: • Water Market: MC conducted a water market study through funding from a USBR WaterSMART grant. The water market strategy was created through a collaborative process with participating stakeholders in 2020-2021, including workshops and interviews. A virtual pilot water market simulation was conducted between January 2021 and November 2021 to test the strategy's effectiveness. The final report was finished in 2022. • Land Repurposing Efforts: MC developed a Voluntary Land Repurposing Program (VLRP) through a stakeholder-driven process in 2020-2022, resulting in approval of rules and criteria for implementing the VLRP in December 2022. The MC GSA received grant funding to support VLRP development, and was also awarded a $9.3 million grant from DWR in 2022 for LandFlex which has been used to support VLRP implementation. MC is also planning land repurposing projects through the Multibenefit Land Repurposing Program (MLRP). These efforts are collectively supporting protection of productive agricultural land and incentivizing water use reduction in other areas through land conversion and repurposing for other lower water demand and multi-benefit uses. • Groundwater Allocation: The MC GSA has developed, approved, and begun enforcing groundwater allocations and penalties. Additional information is provided in **Section 6.1.2.** • Demand Measurement and Verification Projects: MC began implementing a demand measurement program in 2020-2021 to monitor water use throughout MC using a satellite imagery-based monitoring approach. This program evolved into the current MC demand measurement program and verification project. The MC GSA is monitoring demand using the three approved demand measurement options currently available to growers in the MC GSA for allocation enforcement. Since 2022, the MC GSA evaluated and compared data from all three approaches, developed methods and approaches for fairly and accurately using this data to track and enforce the allocation, and sought ways to increase grower engagement, education, and outreach. Initial data shows promising reductions in ETAW and irrigated areas in the MC GSAs across the Chowchilla, Delta-Mendota, and Madera Subbasins. The precise benefits of the groundwater allocation to the Subbasin groundwater system are still being quantified and will be given in future reports as more data is collected. • Rate Study: MC GSA completed a rate study, completed a Proposition 218 process, and approved a rate package to fund GSP implementation (MC GSA is currently restrained from imposing and/or collecting associated fees due to an injunction issued by the Madera County Superior Court in December 2022).
GFWD	*See GFWD GSA GSP 2025 Periodic Evaluation Elements for information on GFWD PMAs.*					
NSWD	*See NSWD GSA GSP 2025 Periodic Evaluation Elements for information on NSWD PMAs.*					
RCWD	*See RCWD GSA GSP 2025 Periodic Evaluation Elements for information on RCWD PMAs.*					

3.1.2 MID GSA PMAs

The MID GSA has fast-tracked many of its PMAs during this Periodic Evaluation cycle, and has worked to refine the details of planned PMAs from the 2020 Initial Joint GSP. Sixteen dedicated recharge basins are now being utilized by MID, including those operated in partnership with other GSAs, and MID has acquired parcels to develop additional recharge basins. Locations of recharge areas in the MID GSA and other areas of the Subbasin are shown in **Figure 3-1**. MID plans to continue operating all recharge basins in future years when surface water is available. Drought conditions during this Periodic Evaluation cycle from 2020-2022 led to reduced surface water supplies and limited the amount of recharge that occurred in these basins during those years, but MID was able to recharge large volumes of surface water in WY 2019 and particularly WY 2023.

MID continues to administer a multi-phased on-farm recharge program and incentivizes the use of surface water, whenever it is available. Outreach remains a major component of the incentive program. Wet conditions in 2023 allowed MID to offer landowners on-farm recharge opportunities throughout the year as well as low-cost water ($0/AF to $10/AF) to promote on-farm recharge.

MID has also partnered with the Natural Resources Conservation Service (NRCS) and U.S. Department of Interior's WaterSMART Initiative, and was selected as a pilot program area for investigating the benefits of implementing new recharge practices. Through this program, $1.5 million in funding was made available to MID landowners in 2022 and another $2.4 million was made available in fall 2023 for projects that conserve water and promote the use of surface water, such as on-farm recharge, recharge basins, or other supporting practices. MID has conducted public outreach, hosted workshops, and offers financial incentives to promote program participation within MID. The program has been a success, with more than 25 parcels in MID participating in recharge activities.

MID has continued benefitting from various infrastructure improvements proposed in the 2020 Initial Joint GSP which are improving MID's water management, reducing system losses, and enhancing flexibility of surface water deliveries to growers who would otherwise use groundwater. MID has also continued localized demand reduction efforts, and has made progress on developing water supply partnerships with partners outside of the Subbasin. The MID GSA's projects are ahead of schedule.

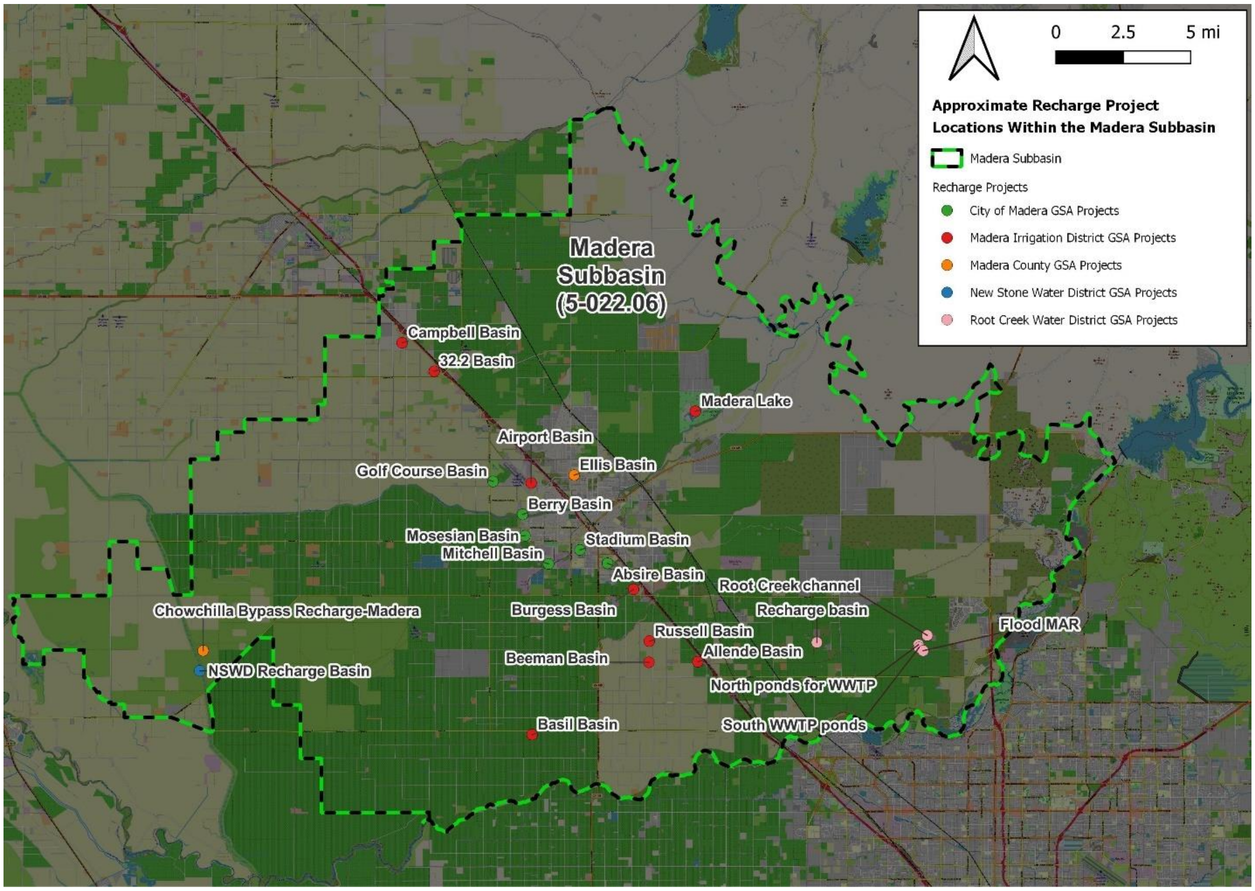

Figure 3-1. Approximate Locations of Reported Recharge Projects in the Subbasin as of the Water Year 2023 Annual Report.

3.1.3 MC GSA PMAs

Since adoption of the 2020 Initial Joint GSP, MC GSA has completed multiple planning studies and a rate study to fund Joint GSP implementation, initiated planning and design for a recharge program, and completed work to support the implementation and enforcement of a substantial demand management program. Many of these efforts are associated with MC GSA authorities and actions described in **Section 6.1**.

MC GSA has engaged in a variety of recharge projects and related planning efforts during this Periodic Evaluation cycle, including:

- Operation of the Ellis Basin for recharge, in cooperation with MID (**Figure 3-1**). Site improvements have been made, and MC GSA plans to continue recharge efforts in the future.
- A recharge planning study conducted to refine the costs, benefits, and schedule for constructing additional basins and to support additional flood managed aquifer recharge (Flood-MAR). This study has resulted in the development of the Chowchilla Bypass Flood Flow Recharge Program, which is being funded through two Proposition 68 grants from DWR. Design efforts and all applicable CEQA and permitting efforts for the first projects in the Chowchilla Bypass Flood Flow Recharge Program have occurred throughout this Periodic Evaluation cycle. Following some

delays in permitting and regulatory processes, construction is anticipated during the upcoming Periodic Evaluation cycle (January 2025 through January 2030).

- Outreach and coordination of recharge efforts and reporting in 2023 related to Executive Order (EO) N-4-23, which allows for flood waters to be used for groundwater recharge in certain circumstances. Recharge efforts are coordinated together with the emergency recharge plan. Substantial recharge occurred under EO N-4-23 in 2023, in excess of 42,000 AF. The majority of this water was diverted from various locations along the Chowchilla Bypass (**Figure 3-1**).
- The Fairmead Groundwater Resilience Project, with grant funding as part of the California Resilience Challenge. MC GSA has developed concept plans with various options for recharge projects and a monitoring framework. Community meetings have been held to gather feedback and guide project development.

As a primary element of its efforts to achieve groundwater sustainability, MC GSA has also continued steps toward implementation of a demand management program that will oversee a managed reduction in the volume of groundwater consumed by irrigated agriculture over the 20-year GSP Implementation Period. The MC GSA has refined its demand reduction targets based on new understanding of overdraft in the MC GSA since the 2020 Initial Joint GSP was developed, increasing targets from 90,000 AFY to 113,000 AFY. These refinements are consistent with the Subbasin GSAs' adaptive management commitment. To implement this overall demand management program, MC GSA has:

- Conducted a water market study through funding from a USBR WaterSMART grant. The water market strategy was created through a collaborative process with participating stakeholders in 2020-2021. Workshops and interviews were held to identify an acceptable strategy that maximizes economic benefits to the regional economy, and a virtual pilot water market simulation occurred with 57 participants across the Madera and Chowchilla Subbasins between January 2021 and November 2021 to test its effectiveness. The final report was completed in 2022.
- Implemented a Voluntary Land Repurposing Program (VLRP), which aims to identify and protect productive agricultural land while incentivizing the conversion of other irrigated agricultural land for other lower water demand uses. The MC GSA developed the VLRP through a stakeholder-driven process in 2020-2022, resulting in approval of rules and criteria for implementing the VLRP in December 2022. The MC GSA received grant funding to support VLRP development, and was also awarded a $9.3 million grant from DWR in 2022 for LandFlex which has been used to support VLRP implementation. MC GSA is also planning land repurposing projects through the Multibenefit Land Repurposing Program (MLRP). These efforts are collectively supporting protection of productive agricultural land and incentivizing water use reduction in other areas through land conversion and repurposing for other lower water demand and multi-benefit uses.
- Developed a groundwater allocation framework, allocation measurement and enforcement methods, allocation penalties, appeals processes, and recharge credit policies. Groundwater use is being tracked against the groundwater allocation on the basis of evapotranspiration of applied groundwater (ETAW) (i.e., water lost from the groundwater system). MC GSA has been enforcing the approved allocation since 2022. Information on all these topics is provided in **Section 6.1.2.**
- Continued implementing a demand measurement program and verification project. The Madera Verification Project began in 2022 to analyze the consistency of allocation measurement methods to ensure that the allocation is accurately, effectively, and equitably enforced. As described in **Section 6.1.2**, the MC GSA is monitoring demand using the three approved demand measurement options that are currently available to growers in the MC GSA for allocation enforcement: two approaches based on satellite imagery (IrriWatch and Land IQ), and the use of approved

flowmeters. Through the Madera Verification Project, MC GSA has evaluated and compared data from all three approaches, developed methods and approaches for fairly and accurately using this data to track and enforce the allocation, and sought ways to increase grower engagement, education, and outreach. The MC GSA has worked with outside consultants to conduct the Madera Verification Project since 2022, but – through cost savings decisions – the MC GSA has hired a Water Resource Specialist who assumed all field work responsibilities in 2024. MC GSA staff will continue to conduct allocation verification efforts, as needed, to ensure the allocation continues to be enforced accurately and fairly. Initial data shows promising reductions in ETAW and irrigated areas in the Madera County GSAs across the Chowchilla, Delta-Mendota, and Madera Subbasins (**Figure 3-2**). As part of independent technical analysis in support of implementing the Madera County GSAs' allocation (not part of the Joint GSP development and/or revision process), the estimated irrigated area in the MC GSA within the Subbasin, specifically, decreased by more than 10,000 acres from 2020 to 2023. These independent technical analyses identified irrigated areas as any land with ETAW equal to or exceeding 12 inches (i.e., actively irrigated land, based on available data). The precise benefits of the groundwater allocation to the Subbasin groundwater system are still being quantified and will be given in future reports as more data is collected.

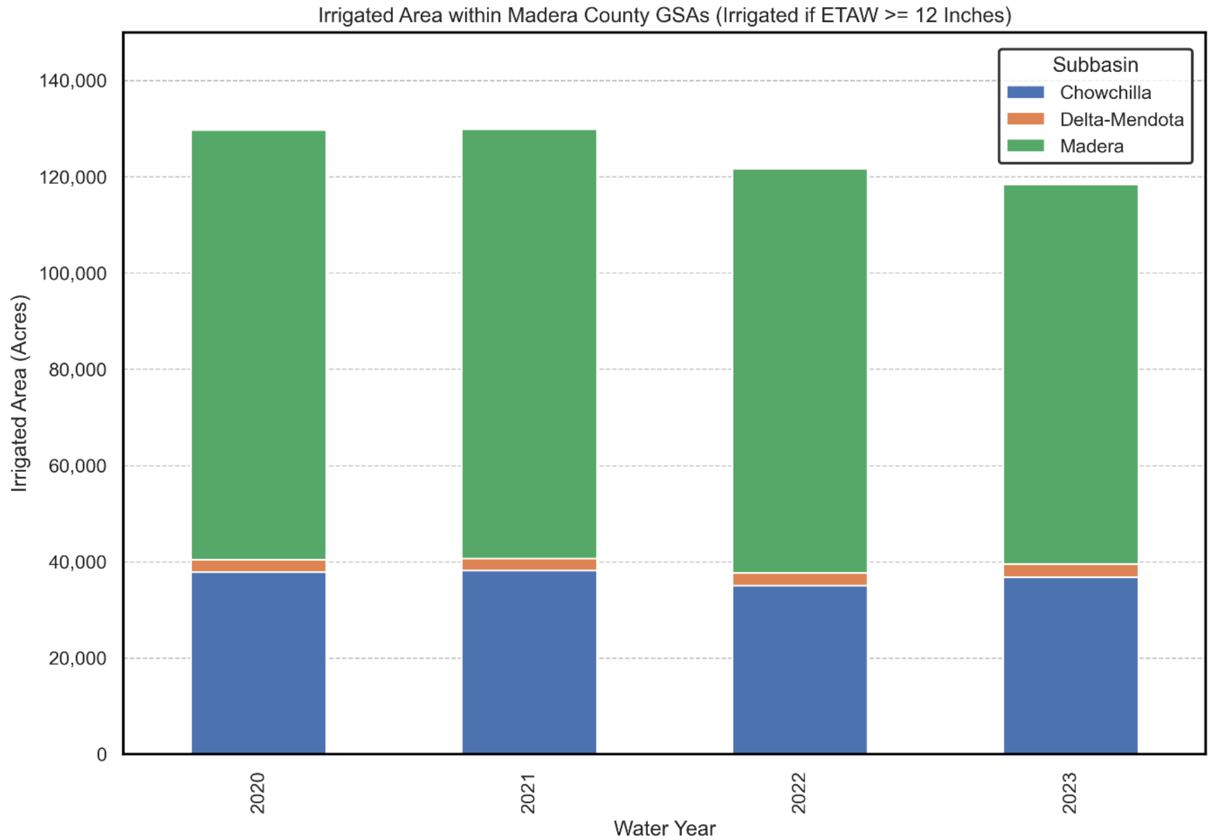

Figure 3-2. Estimated Irrigated Area within the Madera County GSAs in the Chowchilla, Delta-Mendota, and Madera Subbasins (2020-2023).

In addition to these PMA-related efforts, the MC GSA took strides to fund GSP implementation by completing a Proposition 218 process in 2022 that led to approval of an acreage-based rate for irrigated lands within the MC GSA in the Subbasin. The rate was intended to fund implementation of specific GSP-defined projects, including recharge facilities, water purchases, land repurposing, and domestic well mitigation programs. However, a preliminary injunction was issued by the Madera County Superior Court in December 2022. The preliminary injunction remains in place as of fall 2024, although Madera County has filed a motion to dismiss the lawsuit. In the meantime, the MC GSA is continuing GSP implementation and is seeking ways to reduce implementation costs (e.g., grants, refinements) with stakeholder input and discussion. Continued implementation of the allocation program is not delayed. While projects have been developed and are planned to support groundwater sustainability by adding water to the Subbasin, demand management is also being implemented to fully achieve the sustainable yield for the MC GSA area, consistent with the Subbasin GSAs' adaptive management commitment. Together, the combination of PMAs implemented by the MC GSA will achieve the sustainable yield for the MC GSA area. Additional information on MC GSA SGMA-related funding efforts is described in **Sections 6.1 and 8.2**.

3.1.4 CM GSA PMAs

The CM GSA has continued efforts on a project to install water meters and implement a volumetric billing process and rate structure for single-family users to promote water conservation. The project is nearing completion, as the CM proceeds with actions to install water meters on the remaining unmetered water connections. This effort has been funded, in part, by a Proposition 1 Round 1 Integrated Regional Water Management (IRWM) grant.

The CM has also continued working cooperatively with MID to operate and develop several recharge basins (**Figure 3-1).** As of 2023, six recharge basins are operated cooperatively by the CM and MID, including the Berry Basin, the Golf Course Basin, and four additional City Basins. Wet conditions in spring 2023 facilitated substantial recharge in the basins.

3.1.5 MWD GSA PMAs

MWD GSA has continued its efforts to implement the expanded surface water purchase project proposed in the 2020 Initial Joint GSP. As part of this project, MWD has continued to move forward with the Madera Lake Project, which will construct the infrastructure needed to allow additional surface water from MID or other sources to be brought into MWD through Madera Lake. Efforts during this Periodic Evaluation cycle have included planning, design, California Environmental Quality Act (CEQA) processes, and various permitting processes required for project implementation through the USACE, Regional Water Quality Control Board, and the California Department of Fish & Wildlife. In 2022, MWD was awarded approximately $3.7 million in grant funding through DWR's SGM Grant Program that is being used to support this effort. MWD GSA has also continued to purchase additional surface water in years it is available to facilitate in-lieu recharge and preserve groundwater supplies.

3.1.6 Jointly Implemented PMAs

The Joint GSP GSAs have also furthered development of several jointly-implemented PMAs, as described in Section 4.9.5 of the Joint GSP 2025 Plan Amendment. Those include, in brief:

- **Domestic Well Mitigation Program (DWMP)**: A key element of the Joint GSP is a proposed DWMP to mitigate undesirable results for domestic well users that are significantly and adversely impacted by groundwater levels during the GSP implementation period while the GSAs implement other projects and management actions to achieve and maintain sustainability. Since 2022, the GSAs have continued coordination efforts to develop the DWMP for implementation, as needed. To date, the GSAs have developed a MOU that describes, among other things, the responsibilities and principles that will guide administration of the program (Appendix 3.E of the Joint GSP 2025 Plan Amendment). Refinements to the DWMP have been made with consideration of DWR's guidance document pertaining to "Considerations for Identifying and Addressing Drinking Water Well Impacts" (DWR, 2023). The MC GSA has also been awarded a $125,000 grant from DWR that, in part, provides facilitation and related services in connection with the DWMP. For purposes of the 2025 Plan Amendment, it is assumed that the facilitation and related services associated with the DWMP as set-forth above will result in complete development of the DWMP such that implementation can begin in 2025 as set-forth and agreed upon in the MOU.
- **Subsidence Workplan Development and Implementation:** Discussed in Section 5.4 of the Madera Subbasin 2025 Periodic Evaluation.
- **ISW Stakeholder Coordination**: Discussed in **Sections 5.5 and 7.3.2** of the Madera Subbasin 2025 Periodic Evaluation.

3.2 Benefits and Costs of PMA Implementation

The benefits of PMA implementation to the Subbasin are summarized for each of the Joint GSP GSAs in **Table 3-2 and Figure 3-3**, and for each individual PMA in **Table 3-3**. **In total, approximately 86,900 AFY of reported benefits occurred, on average[2], in years when PMA implementation was feasible as of WY 2023** (the most recently completed Annual Report during this Periodic Evaluation cycle). **This represents approximately 43% of the total estimated average benefits at 2040** (**Table 3-2**) not including early benefits achieved through enforcement of MC GSA's groundwater allocation. Drought conditions in 2020-2022 led to reduced surface water supplies and limited the amount of direct and in-lieu recharge that occurred in those years. However, the GSAs were able to recharge large volumes of surface water in WY 2019 and particularly in WY 2023 under the provisions of EO N-4-23.

As described in the Joint GSP 2025 Plan Amendment, PMAs have been focused on supporting groundwater conditions with respect to all applicable sustainability indicators primarily by increasing recharge, reducing groundwater pumping, and/or reducing demand. These mechanisms directly support the GSAs' efforts to avoid undesirable results and achieve and maintain sustainable conditions with respect to groundwater levels, groundwater storage, groundwater quality, land subsidence, and interconnected surface water. Consequently, the suite of identified PMAs are also anticipated to benefit groundwater conditions for all beneficial uses and users in the Subbasin.

[2] Averages were calculated based on reported PMA benefits in *only those years when implementation was feasible* during this Periodic Evaluation cycle.

Estimated and reported costs for PMA implementation are summarized in **Table 3-4**. The Joint GSP GSAs are responsible for tracking and reporting the benefits and costs of their PMAs each year in the Joint GSP Annual Report. PMA implementation is being funded through a combination of grant funds, allocation penalties (in MC GSA), assessments, fees, charges, and/or other funding mechanisms related to agency services. The MC GSA also completed a Proposition 218 process in 2022 that led to an approved rate for funding GSP implementation; howev42er, following a lawsuit and preliminary injunction issued by the Madera County Superior Court in December 2022, the MC GSA is currently restrained from imposing and/or collecting related fees. A discussion of all funding and fee-related actions by the Joint GSP GSAs is provided in **Section 6**.

Table 3-2. Summary of Benefits to the Subbasin from PMA Implementation by the Joint GSP GSAs, Estimated Average at 2040 and Average Reported as of the Water Year 2023 Annual Report.

GSA	Estimated Average Benefit of all PMAs at 2040 (AFY, rounded)[1]	Average Reported Benefit of all PMAs in Years Implementation Occurred[2] (WY 2019-2023) (AFY, rounded)	Average Reported Benefit as a Percent of Estimated Average Benefit at 2040 (%)	Agricultural Demand Reduction[3]
MWD	2,810	2,140	76	-
MID	49,170	38,540	78	💧
MC	145,090	42,130	29	💧💧💧💧💧
CM	4,000	4,120	103	-
Total	**201,070**	**86,930**	**43**	

[1] Estimates developed for full PMA implementation. For PMAs described in the 2020 Initial Joint GSP, the estimated average annual benefit at 2040 is summarized from the Joint GSP. Some PMAs have been modified since the 2020 Initial Joint GSP was adopted, so these totals may not equal the totals reported in the 2020 Initial Joint GSP.

[2] Averages were calculated based on reported PMA benefits in *only those years when implementation was feasible* during this Periodic Evaluation cycle. Reported benefits are consistent with the water budgets in the Annual Reports completed during this Periodic Evaluation cycle, and do not otherwise change the Subbasin water budget as reported in the Annual Reports.

[3] Symbols are representative of the relative magnitude of agricultural demand reduction anticipated from PMA implementation, and are not intended to indicate a specific volume of agricultural demand reduction.

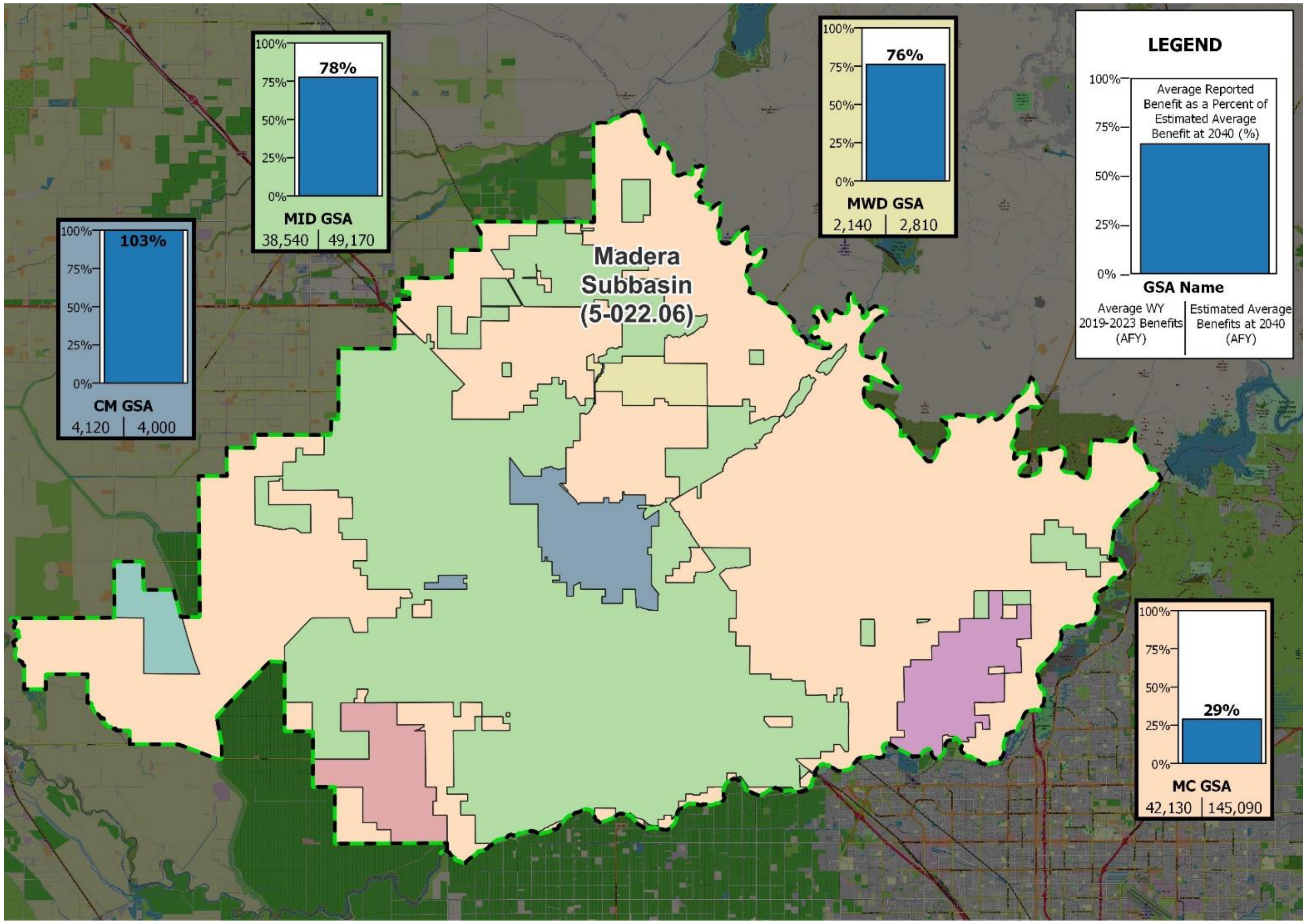

Figure 3-3. Summary of Benefits to the Subbasin from PMA Implementation by the Joint GSP GSAs (Average Reported Benefits as of the Water Year 2023 Annual Report[1] as a Percentage of the Estimated Average Benefits at 2040).

[1] Averages were calculated based on reported PMA benefits from Annual Reports in only those years when implementation was feasible during this Periodic Evaluation cycle (Table 3-2). Reported benefits are consistent with the water budgets in the Annual Reports completed during this Periodic Evaluation cycle, and do not otherwise change the Subbasin water budget as reported in the Annual Reports.

Table 3-3. Benefits to the Subbasin from PMA Implementation, Estimated and Reported as of the Water Year 2023 Annual Report.

GSA	PMA Name	PMA Status as of WY 2023	PMA Mechanism	Estimated Average Benefit at 2040 (AFY, rounded)[1]	Average Reported Benefit in Years Implementation Occurred[2] (WY 2019-2023) (AFY, rounded)	Reported Benefit[3] (WY 2019) (AFY)	Reported Benefit[3] (WY 2020) (AFY)	Reported Benefit[3] (WY 2021) (AFY)	Reported Benefit[3] (WY 2022) (AFY)	Reported Benefit[3] (WY 2023) (AFY)
MWD	Expanded Surface Water Purchase	In Progress	Reduce Groundwater Pumping	2,810	2,140	-	-	-	0	4,283
MID	Rehab Recharge Basins	Implemented	Increase Recharge	5,030	1,850	3,683	229	0	43	5,277
MID/ MC	Ellis Basin	Implemented	Increase Recharge	120	30	153	0	0	0	0
MID/ CM	Berry Basin	Implemented	Increase Recharge	20	140	465	0	0	0	221
MID	Allende Basin	Implemented	Increase Recharge	1,050	1,620	3,088	31	0	0	4,967
MID/ CM	Additional Recharge Basins with City of Madera	Implemented	Increase Recharge	630	630	-	-	-	-	632
MID	Additional Recharge Basins Phase 1	Implemented	Increase Recharge	5,470	2,250	-	-	0	0	6,753
MID	Additional Recharge Basins Phase 2	In Progress	Increase Recharge	21,890	-	-	-	-	-	-
MID	On-Farm Recharge	Implemented	Increase Recharge	510	4,430	3,000	0	0	0	19,161
MID	Phase 2 On-Farm Recharge	Implemented	Increase Recharge	1,690	19,160	-	-	-	-	19,161
MID	MID Pipeline	Implemented	Reduce Evaporation and Groundwater Pumping	420	420	420	420	420	420	420
MID	WaterSMART Pipeline	Implemented	Reduce Evaporation and Groundwater Pumping	880	880	880	880	880	880	880

GSA	PMA Name	PMA Status as of WY 2023	PMA Mechanism	Estimated Average Benefit at 2040 (AFY, rounded)[1]	Average Reported Benefit in Years Implementation Occurred[2] (WY 2019-2023) (AFY, rounded)	Reported Benefit[3] (WY 2019) (AFY)	Reported Benefit[3] (WY 2020) (AFY)	Reported Benefit[3] (WY 2021) (AFY)	Reported Benefit[3] (WY 2022) (AFY)	Reported Benefit[3] (WY 2023) (AFY)
MID	WaterSMART SCADA	Implemented	Reduce Evaporation and Groundwater Pumping	1,230	1,230	1,230	1,230	1,230	1,230	1,230
MID	Water Supply Partnerships	In Progress	Reduce Groundwater Pumping	3,990	10	-	50	0	0	0
MID	Incentive Program	Implemented	Reduce Groundwater Pumping	5,010	4,580	22,900	0	0	0	0
MID	Demand Reduction	Implemented	Reduce Demand	1,020	1,100	1,020	1,020	1,020	1,180	1,260
MID	Grazing Land Annexation	Implemented	Increase Sustainable Yield	210	210	-	206	206	206	206
MID	Water User Software Platform (UI)	Implemented	Education / Outreach	-	-	-	-	-	-	-
MID	Intensive Groundwater Use Policy	Implemented	Reduce Groundwater Pumping	-	-	-	-	-	-	-
CM	Meters and Volumetric Pricing	Implemented	Reduce Groundwater Pumping	3,350	3,350	3,350	3,350	3,350	3,350	3,350
CM/ MID	Berry Basin	Implemented	Increase Recharge	20	140	465	0	0	0	221
CM/ MID	Additional Recharge Basins	Implemented	Increase Recharge	630	630	-	-	-	-	632
MC/ MID	Ellis Basin	Implemented	Increase Recharge	120	30	153	0	0	0	0
MC	Water Imports Purchase	In Progress	Reduce Groundwater Pumping	3,610	-	-	-	-	-	-

GSA	PMA Name	PMA Status as of WY 2023	PMA Mechanism	Estimated Average Benefit at 2040 (AFY, rounded)[1]	Average Reported Benefit in Years Implementation Occurred[2] (WY 2019-2023) (AFY, rounded)	Reported Benefit[3] (WY 2019) (AFY)	Reported Benefit[3] (WY 2020) (AFY)	Reported Benefit[3] (WY 2021) (AFY)	Reported Benefit[3] (WY 2022) (AFY)	Reported Benefit[3] (WY 2023) (AFY)
MC	Millerton Flood Release Imports	In Progress	Reduce Groundwater Pumping	7,060	-	-	-	-	-	-
MC	Chowchilla Bypass Flood Flow Recharge Phase 1[4]	In Progress	Increase Recharge	3,900	42,100	-	-	-	-	42,100
MC	Chowchilla Bypass Flood Flow Recharge Phase 2[4]	In Progress	Increase Recharge	17,400	-	-	-	-	-	-
MC	Demand Management[5]	In Progress	Reduce Groundwater Pumping	113,000	-	-	-	-	-	-
GFWD	*See GFWD GSA GSP 2025 Periodic Evaluation Elements for information on GFWD PMAs.*									
NSWD	*See NSWD GSA GSP 2025 Periodic Evaluation Elements for information on NSWD PMAs.*									
RCWD	*See RCWD GSA GSP 2025 Periodic Evaluation Elements for information on RCWD PMAs.*									
Total				**201,070**	**86,930**	**40,807**	**7,416**	**7,106**	**7,309**	**110,754**

[1] Estimates developed for full PMA implementation. For PMAs described in the 2020 Initial Joint GSP, the estimated average annual benefit at 2040 is summarized from the Joint GSP. Some PMAs have been modified since the 2020 Initial Joint GSP was adopted, so these totals may not equal the totals reported in the 2020 Initial Joint GSP.
[2] Averages were calculated based on reported PMA benefits in *only those years when implementation was feasible* during this Periodic Evaluation cycle. Reported benefits are consistent with the water budgets in the Annual Reports completed during this Periodic Evaluation cycle, and do not otherwise change the Subbasin water budget as reported in the Annual Reports.
[3] Reported benefits noted in this table are as reported by the GSAs in the Annual Reports and do not include any reductions for recharge water applied that meets in-lieu consumptive use needs or other losses that may occur unless otherwise adjusted by the GSAs.
[4] Since the 2020 Initial Joint GSP was adopted, the Chowchilla Bypass Flood Flow Recharge Project Phases 1 and 2 have been further refined into a series of five recharge projects that are expected to undergo planning/design and construction between 2021 and 2030. Phase 1 now corresponds to Project 1, with a revised estimated average annual benefit at 2040 of approximately 3,900 AF per year (11,200 AF in years water is available). Phase 2 now corresponds to Projects 2 through 5, with a revised combined estimated average annual benefit at 2040 of 36,500 AF per year (104,400 AF in years water is available). These anticipated benefits are for full project implementation and have been refined from the initial benefits identified during GSP development. However, benefits have been achieved as of the WY 2023 Annual Report through diversions under the provisions of provisions of EO N-4-23, consistent with the WY 2023 Annual Report water budget.
[5] Initial data shows promising reductions in ETAW and irrigated areas in the MC GSA (see **Section 3.1.3 and Figure 3-2**); however, the precise benefits of the groundwater allocation to the Subbasin groundwater system were still being quantified as of the WY 2023 Annual Report. Updates will be given in future reports as more data is collected.

Table 3-4. Costs of PMA Implementation, Estimated and Reported as of the Water Year 2023 Annual Report.

GSA	PMA Name	PMA Status as of WY 2023	Estimated Annual Operating Costs at 2040 ($)[1]	Estimated Capital Costs at 2040 ($)[1]	Reported Capital Costs as of WY 2023 ($)	Reported Capital Costs (WY 2019)	Reported Capital Costs (WY 2020)	Reported Capital Costs (WY 2021)	Reported Capital Costs (WY 2022)	Reported Capital Costs (WY 2023)
MWD	Expanded Surface Water Purchase	In Progress	$900,000	$14,900,000						
MID	Rehab Recharge Basins	Implemented	$430,000	$60,000	$60,000	$60,000				
MID/MC	Ellis Basin	Implemented	$20,000	$20,000	$20,000	$20,000				
MID/CM	Berry Basin	Implemented	$0	$20,000	$20,000	$20,000				
MID	Allende Basin	Implemented	$70,000	$200,000	$200,000	$200,000				
MID/CM	Additional Recharge Basins with City of Madera	Implemented	-	-						
MID	Additional Recharge Basins Phase 1	Implemented	$240,000	$1,000,000	$2,158,000			$2,158,000		
MID	Additional Recharge Basins Phase 2	In Progress	$3,750,000	$14,200,000	$1,600,000					$1,600,000
MID	On-Farm Recharge	Implemented	$50,000	$0						
MID	Phase 2 On-Farm Recharge	Implemented	$190,000	$0						
MID	MID Pipeline	Implemented	$0	$560,000	$640,000			$320,000	$320,000	
MID	WaterSMART Pipeline	Implemented	$0	$1,300,000						
MID	WaterSMART SCADA	Implemented	$0	$1,200,000						
MID	Water Supply Partnerships	In Progress	$2,500,000	$0						

GSA	PMA Name	PMA Status as of WY 2023	Estimated Annual Operating Costs at 2040 ($)[1]	Estimated Capital Costs at 2040 ($)[1]	Reported Capital Costs as of WY 2023 ($)	Reported Capital Costs (WY 2019)	Reported Capital Costs (WY 2020)	Reported Capital Costs (WY 2021)	Reported Capital Costs (WY 2022)	Reported Capital Costs (WY 2023)
MID	Incentive Program	Implemented	$3,080,000	$0	$151,000				$62,000	$89,000
MID	Demand Reduction	Implemented	$110,000	$12,000	$12,000	$12,000				
MID	Grazing Land Annexation	Implemented	-	-						
MID	Water User Software Platform (UI)	Implemented	-	-						
MID	Intensive Groundwater Use Policy	Implemented	-	-						
CM	Meters and Volumetric Pricing	Implemented	$0	$11,000,000	$1,253,906				$281,860	$972,046
CM/MID	Berry Basin	Implemented	$0	$20,000						
CM/MID	Additional Recharge Basins	Implemented	-	$50,000	$50,000			$50,000		
MC/MID	Ellis Basin	Implemented	$20,000	$20,000						
MC	Water Imports Purchase	In Progress	$2,490,000	$300,000						
MC	Millerton Flood Release Imports	In Progress	$450,000	$31,900,000						
MC	Chowchilla Bypass Flood Flow Recharge Phase 1	In Progress	$800,000	$6,570,000	$257,000			$9,000	$248,000	
MC	Chowchilla Bypass Flood Flow Recharge Phase 2	In Progress	$700,000	$105,200,000						

GSA	PMA Name	PMA Status as of WY 2023	Estimated Annual Operating Costs at 2040 ($)[1]	Estimated Capital Costs at 2040 ($)[1]	Reported Capital Costs as of WY 2023 ($)	Reported Capital Costs (WY 2019)	Reported Capital Costs (WY 2020)	Reported Capital Costs (WY 2021)	Reported Capital Costs (WY 2022)	Reported Capital Costs (WY 2023)
MC	Demand Management	In Progress	$53,900,000	$0						
GFWD	*See GFWD GSA GSP 2025 Periodic Evaluation Elements for information on GFWD PMAs.*									
NSWD	*See NSWD GSA GSP 2025 Periodic Evaluation Elements for information on NSWD PMAs.*									
RCWD	*See RCWD GSA GSP 2025 Periodic Evaluation Elements for information on RCWD PMAs.*									
			Total	**$188,532,000**	**$6,371,906**	**$312,000**	**$0**	**$2,487,000**	**$911,860**	**$2,661,046**

[1] Estimated costs for full PMA implementation as reported in the 2020 Initial Joint GSP or based on available data and refinements during this Periodic Evaluation cycle. Costs are in 2019 dollars.

3.3 Tracking, Administering, and Reporting

Like all GSAs in the Subbasin, the Joint GSP GSAs are each implementing and administering their own proposed PMAs, or are coordinating directly with partnering agencies and other project proponents, as applicable. The Joint GSP GSAs are responsible for tracking and reporting progress on their PMAs. Updates on the progress of all PMAs that are being implemented or developed by the Joint GSP GSAs are collected and reported each year in the Joint GSP Annual Report. The Subbasin GSAs have also developed a shared data management system. Moving forward, the Joint GSP GSAs also anticipate reporting updates to DWR directly and formally through the new PMA Module within DWR's SGMA Portal (made available in Fall 2024).

Each Joint GSP GSA is also responsible for publicly noticing and engaging interested parties regarding their proposed PMAs. Many PMAs in the Joint GSP area are being implemented or developed hand-in-hand with robust communication and outreach efforts, especially those that are most impactful to stakeholders, such as MID's incentive program and on-farm recharge efforts, or MC GSA's demand management program. Specific outreach activities related to PMAs are described in further detail in Section 7.1 of the Madera Subbasin 2025 Periodic Evaluation. In addition to the Joint GSP GSAs' outreach activities related to specific PMAs, the Annual Report contains updates on PMAs and is made publicly available each spring.

4 Basin Setting Evaluation Based on New Information or Changes in Water Use (23 CCR §356.4(c)-(d))

Please refer to the Madera Subbasin 2025 Periodic Evaluation for a summary of the Subbasin GSAs' evaluation of the basin setting based on new information or changes in water use (per 23 CCR §356.4(c)-(d)). Updates are provided for the Subbasin as a whole, with specific reference to content in the Joint GSP 2025 Plan Amendment.

5 Monitoring Networks Evaluation (23 CCR §356.4(e))

Please refer to the Madera Subbasin 2025 Periodic Evaluation for a summary of the Subbasin GSAs' evaluation of the Subbasin monitoring networks during this Periodic Evaluation cycle (per 23 CCR §356.4(e)). Updates are provided for the Subbasin as a whole, with specific reference to RMS in the Joint GSP area for all applicable sustainability indicators.

6 GSA Authorities and Enforcement Actions (23 CCR §356.4(g)-(h))

The purpose of this section is to document any authorities (e.g., regulations or ordinances) and enforcement or legal actions that the Joint GSP GSAs have established or exercised during the first Periodic Evaluation cycle in furtherance of the sustainability goal for the Subbasin. This section also describes other policies, regulations, and orders at the local, state, and/or federal level that have impacted SGMA implementation in the Subbasin.

Actions by each of the Joint GSP GSAs are described first, followed by a summary of applicable local, state, and/or federal policies, regulations, and orders. Actions by the other GSAs in the Subbasin are described in their respective Periodic Evaluation attachments.

6.1 Authorities and Actions by the Joint GSP GSAs

6.1.1 MID GSA

The MID GSA has enacted, or continued to enact, several resolutions and/or policies in furtherance of the Subbasin sustainability goal during this Periodic Evaluation cycle, including:

- **Intensive Groundwater Use Policy** (adopted 10/15/2019): This policy continued to apply to all applicable development within the MID GSA during the first Periodic Evaluation cycle. Further discussion of this policy is provided in the Joint GSP 2025 Plan Amendment Section 4.9. The policy is specifically applicable for any person or entity in the MID GSA that intends to use groundwater for a purpose other than agriculture, defined as the growing of crops. Under this policy, permits are required for any “intensive groundwater use,” defined as:
    - A new or expanded groundwater use (after the policy adoption date), not including the growing of crops, and groundwater demands greater than historic demands in the MID GSA; OR
    - Any other use of groundwater that, in the absence of appropriate permit terms and conditions, would, in the opinion of the MID GSA, have the potential to unreasonably interfere with the MID GSA’s ability to comply with SGMA or the Joint GSP, or would adversely impact the water supplies available to the MID GSA’s agricultural water users.

  The terms of this policy help to ensure that allowable groundwater use within the MID GSA area would not be inconsistent with the Joint GSP and would not decrease the likelihood of achieving the sustainability goal for the Subbasin.

- **Joint GSP Adoption Resolution** (for the 2023 Revised Joint GSP; adopted 04/16/2024): In resolution 2024-GSA01, the MID GSA formally adopted the 2023 Revised Joint GSP. This resolution is included in Appendix 1.H of the Joint GSP 2025 Plan Amendment.

There have been no noted funding or fee actions in the MID GSA during this Periodic Evaluation cycle specifically related to Joint GSP implementation. MID continues to fund efforts related to the MID GSA and Joint GSP implementation primarily through assessments, charges, and/or other funding mechanisms related to MID services. MID has also partnered with the Natural Resources Conservation Service (NRCS) and U.S. Department of Interior’s WaterSMART Initiative, which has made pilot program funds available in MID for recharge projects such as on-farm recharge, recharge basins, or other supporting practices. $1.5 million was made available in 2022, and another $2.4 million was made available in fall 2023. Landowners in MID can apply for these funds through the NRCS to support conservation practices and infrastructure improvements. These efforts are described in **Section 3** of this Periodic Evaluation and in Section 4.9 of the Joint GSP 2025 Plan Amendment.

The MID GSA is not implementing an allocation program, as other PMAs are being implemented in the MID GSA to support groundwater sustainability (described in **Section 3** of this Periodic Evaluation and in Section 4.9 of the Joint GSP 2025 Plan Amendment). MID does not collect groundwater extraction data from landowners at this time. However, MID does continue to collect groundwater-related data at MID wells, as well as surface water-related data at MID diversion and delivery points. All relevant data is reported or considered during development of the Joint GSP Annual Report each year.

6.1.2 MC GSA

The MC GSA has developed and enacted several resolutions and policies in furtherance of the Subbasin sustainability goal during this Periodic Evaluation cycle, including those supporting its groundwater allocation and demand management program. Applicable resolutions that have been adopted by the MC GSA are available at: https://www.maderacountywater.com/resolutions/. These documents define the guiding principles, rules, and regulations of the MC GSA for efforts that are underway to address groundwater sustainability issues in the MC GSA. These efforts are also described in Section 4.9 of the Joint GSP 2025 Plan Amendment.

Notable resolutions, policies, and actions relevant to this Periodic Evaluation cycle include:

Groundwater Allocation Resolutions and Related Actions:
The MC GSA adopted a groundwater allocation approach in calendar year 2020 following extensive community outreach. The allocation and associated penalties are being enforced in the MC GSAs (within the Chowchilla, Madera, and Delta-Mendota Subbasins) through measurements of groundwater demand by approved measurement methods. MC GSA has included certain refinements to the allocation framework over time, including the adoption of penalties, through the resolutions discussed below. MC GSA has also developed a recharge policy that would credit recharge benefits to the allocation of areas where recharge occurred.

Specific resolutions, policies, and actions that have been taken to develop and implement the groundwater allocation are described below.

- **Allocation Framework and Resolutions**: In 2020-2021, the MC GSA developed an allocation framework through a series of public meetings with the MC GSA Advisory Committee. Subsequently, and at the recommendation of the Advisory Committee, the MC GSA Board of Directors adopted the allocation framework through the following resolutions:
  - Resolution 2020-166 (adopted 12/15/2020) adopts a groundwater allocation approach.
  - Resolution 2021-069 (adopted 06/08/2021) establishes groundwater allocation amounts for 2021-2025 and allows for the creation of "farm units." Farm units – commonly operated or managed lands that are grouped and considered together in enforcement of the allocation – provide flexibility and reflect real-world farming conditions in which resources are shared. Farm units are currently allowed to be changed at the end of the calendar year, and never-irrigated lands are currently allowed to opt-in in November of each year.
  - Resolution 2021-113 (adopted 08/17/2021) establishes groundwater allocation refinements including allowing for the possibility that unused allocations may be carried

over, if it is found that doing so will not jeopardize the objectives of the GSP.

- **Allocation Measurement and Enforcement**: In 2022, MC GSA adopted measurement methods for tracking and enforcing the groundwater allocation (Resolution 2022-192, adopted 12/20/2022). MC GSA has been enforcing the approved allocations since 2022. Three approved demand measurement options are available to growers in the MC GSA for allocation enforcement:
    - IrriWatch (a daily irrigation scheduling and crop production information service that uses Surface Energy Balance Algorithm for Land (SEBAL) model outputs to quantify actual consumptive water use from satellite imagery)
    - Land IQ (similar to IrriWatch, quantifying consumptive water use from land use and satellite imagery)
    - Use of approved flowmeters that are installed correctly and calibrated regularly. Although MC GSA is not responsible for installing flowmeters, MC GSA has adopted pre-approval processes for the use of private meters as a means of allocation tracking and enforcement. (Resolution 2022-145, adopted 09/27/2022). The adopted processes are intended to ensure correct installation and maintenance of flowmeters and their accuracy.

  Enforcement of the allocation continues to incorporate adjustments to account for recharge credits, land repurposing (fallowing) credits, and successful allocation appeals. These topics are described later in this section.

- **Allocation Penalties:** In 2022, MC GSA approved penalties for exceeding the allocation through Resolution 2022-145 (adopted 09/27/2022). Penalties in the Subbasin begin at $100 per AF for farm units in calendar year 2023, increasing by $100 per AF each subsequent year up to a maximum of $500 per AF, for the total volume extracted in excess of the authorized amount. These penalties are specific to the Subbasin, and may differ from penalties in the Chowchilla and Delta-Mendota Subbasins.

- **Allocation Appeals**: The MC GSA has allowed and developed an appeals process for growers who have selected to use the IrriWatch and Land IQ approaches, although there is no appeals process for those using approved flowmeters. In 2023, MC GSA revised the rules for appealing the determination of use of the groundwater allocation through Resolution 2023-150 (adopted 11/07/2023). MC GSA expects to reevaluate measurement options for the program moving forward in 2025.

- **Recharge Credit Policies:** MC GSA has developed a recharge policy that would credit recharge benefits to the allocation of areas where recharge occurred. In 2024, MC GSA approved policies related to recharge with surface water that is purchased, and related to recharge with water taken under Executive Order (EO) N-4-23, which was subsequently codified through California Water Code Section 1242.1. Both policies have a “floor” of a 75% recharge credit and a "ceiling" of 90% recharge credit depending on data specific to the land on which the recharge occurred. The recharge credit is limited to the aquifer in which recharge occurred.
    - Resolution 2024-030 (adopted 03/19/2024) adopted recharge credit policies for the Madera, Chowchilla, and Delta-Mendota Subbasins.

- **Allocation Verification Efforts:** Since 2022, the MC GSA has conducted the Madera Verification Project to analyze the consistency of measurements from flowmeters to the demand estimates developed from the IrriWatch and Land IQ remote sensing measurements. Through the Madera Verification Project, the MC GSA has conducted extensive outreach among growers in the Chowchilla, Madera, and Delta-Mendota Subbasins who will be directly impacted by the demand measurement efforts. Through these outreach efforts, the MC GSA has gained substantial feedback and made changes to the demand measurement program to ensure that it is locally accurate, effective, and equitable to growers. Additional information about the Madera Verification Project is discussed in **Section 3** and in the Annual Reports.

<u>Land Repurposing Resolutions and Related Actions</u>:

- **Voluntary Land Repurposing Program (VLRP):** MC GSA developed the VLRP through a stakeholder-driven process in 2020-2022. The VLRP aims to develop criteria for identifying and prioritizing agricultural land for protection, and to develop an incentive structure for agricultural landowners to rest, retire, restore, or permanently protect their land via various types of water-centric conservation easements. Additional information about this process are discussed in **Section 3** and in the Annual Reports. In fall-winter 2022, the MC GSA conducted four public workshops, as well as multiple meetings and interviews, to review the VLRP development process as well as eligibility criteria, monitoring strategies, contracting processes, incentives, land management strategies, and other planned contract provisions. Rules and criteria for implementing the VLRP were approved by the MC GSA in December 2022 (Resolution 2022-194, adopted 12/20/2022).

- **Targeted Land Repurposing Program (LandFlex):** The MC GSA in the Subbasin was awarded a $9.3 million grant from DWR in 2022 for LandFlex, in coordination with the California Department of Food and Agriculture (Resolution 2023-056, adopted 04/18/2023). This funding is being used to support implementation of the VLRP. The MC GSA is working to incorporate this information into implementation of the allocation framework (described above) to ensure that participating landowners are receiving credit for land fallowing under the VLRP.

- **Multibenefit Land Repurposing Program (MLRP):** Madera County has completed and adopted a plan for land repurposing projects through available funding under the California Department of Conservation's Multi-Benefit Land Repurposing Program (MLRP) grant program (Resolution 2024-120, adopted 10/1/2024). The MLRP aims to assist growers who are seeking to convert irrigated agricultural land to a less water intensive use, supporting and incentivizing projects that save water, make business sense, and create additional benefits for local communities and the environment. Total funding of $7 million is available for projects throughout any GSA within Madera County. As of late 2024, Madera County is soliciting pre-applications for interested participants and is hosting informational workshops.

<u>Other Resolutions Related to Joint GSP Implementation:</u>

- **Joint GSP Adoption Resolution** (for the 2023 Revised Joint GSP; adopted 03/21/2023): In resolution 2023-045, the MC GSA formally adopted the 2023 Revised Joint GSP. This resolution is included in Appendix 1.H of the Joint GSP 2025 Plan Amendment.

<u>Funding and Fee Resolutions and Related Actions</u>: The MC GSA has adopted the following funding-related resolutions that are applicable during this Periodic Evaluation cycle:

- **Administrative Fee:** The MC GSA collects an administrative fee of approximately $20-30 per acre for irrigated acres within the GSA that is used for SGMA-related administration and planning efforts. Resolution 2019-172 (adopted 11/12/2019) approved the GSA administrative fee for the Madera, Chowchilla, and Delta-Mendota Subbasins. While the administrative fee is useful for supporting SGMA implementation, these funds cannot be used for implementation of PMAs.

- **Proposition 218 Process:** In 2022, a Proposition 218 process was completed that led to approval of an acreage-based rate for irrigated lands within the MC GSA in the Subbasin. The rate was intended to fund implementation of specific GSP-defined projects, including recharge facilities, water purchases, and domestic well mitigation programs. Resolution 2022-086 (adopted 06/21/2022) approved the GSP implementation-related rate for the Subbasin. However, following a lawsuit and preliminary injunction issued by the Madera County Superior Court in December 2022, Madera County was ordered to refrain from imposing and/or collecting any fees, rates, and/or GSP-related PMA fees enacted under Resolution 2022-086 against landowners in the Subbasin. As of fall 2024, the preliminary injunction remains in place, although Madera County has filed a motion to dismiss the lawsuit. Regardless of the outcome, the MC GSA is continuing GSP implementation and is seeking ways to reduce the implementation costs (e.g., grants, refinements) with stakeholder input and discussion. Updates regarding the injunction will be provided in future Annual Reports. Also, continued implementation of the allocation program, discussed previously, is not delayed.

- **Allocation Penalties:** In 2022, the MC GSA approved a penalty for groundwater extraction above the allocation that is being imposed as of 2023 (Resolution 2022-145, described above). Funds generated from these penalties are also available to support GSP implementation moving forward, as directed by the GSA Board, which has indicated an inclination to fund domestic well mitigation first as a top priority.

6.1.3 CM GSA

The CM GSA has enacted the following resolution in furtherance of the Subbasin sustainability goal during this Periodic Evaluation cycle:

- **Joint GSP Adoption Resolution** (for the 2023 Revised Joint GSP; adopted 03/20/2023): In resolution 23-33, the CM GSA formally adopted the 2023 Revised Joint GSP. This resolution is included in Appendix 1.H of the Joint GSP 2025 Plan Amendment.

There have been no noted funding or fee actions in the CM GSA during this Periodic Evaluation cycle specifically related to Joint GSP implementation. CM continues to fund efforts related to the CM GSA and Joint GSP implementation primarily through assessments, charges, and/or other funding mechanisms related to CM water distribution services.

The CM GSA is not implementing an allocation program, as other PMAs are being implemented in the CM GSA to support groundwater sustainability (described in **Section 3** of this Periodic Evaluation and in Section 4.9 of the Joint GSP 2025 Plan Amendment). The CM GSA does not collect groundwater extraction data from landowners at this time. However, the CM does continue to collect groundwater-related data at CM-operated wells. Groundwater wells operated by the CM for urban water use are 100% metered. The CM GSA is also continuing to implement its "Meters and Volumetric Pricing" project described in **Section 3** of this Periodic Evaluation and in Section 4.9 of the Joint GSP 2025 Plan Amendment. This project is upgrading meters across the CM water distribution system. All relevant data is reported or considered during development of the Joint GSP Annual Report each year.

6.1.4 MWD GSA

The MWD GSA has enacted the following resolution in furtherance of the Subbasin sustainability goal during this Periodic Evaluation cycle:

- **Joint GSP Adoption Resolution** (for the 2023 Revised Joint GSP; adopted 03/21/2023): In this resolution, the MWD GSA formally adopted the 2023 Revised Joint GSP. This resolution is included in Appendix 1.H of the Joint GSP 2025 Plan Amendment.

There have been no noted funding or fee actions in the MWD GSA during this Periodic Evaluation cycle specifically related to Joint GSP implementation. MWD continues to fund efforts related to the MWD GSA and Joint GSP implementation primarily through assessments, charges, and/or other funding mechanisms related to MWD services.

The MWD GSA is not implementing an allocation program as other PMAs are being implemented in the MWD GSA to support groundwater sustainability (described in **Section 3** of this Periodic Evaluation and in Section 4.9 of the Joint GSP 2025 Plan Amendment). The MWD GSA does not collect groundwater extraction data from landowners, as there are no privately-owned agricultural production wells and only two domestic wells within the MWD GSA area. All production wells within the MWD GSA are owned by MWD and are 100% metered. MWD continues to collect groundwater-related data at MWD wells, as well as surface water-related data at MWD diversion and delivery points. All relevant data is reported or considered during development of the Joint GSP Annual Report each year.

6.2 Applicable Policies, Regulations, and Orders at the Local, State, and/or Federal Level

SGMA implementation in the Subbasin has been impacted, to varying degrees, by activities, regulations, and orders outside of SGMA at the local, state, and/or federal level. Those that have most significantly impacted SGMA implementation include the following:

<u>Executive Order (EO) N-7-22 Action 9 and Impacts to Groundwater Well Permitting</u>

- **Context:** On March 28, 2022, Governor Newsom issued EO N-7-22 as a means of providing response to and mitigation of drought impacts. EO N-7-22 requires additional review of well permits by local jurisdictions and GSAs in groundwater subbasins subject to SGMA that are classified as medium or high priority. Both existing wells seeking alteration, and proposed wells, must first determine that extraction of groundwater from the proposed well is not likely to interfere with the production and functioning of existing nearby wells, and will not likely cause subsidence that would adversely impact or damage nearby infrastructure. Requirements under EO N-7-22 are intended to ensure that proposed wells are not inconsistent with achieving the sustainability goal established in any GSP.

- **Impacts to Subbasin:** As described in Section 2.1.3.3 of the Joint GSP 2025 Plan Amendment, the Madera County Environmental Health Division is entrusted with all permitting and enforcement for the construction, reconstruction, and destruction of wells in Madera County, including the entire Subbasin. Wells under their oversight include, but are not limited to, agricultural wells, observation/monitoring wells, community water supply wells, and individual domestic water supply wells. Well permitting processes in Madera County were consistent with all applicable requirements under EO N-7-22, and are helping to ensure that proposed wells are not inconsistent with achieving the sustainability goal for the Subbasin.

Senate Bill (SB) 122 and Impacts to Recharge Efforts

- **Context**:
  - SB122 was signed into law on July 10, 2023, formalizing and refining certain provisions under EO N-4-23 (issued in March 2023) that allow recharge of flood waters in certain circumstances, in absence of an approved water right. SB122 provides a pathway for diversion of flood waters for recharge if, among other requirements and considerations, a local or regional agency with flood control or flood risk responsibilities has given notice that flows downstream of the proposed diversion are at imminent risk of flooding and inundation of land, roads, or structures.
  - SB 1390 was later proposed in the 2024 legislative session, and was intended to address some ambiguities associated with SB122 (as codified in Water Code Section 1242.1) for diversions of flood flows to recharge. Proposed refinements included changes to requirements related to flood control or flood risk planning, and proposed language related to protection of the Delta as part of conditions for diversion. Although the bill did not pass in 2024, it is reasonably foreseeable that additional legislation pertaining to recharge efforts will be proposed in coming legislative sessions. The GSAs will engage in those discussions at that time.

- **Impacts to Subbasin**:
  - The provisions of EO N-4-23 and SB122 have already been very beneficial in supporting groundwater sustainability in the Subbasin, with substantial recharge occurring in 2023 under their allowances. Flood diversions are critical to maximizing recharge and thus SB122 is an essential component or tool to use in making diversions. Without the flexibility afforded by flood diversion under SB122, projects are limited to restrictions imposed by water rights. Moving forward, SB122 and any future clean-up legislation is expected to significantly streamline recharge efforts in the GSAs during flood flows, particularly along the Chowchilla Bypass, while also benefitting local and regional flood protection.
  - Nevertheless, the GSAs have identified certain potential challenges for PMA implementation associated with legal and regulatory interpretations of SB122, specifically related to considerations for new permanent infrastructure construction and its eligibility for use in flood diversions under SB122 (Water Code Section 1242.1). Some interpretations of SB122 are that the intent of the legislation was to prevent installation of new infrastructure during the flood season expressly for diverting water under SB122. In this interpretation, water users can still install permanent infrastructure (going through all appropriate regulatory processes with applicable permitting agencies) and then use that infrastructure to divert flood waters under SB122, among its other uses. Differing interpretations by some permitting agencies when applying SB122 take a stricter stance on new infrastructure, suggesting that new diversion facilities are more broadly not to be constructed in association with SB122.

Land Use Topics

- As described in Section 2.1.3 of the Joint GSP 2025 Plan Amendment, the Subbasin lies entirely within Madera County and the Madera County General Plan is applicable to land use within the entire Subbasin. Additionally, the City of Madera General Plan is applicable to land in the boundaries of the City of Madera. Madera County and City of Madera policies related to land use are described therein. Implementation of proposed land use developments under both General Plans is expected not to adversely impact groundwater sustainability in the Subbasin. Madera County has a net zero ordinance that requires developers to bring in enough water supply for the development such that it does not increase demand. Similarly, new developments in the City of Madera are required to follow the Model Water Efficient Landscape Ordinance (MWELO)[3], and are thus expected to reduce water demands.
- In addition to applicable General Plan policies, PMAs are expected to contribute to land use changes in the Subbasin (e.g., conversion of parcels to recharge basins, land use changes associated with the VLRP, MLRP, and demand management.

[3] The MWELO increases water efficiency standards for new and retrofitted landscapes by encouraging more efficient irrigation systems, graywater usage, and onsite storm water capture, and by limiting the portion of landscapes that can be covered in turf. See Section 2.1.3 of the Joint GSP 2025 Plan Amendment.

7 Outreach, Engagement, and Coordination with other Agencies (23 CCR §356.4(j))

Please refer to the Madera Subbasin 2025 Periodic Evaluation for a summary of the Subbasin GSAs' outreach, engagement, and coordination with other agencies during this Periodic Evaluation cycle (per 23 CCR §356.4(j)). Updates are provided for the Subbasin as a whole, including activities conducted specifically by the Joint GSP GSAs.

8 Other Information (23 CCR §356.4(k))

Please refer to the Madera Subbasin 2025 Periodic Evaluation for a summary of other information relevant to Plan implementation for the Subbasin during this Periodic Evaluation cycle (per 23 CCR §356.4(k)). Updates are provided for the Subbasin as a whole.

9 Summary of Proposed or Completed Revisions to Plan Elements (23 CCR §356.4(i))

Please refer to the Madera Subbasin 2025 Periodic Evaluation for a summary of proposed and completed revisions to Plan elements (per 23 CCR §356.4(i)). Updates are provided for the Subbasin as a whole.

The 2025 Plan Amendment accompanying the 2025 Periodic Evaluation has been amended to address recommended corrective actions identified by DWR in their December 2023 approval of the 2023 Revised Plan. The 2025 Plan Amendment – including all four amended GSPs and the Coordination Agreement – was adopted before the January 2025 submittal.

Specific revisions to the Plan elements that were completed as part of the 2025 Plan Amendment are identified in ***Appendix 1.A.2*** *of the Madera Subbasin 2025 Periodic Evaluation, with reference to revisions in specific sections of the Joint GSP 2025 Plan Amendment.*

10 References

DWR, 2023. Guidance for Sustainable Groundwater management Act Implementation: Considerations for Identifying and Addressing Drinking Water Well Impacts. March 2023.

Appendix 1.B. 2025 Periodic Evaluation GSP Attachments

Appendix 1.B.2. GFWD GSA GSP 2025 Periodic Evaluation Elements

GRAVELLY FORD WATER DISTRICT

GROUNDWATER SUSTAINABILITY PLAN 2025 PERIODIC EVALUATION

JANUARY 2025

GROUNDWATER SUSTAINABILITY PLAN 2025 PERIODIC EVALUATION

Prepared for:

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and

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Fresno, California

January 2025

Project #240102

Table of Contents

Appendices

List of Figures

List of Tables

List of Acronyms

af	Acre Feet/Acre Foot
CDEC	California Data Exchange Center
CIMIS	California Irrigation Management Information System
DWP	Domestic Well Program
DWR	Department of Water Resources
DTW	Depth to Water
ET_0	Evapotranspiration
GFWD	Gravelly Ford Water District
GRF	Gravelly Ford
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
HCM	Hydrogeologic Conceptual Model
IM	Interim Milestone
IWFM	Integrated Water Flow Model
ISW	Interconnected Surface Water
KDSA	Kenneth D. Schmidt and Associates
LSCE	Ludorff-Scalmanini Consulting Engineers
MCL	Maximum Contaminant Level
MCSim	Madera-Chowchilla Groundwater Surface Water Simulation Model
MID	Madera Irrigation District
MO	Measurable Objective
MOU	Memorandum of Understanding
MT	Minimum Threshold
NRCS	Natural Resources Conservation Service
RMS	Representative Monitoring Site
SCADA	Supervisory Control and Data Acquisition
SGMA	Sustainable Groundwater Management Act
SJR	San Joaquin River
SJRRP	San Joaquin River Restoration Project
SMC	Sustainable Management Criteria
SWRQB	State Water Resources Control Board
TDS	Total Dissolved Solids
URF	Unreleased Restoration Flows
USBR	United States Bureau of Reclamation

SECTION 1 - EXECUTIVE SUMMARY

Gravelly Ford Water District (GFWD; District) was formed in 1961 to be eligible for surface water from the United States Bureau of Reclamation (USBR). The District serves approximately 8,300 acres of unincorporated Madera County territory. The primary land uses are grape vineyards, nut tree groves, and on-farm rural residences. The San Joaquin River borders a portion of the District to the south, and Cottonwood Creek flows west through the northern portion of the District. The District is bisected by the Gravelly Ford Canal, which runs north to south.

GFWD is a groundwater sustainability agency (GSA) in the Madera Subbasin. The Madera Subbasin has seven separate GSAs and four individual GSPs. The Madera Subbasin Joint GSP (Groundwater Sustainability Plan) includes Madera Water District, Madera Irrigation District, the City of Madera, and Madera County. This accounts for the majority of the Madera Subbasin. Gravelly Ford Water District, Root Creek Water District, and New Stone Water District have elected to write, analyze, and update their own GSPs; however, all GSAs have agreed to use the Madera Subbasin Joint GSP and their modeling efforts to describe the Subbasin conditions as a whole. It should also be noted that the original GSPs for each of the Plan Areas were submitted in 2020, and amendments to the GSPs were submitted in 2023. The Madera Subbasin Technical Committee is currently in the process of drafting changes to the current Plans to be amended in 2025.

The purpose of this Periodic Evaluation is to analyze the GFWD GSP Amended 2023 as it relates to Department of Water Resources (DWR) the approval letter Recommended Actions (see Appendix B), groundwater conditions during the implementation period, and implementation of projects and management actions. This document will also address proposed changes in the GFWD GSP Amended 2025, including the changes to the GFWD monitoring network and sustainable management criteria (SMC). Changes to the SMC are Subbasin-wide and will be described in more detail in the Madera Subbasin Joint GSP Amended 2025. This document also outlines the progress the District has made during the implementation period with regard to implementing and expanding its monitoring network, raising funds for implementation of projects and management actions, and operations of projects and management actions already in place.

Based on the analysis of the GFWD GSP Amended 2023, the District is seeing groundwater levels recover back to the spring 2015 measurements taken for each of the agricultural wells and representative monitoring site (RMS) wells in most areas. Subsidence is also within the expected range. It is projected that the District will be within the sustainable range by the end of the implementation period.

SECTION 2 - NEW INFORMATION COLLECTED

In the nearly five years since the original GFWD GSP and accompanying Joint GSP were submitted in January 2020, additional resources and data have been developed and analyzed. This information allows GSAs to analyze their GSPs, monitoring programs, HCMs (Hydrogeologic Conceptual Model), and changes in groundwater conditions and relate that information to sustainable groundwater management in the GSA. Some information and data have informed changes to the GFWD GSP Amended 2025 and associated programs.

The District and their Madera Subbasin GSA partners continue to collect data for annual reporting and to steer GSP implementation. However, there have been necessary changes, and the need to obtain new information or alter existing information is detailed in this section. Below is a summary of new information that has been collected and how it has been used or could be used. It should be noted that this may not be an exhaustive list of all information available, and the mentions below are for informational purposes only.

2.1 - Model Update

The Madera Subbasin Technical Committee (Technical Committee) consists of technical representatives for each Madera Subbasin GSP, including Ludorff-Scalmanini Consulting Engineers (LSCE), the technical consultant hired to model groundwater conditions in the Subbasin. LSCE is the same consultant that modeled groundwater conditions for the previous iterations of the Madera Subbasin Joint GSP. The Madera-Chowchilla Groundwater Surface Water Simulation Model (MCSim) is a numerical groundwater flow model based on the Integrated Water Flow Model (IWFM) code developed and maintained by the California Department of Water Resources (DWR). An update of MCSim (MCSim_v2), was completed for the first plan amendment to the Madera Subbasin Joint GSP Amended 2025. According to LS, changes to the model include:

- Updates to the model code for the MCSim.
- Adding the subsidence package to the model. There have also been refinements to the extent of the Corcoran Clay. This subsidence data has been added to the model between the years of 2015 – 2024. Subsidence is being projected until 2090.
- Additional refinements to groundwater conditions and the hydrogeological conceptual model include refinements to the bedrock for simulation, refinements of the texture model, refinement of the texture model, addition of subsidence package, extension of historical simulation, update of boundary conditions, addition of calibration points, model recalibration, refined projected hydrology.
- LSCE also refined projected and proposed projects and management actions for projections and simulations.
- Changes to representative water years and the simulation period include a historical period update from 1989-2015 (v1) to 1989-2023 (v2) and recalibration. The sustainability period (2040-2090) updated the representative hydrology from 1965-2015 (v1) to 1973-2023 (v2).

A detailed description of the updates to and recalibration of MCSim_v2 is included in the Madera Subbasin Joint GSP Amended 2025.

2.2 - New Monitoring Data

The District has been monitoring SMCs since the development stages of the GSP. This data has been reported annually. The analysis of the data is explained further in Section 3. The remainder of this section focuses on changes to the monitoring network as a result of the available data and any data gaps within the District. An additional analysis of the monitoring network is in Section 6.

The District has made significant changes to the existing monitoring network. GFWD is a small water district within the Madera Subbasin and only makes up a small percentage of the Subbasin. Prior to the implementation of the Sustainable Groundwater Management Act (SGMA) the District had no official groundwater monitoring program. However, the District has historically reviewed monitoring data from other agencies including USBR, DWR, SWRCB (State Water Resources Control Board), and nearby water districts and water quality monitoring programs.

The District developed a groundwater monitoring plan that utilized the historical data of two wells within the District that were monitored by DWR. Unfortunately, DWR has not taken a water level measurement from either of the wells selected since 2019. Because DWR no longer measures these wells, the District selected new representative wells. The District does not have a good way to compare current water level data from District agricultural wells with long-term historical data. It should be noted that these are not dedicated monitoring wells and will not be referred to as “monitored” wells rather than “monitoring” wells. The District will now be using agricultural wells 201, 202, 203, 206, 213, and 224 as representative monitored wells for the purposes of annual reporting. The Madera Subbasin also monitors a site within the District (MSB06). They also collect data from subsidence monitoring stations that lie on the border of the northeastern portion of the District. GFWD plans to review relevant data acquired by the Madera Subbasin and compare results to data gathered by the District. Additional details about the monitored wells for water levels in the District can be found in Section 6 of this document and the GFWD GSP Amended 2025.

The District has also implemented an internal subsidence monitoring network. The District is currently monitoring subsidence at agricultural wells. The District is using the same agricultural wells to monitor water levels and subsidence. Additional details about the subsidence monitoring in the District can be found in Section 6 and the GFWD GSP Amended 2025.

The District has not had any known issues with groundwater quality for irrigation, so implementing an internal water quality monitoring network has been a lower priority. It was determined that the District would monitor water quality at domestic wells rather than at the same wells measured for subsidence and water levels for the purposes of annual reporting. Additional details about water quality monitoring in the District can be found in Section 6 of this document and the GFWD GSP Amended 2025.

The Subbasin is working with neighboring subbasins on the interconnectedness of surface waters from the San Joaquin River (SJR) and wells in subbasins adjacent to the San Joaquin River.

2.3 - New Reports

Electromagnetic Survey
The electromagnetic survey supplements existing geological data. As the data is refined, the District will review the results and apply them to the GSP accordingly.

A Guide to Water Quality Requirements under SGMA
This report is intended to assist GSAs in implementing a groundwater quality monitoring program. It outlines the need to understand regulatory authority and groundwater quality standards to develop SMCs, the need for coordination with regulatory agencies and RWQCB, the need to assess groundwater conditions to identify water quality issues, and the need to determine an approach for monitoring and understanding the effects of projects and management actions on groundwater quality.

ISW Guidance
In February 2024, DWR released guidance on Interconnected Surface Water (ISW), which includes definitions and explanations of what constitutes ISW, how to determine if wells are interconnected, what constitutes depletions, and how depletions can be managed. This guidance document is the first of three intended to assist GSAs in identifying ISW. The following two guidance documents aim to assist in quantifying the depletions of ISWs. These guidance documents were published in September of 2024 and will be reviewed and consulted with the development of the 2025 Annual Report. Generally, these two newly released documents cover techniques and examples of estimating depletions of interconnected surface water due to groundwater use.

2.4 - New Interagency Coordination

Domestic Well Program
The Domestic Well Program memorandum of understanding (MOU), dated March 21, 2023, outlines the intent to establish a Domestic Well Program (DWP). The Joint Subbasin DWP MOU identifies the DWP development process. The intention was to develop the DWP within the first five years of the GSP implementation by 2025. However, the MOU was not officially adopted until March of 2023. Currently, no DWP has been presented to the GSAs and the status of the DWP is unknown. GFWD agrees with the need for a DWP; however, the District prefers to address domestic well issues internally due to the nature of the District. It also wants to ensure that parameters for eligibility in the DWP are clearly defined to ensure that affected domestic wells are truly being affected by the sustainable management criteria as defined in the GFWD GSP Amended 2025.

Coordination Agreement
The original coordination agreement for the GSAs within the Madera Subbasin expired on December 31, 2024. A coordination agreement signed by all parties within the Madera

Subbasin is required prior to the submittal 2025 Groundwater Sustainability Plan Periodic Evaluation. The final coordination agreement is attached to this document and can be reviewed in Appendix A.

Interconnected Surface Water MOU
The Madera Subbasin is in discussions with the Kings Subbasin to develop an MOU regarding interconnected surface waters along the San Joaquin River. This MOU is still in draft form and was included in the Madera Subbasin Joint GSP Amended 2025.

2.5 - New Funding Sources

Grants and Financial Assistance for Implementation
The District has applied for several grants since submitting the original GFWD GSP in 2020. The District applied for grant funding from DWR for SGMA project implementation in 2022 but was not awarded. More recently the District has applied for grant money from USBR's WaterSMART Program. The District applied for grants for both the Automatic SCADA Radial Gate Design Project and the Agricultural Well Metering Program. Additional information on grant applications and proposed projects for funding can be found in Section 4 and the GFWD GSP Amended 2025. The District also encourages landowners and growers to apply for Natural Resource Conservation Service (NRCS) programs and grants.

Proposition 218 Fee Assessment
Gravelly Ford Water District has historically levied volumetric water charges and land-based assessments to recover the District's expenses. On July 15, 2024, the property owners within the District voted to approve levying a new special assessment for the District as Resolution 2024-07. The assessment to be levied is $41.18 per acre for the 2024-2025 Fiscal Year, with a maximum of $90 per acre in perpetuity. A large portion of the funding is for surface water purchases for recharge and infrastructure to expand the District's Recharge Program and increase irrigation efficiency.

2.6 - Determinations/New Legislation/Policy/Lawsuits

There have been several decisions, policies, and lawsuits that have the potential to set precedence for the future of SGMA. These decisions will impact the understanding and subsequent implementation of SGMA. Many of the examples listed below are still being legislated, and the exact effects on GSAs are unknown. The following is a sample of potential legal decisions that could change the implementation and understanding of SGMA. This is a summary only and not an exhaustive list of all current and future legal decisions, and the final effects to SGMA are unknown.

DWR has finished the analysis of the initial 2020 GSP submissions for critically overdrafted subbasins and determined each GSP compliance with SGMA. The analyses of GSPs submitted in 2020 were accompanied by a determination that included a list of deficiencies and recommended actions. These recommended actions were a list of suggestions for compliance with and improvements to the GSPs if applicable. These recommended actions are intended to guide the evolution of the GSP and the interpretation of SGMA requirements.

See Section 2.7 for a list of recommended actions that accompanied the Madera Subbasin Joint GSP Amended 2023 approval.

AB 828 is a new California policy that states, "This bill would prohibit a groundwater sustainability agency from imposing a fee upon a small community water system serving a disadvantaged community or *imposing a fee for* managed wetland purposes, provided the water use for each user does not increase above the extractor's average annual extraction from 2015 to 2020, inclusive, as determined by a groundwater sustainability agency using recognized methods to establish average groundwater use. The bill would prohibit these provisions from applying to a groundwater basin with a groundwater sustainability plan that has been approved by the department after January 1, 2025." This policy was sent to the Governor on September 10, 2024. It is unknown how implementation of this bill would affect SGMA implementation as it relates to project implementation and funding. Bill Text: CA AB828 | 2023-2024 | Regular Session | Amended | LegiScan

There have been multiple lawsuits that may affect the interpretation and implementation of SGMA. Some of the lawsuits most likely to affect the Madera Subbasin include California United Water Coalition vs. Madera County regarding the implementation of fees on groundwater usage and Kings County Farm Bureau vs. the SWRCB regarding the requirement of farmers to meter and report their groundwater usage. These actions are not yet settled. These suits have the potential to affect SGMA implementation and the GSA's ability to manage their Plan Areas.

2.7 - New DWR Data

2.7.1 - Recommended Corrective Actions

On September 22, 2022, after a thorough review of the initial 2020 Joint and individual GSPs, DWR issued a staff report and findings determining that the initial 2020 Joint and individual GSPs submitted by the District were incomplete. The Department provided corrective actions in this report that assisted GFWD and other GSAs in the Subbasin in addressing deficiencies in their Plans. The District was given 180 days to address deficiencies within the Plan in coordination with the other GSAs in the Subbasin. The District and partner GSAs resubmitted the revised GSPs with redlines to DWR on March 21, 2023, for subsequent review.

On December 21, 2023, DWR issued a second staff report and statement of findings based on the review of the resubmitted GSPs. This report determined that the Joint GSP Amended 2023 was approved, and sufficient actions had been taken to correct the deficiencies detailed in the September staff report. However, the most recent staff report identified additional corrective actions that will "enhance the GSP and facilitate future evaluations." The full DWR approval letter for the Madera Subbasin is attached as Appendix B. The recommended corrective actions generally focus on the following:

1. Providing a detailed explanation specifically discussing and identifying Madera Irrigation District (MID) GSA's legal, contractual, or other authorities or

arrangements to implement its obligations under the Madera Subbasin Joint GSP in the next periodic evaluation.

As of April 2024, all Madera Subbasin GSAs have adopted the Madera Subbasin Joint GSP Amended 2023 and are implementing both the Joint and individual plans consistent with the requirements of SGMA. More information on MIDs GSP implementation can be found in the Madera Subbasin Joint GSP 2025 Periodic Evaluation and Madera Subbasin Joint GSP Amended 2025.

2. Continuing efforts to further coordinate the GSPs and groundwater management.

   The existing Madera Subbasin coordination agreement expires on December 31, 2024. The Technical Committee has discussed the need to renew it prior to that date. The coordination agreement is attached to this document as Appendix A.

   Additionally, the GSAs, through the Technical Committee and appointed Facilitator, have been working to standardize all data, definitions, and approaches. The Technical Committee meets biweekly to refine GSP requirements and methodologies, define sustainable management criteria, and respond to corrective actions.

   The Technical Committee is also working with Madera County and the Facilitator to develop and implement the Domestic Well Mitigation Program. The County has received a grant to plan and implement the program. It should be noted that the District intends to cooperate with the requirements of the program. However, the program is still under development, and requirements for participation, such as age and depth of wells, eligible replacement costs and depreciation, and costs to Districts and GSAs for participation, have yet to be established. It is the intent of GFWD to privately assist landowners in well replacement if it is clear that well/pump failure is a result of changes in groundwater conditions.

   Additionally, the GSAs are in agreement to use one groundwater model for the Subbasin and water budgets. However, it should be noted that GFWD has been and will continue to perform independent water budgets and assessments for groundwater conditions for the District. This is intended to check the model on a small district scale and inform the model of future projections. As the District's monitoring network grows to include groundwater pumping, this independent groundwater condition assessment will provide more accurate and real-time data for the benefit of the groundwater model.

3. Sufficiently describing the effect of chronic lowering of groundwater level interim milestones on other sustainability indicators.

   Section 3.2.2 of the GFWD GSP 2025 Periodic Evaluation addresses the effects of chronic groundwater lowering on other SMCs. It is generally understood that chronic groundwater lowering can potentially affect other sustainability indicators. This periodic evaluation will discuss these effects on other sustainability indicators in Section 3, and changes will be reflected in the GFWD GSP Amended 2025.

4. Re-evaluating the quantitative metrics that constitute undesirable results due to land subsidence and sufficiently describing the effect and extent of land subsidence interim milestones that allow continued subsidence during the GSP implementation period. Identify the cumulative amount of subsidence that will interfere with groundwater users. Detail projects and schedules to combat subsidence. Discuss relationships between SMCs and management criteria for subsidence and re-evaluate uncertainty in subsidence measurements.

   The Madera Subbasin Technical Committee has discussed the issue of subsidence in depth. Unfortunately, there is a significant lack of historical data that reduces certainty in the effects of the climate and groundwater levels on subsidence. This leaves a significant level of uncertainty in projections. Another issue that has been discussed by the Technical Committee is residual subsidence. This is the continued subsidence that occurs after groundwater pumping has been reduced; or during a significantly wet year, when surface water is the primary source of water use and pumping remains below the sustainable yield. Additional discussion including the changes to undesirable results and interim milestones will be addressed in the GFWD GSP Amended 2025.

5. Describing data gaps in the hydrogeologic conceptual model.

   The Madera Subbasin will need to analyze the Joint Subbasin HCM as a part of their Madera Subbasin Joint GSP Amended 2025. An analysis of data gaps for the preparation of the Hydrogeological Conceptual Model for the Gravelly Ford Water District was performed in 2018 by Kenneth D. Schmidt and Associates (KDSA). Generally, these data gaps remain unchanged. KDSA has identified the following data gaps:

   - Groundwater pumpage.
   - Aquifer characteristics, mainly transmissivity which would be determined using pump tests along the GSA boundary. This will allow the determination of groundwater inflows and outflows.
   - Domestic well canvassing and construction information.
   - Domestic well water quality sampling.
   - Surface water monitoring.

6. Sufficiently detailing the degraded water quality undesirable results and explaining the rationale to allow potential further degradation.

   The District has yet to integrate water quality into their monitoring network. Currently the District plans to follow the guidance from DWR and implement SMCs as determined by the Technical Committee. These water quality SMC parameters will be available in the 2025 Updated Joint Madera Subbasin GSP. It should also be noted that the District will need to obtain groundwater quality information for several years to establish a baseline. This baseline will be used to determine SMCs for future iterations of the GSP.

2.8 - Updated GFWD GSA Boundary

GFWD and GFWD GSA updated their boundary by adding 390 acres to the southeast, near the SJR, previously in the "white area," on January 22, 2020, and removing 411 acres owned by MID to the north, on September 23, 2020. The result was a reduction in acreage from 8,317 acres to 8,295 acres. See Figures 2-1, 2-2, and 2-3 for a comparison of the old District boundary to the new District boundary.

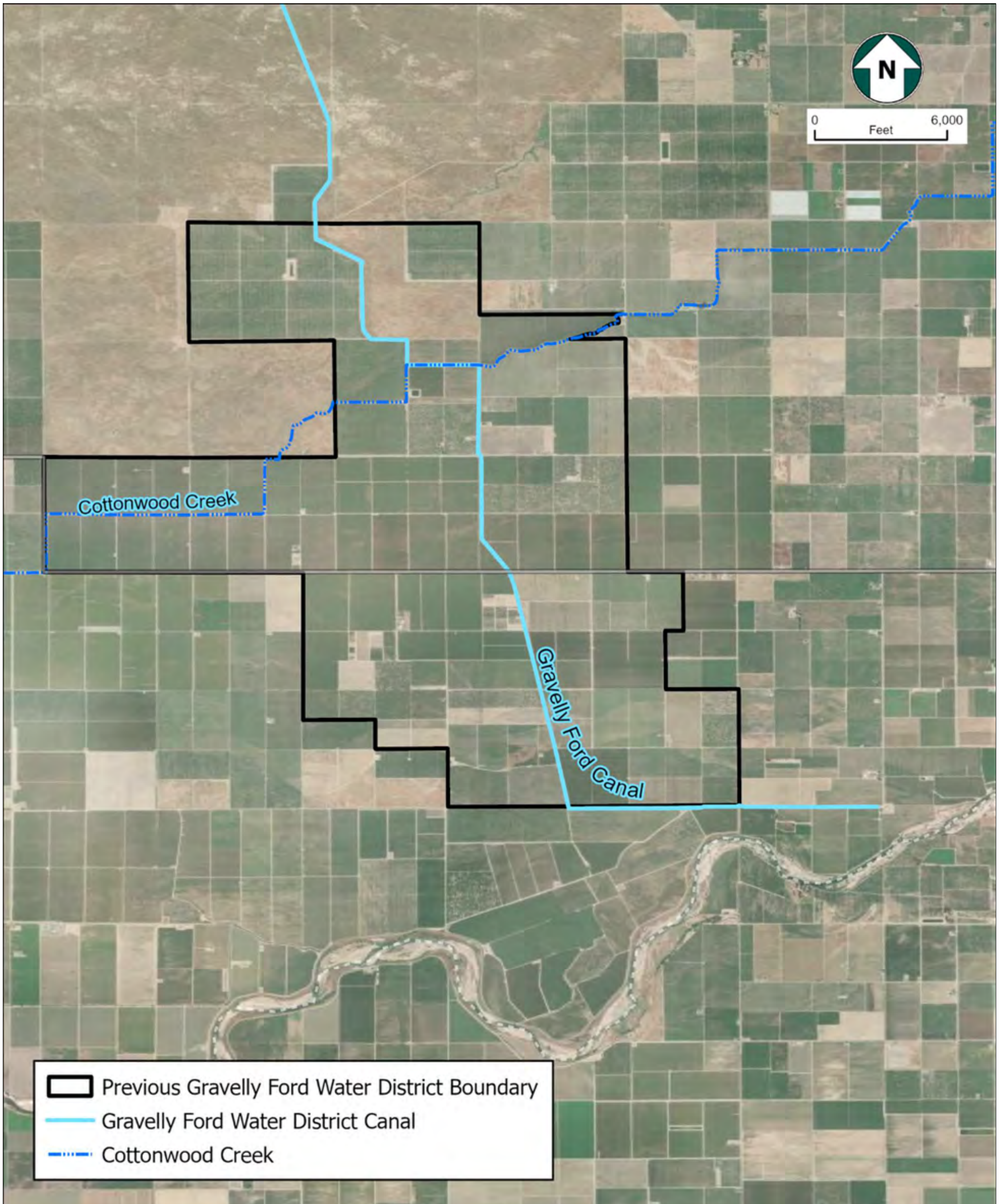

Figure 2-1
Previous GWFD GSA Boundary

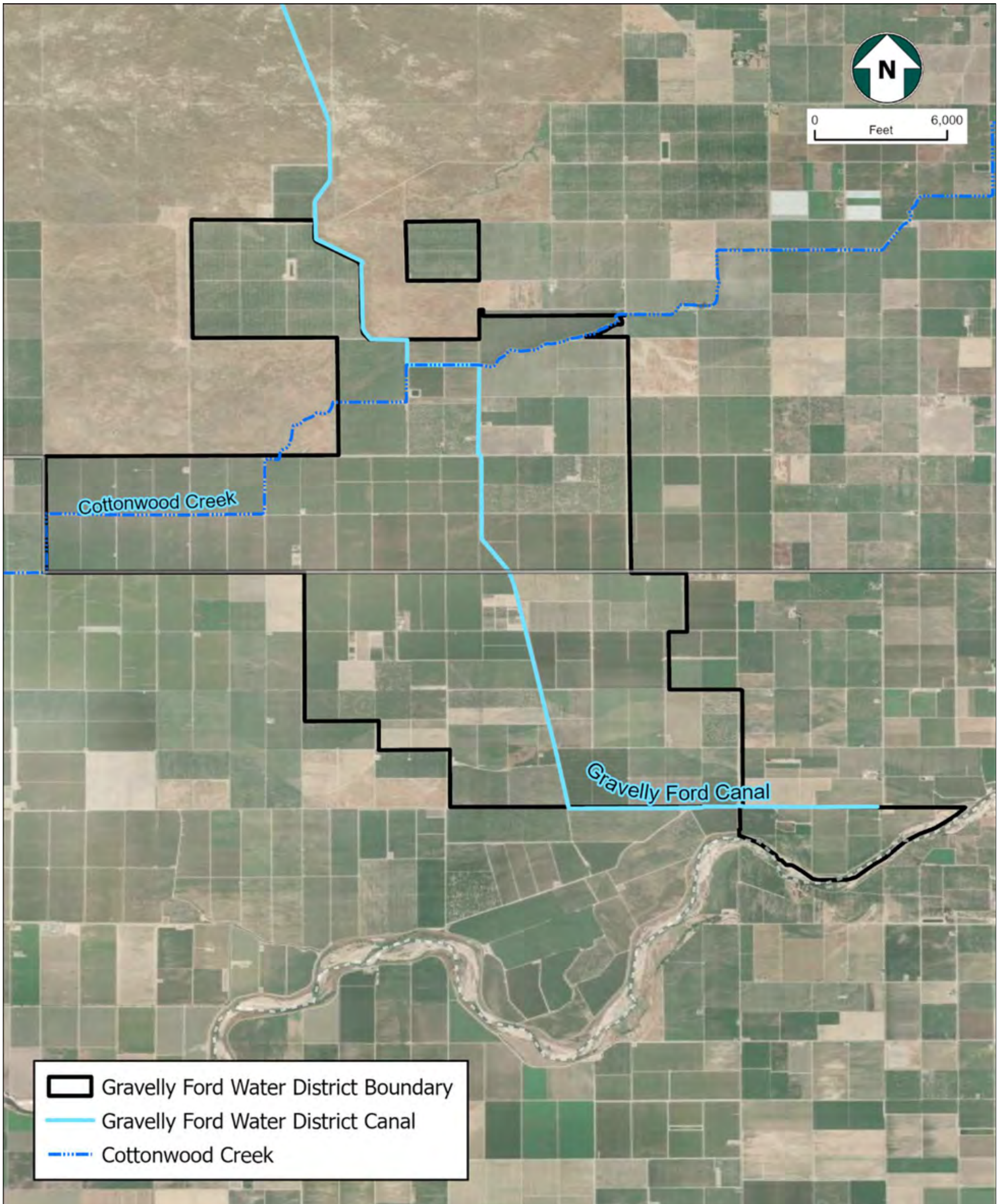

Figure 2-2
Updated GFWD GSA Boundary

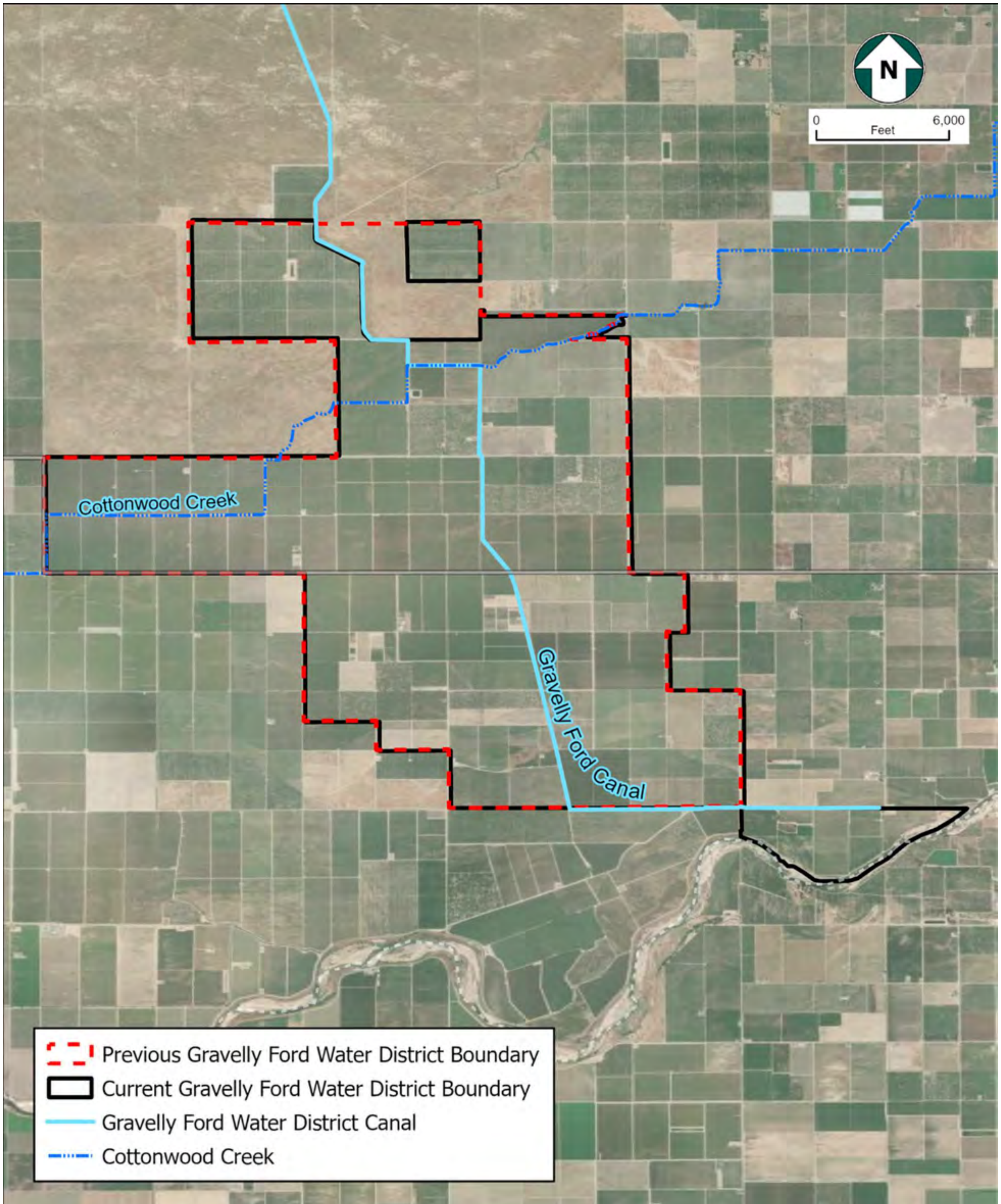

Figure 2-3
Updated GFWD GSA Boundary

SECTION 3 - GROUNDWATER CONDITIONS RELATIVE TO SUSTAINABLE MANAGEMENT CRITERIA

This section contains a summary of groundwater conditions over the implementation period since the submission of the original 2020 GFWD GSP. It also summarizes these conditions as they relate to the SMC established in the GFWD GSP Amended 2023 and the proposed new SMCs developed by the Technical Committee.

The GSP Approval Determination Letter, dated December 21, 2023, outlined several recommended actions. These recommendations, as they relate to SMC and GFWD's plans for implementation, will be addressed in this section. Additional information as it relates to the entire Madera Subbasin groundwater conditions and SMCs can be found in the GFWD GSP Amended 2025 and the Madera Subbasin Joint GSP Amended 2025.

Table 3-1
Sustainable Management Criteria – Madera Subbasin Joint GSP Amended 2023

Sustainability Indicator	Minimum Threshold	Measurable Objective	Undesirable Result (after 2040)[1]
Chronic Lowering of Groundwater Levels	Set equal to the fall 2015 measurement, if that observed data point is available at the RMS. Otherwise, set equal to the expected fall 2015 groundwater level determined from MCSim results, with adjustment, if necessary, to account for the offset between historical observed and modeled data.	Set equal to the fall 2010 measurement, if that observed data point is available at the RMS. Otherwise, set equal to the expected fall 2010 groundwater level determined from MCSim results, with adjustment, if necessary, to account for the offset between historical observed and modeled data.	Same 30 percent of RMS wells within the Subbasin below minimum threshold for two consecutive fall measurements.
Reduction of Groundwater Storage	Same as MTs for chronic lowering of groundwater levels. (Groundwater levels used as a proxy.)	Same as MOs for chronic lowering of groundwater levels. (Groundwater levels used as a proxy.)	Same 30 percent of RMS wells below minimum threshold for two consecutive fall measurements. (Groundwater levels used as a proxy.)
Land Subsidence	0 feet/year, subject to uncertainty of +/-0.16 feet/year	0 feet/year, subject to uncertainty of +/-0.16 feet/year	Average subsidence greater than 75 percent of RMS exceeding minimum threshold for two consecutive years.
Seawater Intrusion	Not Applicable	Not Applicable	Not Applicable

Sustainability Indicator	Minimum Threshold	Measurable Objective	Undesirable Result (after 2040)[1]
Degraded Water Quality	Nitrate = 10 mg/L or existing level plus 20% (whichever is greater) Arsenic = 10 µg/L or existing level plus 20% (whichever is greater) TDS = 500 mg/L or existing level plus 20% (whichever is greater)	Current constituent concentrations	10 percent of RMS wells above the minimum threshold for the same constituent due to projects and/or management actions or overall groundwater extraction based on average of most recent three-year period
Depletion of Interconnected Surface Water	A percent of time surface water is connected to shallow groundwater that is equal to historical conditions for a similar climatic/hydrologic period.	A percent of time surface water is connected to shallow groundwater that is equal to historical conditions for a similar climatic/hydrologic period.	Greater than 30 percent of RMS wells below minimum threshold for two consecutive annual five-year rolling average annual evaluations

3.1 - General Climate Information

The District tracks precipitation and evapotranspiration climate data at several California Irrigation Management Information System (CIMIS) stations. The nearest station to the District is Station number 7 – Firebaugh/Telles; however, they also track data at nearby stations 105 – Westlands and 124 – Panoche to ensure the quality of data and, on occasion, to supplement data that is missing. This data is used to estimate crop consumptive use and effective precipitation. Both are used to calculate the District water budget/balance. Moving forward, at the direction of hydrogeologist Ken Schmidt, the District will also track and use precipitation from the Fresno Airport weather station for calculating the water budget due to the consistency of data.

The water year type is a tool used by surface water managers to determine surface water allocations from water projects such as the Central Valley Project, which allocates surface water from the SJR. These water year types and the associated climate factors are also used to calibrate the groundwater model for the Madera Groundwater Subbasin and project groundwater level data and other SMCs. See Table 3-2 for precipitation data and respective water year type designations.

Table 3-2
GFWD Climate Data

District Climate Data			
Year	Station 7 - Firebaugh/Telles Precipitation (in)	CDEC Water Year Type Designation	National Weather Service Average Annual San Joaquin Valley Precipitation (in)
2020	6.49	Dry	4.44
2021	7.26	Critical	8.22
2022	6.37	Critical	5.43
2023	13.02	Wet**	11.54
2024	8.28*	Above Normal**	7.4*

*2024 data through August 2024 only
** Estimated water year based on historic trends
CDEC Water Year Type Dataset - Dataset - California Natural Resources Agency Open Data
Central and Southern San Joaquin Valley Climate Graphs (weather.gov)
CIMIS (ca.gov)

3.2 - Groundwater Levels

During the GSP development process, the District monitored two CASGEM wells that were measured by DWR to establish historic groundwater level trends. These wells are shown in the original GFWD GSP submitted in 2020 as Figures 3-1 and 3-2 and in the most recent annual report. They also show minimum thresholds and interim milestones identified in the original 2020 GFWD GSP. DWR is no longer measuring these wells, so the District is unable to directly compare current groundwater conditions to historic trends. However, it should be noted that water levels continued to decline at these wells until 2017, beyond the 2015 water level minimum threshold (MT) established in the 2023 Updated GSP. The District is currently using wells 201, 202, 203, 206, 213, and 224 to represent groundwater conditions in the District. The water level hydrographs for the representative monitored wells show spring 2015 water level measurements and spring and fall measurements from 2020 to the present.

It can be seen in Figures 3-1 through Figure 3-7 that water levels vary across the District. Water levels are within a sustainable range at all sites. Even considering there have been several dry years since the beginning of the implementation period. All but one of the representative wells have water levels at or above the fall 2015 MT. Due to the relative stability in groundwater levels the District is on track to meet sustainability by the end of the implementation period. See Figures 3-1 through 3-6 for hydrographs of all the representative monitored wells. It should be noted that Well 213 requires additional analysis to determine SMCs as there were no readily available water levels for either spring or fall of 2015. The District is currently in contact with the contractor responsible for taking well measurements during this time and will be attempting to obtain any historical data available. This data will be added to establish historic trends for the updated monitoring network if available. See Figure 6-1 and 6-2 for monitoring locations within GFWD.

Figure 3-1
Water Level Hydrograph Well 201

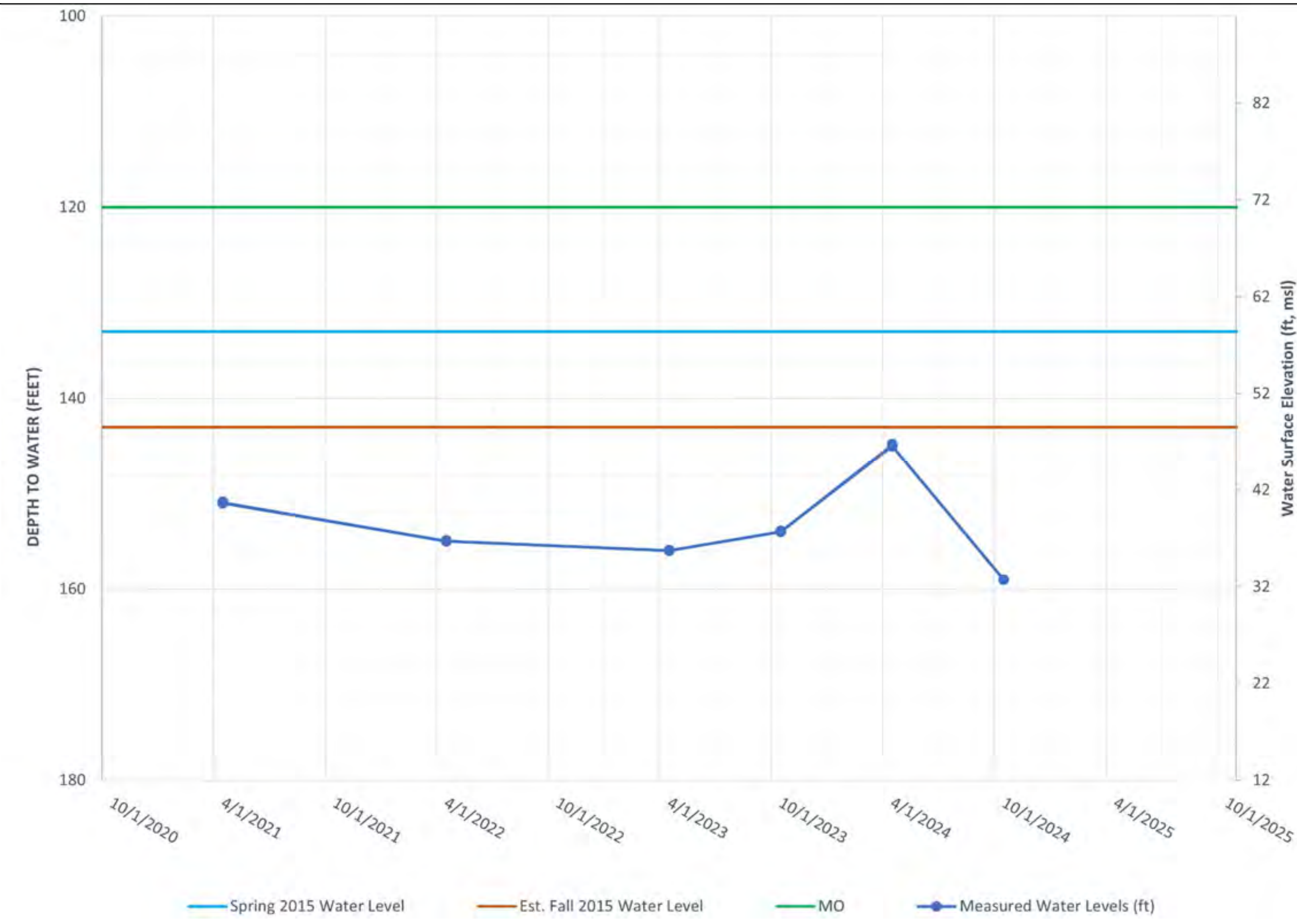

Figure 3-2
Water Level Hydrograph Well 202

Figure 3-3
Water Level Hydrograph Well 203

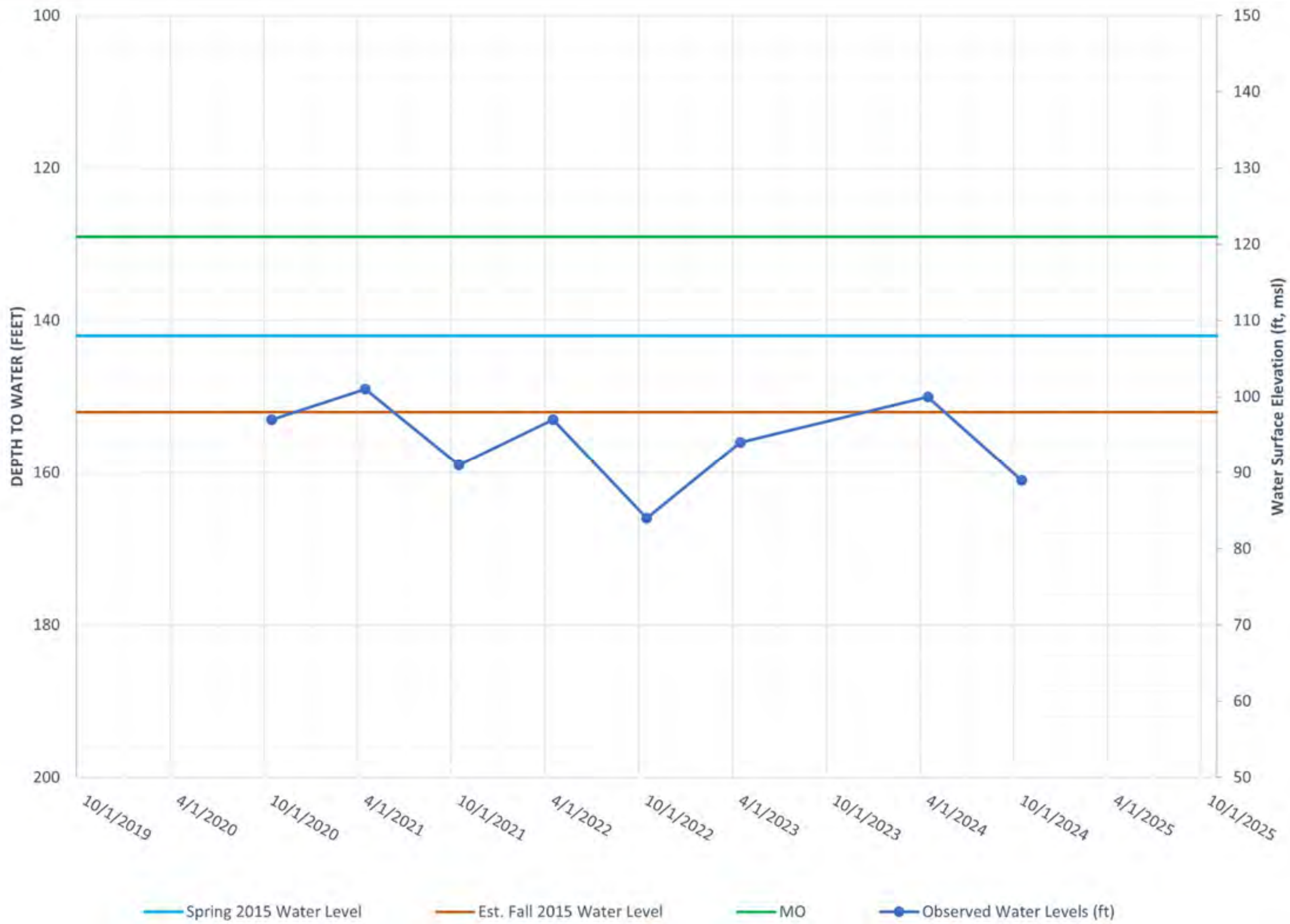

Figure 3-4
Water Level Hydrograph Well 206

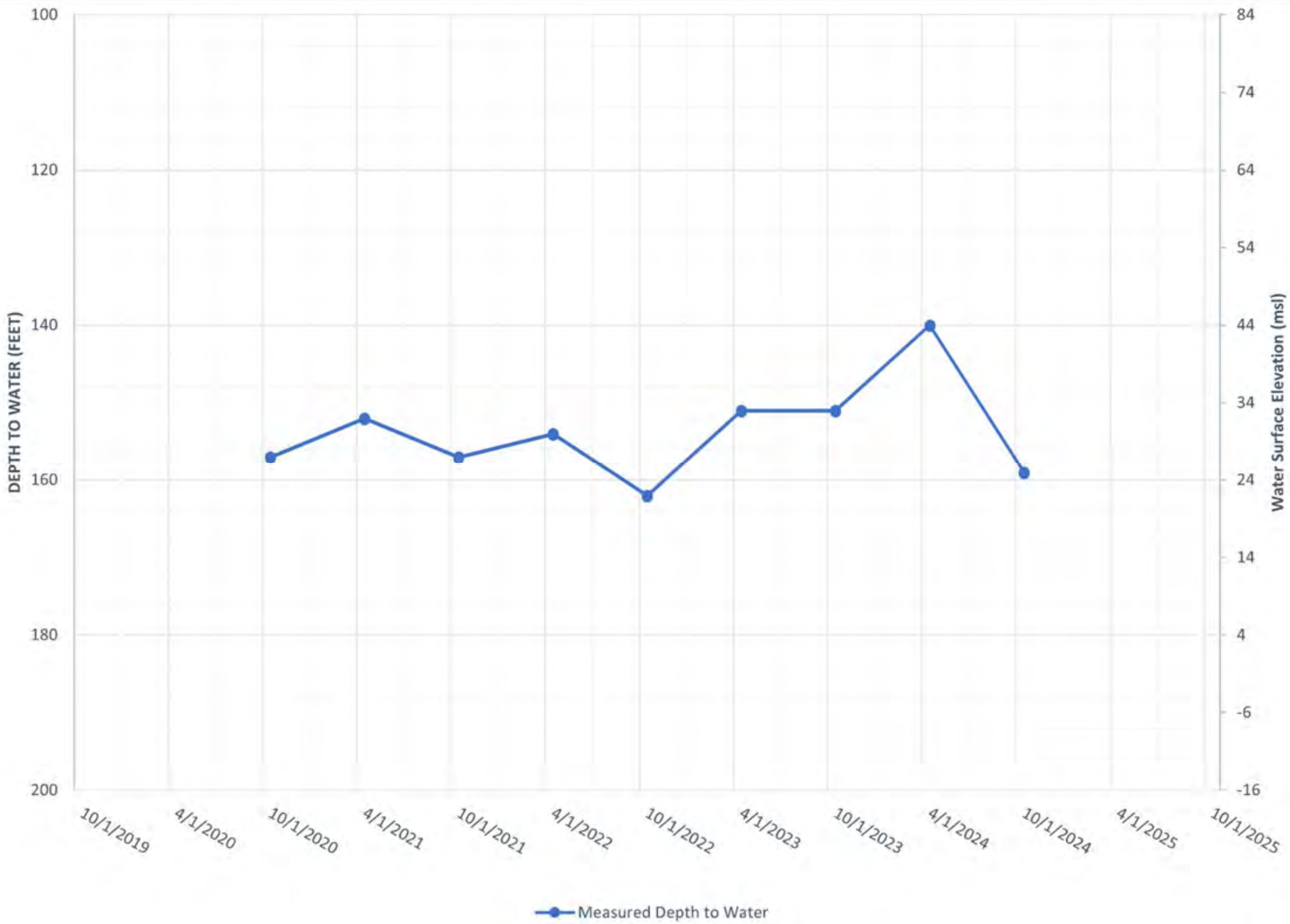

Figure 3-5
Water Level Hydrograph Well 213

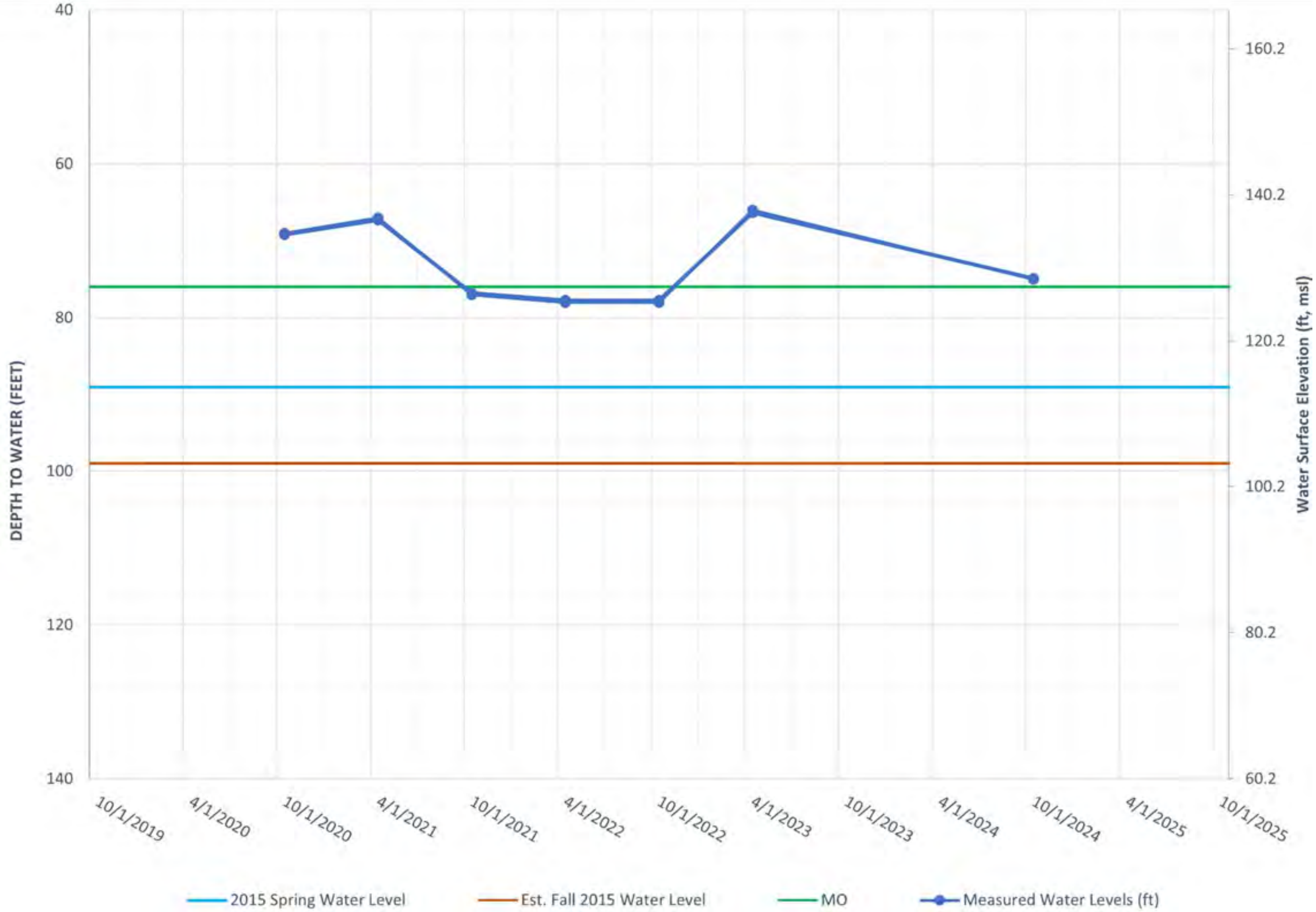

Figure 3-6
Water Level Hydrograph Well 224

3.2.1 - SUSTAINABLE MANAGEMENT CRITERIA EVALUATION

While GFWD adopted the 2023 Updated Madera Subbasin Joint GSP Amended 2023 and submitted edits to its own GSP in 2023, the District still needed to quantify the SMC for its new monitoring network for groundwater levels. The District used data from both its own monitoring network and the Madera Subbasin monitoring network to establish MTs and measurable objectives (MOs) for the new representative monitoring network. The District has data for water levels at the representative monitoring network in the spring of 2015, but not fall. Spring 2015 water levels were compared to seasonal variability for critically dry years in the District. This resulted in an additional 10 feet being added to the spring 2015 water levels to simulate fall 2015 groundwater conditions. See Figures 3-1 through 3-6 for hydrographs showing estimated fall 2015 DTW.

MOs were developed using SMCs from nearby wells in the Madera Subbasin monitoring network. It can be seen in Table 3-3 that the MTs for nearby wells in the Madera Subbasin are 23-25 feet deeper than the MOs. Based on the difference between MOs and MTs at wells in and near the District, an additional 23 feet was added to the MT for each representative well in the monitoring network. See Figures 3-1 through 3-6 for hydrographs showing estimated fall 2015 depth to water (DTW), MTs, MOs, and measured water levels.

Table 3-3
Joint Subbasin Groundwater Level SMCs

	Surface Elevation	Measurable Objective	Interim Milestone 2025	Interim Milestone 2030	Interim Milestone 2035	Minimum Threshold
MCW RMS-4	208	118	159	163	150	141
MCW RMS-5	340	277	328	334	302	302
Site 6 Future	-	-	-	-	-	-

All values are in feet and with the exception of surface elevation, are depth to water.

Table 3-4
Joint Subbasin Groundwater Level SMCs

Representative Well	Measurable Objective	Interim Milestone 2025	Interim Milestone 2030	Interim Milestone 2035	Minimum Threshold
201	149	190	194	181	172
202	120	161	165	152	143
203	119	160	164	151	142
206	129	170	174	161	152
213	TBD	TBD	TBD	TBD	TBD
224	76	117	121	108	99

Measurable Objectives

It was decided by the Technical Committee for GSP amendments in 2023 that fall 2010 groundwater levels represent Madera Subbasin conditions prior to the pre-2012 to 2015 drought period. Fall 2010 groundwater levels are considered a reasonable benchmark for the level at which fall groundwater levels will fluctuate under sustainable conditions after 2040. As stated previously, the wells that were originally selected as historic representative monitoring wells are no longer being monitored so the District used nearby Madera Subbasin representative monitoring wells shown in Table 3-2. Measurable objectives in wells analyzed were 23-25 feet above the minimum thresholds. GFWD used this information and set MTs for wells in the District using estimated fall 2015 water levels for each representative monitoring well and adding 23 feet. See Table 3-3. It should be noted that there may be more variable water levels in the shallow aquifer.

Interim Milestones

Interim milestones shown in Table 3-3, for the Madera Subbasin representative wells were used to develop interim milestones (IMs) for the GFWD representative monitoring wells. MCW RMS-4 is representative of wells accessing the lower aquifer while MCW RMS-5 is more representative of wells in the upper aquifer. As shown in Table 3-2, the lower aquifer shows less variability in water levels than the upper aquifer. Most of the wells being monitored display trends above the MTs and nearing the MO. Some fluctuated between the MO and MT but are trending up, and a couple are at the MT but were trending below the MT until spring 2024 water levels were taken. IMs for wells are at or below the MT; therefore, all wells are on track for sustainability by the end of the implementation period.

Minimum Thresholds

Minimum thresholds were reassessed because of the incomplete DWR letter dated September 22, 2022. It was decided that water level MTs would be set to fall 2015 levels. The hydrographs shown in Figures 3-1 through 3-6 show water levels as they relate to the spring 2015 water levels and estimate fall 2015 water levels based on seasonal variability. All representative monitored wells are at or above the MTs as of spring 2024.

Undesirable Results

According to the Madera Subbasin Joint GSP Amended 2023, undesirable results are exceedances of the 30% of Subbasin-wide RMS wells below the MT after 2040. GFWD is projected to be in compliance with water levels at or above the MT by the end of the implementation period, and there are no anticipated significant and unreasonable effects for any sustainability indicators during the implementation period within the District. The sustainable management criteria is currently being updated for the Madera Subbasin Joint GSP Amended 2025. Any changes to SMCs will be addressed further there.

Effects on Beneficial Uses/Users

There have been no documented effects to beneficial users within the District. See Section 3.2.2 below for the effects of groundwater levels on other SMCs.

3.2.2 - DWR Recommended Actions – Effects Of Groundwater Levels on Other SMCs

DWR provided the following recommended corrective action as it relates to groundwater levels. "Sufficiently [describe] the effect of chronic lowering of groundwater level interim milestones on other sustainability indicators."

<u>Change in Groundwater Storage</u>
Considering water levels serve as a proxy for change in groundwater storage, especially as it relates to the Madera Subbasin, it is safe to say that changes in groundwater levels directly correlate with changes in groundwater storage in the upper aquifer, at least on paper. It should be noted that a majority of the wells in the District are composite wells, which means that they draw groundwater from both the upper and lower aquifers.

The volume of groundwater can be calculated as the thickness of the saturated zone, which is the average elevation of the groundwater levels above the base of bedrock, and the specific yield of the various strata. The thickness of the saturated zone is quantified using groundwater level measurements. As water levels decline, groundwater storage is reduced. It should be noted that changes in groundwater storage in the lower aquifer are also affected by subsidence.

<u>Water Quality</u>
Water quality can be significantly impacted by groundwater levels. Most of the wells in the District are composite; they are perforated in both the upper and lower aquifer. Both aquifers may have their own groundwater quality issues. The upper aquifer can have water quality issues that are from anthropogenic causes such as industrial and commercial operations. Water quality issues in the lower aquifer are often from natural sources such as naturally occurring arsenic. Changes in groundwater levels can cause contaminant plumes to migrate in both the upper and lower aquifer.

<u>Subsidence</u>
Subsidence is the compaction of the pore space in various aquifer strata. As water is drawn from the strata, the pore spaces become void. In coarser layers, these voids remain and are refilled with water as groundwater levels rise. In finer strata these voids may compact, decreasing the thickness of that layer, shifting the entire profile of the aquifer, and lowering the ground surface elevation, a phenomenon known as subsidence.

The change in groundwater storage is a quantified volume of groundwater added to or removed from a specified boundary. This quantity is indirectly measured using values for water levels, specific yield (percentage of water in the soil structure), and boundary area. This value can be attributed to changes in groundwater storage in the upper aquifer. Similarly, changes in groundwater storage in the lower aquifer are indirectly measured using subsidence (change in the ground surface elevation) within a defined boundary.

Inelastic subsidence is the permanent change in ground surface elevation due to the dewatering of the pore space in aquifer strata. Inelastic subsidence often occurs in clay. The lower aquifer in the Madera Subbasin is susceptible to inelastic subsidence under the Corcoran Clay, the confining clay layer that separates the upper and lower aquifers in the Subbasin. The Corcoran Clay lies below the entire GFWD.

Data is lacking on the specifics of the effects of groundwater levels on subsidence in the District. Unknown effects include the effects of groundwater gradients in and out of the District, the effects of the groundwater recovery period, and the quantity of pumping. Because pumping from the lower aquifer is known to be a cause of subsidence, the District monitors both groundwater levels and subsidence directly at active agricultural well sites and plans to monitor groundwater pumping in the future to further understand the effects of irrigation on groundwater levels and subsidence.

Interconnected Surface Water

Interconnected surface water is groundwater that is hydraulically connected to bodies of water on the land surface such as rivers, creeks, and lakes. See Figure 3-7 from the DRW guidance document "Depletions of ISW: An Introduction," depicting scenarios of interconnection between wells and surface water. Interconnectivity is a function of horizontal and vertical proximity to a surface water body as well as any potential confining layers and soil types. Shallow wells near the water bodies, in coarse soil layers, will have the biggest impact on interconnected surface waters. It is unknown the depth and extent of the saturated zone from the SJR, which would be the only interconnected surface water within the District.

Groundwater pumping from interconnected wells can cause depletion of interconnected surface waters. The District and the greater Subbasin are working with adjacent subbasins to determine the extent and depth of the interconnected surface water. The combined efforts will allow the District to determine depletions of interconnected surface water, if any, caused by groundwater pumping.

Figure 5: Considerations and interpretation of ISW based on five example cases of nearby groundwater elevation data

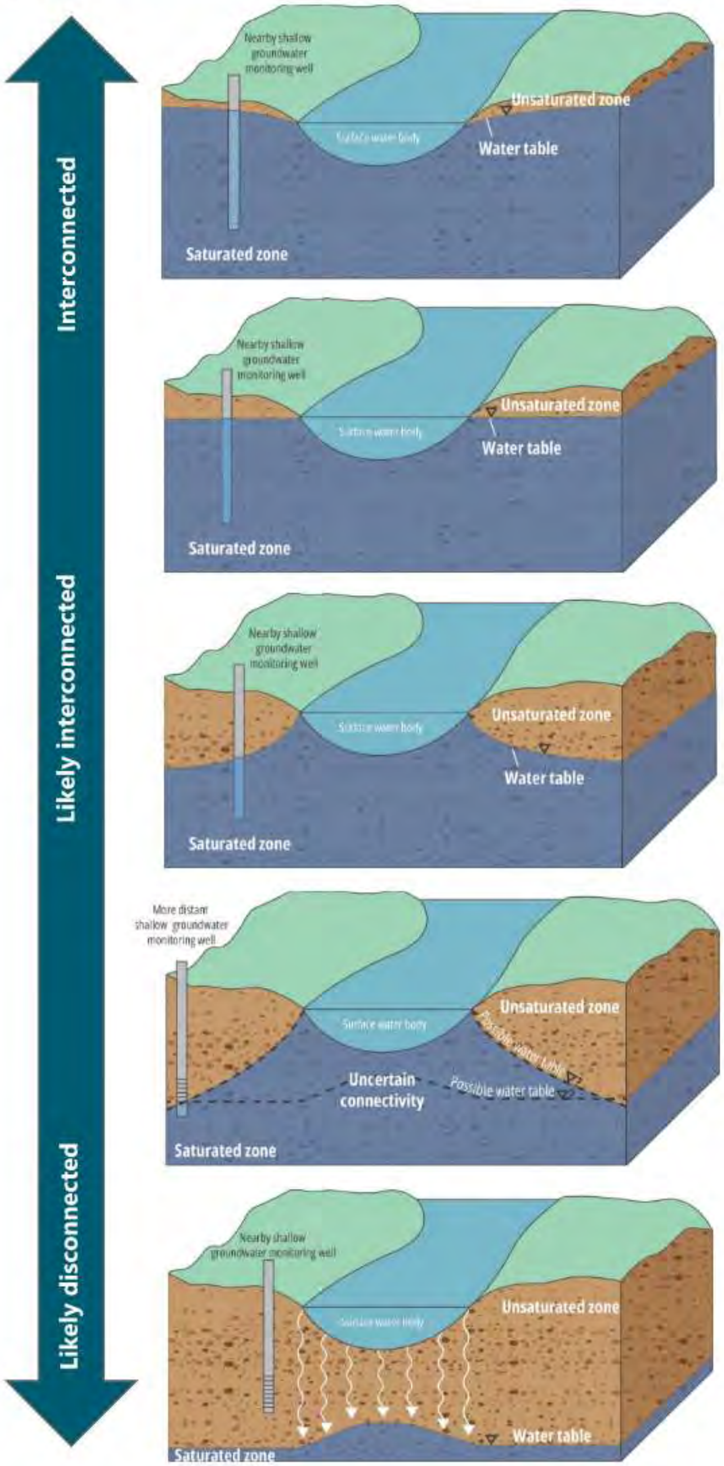

Figure 5a: a stream and a nearby shallow monitoring well with a groundwater elevation above the bottom of the streambed and above the elevation of the surface water, strongly suggesting an ISW.

Figure 5b: a stream and a nearby shallow monitoring well with a groundwater elevation above the bottom of the streambed and similar to the elevation of the surface water, suggesting an ISW.

Figure 5c: a stream and a nearby shallow monitoring well with a groundwater elevation similar to the bottom of the streambed, suggesting a likely ISW.

Figure 5d: a stream and a more distant shallow monitoring well with a groundwater elevation below the bottom of the streambed. Without additional data it is difficult to determine if the stream is an ISW.

Figure 5e: a stream and a nearby shallow monitoring well with groundwater elevation substantially below the bottom of the streambed, suggesting a disconnected stream, not an ISW.

Figure 3-7
Interconnected Surface Water Guidance

3.3 - Change in Groundwater Storage

KDSA calculated average changes in groundwater storage for the 2020 GFWD GPS over an area of 8,500 acres. Based on his report, an average water-level decline of 0.9 feet per year, using an average specific yield of 0.12 feet per year, the unconfined groundwater overdraft averaged about 900 acre-feet per year in the GSA. There was an additional reduction in storage of 700 acre-feet per year due to the collapse of the clay layers.

3.3.1 - Sustainable Management Criteria Evaluation

Groundwater storage is a function of groundwater levels and subsidence at a specific point in time. However, groundwater storage is dynamic and heavily influenced by groundwater gradients and hydraulic conductivity which determines the rate at which groundwater flows into and out of the District and greater Subbasin. As stated in the analysis by KDSA, the collapse of the clay layer also contributes to a reduction in groundwater storage. Therefore, groundwater elevations and subsidence will be used to calculate both permanent and variable changes in groundwater storage within the District.

Figure 3-8 below illustrates changes in groundwater storage in the upper aquifer within the District. Changes in fall well levels between 2014 and 2023 were used to estimate groundwater storage in the upper aquifer (when available). Cumulative changes in groundwater storage are shown relative to changes in groundwater levels. Changes in water levels can change drastically from year. However, the graph shows groundwater storage recovering back to pre-2015 levels.

There is not enough data at the new monitoring points to develop meaningful figures for the change in groundwater storage as it relates to subsidence. The District has implemented a subsidence monitoring plan at the new monitoring sites. As data is gathered the District will be able to analyze the effects of groundwater levels on subsidence and track changes in groundwater storage.

It should be noted that these methods analyze the physical water levels and changes in ground surface elevation as they relate to changes in groundwater storage at a specific point in time. They do not take into account changes in gradient outside the District boundary. Nor do they account for surface water imported into the District for groundwater recharge.

Lastly, subsidence does not occur in all areas of the Subbasin equally nor do portions of the Subbasin have a confining layer such as the Corcoran Clay that is susceptible to inelastic subsidence as described above. Because of this, the Madera Subbasin Joint GSP Amended 2023 set sustainable management criteria for groundwater storage to coincide with groundwater levels (see Figure 3-8). Since groundwater levels are used for a proxy for water storage, evaluation of SMCs should reference groundwater levels in Section 3.2.

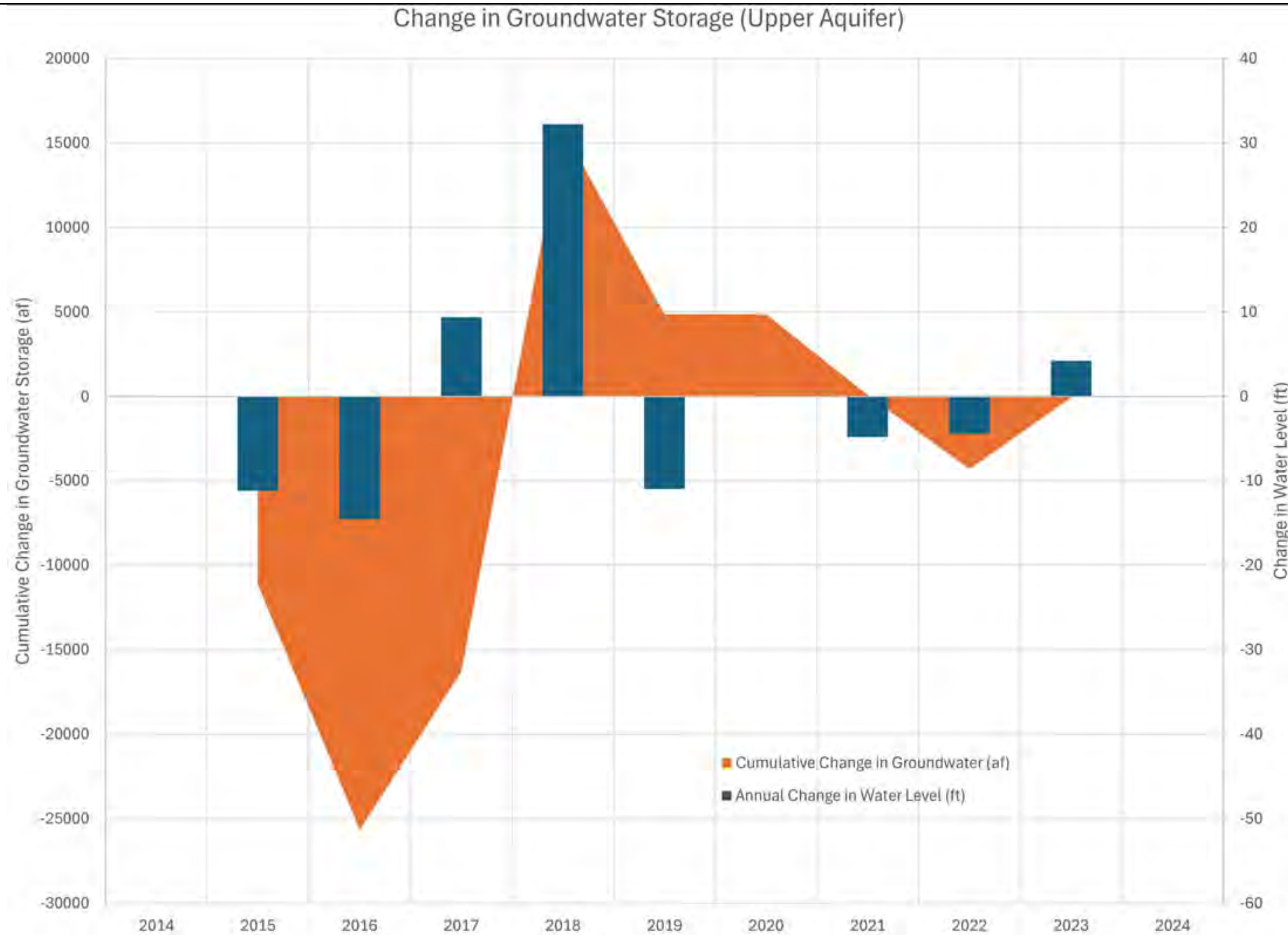

Figure 3-8
Change in Groundwater Storage vs. Change in Groundwater Level

Measurable Objectives
See Section 3.2.1 for SMC evaluation of groundwater levels.

Interim Milestones
See Section 3.2.1 for SMC evaluation of groundwater levels.

Minimum Thresholds
See Section 3.2.1 for SMC evaluation of groundwater levels.

Undesirable Results
See Section 3.2.1 for SMC evaluation of groundwater levels.

Effects on Other Sustainability Indicators
According to the guidance released by DWR. Interconnected Surface Waters can be affected by changes in groundwater storage due to changes in gradient and soil structure caused by changes in water levels and subsidence.

The District is working with the Madera Subbasin and the adjacent subbasins to establish criteria for locating, monitoring, and calculating changes in interconnected surface waters. See the draft interconnected surface water MOU included in the Madera Subbasin Joint GSP Amended 2025 for additional details on proposed coordination between agencies.

Effects on Beneficial Uses/Users
There are no recorded effects to beneficial users in the District.

3.3.2 - DWR Recommended Actions

DWR provided the following recommended corrective action as it relates to Change in Groundwater Storage. “Sufficiently [describe] the effect of chronic lowering of groundwater level interim milestones on change in Groundwater Storage.”

GFWD does not experience declining water levels to the same degree as other areas of the Subbasin. There was a downward trend that matches the overall trend for the Subbasin, but according to recent water level measurements, water levels are recovering. Additionally, the District experiences effects from the Subbasin as a whole; therefore, declining water levels should not be a reflection of GFWD. See Section 3.2.2 for a summary of the effects of groundwater levels on groundwater storage.

3.4 - Water Quality

3.4.1 - Sustainable Management Criteria Evaluation

Because water quality for irrigation is not known to be an issue in the District, implementation of a groundwater level and subsidence monitoring program was prioritized. The District plans to sample groundwater from domestic wells. The wells will be sampled for determination of nitrates, arsenic, and total dissolved solids (TDS) as required by the Madera Subbasin sustainable management criteria, and it will also be sampled for DBCP, 1,2,3-TCP, and gross alpha activity once every three years as part of its comprehensive drinking water sample suite. The Madera Subbasin also measures water quality at a monitoring well (MSB06) located in the District. See the monitoring network included in the Madera Subbasin Joint GSP Amended 2025. Once every five years the Madera Subbasin collects samples for a comprehensive suite of water quality constituents at the monitoring well mentioned above. If, during periodic measurements, it is found that the constituents mentioned are found to exceed the water quality maximum contaminant levels (MCLs), the District will reassess their groundwater quality monitoring plan. Because the District does not yet have water quality results the SMCs below are only summarized

Measurable Objectives
The District aims to keep groundwater quality at current concentrations in alignment with the Joint Madera Subbasin 2023 Updated GSP. The District plans to take water samples at domestic wells as discussed above.

Interim Milestones
According to the Joint Madera Subbasin 2023 Updated GSP, the interim milestones for the measurable objectives are the same. See above for a discussion of groundwater quality MOs.

Minimum Thresholds
The minimum thresholds below are adopted from the Joint Madera Subbasin 2023 Updated GSP. As stated above, the District prioritized water level and subsidence monitoring so there is no data to report for the water quality constituents below. The District will report groundwater quality in the 2024 GSP Annual Report.

- Nitrate = 10 mg/L or existing level plus 20% (whichever is greater)
- Arsenic = 10 µg/L or existing level plus 20% (whichever is greater)
- TDS = 500 mg/L or existing level plus 20% (whichever is greater)

Undesirable Results
Undesirable results are defined as “10 percent of Subbasin-wide RMS wells above the minimum threshold for the same constituent due to projects and/or management actions, based on the average of the most recent three-year period” after the implementation period has ended in 2040. The District will assess the likelihood of avoiding undesirable results in future annual reports.

Effects on Other Sustainability Indicators
It is unlikely that water quality could affect other sustainability indicators. It is possible that poor water quality could affect the amount of groundwater pumping which could potentially affect water levels. However, there is no evidence that this will be the case in the District now or in the future.

Effects on Beneficial Uses/Users
There have been no documented effects to beneficial users within the District.

3.4.2 - DWR Recommended Actions

DWR provided the following recommended corrective action as it relates to degraded water quality. "Sufficiently [detail] the degraded water quality undesirable results and [explain] the rationale to allow potential further degradation."

The District is working with the Madera Subbasin Technical Committee to address DWRs recommended corrective actions from the December 2023 Approval Determination. DWR is requesting that the Subbasin analyze SMCs for water quality, especially as they relate to undesirable results and conditions that would be considered significant and unreasonable. DWR also requested justification of MT and their effects on sustainability.

The District's goal is to prevent domestic users from consuming poor-quality water. As stated above, the District plans to implement their own groundwater quality data into its groundwater monitoring program. The Technical Committee is currently meeting to address DWR's concerns and plans to address them in the Madera Subbasin Joint GSP Amended 2025.

3.5 - Land Subsidence

Land subsidence and the District's plans to monitor subsidence in the GSA are explained in detail in Section 3.3 – Change in Groundwater Storage. Generally, subsidence is caused by loss of pore space in the clay layers of the lower aquifer. There are many factors that contribute to subsidence such as groundwater pumping and groundwater flow into and out of the District.

3.5.1 - Sustainable Management Criteria Evaluation

The District has measured subsidence at the operational agricultural wells three times since the development of the original 2020 GFWD GSP. Since the development of the original GSP, the District has analyzed the network of wells and selected a sampling of wells that represent the conditions of the District and are strategically located throughout the GSA (See Section 6 – Monitoring Network). See Table 3-5 for subsidence measurements between December 2019 and July 2021. Average annual subsidence over the entire District was about 0.15 foot/year.

Table 3-5
Subsidence Measurements

PT NO.	Elevation (as of 12/12/2019)	Elevation (as of 7/29/2021)	Elevation (as of 10/15/2024)	Total Subsidence in Feet
201	187.147	186.777	186.155	-0.992
202	191.784	191.471	190.804	-0.98
203	200.319	200.319	199.728	-0.591
206	183.957	183.957	183.00	-0.957
213	183.815	183.815	182.983	-0.832
224	203.792	203.792	203.50	-0.292

Subsidence near the SJR (Well 224) is significantly less than subsidence at wells further from the SJR. It should also be noted that water levels at this well are also significantly higher than the others in the monitoring network. When omitting Well 224 from the average, the annual subsidence rate increases to 0.17 feet/year.

Measurable Objectives

The MO for subsidence is 0 feet/year by 2040. The District is working on projects to bring and store surface water in the District with the goal of alleviating subsidence in the area. As described previously in the section on changes in groundwater storage. It is important to note that there are external factors that could affect subsidence in the Subbasin. GSAs are working together to understand cross-boundary impacts on groundwater and subsidence in particular.

Interim Milestones

The interim milestones are established at five-year intervals over the implementation period from 2020 to 2040, at years 2025, 2030, and 2035. Interim milestones were established in the Madera Subbasin Joint GSP Amended 2023 for two loosely defined areas: the "Area of Concern," which generally resides in the northeastern portion of the Subbasin, and the rest of the Subbasin.

IMs for the areas of concern were set to the following:

- 2025: -0.60 feet/year
- 2030: -0.40 feet/year
- 2035: -0.20 feet/year
- 2040: 0.00 feet/year

IMs for the rest of the Subbasin were set to the following:

- 2025: -0.20 feet/year
- 2030: -0.13 feet/year
- 2035: -0.07 feet/year
- 2040: 0.00 feet/year

DWR recommended corrective actions related to IMs in particular. They questioned the continued rate of subsidence, which could potentially add up to 6 feet of additional subsidence in some areas. Because of this, IMs will be updated in the 2025 GSPs for the Madera Subbasin. Averages to date show GFWD to be within a sustainable range according to the more restrictive IMs for the "rest of the Subbasin."

Minimum Thresholds

Per the Madera Subbasin Joint GSP Amended 2023, "The land subsidence minimum threshold is set at a rate of 0 feet/year +/- 0.16 feet/year." DWR has also called into question the accuracy and associated uncertainty in subsidence measurements taken by the San Joaquin River Restoration Project (SJRRP). They have also inquired about the choice to not use Interferometric Synthetic Aperture Radar (InSAR) data for analyzing subsidence. It is important to note that all instruments have some error, and it is important to determine how that error will be interpreted. All SMCs for subsidence will be addressed in the 2025 GSP Updates. GFWD will be measuring subsidence in the

GSA independently. However, the District plans to tie survey points at the selected wells to the benchmarks used at the locations used by the Subbasin.

Undesirable Results

Undesirable results are defined as Subbasin-wide exceedances of the MTs in 75% of wells after 2040. DWR also questioned this, asking why 75% of wells were in exceedance. The Technical Committee will be analyzing undesirable results along with other SMCs for subsidence as part of the Madera Subbasin Joint GSP Amended 2025. Due to the lack of data, it is difficult to assess the likelihood of undesirable results for subsidence. The District has only a single rate based on 2 measurements in 2019 and 2021.

Effects on Other Sustainability Indicators

As stated in Section 3.3, groundwater storage is affected by subsidence. As the clay layers are compacted, the available groundwater storage within each layer is reduced, and this reduction is often permanent.

Effects on Beneficial Uses/Users

There are no known effects to beneficial users in the GSA.

3.5.2 - DWR Recommended Actions

DWR provided the following recommended corrective action as it relates to land subsidence. "[Reevaluate] the quantitative metrics that constitute undesirable results due to land subsidence and sufficiently [describe] the effect and extent of land subsidence interim milestones that allow continued subsidence during the GSP implementation period."

As stated above, the Technical Committee is analyzing subsidence SMC and updates to the criteria will be provided in the 2025 GSP Updates.

3.6 - Interconnected Surface Water

Interconnected surface waters are described in more detail in Section 3.2.2 as it relates to groundwater levels. The Subbasin and neighboring subbasin are working on establishing criteria for monitoring, analyzing, and managing interconnected surface waters. Because additional coordination and data are needed, SMCs are loosely defined. Below is a summary of the SMCs. Due to the need for additional data and coordination, it is unlikely that SMCs for ISWs will be updated in the 2025 Joint Subbasin GSP. It also should be noted that percentages of wells below minimum thresholds are cumulative for the Subbasin and not the District.

The Madera Subbasin Joint GSP Amended 2025 provides additional information on the monitoring network for ISW in the Madera Subbasin. The District does not monitor any wells GFWD for ISW. For additional details on proposed coordination between agencies on ISW, see the draft interconnected surface water MOU included in the Madera Subbasin Joint GSP Amended 2025.

3.6.1 - Sustainable Management Criteria Evaluation

Measurable Objectives
"A percent of time surface water is connected to shallow groundwater that is equal to historical conditions for a similar climatic/hydrologic period."

Interim Milestones
N/A

Minimum Thresholds
"A percent of time surface water is connected to shallow groundwater that is equal to historical conditions for a similar climatic/hydrologic period."

Undesirable Results
"Greater than 30 percent of [Subbasin-wide] RMS wells below the minimum threshold for two consecutive annual five-year rolling average annual evaluations"

Effects on Other Sustainability Indicators
It is safe to assume that where interconnected waters exist, they have direct effects on groundwater levels and changes in groundwater storage in the upper aquifer as they relate to gaining and losing ISWs.

Effects on Beneficial Uses/Users
There are no recorded effects to beneficial users as they relate to the depletion of ISW.

3.6.2 - DWR Recommended Actions

None

3.7 - Projected Sustainability Achievement

According to the analysis of the SMCs above, GFWD is on track to meet sustainability goals by 2040. The District will continue to monitor groundwater levels and subsidence and add groundwater quality to their monitoring program. The District and GSA partners in the Subbasin will continue to analyze SMCs to ensure sustainability.

3.7.1 - Potential Effects to Sustainability

Environmental
Continued drought and increasing temperatures have the potential to affect sustainability. The District experienced a wet year in 2019 while drafting the original GSP; however, 2020 through 2022 were all critical or drought years during the initial 5-year implementation period. During these years the District received no surface water deliveries. 2023 can be assumed to be wet year as the District received approximately 20,000 af of water. In addition to drought, the Central Valley

is experiencing record-breaking temperatures that put additional stress on agricultural crops and water resources.

Additional effects to sustainability include movement of the bed of the San Joaquin River (SJR; River) and seepage/losses in the SJR before the GFR turnout, where the GFWD pumps water from the River. The changing geology of the riverbed restricts the District's ability to pump water from the SJR into the GFWD canal that distributes water for irrigation and recharge. The movement of the bed of the SJR has altered the flowline of the River. It has also been found that there is significant groundwater seepage along the river adjacent to GFWD. While this could benefit groundwater recharge in the area, it could also limit available surface water that the District could divert for recharge within their GSA boundary.

Political/Legal

While politics clearly impacts policy, it is not beneficial to speculate on what those policies may be or how they may change in the future. However, Section 2.6 summarizes some current policy changes/legal actions that may affect sustainability. Some current lawsuits may set precedents that could affect sustainability, SGMA implementation, and existing policies that govern surface waters.

Policy as it relates to sustainable groundwater management, include allocations to the Friant Dam Holding Contracts and the San Joaquin River Restoration Settlement (Settlement). Holding contracts govern access and allocations of surface waters from the Friant Dam. The District holds a contract with USBR for 14,000 af of Class 2 Water for irrigation purposes from the Friant Dam. The Settlement is an agreement with USBR regarding flow rates in the San Joaquin River from Friant Dam to the Merced River. The Restoration Program restored Reach 2B for fish passage, which could potentially increase net groundwater inflow where water is now present.

Lawsuits include the California United Water Coalition vs Madera County. This lawsuit was brought against Madera County over land assessments that require landowners to pay a per-acre assessment that was set using a Proposition 218 election. The farmers' coalition argued that the 218 election was improperly conducted. This could affect local GSAs' ability to tax landowners for SGMA implementation and the methods by which these taxes are determined.

Another lawsuit that could alter the future on SGMA implementation is the Kings County Farm Bureau vs the California SWRCB. This lawsuit put a temporary restraining order in place preventing the enforcement of groundwater restrictions on farmers in Kings County. While this lawsuit is not within the Madera Subbasin, the effects could have an impact to all subbasins if the hold on groundwater pumping remains in effect.

Adjacent Basins/GSAs

While GWFD and their partner GSAs within the Madera Subbasin work diligently to coordinate with each other and neighboring subbasins, it is important to express the complexity of the situation. Madera Subbasin is made up of seven GSAs, drafting four separate GSPs. Each GSA has different needs and priorities. The same is true for neighboring subbasins. While the group strives to meet all agency needs, there are always compromises that must be made and decisions that are challenging to implement.

GFWD has the advantage of being located adjacent to the SJR and having access to surface water during wet years. The District has been working to implement a conjunctive use program long before SGMA was enacted. Other GSAs and subbasins are not as fortunate, and sustainability may find implementation of SGMA more complicated. The challenges that neighboring subbasins and GSAs face effect groundwater conditions in the GFWD GSA boundary and the Madera Subbasin as a whole. Because of this GFWD works hard to be transparent and proactive in their management practices.

Beneficial Users

Beneficial users in the District are mainly agricultural users with a minimal number of domestic users that are often tied to agricultural operations. Beneficial users within GFWD are unlikely to experience any direct effects resulting from SGMA implementation initially. However, as lawsuits progress and policies change GFWD may experience effects on operations, which would affect all members of the District, both residential and agricultural, as the District economy is almost entirely dependent on agriculture.

The largest impact on plan implementation and sustainability comes from environmental factors. As climate change impacts rainfall, snowpack, and temperatures these impacts will filter down to the District. The geological changes to the River may also affect the ability to divert surface water for irrigation and recharge.

Proposed Adaptive Management to Meet Goals

As stated previously, the District intends to construct projects that will increase their ability to recharge water during wet years. This is a direct response to the reductions in surface water allocations due to drought and climate change impacts. The District receives Class II surface water as a part of their USBR contract. The District is adapting by pivoting from a water district that focuses on diverting surface water for irrigation to a district that diverts surface water for recharge.

3.8 - Plan Amendments

This periodic evaluation is being developed concurrently with the GFWD GSP Amended 2025 and the Madera Subbasin Joint GSP Amended 2025. The 2025 amendments to the GSPs for all Plan Areas are dependent on the decisions that come out of the Technical Committee discussions as they relate to the DWR corrective actions. Likely changes resulting from the Technical Committee decisions include changes to the groundwater model, most of which have been outlined in Section 2.1, updated SMCs for subsidence and groundwater quality, and updated projects resulting from those changes.

The GFWD GSP Amended 2025 will also address specific changes in the GSA, such as changes to the monitoring network and numerical changes to SMCs for water levels as they pertain to the new monitoring stations. It will also outline the status and progress of proposed projects and future plans for funding and implementation.

SECTION 4 - STATUS OF PROJECTS AND MANAGEMENT ACTIONS

The District has worked to implement projects and management actions by raising funds. The District increased revenue through multiple successful Proposition 218 landowner assessments and is currently seeking grant funding for additional capital project design and, eventually, construction. In 2019, the District passed an assessment that funds GSP implementation and monitoring programs. This assessment was created in perpetuity to provide continued funding for existing programs. In 2023, the District determined that the existing assessment was insufficient to implement new projects and management actions, so a new Engineer's Report was drafted, and ballots were sent out to landowners on May 30, 2024. The election was held on July 15, 2024. The election passed, and the 2019 assessment was replaced with the new 2023 assessment.

The 2023 assessment will fund water purchases for irrigation and recharge, operation and maintenance (including deferred maintenance to increase irrigation efficiency), and capital projects. The Engineer's Report evaluated the total revenue need, assuming that a large portion of capital projects are covered by grants, to be approximately $90/acre. Proposition 218 election approved the $90/acre maximum with the understanding that for the first five years, the board would only assess landowners approximately $40/year (subject to a 2.8% annual increase in costs due to inflation). The $90/acre maximum tax was approved in perpetuity.

In addition to increased revenue for project implementation, the District has applied for several grants. These grants include funding from the Madera Regional Water Management Group, and the Department of Water Resources SGMA Implementation Program for the second round of grant funding. Neither of these grant opportunities resulted in funding. The District is currently applying for funding from the USBR WaterSMART Program and encouraging landowners to apply for NRCS grants. The District applied for the USBR WaterSMART Planning and Design Program and the WaterSMART Small Scale Water Efficiency Program. Awards for these grants are estimated to be determined in April 2025.

A complete summary of projects and management actions, including anticipated completion date, status, and anticipated benefits can be found in Appendix C - Projects and Management Action Implementation Plan and Benefits.

4.1 - Recharge Program

4.1.1 - STATUS UPDATE

The District is actively incorporating their recharge program into their conjunctive use program. Since the initial 2020 GSP submittal, the District received surface water in 2023 and 2024. Surface water deliveries for 2024 have not yet been quantified. In 2023, surface water was received between the months of April and August. Water was delivered to growers for irrigation and any surplus was left to recharge in the Gravelly Ford Canal or diverted into the Gravelly Ford Recharge Basin. See Table 4-1 for a summary of surface water delivered to the District. GFWD recharged approximately 10,000 af of water in 2023. This estimate is based on consumptive use of crops, precipitation, and surface water deliveries. The District has also received surface water in 2024 during the development of this Periodic Evaluation. The total surface water deliveries and recharge will be reflected in the 2024 Annual Report. The District recharge program has been successful in offsetting groundwater consumption by the District. See Figure 3-8 for changes in groundwater storage as they relate to water levels.

Table 4-1
Surface Water Deliveries

	Surface Water Deliveries (Acre-Feet)					
Year	Diversion from San Joaquin River (Bureau Class 2)	Diversions from MID Conveyance System	Diversions from Cottonwood Creek via MID *	Diversions from Cottonwood Creek (Natural Flow)	Other	Totals (AF)
1999	7,174	1,850	3,197	5,287		17,508
2000	8,864	2,102	3,189	3,635		17,790
2001	3,707	872	1,308	841		6,728
2002	5,732	1,338	1,000	721		8,791
2003	7,509	1,367	1,386	1,374		11,636
2004	11,472	1,517	2,340	89		15,418
2005	9,562	1,281	2,736	1,611		15,190
2006	9,730	1,921	3,560	1,211		16,422
2007	7,940	1,183	1,202	291		10,616
2008	7,854	949	545	0		9,348
2009	2,556	373	0	0		2,929
2010	5,965	31	53	1,117		7,166
2011	6,302	2,876	3,604	3,475		16,257
2012	823	442	126	82		1,473
2013	0	0	0	0		0
2014	0	0	0	0		0
2015	0	0	0	0		0
2016	1,540	317	0	0		1,857
2017	12,400	940	0	800		14,140
2018	625	0	0	0		625
2019	12,187	0	0	1,019		13,206
2020		0	0	0		0
2021		0	0	0		0
2022		0	0	0		0
2023	19,332	0	0	2,099	194	21,625

* The District no longer receives water from MID

4.1.2 - Realized Benefits/Expected Benefits

The District had an estimated net recharge of 10,000 for the 2023 water year reporting period. Total deliveries for 2024 will be reported in the 2024 Annual Report. The recharge program will differ in subsequent years depending on precipitation and water availability. Based on historic values, it can be assumed that the District will receive surface water approximately three years out of the 5-year Periodic Evaluation horizon for an estimated average of 5,000 af of recharged water per year.

4.1.3 - Benefits and Impacts to Beneficial Uses and Users

The GFWD Recharge Program is a net benefit to all water users. The water used comes from both Unreleased Restoration Flows (URF) in the SJR and storm waters down Cottonwood Creek. URF water is water that exceeds the channel capacity of the SJRRP. The District taking this water benefits the SJRRP by providing relief to the channel being restored. It also benefits the SJRRP by maintaining and improving groundwater conditions.

The Gravelly Ford Canal and irrigation channels in the District also act as a flood control network, diverting excess flows that would otherwise affect flood-prone areas such as Firebaugh, CA. Severe flooding occurred in February 2017. Fears of flooding arose again in the spring of 2023, prompting diversions of water into the District.

4.2 - Agricultural Well Metering

4.2.1 - Status Update

The Agricultural Well Metering Program is a priority for implementation. Currently, the District monitors groundwater levels and ground surface elevations and will add water quality. The District also requests agricultural groundwater pumping data from growers if wells are metered. However, monthly groundwater pumping is reported on a voluntary basis as many of the agricultural wells do not have meters. Because of the lack of metered wells and the uncertainty of existing data, the District has applied for grant money from the United States Bureau of Reclamation, WaterSMART Small Scale Water Efficiency Project Program, to develop an Agricultural Well Metering Program. If awarded, the program will outline requirements for participation, eligible costs, contractor qualifications, and maximum rebates for meter installation on agricultural wells in the District.

4.2.2 - Realized Benefits/Expected Benefits

If awarded, the Agricultural Well Metering Program will provide funds for the installation of agricultural meters and allow the District to monitor groundwater production and fill data gaps in the Groundwater Sustainability Plan. Because groundwater production is not metered, system leaks or other inefficiencies cannot be quantified. Currently, groundwater production is estimated. Estimates use California Irrigation Management Information System (CIMIS) data which gives monthly evapotranspiration (ET_0) rates that can be converted to consumptive use based on crop type and precipitation data and surface water diversion data. The difference between crop consumptive use and effective precipitation and applied surface water is estimated to be agricultural groundwater pumping. While groundwater use can be estimated, it is unknown how efficient the existing groundwater systems are, and actual extraction amounts could vary greatly from estimated consumptive use. Irrigation efficiency is estimated to be 80%.

A requirement of SGMA is to develop a monitoring network and to continue to close data gaps. This project will work to close data gaps and allow the District to see trends as they relate to real-time groundwater production, including pumping effects on groundwater levels, groundwater storage, groundwater quality, and subsidence. The District is also working with the Madera Subbasin to coordinate an MOU that investigates the effects of groundwater production on interconnected surface waters.

4.2.3 - Benefits and Impacts to Beneficial Uses and Users

Groundwater production monitoring will allow the District and growers to determine inefficiencies in irrigation systems and implement repairs and management practices that conserve both surface and groundwater. Conservation of groundwater will prevent negative impacts on agricultural and domestic water supplies by stabilizing groundwater levels and water quality, which benefits crops and soil health. This benefits agricultural users by reducing production costs and maintaining groundwater quality. It benefits environmental and ecological users by protecting groundwater-dependent ecosystems, preventing invasive species, and promoting natural flow between surface water and groundwater if present.

4.3 - Increased Measurement, Sampling and Monitoring

4.3.1 - Status Update

A number of agricultural wells are monitored semi-annually in April and October for water levels and every other year for subsidence. The District is proposing to monitor wells for water quality annually and a full suite as determined by Ken Schmidt once every 3 years (see water quality in Section 3). The monitoring network also includes measurements of surface water deliveries and climate data. Surface water delivery data comes from estimates at Cottonwood Creek diversion points and the pump station at the San Joaquin River. The District also collects climate data from several CIMIS stations, with Firebaugh/Telles Station #7 being the closest. This station gives monthly ET and precipitation data. The District will begin collecting precipitation data at Yosemite International Airport in Fresno in the future as the data is considered to be more thorough and accurate. The District also collects flow data from the California Data Exchange Center (CDEC) at the San Joaquin River at Gravelly Ford (GRF) station. As stated above, the District is currently applying for grant funding from USBR for several projects to monitor and manage groundwater. One grant would provide funding to design radial gates to better monitor and manage flow through Cottonwood Creek, see Section 4.9 - Automation and SCADA for additional project details.

4.3.2 - REALIZED BENEFITS/EXPECTED BENEFITS

Increased measurement, sampling and monitoring will provide the District, growers, and stakeholders with more precise data at well sites to close data gaps in the monitoring network, comply with the requirements of SGMA, and more efficiently manage both surface water and groundwater resources. Additional and increased monitoring will also allow the District to analyze impacts on sustainability indicators as they relate to each other as suggested by DWR.

4.3.3 - BENEFITS AND IMPACTS TO BENEFICIAL USES AND USERS

This data will benefit the Gravelly Ford Water District and the Madera Subbasin as a whole by providing more accurate, measured quantities of groundwater sustainability indicators. More accurate groundwater monitoring will benefit all the District's neighboring agencies and beneficial users in and out of the District by providing data to more efficiently manage water resources. The District continues to close data gaps and analyze trends in groundwater levels, groundwater storage, groundwater quality, and subsidence as they relate to the District. The District will also work to determine the effects of water management practices on interconnected surface waters.

4.4 - San Joaquin River Restoration Program

4.4.1 - STATUS UPDATE

The San Joaquin River Restoration Project (SJRRP) is an ongoing project that aims to restore flows to the San Joaquin River (SJR) from the Friant Dam to the Merced River with the goal of reintroducing Chinook salmon. The first releases from the Friant Dam to the SJRRP began in October of 2009. The SJRRP was the result of the Restoration Settlement which was reached in September of 2006. The Settlement also addresses water management for the water contractors, such as GFWD, that have contracts with USBR.

4.4.2 - REALIZED BENEFITS/EXPECTED BENEFITS

There are real benefits to the SJRRP for the District. Prior to the SJRRP, the segment of the SJR that is adjacent to the District would only see five cubic feet per second at the GFWD turnout. Often the bed of the SJR beyond the District would be dry. With the addition of the restoration flows, the river is now wet along the SJR, which is adjacent to the District. This provides seepage into the District, which has yet to be quantified. It also provides benefits to fish populations.

However, there are potential negative impacts to beneficial agricultural users. These include seepage that impacts the root zone of crops, and changes to the geology of the riverbed, among others. Changes to the riverbed have had significant impacts on the District as it is now more difficult to divert surface water at the GFWD pump station. The District is working on addressing these concerns.

4.4.3 - Benefits and Impacts to Beneficial Uses and Users

As discussed above, the SJRRP has benefits and impacts, which are described above. No anticipated changes to the SJRRP are anticipated; however, the District plans to work with neighboring GSAs to quantify seepage from the SJR and how this impacts or benefits interconnected surface water.

4.5 - Commitment to Subbasin GSP's Coordination & Implementation

4.5.1 - Status Update

The original GFWD GSP and the larger Joint Madera Subbasin GSP, which compliments the GFWD GSP and acts as a basin-wide document, were submitted to DWR in January 2020 and updated based on comments received in September 2022. The Madera Subbasin Technical Committee drafted a coordination agreement to complement the various Subbasin GSPs. This coordination agreement was deemed satisfactory in the final December 2023 determination by DWR that approved the Revised GSP. The coordination agreement expired on December 31, 2024. The Agreement is being negotiated as this periodic evaluation is being conducted. A coordination agreement signed by all Subbasin parties is required prior to the submission of this document on the SGMA portal. Details of the approved coordination agreement will be available on the DWR SGMA portal.

The Madera Subbasin GSAs and their technical consultants are currently working on their 2025 GSP Periodic Evaluations and Plan Amendments for submittal in January 2025. GFWD plays an active role in the Technical Committee and subbasin coordination. They are active members of the Madera Subbasin Technical Committee who analyze hydrology and groundwater conditions and make decisions regarding sustainability goals, water budget, sustainable yield, and undesirable results. They participate in the development and drafting of coordinated documents including the Madera Subbasin coordination agreement, the Domestic Well Mitigation Program, and the Interconnected Surface Water MOU.

4.5.2 - Realized Benefits/Expected Benefits

The benefits of coordination and implementation are maintaining local control of groundwater resources within the District and Subbasin as a whole. Additional benefits include increased efficiency and conservation of groundwater resources. The coordinated effort also provides an accountability tool so there is a clear understanding of expectations and accounting of implantation and progress.

4.5.3 - Benefits and Impacts to Beneficial Uses and Users

Benefits of this project are realized by all District members, Subbasin GSAs, and beneficial users of water in the Subbasin. The benefits include maintaining local control of groundwater and increased efficiency and conservation of groundwater resources. They also include a method of accounting for Plan expectations and implementation progress.

4.6 - San Joaquin River Flood Water Recharge

4.6.1 - Status Update

This project proposes to increase capacity at road crossings and in open canal channel areas along the Gravelly Ford Canal to convey San Joaquin River flood waters into the District distribution system and to the existing recharge areas for groundwater recharge. The project proposes the installation of additional pumping capacity at the District diversion point on the SJR and to enlarge road crossing culverts and open channels to increase the capacity of the distribution system. This project was identified in the Engineer's Report for the GFWD 2023 Proposition 218 assessment. Funding from the assessment will be used for these projects as decided by the board. This project, when implemented, is the infrastructure portion of the GFWD Recharge Program. See Section 4.1 for additional information on the GFWD Recharge Program.

4.6.2 - Realized Benefits/Expected Benefits

This project benefit will provide a quantifiable additional volume of water that the District can divert during wet years when water is available. The project proposes to install an additional pump at the San Joaquin River to increase the volume of water diverted into the Gravelly Ford Canal. It also includes expanding several road crossings to increase capacity flowing through the Gravelly Ford Canal. This project will be complimented by the Conveyance Pipeline from the San Joaquin River Pumps Project, which will install a 48" pipeline parallel to the existing conveyance pipeline from the San Joaquin River pumping station to the Gravelly Ford Canal. This project also protects nearby communities when the SJR reaches flood capacity and will increase the District's ability to assist in diverting additional flood waters.

4.6.3 - Benefits and Impacts to Beneficial Uses and Users

This project benefits the groundwater users in the District as it diverts additional surplus surface water for recharge in the Gravelly Ford Canal and GFWD recharge basin. Full implementation has the potential to double the diversion capacity of GFWD at the SJR, which could potentially triple the groundwater recharge capacity in the District. For reference, the estimated consumptive use is 22,000 af on average. In 2023 the District diverted 19,500 af of surface water from the SJR. When accounting for precipitation and deep percolation of irrigation water, it was estimated that a net 10,000 af of surface water was recharged. Therefore, by doubling surface water diversion capacity all 20,000 af would go directly to recharge for a total of approximately 30,000 af of water recharged during wet years.

Increased capacity also prevents negative impacts to domestic water supplies by stabilizing groundwater levels and water quality. It benefits agricultural users by reducing production costs and maintaining groundwater quality. It benefits environmental and ecological users by protecting groundwater-dependent ecosystems and promoting natural flow between surface water and groundwater if present.

4.7 - District System Water Metering Project

4.7.1 - Status Update

This project proposes installing meters at Cottonwood Creek coming into the District boundary, Cottonwood Creek, and the diversion to the Gravelly Ford Canal and Cottonwood Creek exiting the District. This will allow the District to monitor losses at Cottonwood Creek due to groundwater recharge and irrigation. This project will complement the Automated SCADA Water Control Gate Design Project (formerly Automation & SCADA) that plans to put radial gates at Cottonwood Creek coming into the District boundary and at the Cottonwood Creek and Gravelly Ford Canal. This District will likely apply for grant funding to install meters to monitor water flowing through the District from Cottonwood Creek.

4.7.2 - Realized Benefits/Expected Benefits

This project will allow the District to quantify surface water used for irrigation and groundwater recharge throughout the Gravelly Ford Canal within the District. This will allow the District to close data gaps. It will also allow the District to determine the effects of groundwater recharge on groundwater levels and other sustainability indicators.

4.7.3 - Benefits and Impacts to Beneficial Uses and Users

All users of groundwater will benefit from this project, and it will improve the existing monitoring network.

4.8 - Conveyance Pipeline from San Joaquin River Pumps

4.8.1 - Status Update

The District will continue to seek funding for capital projects to provide infrastructure that will aid in increasing groundwater recharge. The District has a Class II contract for surface water from the Central Valley Project's Friant Dam. The District diverts surface water from the pump station in the San Joaquin River. The District has two pumps that divert a maximum of 50 cfs from the SJR into a 48-inch pipeline that connects to the Gravelly Ford Canal. The District plans to seek funding to add an additional 48-inch pipeline from the San Joaquin River to the Gravelly Ford Canal in order to double its capacity to divert water during wet years. This project complements the San Joaquin River Flood Water Recharge Project described in Section 4.6.

4.8.2 - Realized Benefits/Expected Benefits

This project has the capability to increase the surface water available for recharge along the Gravelly Ford Canal and in the Gravelly Ford recharge basins by up to 20,000 acre-feet or more. In 2023, the District diverted 19,500 af of surface water. The District recharged approximately 10,000 af of surface water in both the Gravelly Ford recharge basin and the

Gravelly Ford Canal. As stated in Section 4.6, full implementation could result in approximately 30,000 af of recharge in a single wet year.

4.8.3 - Benefits and Impacts to Beneficial Uses and Users

All users of groundwater will benefit from this project as stated in the Recharge Project Sections 4.1 and 4.6, the San Joaquin River Flood Water Recharge.

4.9 - Automated SCADA Water Control Gate Project

4.9.1 - Status Update

GFWD submitted a grant for the design of the Automated SCADA Water Control Gate Project (formerly the Automation & SCADA Project). The grant application was submitted for the USBR WaterSMART Planning and Project Design grant program. USBR anticipates grant awards in March of 2025.

If awarded, the Automated SCADA Water Control Gate Design Project will produce a full set of construction documents for six radial, Rubicon-style gates with SCADA controls at six existing water control structures (weirs). The installation of the automated gates will allow more efficient management of surface water flows through the District conveyance system. A major benefit of this project will be targeted groundwater recharge. This will allow the District to combat the effects of climate change and drought by protecting groundwater within the District and the Madera Groundwater Subbasin as a whole.

4.9.2 - Realized Benefits/Expected Benefits

This project will enhance surface water management for irrigation. However, a large benefit will also be the management of flood flows during wet years with higher rainfall. The District intends to use the radial gates to impound flood water during wet years to target groundwater recharge in the northwestern areas of the District. These areas have been identified because they are more susceptible to climactic changes and are adjacent to the “areas of concern” identified in the Madera Subbasin Joint GSP Amended 2023. The groundwater gradient slopes in the northwest direction. The estimated rate of groundwater outflow is 11,500 af in years when surface water is present and 4,700 af when surface water is not available. This is a general estimate. The District has quantified annual net inflow/outflow in the water budget shown in Table 5-2. The net inflow/outflow is estimated by comparing change storage using groundwater elevation vs change in storage using recharge (precipitation, deep percolation, groundwater inflow, etc.) vs discharge (pumping, groundwater outflow). The difference was assumed to be net groundwater inflow/outflow. These estimates will be refined as data is gathered; however, all of these estimates should be assumed preliminary.

4.9.3 - Benefits and Impacts to Beneficial Uses and Users

Flood flow diversions from the San Joaquin River or Cottonwood Creek will be routed to address irrigation needs for growers or to provide recharge in specific areas of the District. This project will also assist in mitigating impacts to domestic wells within the area as required by the Madera Subbasin Domestic Well Program as part of the adopted GSP for the Madera Subbasin, which aims to prevent or provide corrective actions for domestic wells in the event that they become damaged or inoperable due critical lowering of groundwater levels from drought caused by climate change.

SECTION 5 - BASIN SETTING BASED ON NEW INFORMATION OR CHANGES IN WATER USE

Section 3, which reviews sustainable management criteria for all sustainability indicators, shows changes in current groundwater conditions. The District has not changed its water usage, except for changes in cropping patterns.

DWR provided the following recommended corrective action as it relates to groundwater conditions generally, "Describing data gaps in the hydrogeologic conceptual model."

5.1 - Hydrogeologic Conceptual Model

No updates have been made to the hydrogeologic conceptual model. KDSA addressed data gaps in the hydrologic conceptual model. Generally, the data gaps include adding meters to wells to quantify groundwater pumping, pump tests to determine transmissivity and subsequent groundwater inflow/outflow, locating and sampling all domestic wells, and additional surface water monitoring to determine seepage losses. The full document from KDSA is attached as Appendix E.

5.2 - Groundwater Conditions

As stated above, groundwater conditions have remained consistent. There have been variations in water year type and the amount of surface water available for irrigation and recharge. However, over the period from 2015 to the present, it is apparent that groundwater levels are recovering, and subsidence has remained within sustainable parameters as determined in the Madera Subbasin Joint GSP Amended 2023. See Section 3 for a detailed discussion of groundwater conditions as they relate to sustainable management criteria.

5.3 - Water Use Changes and Associated Water Budget

Unlike the Joint Subbasin, the District calculates the water budget as it relates to groundwater rather than surface water. Historic subsurface groundwater inflows and outflows into and out of the District were not estimated in the 2020 Joint Groundwater Subbasin GSP. Therefore, net groundwater inflow and outflow were calculated as a function of the change in groundwater storage as it equates to a change in water level. See Section 3.3 – Changes in Groundwater Storage for more information on changes in storage calculations. All other numbers were calculated using crop types and acreage, evapotranspiration, precipitation, surface water deliveries, and groundwater levels.

The water budget does not explicitly calculate precipitation evaporation or surface water evaporation in canals and waterways. It also does not specifically calculate groundwater inflow and outflow.

Table 5-1
All Water Sources

Component	Historic Condition Water Budget				
Hydrologic Period Inflows	WY 1989 - 2014	WY2020	WY2021	WY2022	WY2023
Surface Water	12,200	0	0	0	21,801
Other	1,900	0	0	0	194
Contract Water Class 2	6,600	0	0	0	19,508
MID Diversions	1,600	0	0	0	0
CVP supply by Cottonwood Cr.	2,100	0	0	0	2,099
Precipitation *	7,200	4,597	4,597	4,406	9,006
Groundwater Extraction - Ag	15,800	20,674	26,608	25,986	6,569
Subsurface Inflow	500	500	500	500	500
Groundwater Extraction - Residential	100	100	100	100	100
Outside Water Purchases					
San Joaquin River Seepage					
Total Inflows	**35,800**	**25,871**	**31,805**	**30,992**	**37,976**

Table 5-2
GFWD Groundwater Budget

Component	Historic Condition Budget AF/yr.	.	.	.	
Hydrologic Period	WY 1989 - 2014	WY2020	WY2021	WY2022	WY2023
RECHARGE					
Deep Percolation of Precipitation	500	1,417	3,212	2,826	4,645
Canal Seepage	6,200	0	0	0	10,840
Deep Percolation of Irrigation Water	6,400	3,446	4,435	4,331	1,095
Groundwater Inflow	5,200				
Total	**18,300**	**4,862**	**7,647**	**7,157**	**16,580**
DISCHARGE					
Pumpage	15,900	20,674	26,608	25,986	6,569
Groundwater Outflow	4100				
Total:	**20000**	**20674**	**26608**	**25986.3**	**6569**
Subtotal	**-1700**	**-15812**	**-18961**	**-18829.6**	**10011**
Change in Water Level (ft)	NA	NA	-4.8	-4.4	4.25
Change in Water Storage (Upper)	-900	NA	-4781	-4382	4233
Change in Water Storage (Lower)	-700	-141	-141	-141	-141
Net Groundwater Flow to District	NA	NA	14180	14448	-5778

Table 5-3
Surface Water Budget for GFWD From LSCE Model

Hydrologic Period	WY 1989 - 2014	WY 2014	WY 2020 - 2040
Inflows			
Surface Water	12,200	-	13,800
Native Flows	1,900	-	6,000
Contract Water Class 2	6,600	-	6,000
MID Diversions	1,600	-	-
CVP supply by Cottonwood Cr.	2,100	-	1,800
Precipitation *	7,200	2,500	7,200
Groundwater Extraction - Ag	15,800	21,800	14,000
Subsurface Inflow	500	-	-
Groundwater Extraction - Residential	100	100	100
Outside Water Purchases			1,200
San Joaquin River Seepage			1,200
Total Inflows	**35,800**	**24,400**	**37,500**
Outflows			
Evapotranspiration **	18,100	18,000	18,000
Infiltration of Precipitation Loss *	2,700	700	2,700
Infiltration of Surface Water Loss *	6,200	200	6,200
Infiltration of Applied Water Loss *	6,400	5,300	6,400
Subsurface Outflow *	4,100	300	4,100
Total Outflows	**37,500**	**24,600**	**37,500**
Change in Storage	-1700	-200	0

* Values for Historic/Current From Appendix 2.F. Tables f the Report Titled "Ground Sustainability Plan Madera Subbasin".
**ET Value based on total GSA Area of 8,380 acres and 2.16 af/ac/yr

5.4 - Model Updates

Model updates are described in more detail in Section 2.1 and will also be outlined in the Madera Subbasin Joint GSP Amended 2025.

SECTION 6 - MONITORING NETWORKS

6.1 - Monitoring Network Goals

The District and the Madera Subbasin are in the process of updating their GSPs. Changes to the Madera Subbasin monitoring network can be seen in the Madera Subbasin Joint GSP Amended 2025. The District initiated a monitoring plan in 2018 to monitor sustainability indicators at the 24 agricultural wells within the District. GFWD plans to monitor all sustainability criteria, with the exception of interconnected surface water, to determine long-term and seasonal groundwater conditions within the confines of the District. See Table 6-1 for a list of Representative Monitoring Sites.

Table 6-1
Representative Monitoring Sites

Representative Monitoring Sites			
Well 201	36.87367	-120.22513	187.13
Well 202	36.86461	-120.21026	191.77
Well 203	36.86536	-120.18311	200.3
Well 206	36.85081	-120.22789	183.94
Well 213	36.83287	-120.22316	183.8
Well 224	36.81194	-120.16901	203.78

The District currently monitors surface water levels twice a year in April and October at all representative monitoring wells. The District also surveys agricultural wells to calculate subsidence. Water levels and subsidence were prioritized in the monitoring plan implementation. The District plans to measure subsidence in October and water quality during Summer. Results will be available in the 2024 Annual Report.

Table 6-2
Monitoring Location and Frequency for SMCs

Sustainability Indicator	Measurement	Location	Frequency
Water Levels	Depth to Water (ft)	All RMS Wells	April, October
Change in Storage	Depth to Water (ft)	All RMS Wells	April, October
Water Quality	Constituent Concentrations (vol/vol)	Domestic Wells	Annually, Summer
Subsidence	Ground Surface Elevation (amsl, ft)	All RMS Wells	Every Other Year
Interconnected Surface Water*	Depth to Water (ft)	Shallow Wells Only	April, October

* The District is not currently monitoring Interconnected Surface Water.

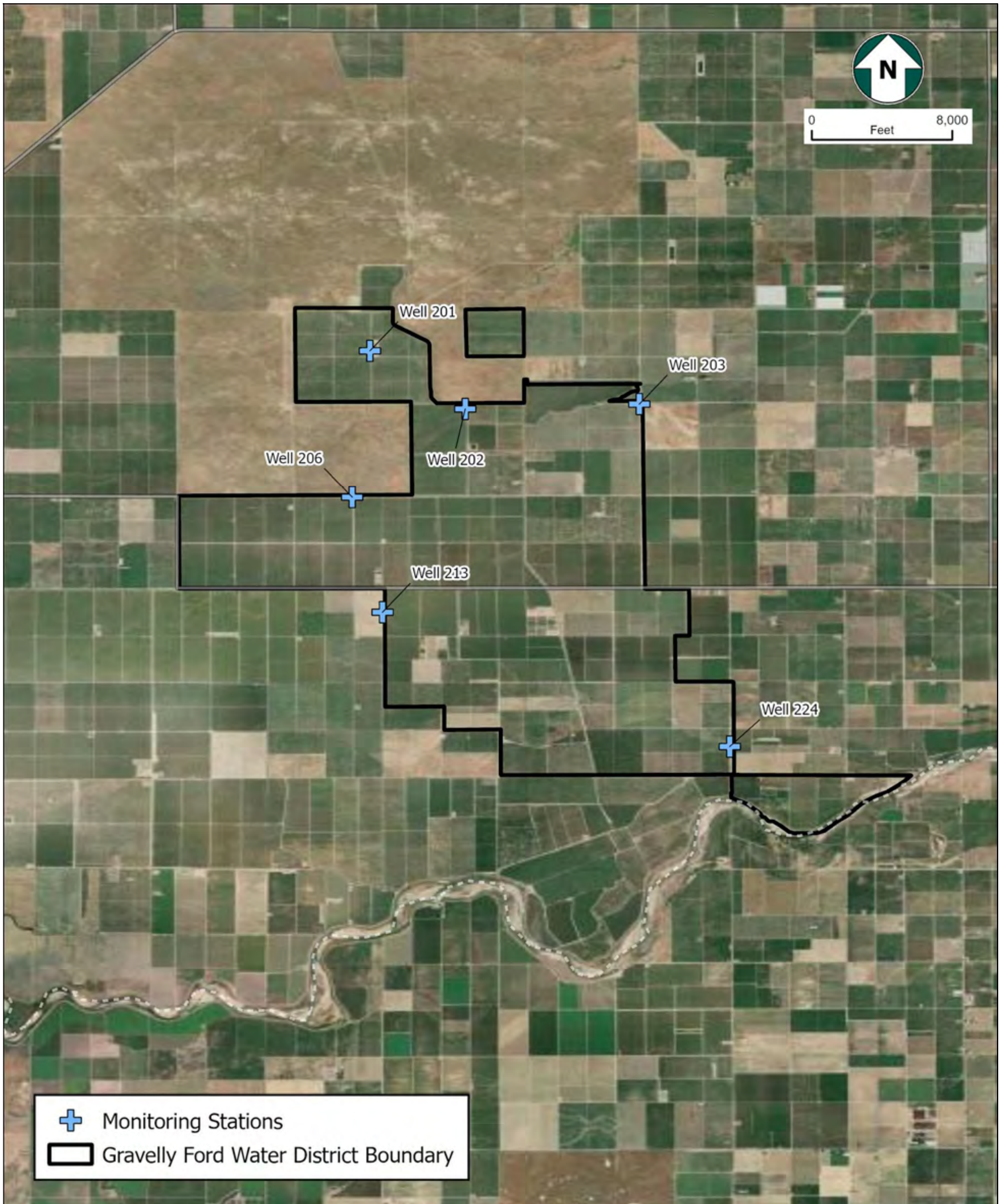

Figure 6-1
Groundwater Monitoring Network

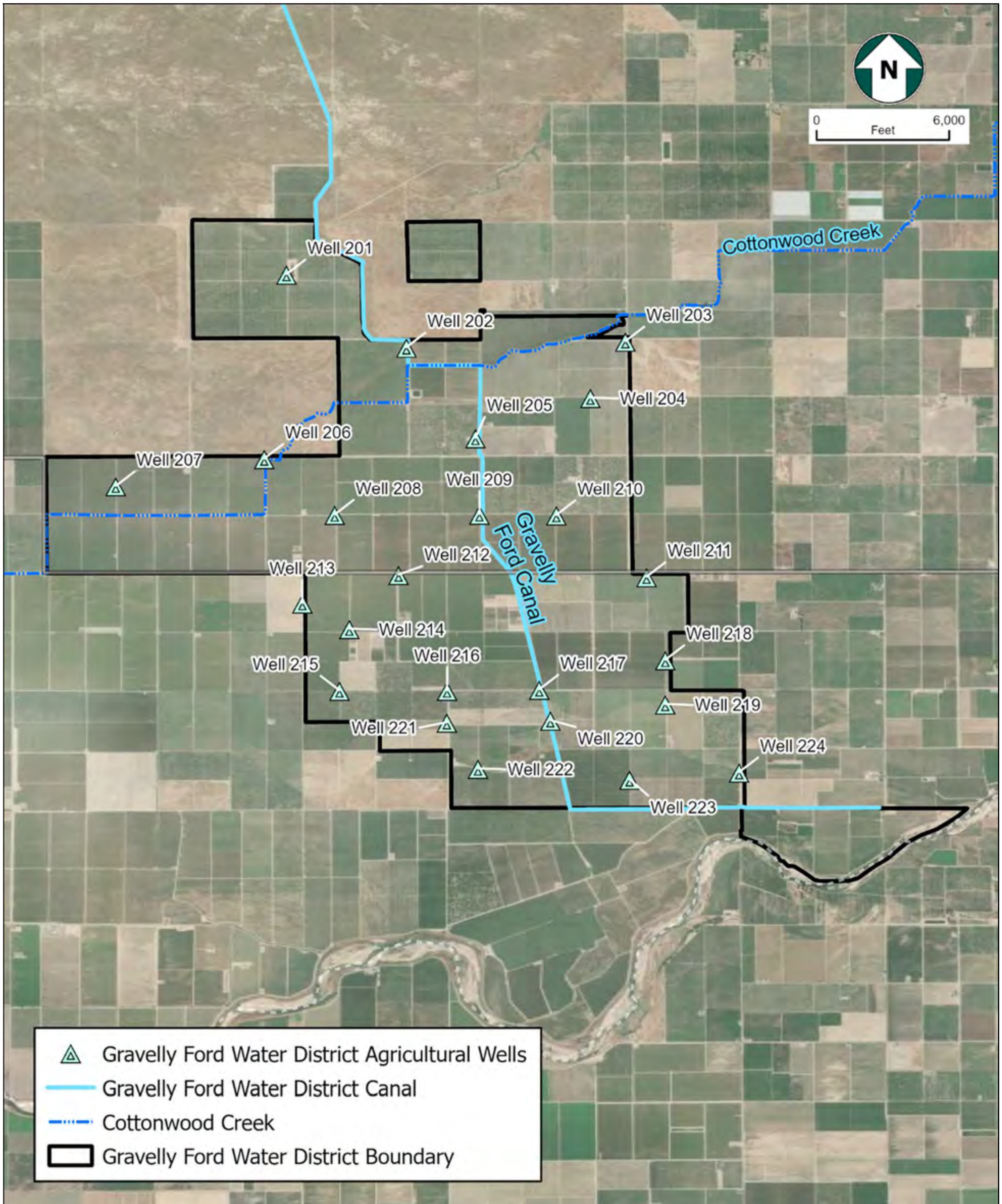

Figure 6-2
Agricultural Groundwater Wells Monitored

Previously, the District tracked water levels in two existing wells monitored by DWR to determine historic trends. In 2019, DWR stopped monitoring water levels at these wells. This has created a disconnect between the historic groundwater levels at the DWR wells, and the current representative monitoring network shown in Table 6-1.

The District had hoped to supplement the wells being monitored by DWR with the current representative monitoring network. However, considering the boundary of the GSA and Water District has changed, monitoring stations for groundwater levels, subsidence, and water quality may be added to the network. These changes will be reflected in future annual reports.

6.2 - Summary of Monitoring Network Changes

6.2.1 - Stations Added

GFWD has been measuring water levels semi-annually in 24 agricultural wells in the District since the fall of 2020. From the available data, a series of wells were selected, based on some simple criteria, to serve as the District's new representative monitoring wells (see Table 6-1). The wells that were selected met the following criteria: The wells were required to have spring 2015 groundwater level data for the basis of SMC development, construction information, and consistent data for the implementation period. These wells will be monitored for groundwater water levels and subsidence, groundwater quality will be sampled at domestic wells, to provide a complete snapshot of conditions at a specific location for all sustainability indicators, except for interconnected surface waters.

Additionally, the District tracks climate data from public sources to calculate crop consumptive use and effective precipitation. The District downloads and records CIMIS data for precipitation and evapotranspiration (ET) from the Firebaugh/Telles Station (#7) as it is the closest to GFWD. This data is used to calculate the consumptive use of agriculture for irrigation. The District also tracks climate at other nearby CIMIS stations and plans to start tracking precipitation at the Yosemite International Airport in Fresno. The District may also start tracking flow at the CDEC San Joaquin River at Gravelly Ford (GRF) station in cubic feet per second and surface water quality. This data is only for informational purposes and would not affect management practices in the District. They may also add shallow wells to the monitoring network to determine the extent and duration of interconnected surface waters, if any.

6.2.2 - Stations Removed

As stated above, DWR monitored historic groundwater levels at several locations in and near the District. Since the implementation of the original 2020 GSP, the wells used to establish historic groundwater trends are no longer been monitored. Because those wells are no longer monitored, they have essentially been removed from the monitoring network. The specifics of these wells can be seen in the original 2020 GFWD GSP in the Groundwater Conditions section.

No additional stations have been removed from the monitoring network. However, the precipitation data comes from the CIMIS station mentioned above rather than Weather Station 045233 as stated in the 2020 GSP.

6.2.3 - Monitoring Frequency/Density Changes

The District plans to schedule monitoring to reflect the schedule of representative sites monitored by the Madera Subbasin. Currently, the Madera Subbasin measures water levels in April and October. The Subbasin also tracks subsidence measured by others, which is typically measured annually in July and December. The District also measures water levels semi-annually in April and October. However, due to funding limitations and other resources, GFWD only measures subsidence every other year. The change to the six representative monitored sites has tripled the density of the monitoring network in the District. The District will implement a water quality monitoring program in the monitoring network. Currently, the plan is to monitor groundwater quality annually at domestic wells in the summer; however, if water quality remains good and within sustainable parameters, the District reserves the right to reduce monitoring frequency.

6.3 - Monitoring Network Data Gaps

6.3.1 - Data Gaps Addressed

Currently the largest data gap within the District is groundwater quality. The District plans to begin monitoring groundwater quality at domestic wells upon gaining access from land owners. The District plans to monitor for TDS, arsenic, and EC during the summers when wells are pumping, and water levels are assumed to be at their lowest. The District plans decide to measure an additional suite of constituents, to establish additional drinking water quality parameters and gradients or patterns. Once a baseline for water quality has been established, the District may change the representative monitoring sites for groundwater quality.

It is also important to note that due to the District boundary change additional monitoring sites may be added for all sustainability indicators to track groundwater conditions in the annexed area.

The District is also working with GSA partners in the Madera Subbasin to explore methods for identifying and monitoring interconnected surface waters.

6.3.2 - New Data Gaps

The District is currently working to get some historic water levels and other data for the updated monitoring network. At that time, the District was in contact with the pump company in charge of monitoring many of the District's wells. The District plans to compare this data to historical trends of nearby wells and the Joint Subbasin water model.

6.4 - Network Functionality Assessment

Currently, the monitoring network in the District functions as expected. There are no plans to change the existing monitoring frequency or locations except as described in the previous sections. The proposed changes will enhance the monitoring network and increase understanding of groundwater conditions and allow the District to track the effects of groundwater management practices on sustainability indicators.

6.5 - Additional Improvements Needed

The District also plans to add additional monitoring efforts as they relate to surface water. The District has outlined several projects and management actions that propose to add surface water monitoring stations to Cottonwood Creek and groundwater production meters on agricultural wells. These projects will allow the District to monitor surface water flowing through the District and groundwater pumping. This will allow GFWD to compare localized groundwater pumping to sustainability indicators. Monitoring Cottonwood Creek will allow the District to estimate percolation into the upper aquifer.

Implementation of these projects and monitoring sites is dependent on funding. Recently the District approved a per parcel assessment for implementation of the GSP. A portion of these funds will be used to address deferred maintenance and capital projects. The District has applied for grant funds from the USBR Water SMART program to offset the cost of the Automated SCADA Water Control Gate Project design and the Agricultural Well Metering Program. Both will assist the District in creating a more complete understanding of groundwater conditions.

SECTION 7 - GSA AUTHORITIES AND ENFORCEMENT ACTIONS

The District (GSA) has taken several actions to increase its ability to act regarding sustainability. One such action was to require all future well construction to include meters to quantify water production for integration into the well metering program. The District has also been authorized via popular vote to levy a per-acre tax on landowners for implementation of SGMA.

The District is working with their GSA partners to develop a Domestic Well Mitigation Program. The GSAs are also considering the development of a Demand Management Program that would establish triggers for implementation of demand management measures intended to maintain groundwater sustainability.

The District has not put in place any demand management plans or policies. Unlike other GSAs, the District intends to increase surface water use and increase irrigation efficiency rather than implement a reduction in groundwater pumping to achieve sustainability.

SECTION 8 - OUTREACH, ENGAGEMENT, AND COORDINATION WITH OTHER AGENCIES

8.1 - Outreach and Engagement

The GFWD District Engineer attends the Technical Committee regularly. Most recently the Technical Committee has been meeting every other Thursday, but as the deadline for the submission of the 2025 GSP looms nearer, the Technical Committee plans to meet weekly. The decisions made at these technical meetings inform the GSA boards and, ultimately, the drafting of the 2025 GSP. The GSAs have agreed to allow a 45-day public comment period despite the requirement for GSAs to only inform the public. GFWD publicly announced the development of the 2025 GSP on October 21, 2024, at their regularly scheduled board meeting. The District has also emailed all interested parties and uploaded notice of amendments to the GSP on their website.

The district has a standing agenda item in their monthly board meetings, during which the District Engineer updates the board members on project implementation decisions made by the technical committee and GSP matters. The public is welcome to attend all board meetings and agendas are sent out monthly to board members and other interested parties. The District also posts board meeting information on their website.

The District conducted a large outreach campaign for their Proposition 218 assessment. The District was clear when describing how assessment money would be spent. A large portion would be set aside for the purchase of surface water when available. The remainder will be used for deferred maintenance and to increase efficiency. A small amount is set aside to pay for consultants to develop plans and construction documents for projects.

8.2 - Responsibilities of GSA Boards

The board is responsible for approving plans and funds. They are responsible for hiring companies and consultants to draft plans and monitor groundwater conditions. Lastly, the board is responsible for informing the public and answering questions.

8.3 - Coordination with Other Agencies

The District is coordinating with other GSAs, subbasins, and DWR to develop the 2025 GSP.

SECTION 9 - OTHER INFORMATION

The Madera Subbasin is adjacent to the Chowchilla Subbasin, the Delta Mendota Subbasin, and the Kings Subbasin. Several factors affect the Madera Subbasin as a result of Plan implementation or lack thereof. It should be noted that neither the Delta Mendota nor Chowchilla Subbasins' GSPs were approved by DWR. This resulted in the SWRCB taking over the authority as the agency in charge.

It is important to consider the actions of the Madera Subbasin and more specifically GFWD on other subbasins as well. The Subbasin is adjacent to the SJR and diverts water directly from the River. This water can be used to offset groundwater use and for recharge. This is a net benefit to the Subbasin and prevents the District from causing effects to adjacent GSAs and subbasins.

To the northwest of the Subbasin is adjacent to the Chowchilla Subbasin where significant subsidence has occurred over the years. This subsidence can radiate outward and affect neighboring subbasins such as the Madera Groundwater Subbasin.

9.1 - Challenges Not Previously Discussed

There are no additional challenges not already addressed in this periodic evaluation.

9.2 - Legal Challenges

There are no legal challenges directly impacting the District. Legal challenges that could affect SGMA as a whole or the greater Madera Subbasin are explained in more detail in Section 2.6.

SECTION 10 - SUMMARY OF PROPOSED OR COMPLETED REVISIONS TO PLAN ELEMENTS

10.1 - Proposed Revisions to Plan Elements

The District will revise the monitoring network and sampling as part of its GFWD GSP Amended 2025 and add monitoring for groundwater quality. The District will update SMCs in accordance with the guidance of the Technical Committee and the Madra Subbasin Joint GSP Amended 2025. Other changes and information may be reflected in the Madra Subbasin Joint GSP Amended 2025. These changes include changes to the groundwater model and water budgets.

SECTION 11 - REFERENCES

2020 Gravelly Ford Water District Groundwater Sustainability Plan, January 2020, QK Inc.

Gravelly Ford Water District Annual Reports, 2020-2024, QK Inc

Madera Subbasin Joint GSP, 2020-Amended 2023, David's Engineering & Ludorff Scalmanini Consulting Engineer

A Guide to Annual Reports, Periodic Evaluations, and Plan Amendments, October 2023, DWR

Groundwater Sustainability Plan Annotated Outline, December 2016, DWR

San Joaquin River Restoration Settlement, March 2009, Public Law

Farmers Surprised: Judge blocks groundwater restrictions, July 2024, western-water.com

Depletions of Interconnected Surface Water, An Introduction, February 2024, DWR

Techniques for Estimating Interconnected Surface Water Depletion Caused by Groundwater Use, September 2024, DWR

Stream Depletions and Groundwater Pumping, June 2010, Nebraska Department of Natural Resources, Water Matters

Land Repurposing Program, Merced Subbasin GSA, mercedsubbasingas.org

A Guide to Water Quality Requirements Under SGMA, Spring 2009, Moran & Belin

DWR Electromagnetic Survey Project, February 2024, DWR

APPENDIX A
COORDINATION AGREEMENT

Add Final Coordination Agreement Here

APPENDIX B
DWR APPROVAL LETTER

CALIFORNIA DEPARTMENT OF WATER RESOURCES

SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

715 P Street, 8th Floor | Sacramento, CA 95814 | P.O. Box 942836 | Sacramento, CA 94236-0001

December 21, 2023

John Davids
Madera Point of Contact
1772 Picasso Avenue, Suite A
Davis, CA 95618
john@davidsengineering.com

RE: Approved Determination of the Revised Groundwater Sustainability Plans Submitted for the San Joaquin Valley – Madera Subbasin

Dear John Davids,

The Department of Water Resources (Department) has evaluated the four groundwater sustainability plans (GSPs) submitted for the San Joaquin Valley – Madera Subbasin (Subbasin), as well as the materials considered to be part of the required coordination agreement. Collectively, the four GSPs and the coordination agreement are referred to as the Plan for the Subbasin. The Department has evaluated the resubmitted Plan for the Madera Subbasin in response to the Department's incomplete determination on September 22, 2022, and has determined the Plan 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 Plan has taken sufficient action to correct deficiencies identified by the Department and satisfies the objectives of the Sustainable Groundwater Management Act (SGMA) and substantially complies with the GSP Regulations. The Staff Report also proposes recommended corrective actions that the Department believes will enhance the GSP and facilitate future evaluation by the Department. The Department strongly encourages the recommended corrective actions be given due consideration and suggests incorporating all resulting changes to the GSP in future updates.

Recognizing SGMA sets a long-term horizon for groundwater sustainability agencies (GSAs) to achieve their basin sustainability goals, monitoring progress is fundamental for successful implementation. GSAs are required to evaluate their GSPs at least every five years and whenever the Plan is amended, and to provide a written assessment to the Department. Accordingly, the Department will evaluate approved GSPs and issue an assessment at least every five years. The Department will initiate the first periodic review of the Plan no later than January 31, 2025.

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 – Madera Subbasin Groundwater Sustainability Plans (December 21, 2023)

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

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

The Department of Water Resources (Department) is required to evaluate whether a submitted groundwater sustainability plan (GSP or Plan) conforms to specific requirements of the Sustainable Groundwater Management Act (SGMA or Act), is likely to achieve the sustainability goal for the basin covered by the Plan, and whether the Plan adversely affects the ability of an adjacent basin to implement its GSP or impedes achievement of sustainability goals in an adjacent basin. (Water Code § 10733.) The Department is directed to issue an assessment of the Plan within two years of its submission. (Water Code § 10733.4.) If a Plan is determined to be Incomplete, the Department identifies deficiencies that preclude approval of the Plan and identifies corrective actions required to make the Plan compliant with SGMA and the GSP Regulations. The groundwater sustainability agency (GSA) has up to 180 days from the date the Department issues its assessment to make the necessary corrections and submit a revised Plan. (23 CCR § 355.2(e)(2)). This Statement of Findings explains the Department's decision regarding the revised Plan submitted by the City of Madera GSA, Madera County GSA, Madera Irrigation District GSA, Madera Water District GSA, Gravelly Ford Water District GSA, New Stone Water District GSA, and Root Creek Water District GSA (GSAs or Agencies) for the San Joaquin Valley – Madera Subbasin (No. 5-022.06) (Subbasin) on March 21, 2023 (2023 Plan).

Department management has discussed the 2023 Plan with staff and has reviewed the Department Staff Report, entitled Sustainable Groundwater Management Program Groundwater Sustainability Plan Assessment Staff Report, attached as Exhibit A, recommending approval of the 2023 Plan. Department management is satisfied that staff have conducted a thorough evaluation and assessment of the 2023 Plan and concurs with staff's recommendation and all the recommended corrective actions. The Department therefore **APPROVES** the 2023 Plan and makes the following findings:

A. The initial Plan for the basin submitted by the GSAs for the Department's evaluation on January 31, 2020 (2020 GSP or 2020 Plan) was determined by Department staff to satisfy the preliminary requirements for Plan review as outlined in § 355.4(a) of the GSP Regulations (23 CCR § 350 et seq.), and Department Staff therefore evaluated the initial Plan.

B. On September 22, 2022, the Department issued a Staff Report and Findings determining the initial 2020 GSP submitted by the Agencies for the basin to be incomplete because the 2020 Plan did not satisfy the requirements of

SGMA, nor did it substantially comply with the GSP Regulations. At that time, the Department provided corrective actions in the Staff Report that were intended to address the deficiencies that precluded approval. Consistent with the GSP Regulations, the Department provided the Agencies with up to 180 days to address the deficiencies detailed in the Staff Report. On March 21, 2023, within the 180 days provided to remedy the deficiencies identified in the Staff Report related to the Department's initial incomplete determination, the Agencies resubmitted a revised Plan to the Department for evaluation.

When evaluating a revised Plan that was initially determined to be incomplete, the Department reviews the materials (e.g., revised or amended Plan) that were submitted within the 180-day deadline and does not review or rely on materials that were submitted to the Department by the GSAs after the resubmission deadline. Part of the Department's review focuses on how the Agencies have addressed the previously identified deficiencies that precluded approval of the initially submitted Plan. The Department shall find a Plan previously determined to be incomplete to be inadequate if, after consultation with the State Water Resources Control Board, the Agencies have not taken sufficient actions to correct the deficiencies previously identified by the Department. (23 CCR § 355.2(e)(3)(C).) If the Department determines the Agencies have 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.

C. The Department's initial Staff Report identified the deficiencies that precluded approval of the initially submitted 2020 Plan. After staff's thorough evaluation of the revised 2023 Plan, the Department makes the following findings regarding the sufficiency of the actions taken by the Agencies to address those deficiencies:

1. <u>Deficiency 1</u>: The corrective action advised the Agencies to modify several aspects of their respective GSPs to substantially comply with the GSP Regulations in a coordinated manner. The Department found that the initial GSPs did not sufficiently coordinate on data and methodologies, including coordination of the sustainability goal, water budget and sustainable yield, and undesirable results as required by SGMA and the GSP Regulations. The Department also determined that the 2020 Plan's definition of an undesirable result for the chronic lowering of groundwater levels was not consistent with the requirements of SGMA.

The 2023 Staff Report indicates that the Agencies have taken sufficient actions to correct this deficiency, and it should no longer materially affect the ability of the Agencies to achieve sustainability and the ability of the Department to evaluate the likelihood of the 2023 Plan to achieve sustainability.

2. Deficiency 2: The corrective action advised the Agencies to address several aspects of the 2020 Plan's disclosure, discussion, and analyses of groundwater level sustainable management criteria and potential impacts to groundwater users and uses. The initial 2020 Plan did not establish undesirable results and minimum thresholds for chronic lowering of groundwater levels in a manner substantially compliant with the GSP Regulations. Additionally, the Department found that the Plan did not present sufficient analysis of the effects of minimum thresholds on beneficial uses and users of groundwater in the Subbasin.

   The 2023 Staff Report indicates that the Agencies have taken sufficient actions to correct this deficiency, and it should no longer materially affect the ability of the Agencies to achieve sustainability and the ability of the Department to evaluate the likelihood of the 2023 Plan to achieve sustainability.

3. Deficiency 3: The corrective action advised the Agencies to address several aspects of the 2020 Plan's disclosure, discussion, and analyses of land subsidence sustainable management criteria and potential impacts to groundwater users and uses. The initial Plan did not establish sustainable management criteria for subsidence. The Department determined that the GSAs did not sufficiently demonstrate that undesirable results related to land subsidence are not present and are not likely to occur in the Subbasin.

   The 2023 Staff Report indicates that the Agencies have taken sufficient actions to correct this deficiency, and it should no longer materially affect the ability of the Agencies to achieve sustainability and the ability of the Department to evaluate the likelihood of the 2023 Plan to achieve sustainability.

4. Deficiency 4: The corrective action advised the Agencies to address several aspects of the 2020 Plan's disclosure, discussion, and analyses of interconnected surface water sustainable management criteria and potential impacts to groundwater users and uses. The initial 2020 Plan did not establish sustainable management criteria for interconnected surface water. The Department determined that the GSAs do not sufficiently demonstrate that interconnected surface

water or undesirable results related to depletions of interconnected surface water are not present and are not likely to occur in the Subbasin.

The 2023 Staff Report indicates that the Agencies have taken sufficient actions to correct this deficiency, and it should no longer materially affect the ability of the Agencies to achieve sustainability and the ability of the Department to evaluate the likelihood of the 2023 Plan to achieve sustainability.

D. The 2023 Plan satisfies the required conditions as outlined in § 355.4(a) of the GSP Regulations (23 CCR § 350 et seq.):

1. The 2020 Plan was submitted within the statutory deadline of January 31, 2022 (Water Code § 10720.7(a); 23 CCR § 355.4(a)(1)), and the 2023 Plan was submitted within 180 days of the Department's Incomplete determination (23 CCR § 355.2(e)(2)).

2. The 2023 Plan is complete, meaning it generally appeared to include the information required by the Act and the GSP Regulations sufficient to warrant a thorough evaluation and issuance of an assessment by the Department. (23 CCR § 355.4(a)(2).)

3. The 2023 Plan, either on its own or in coordination with other Plans, covers the entire Subbasin. (23 CCR § 355.4(a)(3).)

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

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

F. In making these findings and Plan determination, the Department also recognized that: (1) it 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 with 20 years of implementation to achieve the sustainability goal in a Subbasin (with the possibility that the Department may grant GSAs an additional five years upon request if the GSA has made satisfactory progress toward sustainability); and, (4) local agencies acting as GSAs are authorized, but not required, to address undesirable results that occurred prior to enactment of SGMA. (Water Code §§ 10721(r); 10727.2(b); 10733(a); 10733.8.)

G. The 2023 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 2023 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 2023 Plan's goal to implement a package of projects and management actions that will, by 2040, balance long-term groundwater system inflows and outflows based on a 50-year period representative of average historical hydrologic conditions are sufficiently justified and explained. The 2023 Plan relies on credible information and science to quantify the groundwater conditions that the Plan seeks to avoid and provides an objective way to determine whether the Subbasin is being managed sustainably in accordance with SGMA. (23 CCR § 355.4(b)(1).)

2. The 2023 Plan demonstrates an understanding of where data gaps exist and has identified areas for improvement of its Plan, including addressing data gaps related to land subsidence and interconnected surface water, refining water budgets, incorporating new information

into the numerical model, and expanding monitoring networks. (23 CCR § 355.4(b)(2).)

3. The projects and management actions proposed are designed to meet interim milestones and bring groundwater levels back up to minimum thresholds, mitigate overdraft, and operate the Subbasin sustainably. 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. (23 CCR § 355.4(b)(3).)

4. The 2023 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 wells, would be impacted by the chosen minimum thresholds. (23 CCR § 355.4(b)(4).)

5. The 2023 Plan's projects and management actions appear feasible at this time and appear likely to prevent undesirable results and ensure 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. (23 CCR § 355.4(b)(5).)

6. The 2023 Plan includes a reasonable assessment of overdraft conditions and includes reasonable means to mitigate overdraft. (23 CCR § 355.4(b)(6).)

7. At this time, it does not appear that the 2023 Plan will adversely affect the ability of an adjacent basin to implement its GSP or impede achievement of sustainability goals in an adjacent basin. The Plan states that the Subbasin's GSAs have met with GSAs in adjacent basins to share data and information to ensure that the implementation of the GSPs will not interfere with neighboring basins. The Plan also qualitatively describes how minimum thresholds and measurable objectives may affect an adjacent basin, concluding that the Madera Subbasin Plan will not hinder the ability of an adjacent basin to be sustainable; however, the evaluation is provided without specifics. (23 CCR § 355.4(b)(7).)

8. A satisfactory coordination agreement has been adopted by all relevant parties. (23 CCR § 355.4(b)(8).)

9. The City of Madera GSA, Madera County GSA, Madera Irrigation District GSA, Madera Water District GSA, Gravelly Ford Water District GSA, New Stone Water District GSA, and Root Creek Water District GSA have historically had a role in water planning and management in the Subbasin. The seven GSAs' history of groundwater management provide a reasonable level of confidence that the GSAs have the legal authority and financial resources necessary to implement the 2023 Plan. (23 CCR § 355.4(b)(9).)

10. Through review of the 2023 Plan and consideration of public comments, the Department determines that the GSAs adequately responded to comments that raised credible technical or policy issues with the Plan, sufficient to warrant approval of the Plan at this time. The Department also notes that the recommended corrective actions included in the Staff Report are important to addressing certain technical or policy issues that were raised and, if not addressed before future, subsequent plan evaluations, may preclude approval of the Plan in those future evaluations. (23 CCR § 355.4(b)(10).)

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

1. The 2023 Plan provides an analysis that documents the expected location and quantity of domestic wells that will experience undesirable results during the GSP implementation period based on future modeled groundwater conditions. Additionally, the Plan describes a domestic well mitigation program that the GSAs will implement to provide assistance to domestic and municipal wells adversely impacted by declining groundwater levels that have occurred since 2015. The Plan describes that the cost of mitigating domestic wells due to lowering groundwater levels is shown to be economically preferable to the costs associated with immediately stabilizing groundwater levels and the resulting impact to the local economy. The Plan's compliance with the requirements of SGMA and substantial compliance with the GSP Regulations supports the state policy regarding the human right to water (Water Code § 106.3). The Department developed its GSP Regulations consistent with and intending to further the policy through implementation of SGMA and the Regulations, primarily by achieving sustainable groundwater management in a basin. By ensuring substantial compliance with the GSP Regulations, the Department has considered the state policy

regarding the human right to water in its evaluation of the Plan. (23 CCR § 350.4(g).)

2. The 2023 Plan acknowledges and identifies interconnected surface waters within the Subbasin. The GSAs propose interim 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 updates to the Plan should aim to improve the initial sustainable management criteria as more information and improved methodology becomes available.

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

Accordingly, the revised 2023 Plan submitted by the Agencies for the San Joaquin Valley – Madera Subbasin is hereby **APPROVED.** The recommended corrective actions identified in the Staff Report will assist the Department's future review of the Plan's implementation for consistency with SGMA and the Department therefore recommends the Agencies address them by the time of the Department's periodic review, which is set to begin on January 31, 2025, 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: December 21, 2023

Exhibit A: Groundwater Sustainability Plan Assessment Staff Report – San Joaquin Valley – Madera Subbasin (December 21, 2023)

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

Groundwater Basin Name:	San Joaquin Valley - Madera Subbasin (No. 5-022.06)
Number of GSPs:	4 (see list below)
Number of GSAs:	7 (see list below)
Submittal Type:	Revised Plan in response to Incomplete Determination
Submittal Date:	March 21, 2023
Recommendation:	Approve
Date:	December 21, 2023

On March 21, 2023, multiple groundwater sustainability agencies (GSAs) resubmitted multiple groundwater sustainability plans (GSPs) for the entire Madera Subbasin (Subbasin), which are coordinated pursuant to a required coordination agreement, to the Department of Water Resources (Department) in response to the Department's incomplete determination on September 22, 2022[1] for evaluation and assessment as required by the Sustainable Groundwater Management Act (SGMA) [2] and GSP Regulations.[3] In total, four GSPs have been revised and implemented by seven GSAs. Collectively, all GSPs and the Coordination Agreement are, for evaluation and assessment purposes, treated and referred to as the Plan for the Subbasin. Individually, the GSPs include the following:

- *Gravelly Ford Water District Groundwater Sustainability Plan (Gravelly Ford GSP)* – prepared by the Gravelly Ford Water District GSA.
- *Joint Groundwater Sustainability Plan (Joint GSP)* – prepared jointly by the City of Madera GSA, Madera County GSA, Madera Irrigation District GSA, and Madera Water District GSA.
- *New Stone Water District Groundwater Sustainability Agency Groundwater Sustainability Plan (New Stone GSP)* – prepared by the New Stone Water District GSA.

[1] Water Code § 10733.4(b); 23 CCR § 355.4(a)(4). https://sgma.water.ca.gov/portal/service/gspdocument/download/9363; Water Code § 10733.4(b); 23 CCR § 355.4(a)(4).
[2] Water Code § 10720 *et seq*.
[3] 23 CCR § 350 *et seq*.

- *Root Creek Water District Groundwater Sustainability Agency Groundwater Sustainability Plan (Root Creek GSP)* – prepared by the Root Creek Water District GSA.

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 recommended corrective actions which will be required to be addressed by the Plan's next periodic evaluation.

Overall, Department staff believe the 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 Plan, and proposes a set of projects and management actions that, if successfully implemented, are likely achieve the sustainability goal defined for the Subbasin.[4] Department staff will continue to monitor and evaluate the Subbasin's progress toward achieving the sustainability goal through Annual Reports and future Periodic Evaluations of the GSP and its implementation.

Based on the reevaluation of the Plan, Department staff recommend the Plan be approved.

This assessment includes six sections:

- **Section 1 – Summary:** Provides an overview of the Department Staff's assessment and recommendations.
- **Section 2 – Evaluation Criteria:** Describes the legislative requirements and the Department's evaluation criteria.
- **Section 3 – Required Conditions:** Describes the submission requirements of a response to an incomplete determination to be evaluated by the Department.
- **Section 4 – Deficiency Evaluation:** Provides an assessment of whether and how the contents included in the GSP submittal 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 Plan and any recommended corrective actions.

[4] 23 CCR § 354.24.

1 SUMMARY

Department staff recommend approval of the Plan for the Madera Subbasin and have recommended corrective actions designed to address shortcomings of the Plan described in this Staff Report. In the evaluation of the Plan, Department staff concluded that sufficient action was taken to correct the deficiencies; however, Department staff have provided recommended corrective actions which will be required to be address by the Plan's next periodic evaluation.

The GSA has identified areas for improvement of its Plan (e.g., addressing data gaps related to land subsidence and interconnected surface water, refining water budgets, incorporating new information into the numerical model, and expanding monitoring networks). Department staff concur that those items are important and recommend the GSA address them as soon as possible. As mentioned, Department staff have also identified additional recommended corrective actions that the GSA should consider for the next periodic evaluation of the Plan or sooner (see Section 6). 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. Providing a detailed explanation specifically discussing and identifying Madera Irrigation District GSA's legal, contractual, or other authorities or arrangements to implement its obligations under the Joint GSP in the next periodic evaluation.
2. Continuing efforts to further coordinate the GSPs and groundwater management.
3. Sufficiently describing the effect of chronic lowering of groundwater level interim milestones on other sustainability indicators.
4. Reevaluating the quantitative metrics that constitute undesirable results due to land subsidence and sufficiently describing the effect and extent of land subsidence interim milestones that allow continued subsidence during the GSP implementation period.
5. Describing data gaps in the hydrogeologic conceptual model.
6. Sufficiently detailing the degraded water quality undesirable results and explaining the rationale to allow potential further degradation.

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 update 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 is a revision of the 2020 Plan, which was evaluated by the Department and found to be incomplete. An incomplete Plan is one which Department staff identify as containing one or more deficiencies that preclude its initial approval. Deficiencies may result from supporting information that is insufficiently detailed or analyses that are insufficiently thorough or unreasonable, or where Department staff determine it is unlikely the GSAs in the basin could achieve the sustainability goal under the proposed Plan. 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 revised or amended Plan, subsequent to the initial Plan being found 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

[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*.

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]

The recommendation to approve a Plan previously determined to be incomplete is based on a determination that the GSAs have taken sufficient actions (e.g., amended or revised the Plan) to correct the deficiencies previously identified by the Department that precluded earlier approval.

3 Required Conditions

For a Plan that the Department determines to be incomplete, the Department identifies corrective actions to address those deficiencies that preclude approval of the Plan as initially submitted. The GSAs in a basin, whether developing a single GSP covering the basin or multiple GSPs, must attempt to address those corrective actions within the time provided, not to exceed 180 days, for the Plan to be evaluated by the Department.

3.1 Incomplete Resubmittal

GSP Regulations specify that the Department shall evaluate a resubmitted GSP in which the GSAs have taken corrective actions within 180 days from the date the Department issued an incomplete determination to address deficiencies.[18]

The Department issued the incomplete determination on September 22, 2022. The GSAs resubmitted their individual GSPs and the Coordination Agreement on March 21, 2023 in compliance with the 180 day deadline. However, the Madera Irrigation District GSA (MID GSA) did not adopt a resolution approving and/or adopting the Revised Joint GSP, which was prepared jointly by MID GSA, the City of Madera GSA, Madera County GSA, and Madera Water District GSA. However, MID GSA did approve the related Coordination Agreement.

MID GSA's failure to adopt the Revised Joint GSP concerned Department staff. Accordingly, on April 6, 2023, the Sustainable Groundwater Management Office sent a letter seeking clarification from MID GSA regarding its failure to adopt the Revised Joint GSP. The MID GSA responded by letter dated April 21, 2023, confirming that "the MID GSA has not and does not intend to adopt the Revised Joint GSP," stating that "MID GSA has determined the Revised Joint GSP is inadequate," and explaining that "the MID GSA cannot adopt the Revised Joint GSP without substantial revision." At the same time, the letter indicated that "[t]he lack of action on the Revised Joint GSP was not due to any intention on the part of MID GSA to avoid its implementation of the Revised Joint GSP," and vowed that "MID GSA will continue to fully implement its own obligations under the Revised Joint GSP."

[17] 23 CCR § 355.4(b).
[18] 23 CCR § 355.4(a)(4).

MID GSA's refusal to adopt the Revised Joint GSP, but its apparent intent to implement its obligations under the Revised Joint GSP, creates a level of inconsistency and uncertainty regarding Plan implementation that continues to concern staff. SGMA provides that a GSA may exercise any of the powers granted by SGMA if the GSA adopts and submits a Plan to the Department. Because of MID GSA's failure to adopt the Revised Joint GSP, it is unclear whether MID GSA has the necessary powers and authorities to implement its obligations under the Revised Joint GSP. In its previous letter, MID GSA claimed it would implement the Plan, but did not provide specific references to existing, non-SGMA authorities granting it the powers to implement the Revised Joint GSP or otherwise explaining how it retained SGMA authorities to do so, or identifying other agreements or entities that had the power and would implement those aspects of the Revised Joint GSP. Without an understanding of these issues, Department staff remain concerned that overall SGMA implementation in the Subbasin may be infeasible or delayed as a result of MID GSA's failure to adopt the Revised Joint GSP. However, Department staff do not believe this issue precludes an approval recommendation at this time, because various components of the overall Subbasin Plan have been and continue to be implemented and staff is not aware of any existing impediment or delay in implementation caused by these circumstances.

Nevertheless, MID GSA is the only GSA of which Department staff are aware that has refused to adopt a GSP that it intends to implement. This novel circumstance continues to be a concern to Department staff. To alleviate those concerns, Department staff provide a recommended corrective action requiring identification and listing of the specific projects and management actions that MID GSA will or may be responsible for implementing under the Revised Joint GSP and a parallel listing and detailed identification and discussion of the legal, contractual, or other authorities or arrangements that MID GSA is relying or will rely upon in adequately implementing the Plan including those projects or management actions to clearly demonstrate the feasibility of all projects and management actions (see Recommended Corrective Action 1) Department staff will closely monitor Plan implementation and may change its recommendation if MID GSA does not provide a satisfactory response addressing these issues in the next periodic evaluation or if it appears that MID GSA's failure to adopt the Revised Joint GSP is preventing or delaying Plan implementation or otherwise impacting the likelihood of the Subbasin to achieve sustainability consistent with SGMA timelines.

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 in September 2022.[19] In September 2022 the GSAs were given 180 days to take corrective actions to remedy the identified deficiencies. Consistent with the GSP Regulations, Department staff have evaluated the revised 2022 Plan to determine if the GSAs have taken sufficient actions to correct the deficiencies.

4.1 Deficiency 1. The GSPs have not sufficiently coordinated on data and methodologies including coordination of sustainability goal, water budget and sustainable yield, and undesirable results as required by SGMA and the GSP Regulations.

4.1.1 Corrective Action 1

As described in the Department's GSP Assessment Staff Report released on September 22, 2022, Department staff determined that the Subbasin's definition of an undesirable result for the chronic lowering of groundwater levels was not consistent with the requirements of SGMA. The Department provided the following corrective actions for the Subbasin to consider and address:

> *The Plan does not provide sufficient explanation to confirm that the GSPs have been developed using the same data and methodologies and that elements of the GSPs have been based upon consistent interpretations of the Subbasin's setting. The GSAs in the Subbasin should modify each of their respective GSPs, as well as any applicable coordination materials, to substantially comply with the GSP Regulations and define sustainable yield and undesirable results, and develop water budgets in a manner that addresses groundwater conditions occurring throughout the Subbasin, not for only the portion of the Subbasin represented by the respective GSPs.*

[19] *Incomplete Determination of the 2020 Groundwater Sustainability Plan for the San Joaquin Valley – Madera Subbasin*, Department of Water Resources, September 22, 2022. https://sgma.water.ca.gov/portal/service/gspdocument/download/9363

4.1.2 Evaluation

To address the identified deficiencies, the GSAs have supplemented portions of each Plan to use consistent data and methodologies. Specifically, the descriptions supporting the sustainability goal, water budgets, and undesirable results have been further detailed or revised. Most of the supplemented material is provided in the Joint GSP and Coordination Agreement and referenced by the other GSPs.

The Department's Incomplete Determination notified the GSAs that the Plan did not present a coordinated sustainability goal in the Coordination Agreement applicable to the entire Subbasin. Instead, each GSP described related, but varied sustainability goals. In response, the GSAs amended the Coordination Agreement to include a sustainability goal that all parties agree to as presented below:

> *The sustainability goal for the Madera Subbasin is to implement a package of projects and management actions that will, by 2040, balance long-term groundwater system inflows and outflows based on a 50-year period representative of average historical hydrologic conditions.*[20]

The Gravelly Ford GSP,[21] New Stone GSP,[22] and Root Creek GSP[23] still contain the varied language describing the sustainability goal that was present in the initial Plan submission; however, the language does not conflict with the overarching sustainability goal definition found in the Coordination Agreement. A detailed assessment of the sustainability goal is provided in Section 5.3.1.

The Department's Incomplete Determination also notified the GSAs that the water budgets presented in each GSP were unclear, used different data, and were difficult to assess. Additionally, the water budget along with an estimate of sustainable yield was not included in the Coordination Agreement as required. In response, the GSAs have amended the GSPs and the Coordination Agreement to include agreed upon water budgets and estimates of sustainable yield. Specifically, the GSPs now all reference historical, current, and projected water budgets[24] developed in February 2018 for the entire Madera Subbasin and developed for the seven subregions representing each GSA. This water budget information was part of the initial Joint GSP submission in 2020 but was not clearly recognized in the other GSPs at the time. A detailed assessment of the water budget is provided in Section 5.2.3.

The GSPs acknowledge that there are still refinements needed to remove discrepancies and further improve the accuracy of the water budgets. The New Stone and Root Creek resubmitted GSPs note that the availability of more specific information and knowledge on the regional scale (i.e., geography, geology, water management practices, familiarity,

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[20] Madera Subbasin Coordination Agreement, p. 34.
[21] Gravelly Ford GSP (Redlined), Section 3.1, p. 53.
[22] New Stone GSP (Redlined), Section 4.1, pp. 129-130.
[23] Root Creek GSP (Redlined), Section 4.1, pp. 184-185.
[24] Joint GSP (Resubmitted), Appendix 2.F, pp. 1322-1620; Appendix 6.D, pp. 2012-3335.

and understanding)[25] have been discussed amongst the GSAs and updates to the model will occur during the 2025 evaluation cycle.[26] Department staff encourage these efforts and also recommend the GSAs continue productive coordination and refinement of each GSP to be a cohesive Plan for sustainable groundwater management in the Subbasin (see Recommended Corrective Action 2).

4.1.3 Conclusion

Overall, Department staff believe the GSAs have taken sufficient action to address the identified deficiencies. Staff conclude that the enhanced coordination and addition of a coordinated sustainability goal and water budget with agreed upon estimates of sustainable yield for the Subbasin allows the GSAs to manage the Subbasin as intended by SGMA. However, as highlighted in the recommended corrective actions, the GSP should continue efforts to increase cooperative coordination and alignment of each GSP by the next periodic evaluation. The Plan also provides an agreed upon definition of undesirable results occurring in the Subbasin, which is discussed in Section 4.2.2.1.

4.2 Deficiency 2. The Plan does not establish minimum thresholds for chronic lowering of groundwater levels in a manner substantially compliant with the GSP Regulations.

4.2.1 Corrective Action 2

As described in the Department's GSP Assessment Staff Report released on September 22, 2022, Department staff determined that the GSAs must provide more detailed explanation and justification regarding the selection of the sustainable management criteria for groundwater levels, particularly the undesirable results, the minimum thresholds, and the effects of those criteria on the interests of beneficial uses and users of groundwater. The Department provided the following corrective actions for the Subbasin to consider and address:

1. The GSAs should describe the specific undesirable results they aim to avoid through implementing the Plan. If, for example, significant and unreasonable impacts to domestic wells are a primary management concern for the Subbasin, then the GSAs should sufficiently explain why that effect was selected and what level of impact(s) to those wells the GSAs consider to be significant and unreasonable. In support of its explanation, the GSPs should also clearly discuss and disclose the anticipated impact of operating the Subbasin at conditions protective against those effects on users of domestic wells and all other beneficial uses and users of groundwater in the Subbasin. The discussion should be supported using best available information, such as using State or county information on well completion reports and dry well reports, to analyze the

[25] New Stone GSP (Redlined), Section 3.3, p. 106; Root Creek GSP (Redlined), Section 3.3.3, p. 180.
[26] New Stone GSP (Redlined), Section 3.3.1, p. 107.

locations and quantities of domestic wells and other types of well infrastructure that could be impacted by groundwater management when implementing the Plan.

2. The GSAs should either explain how the existing minimum threshold groundwater levels are consistent with avoiding undesirable results or they should establish minimum thresholds at the representative monitoring wells that account for the specific undesirable results the GSAs aim to avoid. The Plan should include a detailed description of the factors and information considered and the analytic route and rationale the GSAs employed to reach conclusions regarding significant and unreasonable effects constituting undesirable results for groundwater levels and other applicable sustainability indicators.

3. The GSAs need to provide a description of the relationship between established minimum thresholds for all applicable sustainability indicators including how conditions at minimum thresholds avoid undesirable results for each applicable indicator.

4.2.2 Evaluation

To address the identified deficiencies, the GSAs have supplemented portions of the Plan related to the sustainable management criteria for chronic lowering of groundwater levels. Specifically, descriptions supporting the undesirable result, minimum thresholds, measurable objectives, interim milestones, and a domestic well mitigation program have been further detailed or revised. Most of the supplemented material is provided in the Joint GSP and referenced by the other GSPs.

4.2.2.1 Describing Undesirable Results and Potential Effects (1)

The Department's Incomplete Determination notified the GSAs that the Plan incorrectly established undesirable results which were applicable only within each GSP area—without agreement between GSPs—and some of the information provided in each GSP was insufficiently detailed.

In response to the corrective action, the GSAs coordinated to develop agreed-upon undesirable results applicable to the entire Subbasin. The GSPs reference information in the Joint GSP as a basis for developing undesirable results, particularly coordinating on defining when an undesirable result will occur (i.e., the quantitative description of minimum threshold exceedances that cause significant and unreasonable effects). In describing undesirable results, each GSP provides a different level of detail. For example, the Joint GSP describes an undesirable result as "those conditions that: 1) Cause significant financial burden to local agricultural interests or other beneficial uses and users who rely on the Subbasin's groundwater resources, 2) Cause groundwater level conditions at private domestic wells that cannot be mitigated, and 3) Interfere with other sustainability indicators." [27] The Gravelly Ford GSP refers to this information but also, alongside the New Stone GSP and the Root Creek GSP, provides additional description

[27] Joint GSP (Redlined), Section 3.4.1, p. 323.

such as: “Chronic lowering of groundwater levels in the Plan area cause significant and unreasonable declines if they are sufficient in magnitude to lower the rate of production of pre-existing groundwater wells below that necessary to meet the minimum required to support overlying beneficial use where alternative means of obtaining sufficient groundwater resources are not technically or financially feasible.” [28] The varied descriptions presented in each GSP do not conflict and appear to be generally coordinated. All GSPs refer to a domestic well mitigation framework which provides more specific information describing effects on beneficial uses and users.[29]

The Plan states that an undesirable result would occur when “… more than 30 percent of RMS in the Subbasin (including RMS in all four GSP plan areas) [are] exceeding their [minimum thresholds] for the same two consecutive Fall readings.”[30] The Plan further describes that “…implementation of the GSP is designed to avoid undesirable results during the sustainability period (i.e., the “planning and implementation horizon,” per CWC §10721(v)), after 2040.”[31]

As mentioned, the Plan describes details for a domestic well mitigation program,[32] which the GSAs will implement to provide assistance to domestic and municipal wells adversely impacted by declining groundwater levels that have occurred since 2015.[33] The Plan includes supporting information for the mitigation program which document the expected location and quantity of domestic wells that will experience undesirable results during the GSP implementation period. Staff believe the details provided for this framework effectively describe the specific undesirable results the GSAs are trying to avoid. Based on an analysis of 4,822 wells, the GSP documents that up to 1,294 wells,[34] located primarily in the central and eastern portion of the Subbasin,[35] would be impacted due to future modeled groundwater conditions. The total cost to assist impacted wells is estimated to be approximately $39,000,000; however, the Plan describes that the cost of mitigating domestic wells due to lowering groundwater levels is shown to be economically preferable to the costs associated with immediately stabilizing groundwater levels and the resulting impact to the local economy.[36] The GSAs have provided a commitment to this program including a schedule, timeline, and have reported progress in recent Annual Reports. The GSAs expect that the program would be implemented during the GSP

[28] Gravelly Ford GSP (Redlined), Section 3.4.1, p. 60; New Stone GSP (Redlined), Section 4.2.1.1, p. 131; Root Creek GSP (Redlined), Section 4.2.1, p. 186.
[29] Joint GSP (Redlined), Section 3.3.1.1, pp. 294-295; Gravelly Ford GSP (Redlined), Section 3.4.1, p. 60; New Stone GSP (Redlined), Section 4.2.1.2, pp. 132-133; Root Creek GSP (Redlined), Section 4.2.1.1, pp. 187-188.
[30] Joint GSP (Redlined), Section 3.4.1, p. 323.
[31] Joint GSP (Redlined), Section 3.4.1, p. 323.
[32] Joint GSP (Resubmitted), Appendix 3.E, pp. 1904-1918, Appendix 2.G, pp. 1733-1813.
[33] Joint GSP (Redlined), Section 3.3.1.1, p. 294.
[34] Joint GSP (Resubmitted), Appendix 2.G, p. 1762.
[35] Joint GSP (Resubmitted), Appendix 2.G, pp. 1783-1787.
[36] Joint GSP (Resubmitted), Appendix 3.D, p. 1902.

implementation period, no later than 2025; as of March 2023, the GSP states, the GSAs are continuing to develop the program's eligibility criteria and terms.[37]

In addition to the domestic well mitigation program, the Plan includes a suite of over 25 projects and management actions (e.g., demand management, increased recharge, increased surface water supply) which will be utilized to meet interim milestones and bring groundwater levels back up to minimum thresholds, mitigate overdraft, and operate the Subbasin sustainably. At full implementation, by 2040, the projects and actions will provide 215,840 acre-feet per year of annual gross benefit. The estimated capital cost of the projects is over $260,000,000, with an estimated annual operating cost of over $70,000,000; Department staff note that the GSAs have included an estimated economic cost from reduced crop production resulting from demand management in the estimated annual operating cost, which is approximately $54,000,000 per year or over 75% of the total annual cost provided.[38] The implementation schedule and expected benefit of each project was also considered in the modeling scenario used to develop interim milestones.[39] A review of the Annual Reports submitted to the Department shows progress on many of the projects.[40] For example, the GSAs report a cumulative total benefit of over 63,000 acre--feet from projects and management actions to date, with a benefit of 7,300 acre-feet for the latest reported water year.[41] With reporting of active progress toward project implementation, Department staff have increased confidence in the likelihood of the Plan to achieve the sustainability goal of the Subbasin.

Based on the information provided, Department staff think the Plan provides a reasonable description of the potential effects of undesirable results due to lowering of groundwater levels to domestic wells, generally the shallowest wells, and encourage the GSAs to continue development of the domestic well mitigation program and provide progress updates in Annual Reports. The GSAs should continue to progress projects and provide updates of observed benefits to the Department in Annual Reports. Department staff conclude that defining agreed upon undesirable results for the Subbasin and describing the potential effects of planned undesirable results that are likely to occur has sufficiently addressed component 1 of the corrective action.

4.2.2.2 Establishing Minimum Thresholds, Measurable Objectives, and Interim Milestones (2)

The Department's Incomplete Determination notified the GSAs that each Plan's varied descriptions and methods to establish minimum thresholds for chronic lowering of groundwater levels were not provided with sufficient supporting information to allow Department staff to evaluate whether the criteria were reasonable or whether operating

[37] Joint GSP (Redlined), Section 3.3.1.1, p. 295.
[38] Joint GSP (Redlined), Table 4-3, p. 366; Section 4.4.4.5, p. 409.
[39] Joint GSP (Redlined), Section 3.2.1.2, p. 270; Joint GSP, Appendix 6.D, pp. 2323-2326.
[40] Madera Subbasin Annual Reports, https://sgma.water.ca.gov/portal/gspar/submitted.
[41] Joint GSP Water Year 2022 Annual Report, pp. 57-58.

the Subbasin to avoid those thresholds is consistent with avoiding undesirable results—in part due to undesirable results being insufficiently defined in the Plan.

In response to the corrective action, the GSAs revised the chronic lowering of groundwater levels minimum thresholds to be set at the fall 2015 groundwater level measurement recorded at each representative monitoring site.[42] The Plan explains that the groundwater level minimum thresholds based on fall 2015 groundwater levels are consistent with the avoidance of significant and unreasonable impacts to other sustainability indicators.[43] The Plan states that the minimum thresholds will keep groundwater elevations generally above levels that have been experienced in the past, and that impacts to shallow well users and other beneficial users of groundwater will generally not exceed what has historically been experienced in the Subbasin.[44] Furthermore, the Plan explains that minimum thresholds established at fall 2015 groundwater levels are consistent with the avoidance of significant and unreasonable impacts for subsidence, water quality, and depletions of interconnected surface water.[45] The measurable objectives were revised to the fall 2010 groundwater levels which represents Subbasin conditions prior to the 2012 to 2015 drought period.[46]

Department staff believe that establishing minimum thresholds at the fall 2015 groundwater level is a reasonable approach. However, the GSAs intend to allow continued groundwater level declines during the 20-year implementation period based on the GSP's proposed interim milestones. The process to establish interim milestones is described as a "review and evaluation of measured groundwater level data and future projected fluctuations in groundwater levels during the GSP implementation period utilizing the numerical groundwater flow model, which simulated implementation of projects and management actions."[47] As a result, interim milestones were set to levels below minimum thresholds in years 2025, 2030, and 2035, prior to recovering by 2040 due to the implementation of projects and management actions.[48] Interim milestones for 2030 are the lowest groundwater elevations expected to occur during the GSP implementation period. When examining the hydrographs provided, Department staff note the 2030 milestones are frequently below historical lows.[49]

To successfully implement such a management program, GSAs are required to fully and thoroughly describe undesirable results that may occur prior to achieving sustainability, implement necessary projects and management actions to eliminate those undesirable results, and show measurable progress in annual reporting. The GSP provides information detailing how the proposed management of lowering groundwater levels

[42] Joint GSP (Redlined), Section 3.3.1, p. 293.
[43] Joint GSP (Redlined), Section 3.3.1.4, pp. 301-303.
[44] Joint GSP (Redlined), Section 3.3.1, pp. 293-294.
[45] Joint GSP (Redlined), Section 3.3.1.4, pp. 302-303.
[46] Joint GSP (Redlined), Section 3.2.1.1, pp. 269-270.
[47] Joint GSP (Redlined), Section 3.2.1.2, p. 270.
[48] Joint GSP (Redlined), Section 3.2.1.3, p. 271.
[49] Joint GSP (Resubmitted), Appendix 2.E.b, pp. 1243-1380; Gravelly Ford GSP (Redlined), Appendix G, pp. 218-224.

below minimum thresholds for an extended period will affect the interests of beneficial uses and users of groundwater in the Subbasin. As discussed above, during the period when interim milestones exceed minimum thresholds, the GSAs plan to implement a domestic well mitigation program to assist impacted users that effectively manages the effects of the undesirable results that are expected to occur; also, the Plan includes a suite of over 25 projects and management actions which the GSAs have reported progress on implementing in recent Annual Reports.

Based on a review of the information found in the resubmitted Plan and Annual Reports, Department staff conclude that at this time the GSAs have sufficiently addressed component 2 of the corrective action.

4.2.2.3 Describing How Minimum Thresholds Avoid Undesirable Results For Other Sustainability Indicators (3)

The Department's Incomplete Determination notified the GSAs that the GSPs require a description of how conditions at minimum thresholds avoid undesirable results for each applicable indicator.

In response to the corrective action, the GSAs revised the GSPs to include a discussion of the relationship between established minimum thresholds and undesirable results for other sustainability indicators. However, the GSP Regulations require the Department to evaluate whether the minimum thresholds and interim milestones are reasonable[50] and established in a manner to avoid undesirable results for each of the other sustainability indicators.[51] Department staff believe the lower interim milestones have the potential to cause undesirable results related to land subsidence, water quality, and interconnected surface water in the Subbasin. For example, the highest annual rate of subsidence was recorded between December 2012 and July 2014, when groundwater levels were declining to historical lows.[52] The GSAs should consider and disclose their understanding of the correlation between the declining groundwater levels and the maximum historical rate of subsidence while also describing the relationships between groundwater levels and the other applicable sustainability indicators. Department staff are concerned that impacts on other indicators (such as subsidence and water quality) may not recover in the same manner that groundwater levels may. Therefore, the GSAs should analyze how the groundwater levels at interim milestones will avoid causing undesirable results for other sustainability indicators (see Recommended Corrective Action 3).

Based on a review of the information found in the resubmitted Plan, Department staff conclude that the GSAs have taken sufficient action to address component 3 of the corrective action.

[50] 23 CCR § 355.4(b)(1).
[51] 23 CCR § 354.28(b)(2).
[52] New Stone GSP (Redlined), Section 3.2.6.1, p. 99.

4.2.3 Conclusion

At this time, Department staff believe the GSAs have taken sufficient action to address the deficiency identified. Department staff believe that having all the GSPs coordinated and establishing minimum thresholds at 2015 groundwater levels – in conjunction with the implementation of a well mitigation program and the projects and managements actions outlined in the Plan – to be a reasonable means of mitigating overdraft to achieve sustainability by 2040. However, Department staff note the GSAs intend to continue overdraft before 2040 based on the revised interim milestones, which after examining the hydrographs provided, are frequently below historical lows.[53] While SGMA and the GSP Regulations do not preclude undesirable results from occurring during Plan implementation, undesirable results cannot remain or continue after 20 years of Plan implementation. Department staff encourage the GSAs to continue with planning and implementation of the domestic well mitigation program to assist those users and uses of groundwater and other sustainability indicators (e.g., land subsidence, water quality, or interconnected surface water) that may be affected by lowering groundwater levels. The recommended corrective actions should also be considered by the next Periodic Evaluation for further advancement of the sustainable groundwater management in the Subbasin.

4.3 Deficiency 3. The Plan does not develop sustainable management criteria for land subsidence based on best available information and science.

4.3.1 Corrective Action 3

As described in the Department's GSP Assessment Staff Report released on September 22, 2022, Department staff determined that the GSAs do not sufficiently demonstrate that undesirable results related to land subsidence are not present and are not likely to occur in the Subbasin. The Department provided the following corrective actions for the Subbasin to consider and address the following:

1. Clarify and address the currently conflicting information in the Plan regarding what is known, qualified by the level of associated uncertainty, about the existence and impact of land subsidence.

2. The GSP should develop sustainable management criteria based on information in the basin setting and establish a monitoring network to adequately monitor conditions.[54] The basin setting should sufficiently detail the physical setting and characteristics of the Subbasin including descriptions of principal aquifers. the definable bottom of the Subbasin and identify data gaps and uncertainty within the

[53] Joint GSP (Resubmitted), Appendix 2.E.b, pp. 1243-1380; Gravelly Ford GSP (Redlined), Appendix G, pp. 218-224, New Stone GSP (Redlined), Figures 4-2 through 4-7, pp. 145-150; Root Creek GSP (Redlined), Figures 4-2 through 4-7, pp. 196-201.
[54] 23 CCR § 354.26.

hydrogeologic conceptual model. If applicable, data gaps monitoring and steps to fill data gaps before the next periodic assessment should be described.

4.3.2 Evaluation

To address the identified deficiency, the GSAs have supplemented portions of each Plan to develop sustainable management criteria and monitoring for land subsidence. Most of the supplemented material is provided in the Joint GSP and referenced by the other GSPs.

4.3.2.1 Clarifying Conflicting Information in the Plan (1)

The Department's Incomplete Determination notified the GSAs that the GSPs provided conflicting information related to whether significant and unreasonable land subsidence has occurred or will occur in the Subbasin.

In response to the corrective action, the GSPs acknowledge that significant and unreasonable land subsidence has historically occurred during periods with groundwater pumping in excess of the sustainable yield in areas where critical infrastructure exists and in the western areas that overlay the Lower Aquifer, where the Corcoran Clay exists.[55] Additionally, loss of groundwater storage and associated reduction in pore pressures in clay layers in the Lower Aquifer (indicated by lowering groundwater levels) is understood by all parties to lead to conditions that cause or exacerbate land subsidence.[56] Between 1926 and 1972, subsidence resulted in up to 4.0 feet of elevation change within the western portion of the Subbasin.[57] The highest rate of subsidence, also in western portion of the Subbasin, was 0.60 feet per year from December 2012 through July 2014.[58] The Plan also provides various maps documenting the location and extent of subsidence in the Subbasin.[59]

The Plan provides information about infrastructure that is susceptible to subsidence. Specifically, the Joint GSP provides an infrastructure sensitivity assessment of critical infrastructure including roads, railroads, highways, waterways, surface water conveyance structures, agricultural wells, domestic wells, public supply wells, and wastewater infrastructure. The assessment discusses impacts or interference with surface land uses and includes details such as proximity, orientation, and relative vulnerability to adverse effects of land subsidence.[60] Generally, the assessment states that the critical infrastructure were not anticipated to be impacted by future subsidence rates. For example, the GSP identifies the Chowchilla Bypass and the Eastside Bypass as critical infrastructure overlaying the Corcoran Clay, near an area of past documented subsidence; based on annual average subsidence rates from 2011 to 2017, the design profile and freeboard of the bypass will not be impacted by residual subsidence through

[55] Joint GSP (Redlined), Section 3.4.3, p. 325.
[56] Joint GSP (Redlined), Section 3.3.3.7, p. 313.
[57] Gravelly Ford GSP (Redlined), Section 2.2.2, p. 41.
[58] New Stone GSP (Redlined), Section 3.2.6.1, p. 99.
[59] New Stone GSP (Redlined), Figures 3-23 and 3-24, pp. 101-102.
[60] Joint GSP (Resubmitted), Appendix 3.G, pp. 1921-1953.

2026.[61] Additionally, for impacted wells, such as domestic wells, well owners are to be assisted by the domestic well mitigation program.[62] The GSP also states the GSAs are analyzing the potential to couple implementation efforts with the Subsidence Control Measures Agreement that is currently in effect in parts of the Chowchilla Subbasin near the Subbasin boundary.[63]

Based on a review of the information found in the resubmitted Plan, Department staff conclude that the GSAs have addressed component 1 of the corrective action.

4.3.2.2 Developing Sustainable Management Criteria and Monitoring Network (2)

The Department's Incomplete Determination notified the GSAs that the GSPs do not sufficiently demonstrate that undesirable results related to land subsidence are not present and are not likely to occur in the Subbasin.

In response to the corrective action, the GSPs establish revised, coordinated sustainable management criteria for the Subbasin to not allow subsidence once sustainability is achieved in 2040. With that the GSPs amended the minimum thresholds to 0 feet per year (ft/yr).[64] The Plan also identifies a total uncertainty of subsidence to be -0.16 ft/yr, meaning any amount of subsidence less than -0.16 ft/yr would be considered within the uncertainty of measurement and considered 0 ft/yr.[65] The Plan states that this minimum threshold is consistent with the sustainable management criteria for groundwater levels which seeks to keep levels above 2015 conditions by 2040.[66] The GSAs also revised the measurable objective rate to 0 ft/yr.[67] The Plan allows for minimum threshold exceedances throughout the duration of the implementation phase with the proposed interim milestones, which were revised based on two areas: areas of subsidence monitoring and areas of greater subsidence concern.[68] For areas of monitoring, interim milestones are established at -0.20 ft/yr by 2025, -0.13 ft/yr by 2030, -0.07 ft/yr by 2035, and 0 ft/yr by 2040 which are monitored by three survey benchmarks and one continuous GPS station. For areas of concern, interim milestones are established at -0.60 ft/yr by 2025, -0.40 ft/yr by 2030, -0.20 ft/yr by 2035, and 0 ft/yr by 2040 and monitored at three survey benchmarks. The established interim milestones are based on observed data with the highest rates (i.e., milestones to 2025) being slightly higher than actual subsidence rates experienced in the Subbasin between 2011 and 2016.[69] The Plan defines an undesirable result as occurring when "… the average subsidence across 75 percent or

[61] Joint GSP (Resubmitted), Appendix 3.G, p. 1932.
[62] Joint GSP (Resubmitted), Appendix 3.G, p. 1935.
[63] Joint GSP (Resubmitted), Appendix 3.G, p. 1933; Joint GSP (Redlined) Section 3.3.3.7, p. 312.
[64] Joint GSP (Redlined), Section 3.3.3, pp. 310-314.
[65] Joint GSP (Redlined), Section 3.3.3.1, p. 311.
[66] Joint GSP (Redlined), Section 3.3.1.4, p. 301.
[67] Joint GSP (Redlined), Section 3.2.3.1, p. 279.
[68] Joint GSP (Redlined), Section 3.2.3.2, pp. 279-280.
[69] Joint GSP (Redlined), Section 3.2.3.2, p. 280.

more RMS in the Subbasin (including RMS in all four GSP plan areas) exceeds the minimum threshold for two consecutive years."[70]

Department staff have identified areas for improvement in the GSAs' defined undesirable results. Specifically, the quantification of conditions that likely would cause undesirable results as when more than 75 percent of the representative monitoring sites in the Subbasin exceed threshold levels for two consecutive years is unsatisfactory, because the Plan does not explain how this threshold would avoid effects the GSAs have determined to be significant and unreasonable. On the contrary, the values and timing of exceedances appear to be arbitrary. Subsidence is prominent and likely to occur in western portions of the Subbasin in correlation with the presence of the Corcoran Clay. Two of the seven representative monitoring sites are located in that area of the Subbasin; using the current definition, localized subsidence could occur indefinitely without meeting the quantitative criteria for an undesirable result. Furthermore, when considering land subsidence, compacted sediments may not rebound alongside rising groundwater levels due to irreversible changes in the subsurface. Additionally, the Plan establishes two subsidence areas, as mentioned above, which the GSAs do not consider when establishing the quantitative metrics for an undesirable result (i.e., Department staff would expect more stringent metrics in the areas of greater subsidence concern as compared to the subsidence monitoring areas). These criteria should be considered when defining when and where undesirable results occur (see Recommended Corrective Action 4a)

While Department staff are encouraged by the updated sustainable management criteria, the Plan still does not identify a total (i.e., cumulative) amount of subsidence which would be considered significant and unreasonable. The interim milestones established using annual rates would allow for up to 6.5 feet of total subsidence by 2040. This appears inconsistent with the legislative intent of SGMA to avoid or minimize subsidence, and no adequate justification for allowing this amount of additional subsidence is provided in the GSP.[71] Considering the Subbasin has recently experienced subsidence and contains infrastructure that the GSP identifies as susceptible to subsidence, the GSAs should identify and disclose the cumulative amount of subsidence that can occur without causing significant and unreasonable impacts to the beneficial uses and users of groundwater, surface land uses, and property interests, all of which must be clearly defined. In establishing the cumulative amount of potential subsidence that could occur during GSP implementation, the GSAs should consider the conditions necessary to minimize or halt subsidence during GSP implementation and maintain those conditions once sustainability has been achieved on or before 2040. Based on the amount of subsidence anticipated between now and 2025, Department staff believe this does not preclude approval at this time. However, given that the Plan projects minimum threshold exceedances during implementation, which may likely result in undesirable results related to water levels, and the Plan intends for subsidence to be 0 ft/yr only by and after 2040, Department staff

[70] Joint GSP (Redlined), Section 3.4.3, p. 325.
[71] Water Code § 10720.1 (e).

recommend identifying and including a quantitative value for cumulative subsidence for minimum thresholds and other sustainability criteria related to subsidence by the first Periodic Evaluation (see Recommended Corrective Action 4b).

SGMA and the GSP Regulations indicate that for a basin to be sustainably managed, the basin must experience no undesirable results within 20 years of plan implementation and then throughout the planning and implementation horizon. Unlike other indicators, the legislature specifically indicated its intent that SGMA implementation avoid or minimize subsidence.[72] Unlike groundwater levels that may fall and then rise in a basin, subsidence can often be inelastic and permanent. This means that undesirable results from subsidence during plan implementation will likely still exist and persist to 2040 and beyond. For instance, subsidence that occurs during early Plan implementation that causes lasting impacts to infrastructure, like flood control structures, that substantially interferes with the infrastructure's operations and utility in 2040 and beyond, constitutes an undesirable result under SGMA. Department staff believe that the Plan's continued allowance of minimum threshold exceedances during the first 20 years of plan implementation (i.e., allowing further subsidence as a result of water level declines below historic lows at the interim milestones) and potential permanent impacts to surface infrastructure and uses is not consistent with the intent of SGMA to achieve sustainability and to avoid or minimize subsidence. The Plan should consider and provide details describing the current and potentially lasting impacts of subsidence on land uses and groundwater beneficial uses and users as described above in Recommended Corrective Action 4b.

The GSP Regulations require the Department to evaluate whether the minimum thresholds and interim milestones are reasonable[73] and established in a manner to avoid undesirable results for each of the other sustainability indicators.[74] Department staff believe the interim milestones below the minimum threshold have the potential to cause undesirable results related to other sustainability indicators which the GSAs also have a responsibility to avoid. For example, the Plan does not provide a discussion of how the subsidence milestones, that allow for continued subsidence and associated irreversible compaction of aquifer materials, relate to the reduction of groundwater storage or the degradation of water quality sustainability indicators. The GSAs should consider and disclose their understanding of this and other relationships between sustainability indicators. The GSAs should analyze whether or how the land subsidence rates at interim milestones will avoid causing undesirable results for other sustainability indicators (see Recommend Corrective Action 4c).

In the establishment of the minimum thresholds for land subsidence, the Plan describes the application of a level of uncertainty to measurements, claiming that the survey measurements have a vertical accuracy of plus or minus 2.5 centimeters. The Plan

[72] Water Code § 10720.1(e).
[73] 23 CCR § 355.4(b)(1).
[74] 23 CCR § 354.28(b)(2).

proposes adding these uncertainty values so that when two measurements are taken the Agencies consider the total uncertainty in subsidence to be 5 centimeters, which equals approximately -0.16 ft/yr. By this rationale, the Plan assumes that subsidence values less than 0.16 ft/yr are within the uncertainty of measurement and considered to be compliant with the minimum threshold of 0 ft/yr.[75] However, although there may be some uncertainty in subsidence measurements, the uncertainty does not necessarily mean that small measurements of subsidence within that range of uncertainty (or accuracy) should be ignored or mean that no subsidence is occurring. Department staff believe this approach of always rounding any annual subsidence measurements within the range of error to zero every year is inconsistent with standard practices. When multiple measurements are taken at the same location, they are compared to the same baseline measurement and, in turn, have the same single level of uncertainty. While it's understandable to build in an allowance for some level of uncertainty, it appears the Plan allows for the continued subsidence if the measured rate is equal to or less than 0.16 ft/yr. Department staff recommend the Plan revise its application of the level of uncertainty as it relates to subsidence measurements according to standard professional practices (see Recommended Corrective Action 4d).

The Plan acknowledges there are data gaps in assessing subsidence in the Subbasin and provides a workplan[76] which aims to provide sufficient data and analysis to fill data gaps, including enhancing monitoring and understanding relationships between land subsidence and groundwater levels at different depths within the western part of the Subbasin, improving quantification of groundwater pumping within Upper Aquifer and Lower Aquifer, and assessing the adequacy of the sustainable management criteria. Considering the Department provides quarterly updates for monthly InSAR subsidence data covering much of the Subbasin, the GSP should address or explain why the GSAs have decided to not utilize this reliable data source to assess whether management is causing significant and unreasonable effects to surface land uses. Department staff encourage these efforts and also recommend the GSAs take steps to address the recommended corrective actions by the next Periodic Evaluation of the Plan.

Based on a review of the information found in the resubmitted Plan, Department staff conclude that the GSAs have addressed component 2 of the corrective action.

4.3.3 Conclusion

Overall, Department staff believe the GSAs have taken sufficient action to address the deficiency identified. Staff conclude that the zero tolerance for land subsidence minimum thresholds and measurable objectives at the end of the implementation period in 2040 is commensurate with the understanding of SGMA. However, Department staff are concerned with the amount of subsidence that may occur during the implementation period and the potential undesirable results that may cause as a result of permanent impacts to infrastructure and surface land uses. The recommended corrective actions

[75] Joint GSP (Redlined), Section 3.3.3.1, p. 311.
[76] Joint GSP (Resubmitted), Appendix 3.H, pp. 1954-1968.

should be considered by the next Periodic Evaluation to more align with the intent of SGMA to avoid or minimize subsidence.

4.4 Deficiency 4. The Plan does not develop sustainable management criteria for the depletions of interconnected surface water based on best available information and science.

4.4.1 Corrective Action 4

As described in the Department's GSP Assessment Staff Report released on September 22, 2022, Department staff determined that the GSAs do not sufficiently demonstrate that interconnected surface water or undesirable results related to depletions of interconnected surface water are not present and are not likely to occur in the Subbasin. The Department provided the following corrective actions for the Subbasin to consider and address the following:

1. Clarify and address the currently conflicting information in the Plan regarding what is known, qualified by the level of associated uncertainty, about the presence and degree of interconnected surface water and, if applicable, the depletion of that interconnected surface water by groundwater use, including quantities, timing, and locations.[77]

2. If the GSAs cannot provide a sufficient, evidence-based justification for the absence of interconnected surface water, then they should develop sustainable management criteria, as required in the GSP Regulations[78] based on best available information and science. Evaluate and disclose, sufficiently and thoroughly, the potential effects of the Plan's sustainable management criteria for depletion of interconnected surface water on beneficial uses of the interconnected surface water and on groundwater uses and users. Additionally, development of sustainable management criteria must be supported by information in the basin setting and the GSAs must develop a monitoring network capable of collecting sufficient data to support analysis of the quantified spatial and temporal exchanges between surface water and groundwater that can be associated with groundwater pumping.

4.4.2 Evaluation

To address the identified deficiency, the GSAs have supplemented portions of the Plan to describe the basin setting, develop sustainable management criteria and monitoring for depletions of interconnected surface water.

4.4.2.1 Clarifying Conflicting Information in the Plan (1)

The Department's Incomplete Determination notified the GSAs that the GSPs provided conflicting information related to identifying the presence of interconnected surface water in the Subbasin.

[77] 23 CCR §§ 354.28(c)(6)(A-B).
[78] 23 CCR §§ 354.26, 354.28, 354.30.

In response to the corrective action, the GSPs revised the descriptions of groundwater—surface water interactions in the Subbasin, acknowledging that data indicates that the San Joaquin River appears to be in connection with groundwater during some periods and there is at least some potential for regional groundwater pumping to impact groundwater dependent ecosystems (GDEs) with roots extending down 20 to 30 feet along the San Joaquin River.[79]

The method the GSP used to determine the connectivity was to compare the historical regional aquifer groundwater elevations to stream thalweg (deepest portion of stream channel) elevations and assess stream seepage. The comparison of the groundwater levels and stream thalweg suggest the San Joaquin River was likely connected with groundwater from 1958 through 1984, but groundwater was about 10 to 50 feet below the thalweg from 1989 through 2016.[80] While this approach is sufficient to confirm the presence of a hydraulic connection, Department staff note groundwater levels dropping below the thalweg of the San Joaquin River would not be sufficient to prove surface water and groundwater are disconnected. This is because water from the river is still recharging the aquifer and may do so at a rate that would cause mounding in the local water table surrounding the river. The mounding in the water table may enable the river and aquifer to maintain a saturated hydraulic connection when groundwater levels drop well below the bottom of the river. Additionally, stream seepage indicates that during above normal and wet years, such as 2017 and 2019, groundwater is discharged to streams.[81] The GSP states that there are data gaps, and provides a workplan[82] which aims to provide sufficient data and analysis to fill data gaps, including making a more informed determination of whether or not interconnected surface water is present along the San Joaquin River, improving understanding of the relationship between streamflow and regional groundwater pumping, and providing an improved basis for setting sustainable management criteria if it is determined that interconnected surface water conditions exist.[83] At this time, Department staff conclude sufficient action has been taken on this deficiency and believe the GSAs can work with the Department to further efforts on interconnected surface water.

Based on a review of the information found in the resubmitted Plan, Department staff conclude that the GSAs have addressed component 1 of the corrective action.

4.4.2.2 Sustainable Management Criteria and Monitoring Network (2)

The Department's Incomplete Determination notified the GSAs that the GSPs do not sufficiently demonstrate that undesirable results related to depletions of interconnected surface water are not present and are not likely to occur in the Subbasin. Therefore, if the GSAs cannot provide a sufficient, evidence-based justification for the absence of

[79] Joint GSP (Redlined), Section 2.2.2.5, p. 120.
[80] Joint GSP (Redlined), Section 2.2.2.4, p. 118.
[81] Joint GSP (Resubmitted), Figure 2-76, p. 310.
[82] Joint GSP (Resubmitted), Appendix 3.I, pp. 1969-1981
[83] Joint GSP (Resubmitted), Appendix 3.I, p. 1971.

interconnected surface water, then they should develop sustainable management criteria, as required in the GSP Regulations.

In response to the corrective action, the GSPs established interim sustainable management criteria for depletions of interconnected surface water along the San Joaquin River. Specifically, the GSAs define an undesirable result occurring when greater than 30 percent of representative monitoring wells exceed their minimum thresholds for two consecutive five-year rolling averages.[84] Minimum thresholds are defined as the percent of time surface water and groundwater was connected over the historical period of 1989 to 2015. Measurable objectives and interim milestones are the same as minimum thresholds. Monitoring will be conducted annually using three monitoring sites.

The GSAs used a metric called "percent of time connected" to develop the interim sustainable management criteria for depletion of interconnected surface water.[85] In reviewing the information provided in the GSP, Department staff conclude that while developing sustainable management criteria for interconnected surface water is a substantial step forward in addressing the deficiency, the development of sustainable management criteria in the Plan is not consistent with the GSP Regulations. Reporting the percent of time connected does not provide adequate information to describe or evaluate the quantity and timing of depletions of interconnected surface water due to groundwater use, as required by the GSP Regulations.[86] As mentioned in Section 4.4.2.1, the GSAs prepared a work plan outlining an approach to fill these data gaps.[87] The work plan states the GSAs intend to compile and review pertinent existing data and reports, construct and install new monitoring facilities, collect additional field data, and conduct additional technical analysis. The purpose is to make a more informed determination of whether interconnected surface water is present along the San Joaquin River, to improve understanding of the relationships between streamflow, shallow groundwater levels, and regional groundwater pumping.[88] While the work plan states that the GSAs will potentially refine or modify the interim sustainable management criteria, it also indicates that the GSAs will continue using the metric of "percent of time connected" for sustainable management criteria[89] – a metric Department staff conclude is not appropriate in estimating timing and volume of interconnected surface water depletion and evaluating potential impacts to beneficial uses and users. The GSAs proposed to complete most of the tasks in the work plan by 2024 with the intent of including the early results in the first Periodic Evaluation.[90] Department staff are encouraged by the GSA's intent to increase data collection and fieldwork. At this time, Department staff conclude sufficient action has

[84] Joint GSP (Redlined), Section 3.4.5, p. 327.
[85] Joint GSP (Redlined), Section 3.2.5.1, p. 291, Section 3.3.5.1, p. 319.
[86] 23 CCR §§ 354.28(c)(6)(A), 354.28(c)(6)(B).
[87] Joint GSP (Resubmitted), Appendix 3.I, pp. 1969-1981.
[88] Joint GSP (Resubmitted), Appendix 3.I, pp. 1970-1971.
[89] Joint GSP (Resubmitted), Appendix 3.I, p. 1979.
[90] Joint GSP (Resubmitted), Appendix 3.I, p. 1980.

been taken on this deficiency and believe the GSAs can work with the Department to further efforts on interconnected surface water.

Based on a review of the information found in the resubmitted Plan, Department staff conclude that the GSAs have addressed component 2 of the corrective action.

4.4.3 Conclusion

Overall, Department staff believe the GSAs have taken sufficient action to address the deficiency identified.

Department staff understand that quantifying depletions of interconnected 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 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 GSAs 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 and establish sustainable management criteria based on timing, volume, and depletion as required by the GSP Regulations.

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, GSAs, where applicable, should consider incorporating appropriate guidance approaches into their future periodic updates to the GSP. 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. 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.

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 Basin 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, describing the plan area, and demonstrating the legal authority and ability of the submitting Agency to develop and implement a Plan for that area.[91]

The Madera Subbasin is bound by the San Joaquin River and Kings Subbasin in the south, Delta-Mendota Subbasin in the west, Chowchilla Subbasin in the north, and the foothills of Sierra Nevada in the east.[92] No adjudicated areas are shown on the maps provided in the GSP.[93] The Subbasin does not have any considerable federal lands or state-owned lands.[94]

The Subbasin is managed by seven groundwater sustainability agencies. Four of those seven groundwater sustainability agencies have developed the Madera Joint Groundwater Sustainability Plan, and the other three groundwater sustainability agencies developed individual groundwater sustainability plans.[95] The four GSPs that cover the entire Madera Subbasin are:

- Madera Joint Groundwater Sustainability Plan (Joint GSP)
- Gravelly Ford Water District Groundwater Sustainability Plan (Gravelly Ford GSP)
- New Stone Water District Groundwater Sustainability Plan (New Stone GSP)

[91] 23 CCR § 354.2 *et seq*.
[92] Joint GSP, Section 2.1, p. 63.
[93] Joint GSP, Section 2.1.1, p. 63, Figure 2-1, p. 64.
[94] Joint GSP, Section 2.1.1, p. 63. Note: Federal land includes primarily rights of way along canals conveying USBR Central Valley Project water. State land includes primarily California Department of Parks and Recreation land along San Joaquin River near Friant, California.
[95] Joint GSP, Table 1-4, p. 56.

- Root Creek Water District Groundwater Sustainability Plan (Root Creek GSP)

The four groundwater sustainability agencies that developed the Joint GSP collectively are:

- Madera County Groundwater Sustainability Agency
- City of Madera Groundwater Sustainability Agency
- Madera Irrigation District Groundwater Sustainability Agency
- Madera Water District Groundwater Sustainability Agency

The Joint GSP plan area represents 94% of the Madera Subbasin.[96] The Joint GSP provides information that is encompassing-of, relevant-to, and reiterated-in the other three groundwater sustainability plans and is often cited by Department staff when referencing information relevant to the entire Subbasin. Collectively, unless otherwise specified, the four GSPs are referred to as the Plan for the Subbasin.

The Gravelly Ford GSP boundaries are contiguous with the Gravelly Ford Water District and contain approximately 8,500 acres comprised of grape vineyards, tree groves, and rural residences.[97] The New Stone GSP boundaries are coterminous with the New Stone Water District boundaries, encompassing approximately 4,200 acres in the northwestern area of the Madera Subbasin. The New Stone Water District consists primarily of agriculture and two landowners.[98] The Root Creek GSP boundaries are the same as the Root Creek Water District boundaries and is located in the southeastern portion of the Madera subbasin—bounded on the south by San Joaquin River—with the majority of the land being used as agriculture.[99]

A map showing the Subbasin and adjacent subbasins is shown in Figure 1 below.

[96] Joint GSP, Table 1-2, p. 42.
[97] Gravelly Ford GSP, Section 1.1.1, p. 6.
[98] New Stone GSP, Executive Summary, p. 12.
[99] Root Creek GSP, Executive Summary, p. 13, Figure 2-5, p. 43.

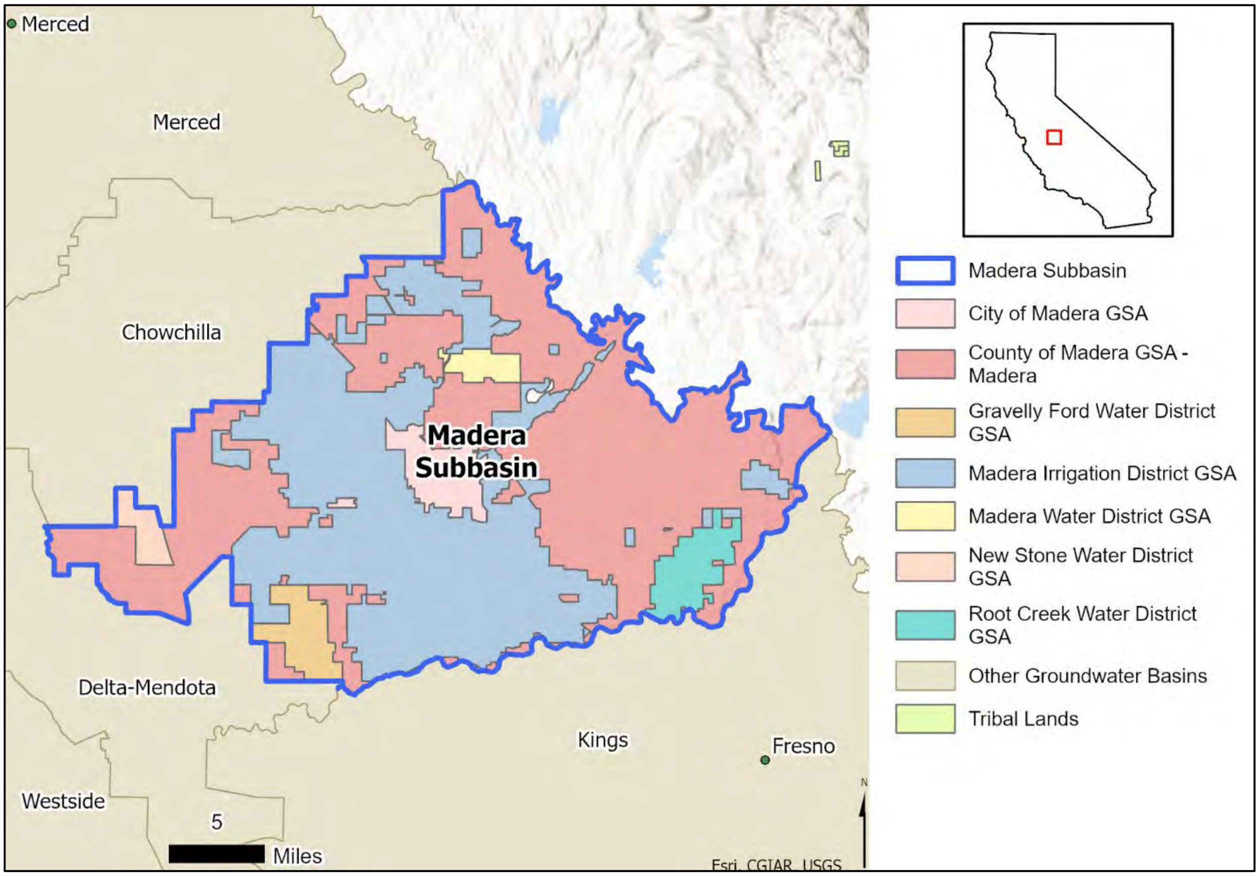

Figure 1. Madera Subbasin Location Map[100]

The land use areas in the Subbasin are broadly classified across three sectors: agricultural (including dairies), urban, and native vegetation.[101] The Plan includes a summary of land use stating irrigated agriculture is the most prominent land use in the Subbasin, covering approximately 213,000 acres.[102] For example, the New Stone GSP states that 100% of land use in the GSP is agricultural.[103] Native vegetation and water surfaces collectively were reported to cover the second highest acreage approximately 100,000 acres.[104] Urban area that includes cities, residential, and semi-agricultural cover approximately 36,000 acres.[105]

The water use source type was not independently presented for the entire Subbasin. For example, the Gravelly Ford GSP states an unquantified, small amount of groundwater pumping occurs for domestic use.[106] Instead, it is reported that the water source type is

[100] Joint GSP, Figure 2-1, p. 64.
[101] Joint GSP, Section 2.1.1, p. 65, Figure 2-2, p. 66.
[102] Joint GSP, Table 2-1, p. 68.
[103] New Stone GSP, Section 2.5.1, p. 38.
[104] Joint GSP, Table 2-1, p. 68.
[105] Joint GSP, Table 2-1, p. 68.
[106] Gravelly Ford GSP, Section 2.1.5, p. 21.

both groundwater and local surface water supplies, but groundwater appears to be the primary water source in the Subbasin.[107]

The Plan includes maps that depict the density of wells (domestic, agricultural, and public supply) by township range and section in Figure 2-5, Figure 2-6, and Figure 2-7 of the Joint GSP prepared from the Department's Well Completion Report Map Application.[108] The highest concentrations of reported domestic wells are centered primarily around the City of Madera and Bonadelle Ranchos-Madera Ranchos in the eastern portion of the Subbasin.[109] Reported irrigation wells are generally less concentrated and more evenly distributed across the Subbasin, though slightly higher concentrations are found in some areas within rural Madera County, Madera Irrigation District, and Root Creek Water District.[110]

The Plan describes existing water resource management programs operating in the Subbasin. The Joint GSP states the local agencies that have formed each of the Subbasin's groundwater sustainability agencies have prepared and adopted several water planning documents in the past, including Madera Integrated Regional Water Management Plan and Madera Regional Groundwater Management Plan. The Subbasin's other local water management plans, federal, state, and regional groundwater and surface water programs were discussed.[111] The Joint GSP states the existing water resource monitoring and management programs constitute a well-developed and broadly distributed system that provides representative data throughout the Subbasin that have been, and will be, incorporated into the Plan as appropriate.[112]

The Plan provides a list of public meetings where the Plan was discussed, including GSA board meetings, Coordination Committee meetings, stakeholder advisory committee meetings, and public workshops.[113] The GSPs include stakeholder communication and engagement plans to assist Subbasin groundwater sustainability agencies in their efforts to develop general and strategic communications to engage stakeholders in groundwater management activities.[114]

The Plan identifies beneficial uses and users of groundwater in the Subbasin. The various stakeholders identified are the general public, private water users, urban and agricultural water users, industrial water users, environmental and ecosystem water uses, tribes, federal lands and integrated regional water management groups.[115] The Plan describes the beneficial uses of groundwater in the Subbasin, which includes irrigation and drinking

[107] Joint GSP, Figure 2-2, p. 66.
[108] Joint GSP, Figures 2-5 through 2-7, pp. 171-173.
[109] Joint GSP, Section 2.1.1, p. 70.
[110] Joint GSP, Section 2.1.1, p. 70.
[111] Joint GSP, Section 2.1.2, pp. 70-77.
[112] Joint GSP, Section 2.1.2, pp. 70-77.
[113] Joint GSP, Section 2.1.5, pp. 83-90, Table A6.C-2, pp. 1768-1779.
[114] Joint GSP, Appendix 2.C.a, pp. 586-638; Gravely Ford GSP, Section 2.1.5, p. 22, New Stone GSP, Section 2.5.3 and 2.5.4, pp.39-40, Root Creek GSP, Section 2.5.3 to 2.5.4, pp. 73-75.
[115] Joint GSP, Table 2-5, pp. 85-86, Table A2.C.a-1, pp. 592-593.

water supply (i.e., municipal, urban, and rural).[116] According to the Joint GSP, each of the seven groundwater sustainable agencies in the Subbasin held regular public meetings, coordination committee meetings, and subbasin wide technical meetings.[117] For example, according to the Root Creek GSP,[118] engagement with the groundwater users occurred at the time of formation of GSAs, development of the draft GSP, finalization of the GSP and engagement will continue for the implementation of the GSP.[119]

Overall, Department staff believe the GSAs have thoroughly described Agency information, plan area, and notice and communication process, in substantial compliance with the GSP Regulations.

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.[120]

5.2.1 Hydrogeologic Conceptual Model

The GSP Regulations require a descriptive hydrogeologic conceptual model of the basin that includes a written description supported by cross sections and maps.[121] 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 GSA'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.[122]

The Plan provides a description of the hydrogeologic conceptual model documented in a 2017 technical memoranda[123] and qualified maps.[124] The Gravelly Ford GSP provided additional descriptions to the hydrogeological conceptual model using a 2018 report titled *Hydrogeologic Conceptual Model and Groundwater Conditions for the Gravelly Ford Water District GSP*,[125] which describes the physical components in the Gravelly Ford

[116] Joint GSP, Section 1, p. 40.
[117] Joint GSP, Section 2.1.5.3, p. 86.
[118] Root Creek GSP, Appendix 2-C, pp. 245-246.
[119] Root Creek GSP, Section 2.5.1, pp. 72-73.
[120] 23 CCR § 354.12 *et seq*.
[121] 23 CCR § 354.12 *et seq*.
[122] 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.
[123] Joint GSP, Section 2.2.1, pp. 90-96.
[124] Joint GSP, Figures 2-5 through Figure 2-46, pp. 171-211, Appendix 2.D, pp. 1078-1090.
[125] Gravelly Ford GSP, Appendix B, pp. 89-124.

GSP area, including, but not limited to, the principal aquifers,[126] surface water bodies,[127] and primary users of groundwater[128] in the Gravelly Ford GSP area.

The surface geology of the Subbasin is described predominantly as younger and older alluvium with subsurface deposits, from the surface to the bottom of the Subbasin, consisting of alluvium and unconsolidated continental deposits.[129] The Subbasin is depicted to be underlain by crystalline basement complex rocks of the Sierra Nevada.[130]

The lateral boundaries of the Subbasin are described as the hydrogeologic boundary created by the bedrock of the Sierra Nevada to the east; and the political boundaries of the Kings Subbasin to the south, Chowchilla Subbasin to the north, and Delta-Mendota Subbasin to the west.[131]

The Plan describes that the bottom of the Subbasin, throughout most of the Subbasin, is defined by the depth to the base of fresh water (groundwater with conductivity up to 3,000 micromhos per centimeter), except in the eastern portion where it is defined by the depth to basement rock.[132] However, the Plan states that there are wells screened below the defined base of fresh water while explaining these wells will likely have hydraulic connection with the overlying freshwater zone, so they are considered to be part of the Subbasin.[133] For example, cross-sections provided by the Joint GSP depict wells that extend below the bottom of the Subbasin.[134]

The Plan does not explicitly use the term principal aquifers to describe aquifers within the Subbasin, instead the Plan provides a description of aquifer systems present in the Subbasin. The Plan states that the Corcoran Clay underlies the western one-third of the Subbasin[135] and acts as a confining layer separating the upper unconfined aquifer from the lower confined aquifer.[136] The top of Corcoran Clay lies between 200 to 350 feet beneath the New Stone GSP area.[137] The Plan describes that the area outside of the Corcoran Clay, located in the central and eastern portions of the Subbasin, contains discontinuous clay layers interspersed with permeable coarse-grained units and is generally considered to be semi-confined. The semi-confined aquifer is further described as an upper semi-confined aquifer and a lower semi-confined aquifer (at an estimated depth ranging from 200 to 400 feet which generally correlates to the depth of the Corcoran Clay).[138] The Plan states the Subbasin contains areas of perched water. For example,

[126] Gravelly Ford GSP, Appendix B, p. 102.
[127] Gravelly Ford GSP, Appendix B, pp. 96-99.
[128] Gravelly Ford GSP, Appendix B, p. 107.
[129] Joint GSP, Section 2.2.1.1, p. 91.
[130] Joint GSP, Section 2.2.1.1, p. 91, Figure 2-19, p. 184.
[131] Joint GSP, Section 2.2.1.2, p. 91, Figure 2-17, p. 182.
[132] Joint GSP. Section 2.2.1.2. pp. 91-92, Figures 2-24 through 2-34, pp. 189-199.
[133] Joint GSP, Section 2.2.1.2, p. 92.
[134] Joint GSP, Figures 2-24 to 2-34, pp. 189-199.
[135] Joint GSP, Section 2.2.1.3, p. 93.
[136] New Stone GSP, Section 3.1.8, p. 60.
[137] New Stone GSP, Section 3.1.8, p. 60.
[138] Joint GSP, Section 2.2.1.3, pp. 93-94.

the Joint GSP states that the approximate location of the perched aquifers are six miles southeast of the City of Madera and ten miles northwest of the City of Madera; depths range from 3 to 27 feet southeast of the City of Madera, 100 feet within the City of Madera, and 105 to 130 feet northeast of Madera. Other sites with perched groundwater are believed to exist, but locations and depths are uncertain due to limited data.[139]

Department staff find that the Plan introduces uncertainty in the hydrogeologic conceptual model by identifying several aquifers in the Subbasin, but not directly defining any of these aquifers as principal aquifer(s). Additional details are provided below.

- The Plan identifies formations (i.e., Modesto, Riverbank, and Turlock Lake Formation - which contains the Corcoran Clay)[140] of the Subbasin but does not associate them with principal aquifer(s).
- The Plan describes the lateral and vertical boundaries of the Subbasin[141] but does not provide details that describe the lateral and vertical boundaries by principal aquifer. Also, the GSP does not provide sufficient details to support that east of the Corcoran Clay, the upper regional aquifer is semi-confined, instead of unconfined.
- The Plan does not provide a map depicting the source and point of delivery for imported waters.
- The Plan provides a description of water quality for total dissolved solids, nitrate, and arsenic along with maps of concentrations within the Subbasin.[142] None of the water quality data is identified by principal aquifer, although some of the data is identified by different aquifer descriptions such as upper, lower, shallow wells and deep wells.[143]

The Plan provides cross-sections that provide sufficient information to depict the major stratigraphic and structural features in the Subbasin. Physical characteristics of the Subbasin are depicted on various maps and figures. The cross-sections depict the base of freshwater, top of crystalline basement complex of the Sierra Nevada along the eastern portion of the Subbasin. Also shown is the upper aquifer and lower aquifer separated by the Corcoran Clay. Additionally, the GSP describes that east of the Corcoran Clay extent, the aquifer system is considered to consist of an upper semi-confined aquifer and a lower semi-confined aquifer;[144] however, the cross-sections show unconfined groundwater levels in the areas identified in the GSP as semiconfined.

The Plan does not explicitly identify data gaps and uncertainty concerning the hydrogeologic conceptual model as required by the GSP Regulations.[145] Department staff believe that a discussion regarding data gaps and uncertainty in the hydrogeologic

[139] Joint GSP, Section 2.2.2.1, p. 98.
[140] Joint GSP, Section 2.2.1.1, p. 91; Root Creek GSP, Section 3.1.2, p. 76.
[141] Joint GSP, Section 2.2.1.2, p. 91.
[142] Joint GSP, Section 2.2.2.3, pp. 102-104.
[143] Joint GSP, Appendix 2.E., pp. 1267-1321.
[144] Joint GSP, Section 2.2.1.1, p. 95.
[145] 23 CCR § 354.14(b)(5).

conceptual model, and plans to address data gaps is necessary, as lack of data and understanding of the physical characteristics of the subbasin may limit sustainable groundwater management (see Recommended Corrective Action 5).

5.2.2 Groundwater Conditions

The GSP Regulations require a written description of historical and current groundwater conditions for each of the six sustainability indicators and groundwater dependent ecosystems.[146]

Groundwater levels are currently declining across much of the Subbasin in both the unconfined and lower aquifer zones.[147] The current conditions are a continuation of historical trends of declining groundwater levels across much of the Subbasin that have been observed for at least the past 30 years.[148] In total, more than 500 hydrographs are included in the Plan covering varying timelines over the last 100 years. Hydrographs included in the Plan show two measurements per year over the well's entire period of record with the timeline beginning in 1945 or 1920.[149]

The Subbasin is also losing groundwater storage and has been since at least 1988 based on information provided in the Plan.[150] The Joint GSP includes a summary of various studies which utilized different specific yield values to estimate the total volume of groundwater storage loss ranging between 1,891,308 acre-feet to 3,073,376 acre-feet for the period 1988 to 2014 and 2,809,149 acre-feet to 4,564,868 acre-feet for the period 1988 to 2016.[151] This equates to an annual storage loss of 73,000 to 163,000 acre-feet per year since 1988. [152] The range in change in groundwater storage conditions result from five different specific yield estimates that vary from 5% to 12% for the Subbasin. The Joint GSP includes a summary table (Table 2-8) showing the total change of storage over two time periods: 1988 to 2014 and 1988 to 2016 based on five different specific yield values.[153]

The Plan identifies nitrate, total dissolved solid (TDS), and arsenic as the current key water quality constituents in the Subbasin. These three constituents were highlighted because they "have greater potential for presenting broader regional groundwater quality concerns extending beyond localized or site-specific contamination cases and are likely to reflect a range of potential contamination sources."[154] The New Stone GSP also states that salinity, chloride, specific conductance, and pesticides are constituents being detected in areas in the district; however, data available within and near the district indicates that levels of these constituents are generally below respective maximum

[146] 23 CCR § 354.16 (a-f).
[147] Joint GSP, Section 2.2.2.1, pp. 97-100.
[148] Joint GSP, Figures 2-56 and 2-57, pp. 221-222.
[149] Joint GSP, Appendix 2.E.b, pp. 1129-1266.
[150] Joint GSP, Section 2.2.2.2, p. 101.
[151] Joint GSP, Section 2.2.2.2, pp. 101-102, Table 2-8, p. 102.
[152] Joint GSP, Section 2.2.2.2, pp. 101-102, Table 2-8, p. 102.
[153] Joint GSP, Table 2-8, p. 102.
[154] Joint GSP, Section 2.2.2.3, p. 102.

contaminant limits (MCLs) for drinking water. [155] The Root Creek GSP also included an evaluation of other constituents historically present in the GSP area, and states that the evaluation of historical results indicate that the area generally has acceptable groundwater quality for agricultural use and drinking water.[156] The Plan includes more than 50 maps displaying chemical concentrations for the key water quality constituents and other chemicals.[157]

Land subsidence has occurred and continues to occur in the Subbasin. The Joint GSP includes a written description detailing land subsidence over three time periods: 1926 to 1970, 2007-2011, and 2015-2017. [158] The discussion in the GSP focuses on the northwestern portion of the Subbasin where 1 to 2 feet of land subsidence occurred between 1926 and 1970, 0.5 to 1.0 feet occurred between 2007 and 2011, and 1.0 to 1.5 feet between 2015 and 2017.[159] The New Stone GSP states the subsiding area near El Nido is approximately 25 miles in diameter and its outer reach extends to the Plan area and the western area of the Subbasin.[160] United States Bureau of Reclamation monitoring point 1007R located on the western boundary of Plan area has indicated an annual subsidence rate ranging from 0.09 to 0.60 feet per year since December 2011 with the highest annual rate occurring from December 2012 through July 2014. [161] The Plan includes maps displaying both historical and current land subsidence.[162] Department staff provide information relevant to this in Section 4.3.

Interconnected surface water potentially exists in localized areas along the San Joaquin River within the Subbasin based on an analysis of comparing groundwater levels to the stream thalweg.[163] Based on this analysis, there were also additional portions of the San Joaquin River that were connected with groundwater historically (from 1958 to 1984) but may no longer be connected due to declining groundwater levels.[164] The Joint GSP states characterization of hydrogeologic conditions related to the potential for interconnected surface water is currently based on very limited data and, therefore, additional data collection and analyses are needed to update and refine the understanding of how surface water and GDEs may (or may not) be connected to the regional aquifers where groundwater pumping occurs.[165] Department staff provide information relevant to this in Section 4.4.

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[155] New Stone GSP, Section 3.2.5, pp. 77-79.
[156] Root Creek GSP, Section 3.2.6, pp. 120-125.
[157] Joint GSP, Appendix 2.E, pp. 1268-1321; Root Creek GSP, Figures 3-27 through 3-29, pp. 121-123.
[158] Joint GSP, Section 2.2.2.4, p. 105.
[159] Joint GSP, Section 2.2.2.4, p. 105, Figures 2-67 through 2-70, pp. 232-235.
[160] New Stone GSP, Section 3.2.6.1, p. 82.
[161] New Stone GSP, Section 3.2.6.1, p. 82.
[162] New Stone GSP, Figures 3-23 and 3-24, pp. 84-85.
[163] Joint GSP (Redline), Section 2.2.2.5, p. 118.
[164] Joint GSP, Section 2.2.2.5, p. 105.
[165] Joint GSP (Redline), Section 2.2.2.5, p. 121.

The Plan identifies four areas within the Subbasin as “Potential GDE Units”.[166] The Joint GSP includes a technical memorandum that provides additional information about each of the four Potential GDE Areas including a series of maps, identification of potential GDE species, and a description of GDE conditions in the Subbasin.[167]

Overall, the Plan sufficiently describes the historical and current groundwater conditions throughout the Subbasin and the information included in the Plan substantially complies with the requirements outlined in the GSP Regulations.

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, and the change in the volume of water stored, as applicable.

The seven GSAs in the Subbasin use the data and analysis provided in the Technical Memorandum: Data Collection and Analysis (Davids engineering and Luhdorff & Scalmanini Consulting Engineers, July 2017) and the Draft Preliminary Basin Boundary Water Budget (Davids engineering and Luhdorff & Scalmanini Consulting Engineers, February 2018).[168] These documents were used to develop the Subbasin’s water budget.[169] The water budget described in the Joint GSP presents a water budget for the entire Plan area, including annual water budget information for Gravelly Ford GSP, New Stone GSP, and Root Creek GSP; the Gravelly Ford GSP, New Stone GSP, and Root Creek GSP also reference the water budget information in the Joint GSP.[170] Detailed information is provided for all seven GSAs in Appendix 6.D of the Joint GSP.[171] An assessment of the information is provided below.

The water budgets contain a surface water system and a groundwater system (referred to as accounting centers) for the entire Subbasin. The Plan clearly lists the inflow, outflow, and change in storage components for each accounting center.[172] This framework is applied to the current, historical, and projected budgets.

The period 1989-2014 is used as the base period for both the historical and current water budget and represents average hydrologic conditions based on cumulative departure from mean precipitation.[173] The average annual change in storage is calculated as -34,200 acre-feet per year[174] for the historical budget. The overdraft estimate for the current water budget is -93,276 acre-feet, calculated using an average of historical

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[166] Joint GSP, Section 2.2.2.6, p. 107.
[167] Joint GSP, Appendix 2.B, pp. 518-584.
[168] Madera Subbasin Coordination Agreement, p. 12.
[169] Joint GSP, Section 2.2.3.1, p. 114.
[170] Joint GSP, Appendix 2.F, pp. 1322-1620.
[171] Joint GSP, Appendix 6.D, pp. 2012-2175.
[172] Joint GSP, Table 2-10, p. 117.
[173] Joint GSP, Section 2.2.3.2, pp. 122-123, Figures 2-81 and 2-82, p. 124.
[174] Joint GSP, Table 2-26, p. 159.

hydrologic conditions from 1989-2014 with 2015 land use data.[175] The information presented indicates that change in storage is positive only during wet years at a volume of 122,900 acre-feet. All other years indicate decreases in storage ranging from -82,700 to -230,400 acre-feet.[176]

Sustainable yield is calculated for the historical and projected water budgets.[177] As reported in the Plan, the historical sustainable yield for the Subbasin is 437,300 acre-feet per year.[178] The projected sustainable yield for the Subbasin is 439,300 acre-feet per year with a lower bound of 329,500 acre-feet per year and upper bound of 549,100 acre-feet per year.[179] The projected sustainable yield was calculated only for the sustainability period 2040-2090 with the reasoning that ongoing projects and demand management during the implementation period (2020-2039) will continually shift sustainable yield as project efficacy is evaluated.[180] The similarity of historical and projected sustainable yields suggests the sustainable yield during the implementation period would not differ appreciably from these estimates.

Department staff conclude the historical, current, and projected water budgets included in the Plan substantially comply with the requirements outlined in the GSP Regulations. The GSP 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 and projected future water demands.

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.[181]

No management areas were designated per the information provided in the Plan.

5.3 Sustainable Management Criteria

The 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

[175] Joint GSP, Table 2-30, p. 163.
[176] Joint GSP, Table 2-33, p. 165.
[177] Joint GSP, Section 2.2.3.4, pp. 166-167.
[178] Joint GSP, Table 2-34, p. 167.
[179] Joint GSP, Table 2-35, p. 168.
[180] Joint GSP, Section 2.2.3.4, p. 167.
[181] 23 CCR § 345.20.

characterizes undesirable results and establishes minimum thresholds and measurable objectives for each applicable sustainability indicator.[182]

5.3.1 Sustainability Goal

The GSAs establish a sustainability goal for the Subbasin in the Coordination Agreement which is to "…implement a package of projects and management actions that will, by 2040, balance long-term groundwater system inflows and outflows based on a 50-year period representative of average historical hydrologic conditions."[183] The Joint GSP explains that during the 20-year implementation period a combination of recharge projects, replacing groundwater use with surface water, and demand reduction management actions are planned. These efforts will "increase groundwater inflows and decrease groundwater outflows to bring the groundwater system into balance by 2040 and will allow its operation to remain sustainable over a 50-year period representing average hydrologic conditions."[184]

Each GSP also provides additional specific information describing the goal for each GSP area. For example, the Gravelly Ford GSP describes the sustainability goal for the Subbasin as "…to minimize the listed undesirable results throughout the Subbasin by providing a Gravelly Ford GSP water supply that supports current cultivated acreage in the Plan area by developing an expanded surface water irrigation and recharge program, and groundwater monitoring and land elevation measurement program."[185] The New Stone GSP states that "[t]he goal for the GSP is to provide a tool for managing groundwater, basin-wide, on a long-term basis and to meet measurable objectives for each indicator by maintaining a sustainable yield, thus avoiding undesirable results."[186] The Root Creek GSP explains that the sustainability goal is to work collectively with the other GSAs within the Subbasin to "sustainably manage the groundwater resources of the basin while maintaining openness to the public and stakeholders such that local citizenry has a voice in the outcome."[187] Additionally, the goal of the Root Creek GSP is to "immediately reduce and eventually eliminate systematic overdraft within the [GSP] area.[188] While, specifying how each GSP will support the Subbasin sustainability goal within its' GSP area is an appropriate level of detail for each GSP, Department staff recommend the GSAs continue to coordinate and align this portion of each GSP to provide a more cohesive definition between the specific GSP goal and the sustainability goal for the Subbasin (see Recommended Corrective Action 2).

[182] 23 CCR § 354.22 *et seq*.
[183] Madera Subbasin Coordination Agreement, p. 34.
[184] Joint GSP, Section 3.1.2, p. 244.
[185] Gravelly Ford GSP, Section 3.1, p. 48.
[186] New Stone GSP, Section 4.1, p. 110.
[187] Root Creek GSP, Section 4.1, p. 157.
[188] Root Creek GSP, Section 1.2, p. 17.

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.[189] 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[190] – 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.

The following subsections 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 basin, as quantified through the establishment of minimum thresholds, are addressed for each sustainability indicator. However, a GSA is not required to establish criteria for undesirable results that the GSA can demonstrate are not present and are not likely to occur in a basin.[191]

5.3.2.1 Chronic Lowering of Groundwater Levels

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.[192]

In the September 2022 Incomplete Determination, the Department identified deficiencies related to the sustainable management criteria for the chronic lowering of groundwater levels. The GSAs revised this portion of the Plan, and Department staff evaluate this sustainability indicator in Section 4.2 of this Staff Report. As presented above, Department staff concluded that the GSAs took sufficient action to correct this deficiency to warrant approving the Plan, but staff also provided recommended corrective actions based on the changes the Agencies have made to the sustainable management criteria for this sustainability indicator to further improve management during Plan implementation.

[189] 23 CCR § 351(ah).
[190] Water Code § 10721(x).
[191] 23 CCR § 354.26(d).
[192] 23 CCR § 354.28(c)(1).

5.3.2.2 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 basin's sustainable yield, calculated based on the basin's historical trends, water year type, and projected water use.[193]

The Plan states groundwater levels act as a proxy for the groundwater storage sustainability indicator and the sustainable management criteria for reduction in groundwater storage are the same as those established for chronic lowering of groundwater levels.[194] Department staff will evaluate and compare the groundwater level conditions and reduction of storage in Annual Reports submitted to the Department. Department staff expect the information will be reported on a per aquifer basis given the groundwater level monitoring network identifies which aquifer the representative monitoring site is monitoring.

5.3.2.3 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.[195]

As stated in the Plan, seawater intrusion sustainability criteria are not applicable to the Subbasin, because it is located more than 70 miles inland and hydraulically disconnected from the ocean.[196]

5.3.2.4 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 thresholds 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.[197]

The GSP states that "an undesirable result for degraded groundwater quality occurs when groundwater quality exceeds an established MCL and minimum threshold for arsenic, nitrate, or TDS [total dissolved solids] for a significant duration of time and at a significant number of representative monitoring sites and is the direct result of projects or management actions undertaken as part of the GSP implementation."[198] More

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[193] 23 CCR § 354.28(c)(2).
[194] Joint GSP, Section 3.4.2, pp. 277-278.
[195] 23 CCR § 354.28(c)(3).
[196] Joint GSP, Section 3.2.6, p. 259.
[197] 23 CCR § 354.28(c)(4).
[198] Joint GSP, Section 3.4.4, p. 279.

specifically, a “significant duration of time” is defined as “a three-year monitoring period” and a “significant number of representative monitoring sites” is defined as “greater than 10 percent of representative groundwater quality monitoring wells exceeding a minimum threshold for a given constituent.”[199] This definition is overly narrow. SGMA specifies that the significant and unreasonable effects are those “caused by groundwater conditions occurring throughout the basin” not just from groundwater management activities. By solely focusing on water quality impacts caused directly by the GSAs implementing an action, the GSP does not define undesirable results for degraded water quality in accordance with the SGMA. SGMA’s definition of undesirable results includes “significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.”[200] As currently defined in the Plan, 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 in the Subbasin, but the GSAs have not determined this to be a result of a project or management action, the GSAs would not identify this as an undesirable result. 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, changes in groundwater levels, changes in the direction of groundwater flow, or changes in horizontal or vertical movement of groundwater within the Subbasin should be considered in the assessment of undesirable results in the Subbasin. Department staff recommend the GSAs revise the definition of their overly-narrow definition of undesirable results such that groundwater pumping and other factors, whether due to action or inaction of the GSAs with respect to Subbasin management, is considered and not excluded in the undesirable result definition (see Recommended Corrective Action 6a).[201]

Significant and unreasonable degradation of water quality is defined as “when beneficial uses for groundwater are adversely impacted by constituent concentrations increasing to levels above the drinking water MCLs for one of the key constituents of interest …due to implementation of a GSP project or management action.”[202] Though the definition provided appears to consider specific effects of degradation of groundwater quality, the GSP does not provide details that explain how the GSAs determined what “adversely impacted by constituent concentrations” means. Additionally, the GSP does not provide descriptions, supported by analysis, of the potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results. The GSAs should update the definition of undesirable results to include specific scenarios the GSAs are trying to avoid (e.g., additional cost to domestic well users for well treatment, decrease in water available

[199] Joint GSP, Section 3.4.4, p. 279.
[200] Water Code § 10721(x).
[201] 23 CCR § 354.26 (b)(2).
[202] Joint GSP, Section 3.4.4, p. 279.

for certain beneficial uses, etc.). Department staff recommend that the GSAs refine the definition to better describe the specific significant and unreasonable effects related to degraded water quality the GSAs are managing to avoid (see Recommended Corrective Action 6b).

The GSP provides a description of potential causes of an undesirable result, limited to direct effects of GSP projects or management actions, such as localized pumping clusters (which would particularly affect areas prone to elevated arsenic concentrations occurring at greater pumping water level depths)[203] and groundwater recharge which particularly affect areas of actively or formerly cultivated lands where high residual concentrations of nutrients, especially nitrogen, may exist.[204]

The GSP establishes the minimum thresholds for degraded water quality at the "[maximum contaminant level (MCLs)] for drinking water for identified key constituents (10 mg/L for nitrate as nitrogen; 500 mg/L for TDS; 10 ug/L for arsenic) or when existing or historical concentrations for the key constituents already exceed the MCL, the minimum threshold is set at the recent concentration plus 20 percent."[205] Measurable objectives are set at current constituent concentrations.[206] However, the GSP does not identify which wells have had exceedances in the past or provide the current constituent concentrations in the Plan. The GSP also states "significant and unreasonable degradation of water quality occurs when beneficial uses for groundwater are adversely impacted by constituent concentrations increasing to levels above the drinking water MCLs,"[207] but the GSP does not explain or justify setting minimum thresholds at 20 percent above MCLs, or demonstrate that these increased levels would not adversely impact beneficial uses and users of water. Department staff are not aware of specific concerns regarding degraded water quality that warrant immediate action based on what is provided in the Plan; however, staff believe the GSAs should identify the exact minimum threshold values what will be used and justify how establishing minimum thresholds at the higher of either MCLs or existing concentrations plus 20 percent does not constitute significant and unreasonable effects as defined by the GSP (i.e., "when beneficial uses for groundwater are adversely impacted by constituent concentrations) (see Recommended Corrective Action 6c).

5.3.2.5 Land Subsidence

SGMA defines the undesirable result for subsidence to be significant and unreasonable land subsidence that substantially interferes with surface land uses, caused by groundwater conditions occurring throughout the basin.[208] The GSP Regulations require the minimum threshold for land subsidence to be the rate and extent of subsidence that

[203] Joint GSP, Section 3.4.4, pp. 279-280.
[204] Joint GSP, Section 3.4.4, p. 280.
[205] Joint GSP, Section 3.3.4, p. 271.
[206] Joint GSP, Section 3.4.2.1, p. 253.
[207] Joint GSP, Section 3.4.4, p. 271.
[208] Water Code § 10721(x)(5).

substantially interferes with surface land uses and may lead to undesirable results.[209] Minimum thresholds for subsidence shall be supported by the identification of land uses and property interests that have been affected or are likely to be affected by land subsidence in the basin, including an explanation of how the Agency has determined and considered those uses and interests, and the Agency's rationale for establishing minimum thresholds in light of those effects and maps and graphs showing the extent and rate of land subsidence in the basin that defines the minimum threshold and measurable objectives.[210]

In the September 2022 Incomplete Determination, the Department identified deficiencies related to the sustainable management criteria for land subsidence. The GSAs revised this portion of the Plan and Department staff provide evaluation for this sustainability indicator in Section 4.3 of this Staff Report. As presented above, Department staff concluded the GSAs had taken sufficient actions to correct the deficiencies and provided additional recommended corrective actions based on the changes the Agencies have made to the sustainable management criteria for this sustainability indicator to further improve basin management as the Plan is implemented.

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.[211] 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.[212] The GSP Regulations further require that minimum thresholds be set based on the rate or volume of surface water depletions caused by groundwater use, supported by information including the location, quantity, and timing of depletions, that adversely impact beneficial uses of the surface water and may lead to undesirable results.[213]

In the September 2022 Incomplete Determination, the Department identified deficiencies related to the sustainable management criteria of depletions of interconnected surface water. The GSAs revised this portion of the Plan and Department staff provide evaluation for this sustainability indicator in Section 4.4 of this Staff Report. As presented above, Department staff concluded the GSAs had taken sufficient actions to correct the deficiencies and provided additional recommended corrective actions based on the changes the Agencies have made to the sustainable management criteria for this sustainability indicator.

[209] 23 CCR § 354.28(c)(5).
[210] 23 CCR §§ 354.28(c)(5)(A-B).
[211] Water Code § 10721(x)(6).
[212] 23 CCR § 354.16(f).
[213] 23 CCR § 354.28(c)(6).

5.4 Monitoring Network

The GSP Regulations describe the monitoring network that must be developed for each basin including monitoring objectives, monitoring protocols, and data reporting requirements. Collecting monitoring data of 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.[214] Specifically, a monitoring network must be able to monitor impacts to beneficial uses and users,[215] monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds,[216] capture seasonal low and high conditions,[217] include required information such as location and well construction, and include maps and tables clearly showing the monitoring site type, location and frequency.[218] Department staff encourage GSAs to collect monitoring data as specified in the GSP, fill data gaps identified in the GSP prior to the first 5 year update,[219] update monitoring network information as needed, follow monitoring best management practices,[220] 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. 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.

Each GSP identifies a distinct monitoring network that measures groundwater elevations for assessment of chronic lowering of groundwater levels. The Joint GSP identifies 37 monitoring wells with 11 wells in the Upper Aquifer, 22 wells in the Lower Aquifer, and four composite wells screened in both aquifers.[221] The Joint GSP acknowledges the spatial coverage of the monitoring network for the Upper Aquifer is limited to the southwestern portion of the GSP area.[222] The Gravelly Ford GSP states that two different groups of wells are currently being used for monitoring chronic lowering of groundwater levels; one with a network of 24 wells and another network of four wells from outside the GSP area to compare future measurements.[223] However, the Gravelly Ford GSP does not specify which aquifer the wells are monitoring. The New Stone GSP monitoring network includes six monitoring wells comprised of three California Groundwater Elevation Monitoring Program (CASGEM) monitoring sites and three district wells that will

[214] 23 CCR § 354.32.
[215] 23 CCR § 354.34(b)(2).
[216] 23 CCR § 354.34(b)(3).
[217] 23 CCR § 354.34(c)(1)(B).
[218] 23 CCR §§ 354.34(g)-(h).
[219] 23 CCR § 354.38(d).
[220] Department of Water Resources, 2016, Best Management Practices and Guidance Documents.
[221] Joint GSP, Section 3.5.1, p. 281.
[222] Joint GSP, Section 3.5.1, p. 282.
[223] Gravelly Ford GSP, Section 3.5.1, pp. 57-58.

be monitoring the unconfined aquifer and confined aquifer respectively.[224] The Root Creek GSP states that the GSA will use the five wells in the monitoring network within the single aquifer that underlies the GSP area.[225]

The Plan proposes to use groundwater levels and the groundwater level monitoring network as a proxy for the loss of groundwater in storage monitoring network because changes in groundwater storage are directly dependent on changes in groundwater levels.[226]

The groundwater quality monitoring network in the Joint GSP consists of 12 monitoring sites selected from the GSP groundwater level monitoring network.[227] Of these wells, two are screened in the Upper Aquifer, eight in the Lower Aquifer, and two are composite wells screened in both.[228] Additionally, two domestic wells from the Irrigated Lands Regulatory Program, and thirteen public supply wells with ongoing monitoring conducted by other entities are also part of the representative monitoring sites but the GSP does not identify which aquifers the wells are completed in.[229] The Gravelly Ford GSP states groundwater quality samples will be collected from 24 wells throughout the district and the samples will be collected once a year.[230] The New Stone GSP states the GSA will use the three district wells that monitor the confined aquifer.[231] The Root Creek GSP states that degraded water quality will be monitored from 17 sites throughout the GSA's area of the Subbasin which includes municipal wells, monitoring wells associated with the Riverstone wastewater treatment plant, agricultural wells used in the GSP, and wells associated with CASGEM.[232] The Plan states that several agencies monitor and regulate water quality in the Subbasin and the GSAs will collect and review the data published by these agencies, which include the Regional Water Quality Control Board, Environmental Protection Agency, Department of Toxic Substance Control, Madera County, United States Geological Survey, and State Water Resources Control Board.[233]

The land subsidence monitoring network in the Joint GSP is comprised of six benchmark survey points monitored by the United States Bureau of Reclamation as part of the San Joaquin River Restoration Program (SJRRP) and one continuous GPS station monitored by UNAVCO as part of the Plate Boundary Observatory Project.[234] Two of the benchmark survey points are underlaid by the Corcoran Clay, where subsidence is of most concern. Representative monitoring site 1007R, a benchmark survey point which is located on the

[224] New Stone GSP, Section 5.2.1, pp. 133-134.
[225] Root Creek GSP, Section 5.2.1, p. 191.
[226] Joint GSP, Section 3.5.1.2, p. 286; Gravelly Ford GSP, Section 3.5, p. 59; New Stone GSP, Section 5.3.1, p. 138; Root Creek GSP, p. 196.
[227] Joint GSP, Section 3.5.1.4, p. 287.
[228] Joint GSP, Figure 3-2, p. 300.
[229] Joint GSP, Section 3.5.1.4, p. 287.
[230] Gravelly Ford GSP, Section 3.5.1, p. 58.
[231] New Stone GSP, Section 5.5.1, p. 139, Figure 5-1, p. 137.
[232] Root Creek GSP, Section 5.4.1, pp. 199-201.
[233] Root Creek GSP, Section 5.4.1, p. 199.
[234] Joint GSP (Redlined), Section 3.2.3.2, p. 279, Figure 3-10, p. 360.

western edge of the New Stone GSP area, has reported the most severe rate of recent subsidence in the Subbasin.[235] The Plan states that all SJRRP and UNAVCO sites will be used to monitor for subsidence in the area and monitoring stations outside the Subbasin will be used to provide regional context. The Root Creek GSP also provides a list of subsidence monitoring done by other agencies such as USGS, DWR, USACE which will be used to verify the Plan's monitoring network.[236] The Gravelly Ford GSP subsidence monitoring program will be expanded by the district to include observations on all the 24 monitoring sites in the GSP area, at a period of three to five years, with some wells observing the Lower Aquifer.[237] See Section 4.3.2 for further evaluation of the Plans sustainable management criteria and monitoring network for land subsidence.

Interconnected surface water is evaluated by monitoring groundwater levels at three wells[238] screened in the Upper Aquifer near the San Joaquin River. The Joint GSP explains the representative monitoring sites include a combination of irrigation and monitoring wells with data representing surface water-groundwater interconnection trends from 1989.[239] Streamflow data from gaging stations is also collected and will be used in future studies and evaluations of interconnected surface water, including generating data to better estimate groundwater basin conditions related to interconnected surface water[240] (also see Section 4.4.2).

The description of the monitoring in the Plan substantially complies with the requirements outlined in the GSP Regulations. Overall, the Plan describes in sufficient detail a monitoring network that promotes the collection of data of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the Subbasin and evaluate changing conditions that occur through Plan implementation. The GSP provides a good explanation for the conclusion that the monitoring network is supported by the best available information and data and is designed to ensure adequate coverage of sustainability indicators. The Plan also describes existing data gaps and the steps that will be taken to fill data gaps and improve the monitoring network. Department staff consider the information presented in the Plan as satisfying the general requirements of the GSP Regulations regarding monitoring networks, but also provide recommended corrective actions related to managing and monitoring land subsidence (see Recommended Corrective Action 4).

[235] New Stone GSP (Redlined), Section 3.2.6.1, p. 99, Figure 5-2, p. 185.
[236] Root Creek GSP (Redlined), Section 5.5.1, pp. 266-267, Section 5.5.3, p. 268.
[237] Gravelly Ford GSP (Redlined), Section 3.5.1, p. 76, Section 3.5.4.2, p. 77.
[238] Joint GSP (Redlined), Figure 3-4, p. 352, Section 3.5.1.5, p. 336.
[239] Joint GSP (Redlined), Section 3.5.1.5, p. 336, Section 3.2.5, p. 288.
[240] Joint GSP (Redlined), Section 3.5.1.5, p. 336.

5.5 PROJECTS AND MANAGEMENT ACTIONS

The GSP Regulations require a description of the projects and management actions the GSAs have determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin.[241]

The Plan lays out the projects which were selected by the GSAs to achieve the Subbasin sustainability goal by 2040.[242] Generally, the projects are supply augmentation (i.e., recharge or conveyance enhancement) projects which source water from flood releases, Section 215 water, bypass flows, or water purchases. While the total cost of project implementation is not provided, the estimated costs provided in each individual GSP total to over $270,000,000 in capital costs and over $70,000,000 in annual costs; Department staff note that the GSAs have also included an estimated economic cost from reduced crop production resulting from demand management in the estimated annual operating cost, which is approximately $54,000,000 per year or over 75% of the total.[243] Many of the projects are currently being implemented, having been initiated by past efforts, or will be implemented by 2040. The total expected benefit is 215,840 acre-feet per year[244] at full implementation with the majority of the benefit deriving from a demand management program led by the Madera County GSA which will conserve 90,000 acre-feet per year. Madera County determined that projects were unlikely to generate enough benefit to offset the estimated current and projected future overdraft conditions and decided to implement a management action to gradually reduce groundwater pumping over the GSP implementation period.[245] The demand management effort started in 2020 with 2% demand reduction per year until 2025. Starting in 2026, the demand reduction increases to a 6% reduction rate until 2040.[246]

Since the submission of the Plan in 2020, the GSAs have provided Annual Reports to the Department that provide updates on progress, a brief overview of these efforts from Water Year 2019 to Water Year 2022 is provided in each revised GSP. A review of the Annual Reports submitted shows progress on a majority of the projects and enhancements of monitoring networks, which now collect more land subsidence, water quality, and groundwater level data; the GSAs also report efforts being made to collect more interconnected surface water data.[247]

A review of the projects presented in each GSP is provided below.

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[241] 23 CCR § 354.44 et seq.
[242] Joint GSP (Redlined), Section 4, pp. 361-431; Gravelly Ford GSP (Redlined), Section 4, pp. 83-37; Root Creek GSP (Redlined), Section 6, pp. 309-327; New Stone GSP (Redlined), Section 6, pp. 189-199.
[243] Joint GSP, Table 4-3, p. 312, Section 4.4.4.5, p. 352.
[244] Joint GSP, Tables 4-1 and 4-2, pp. 310-311.
[245] Joint GSP, Section 4.4.4, p. 347.
[246] Joint GSP, Section 4.4.4.2, p. 348.
[247] Joint GSP Water Year 2022 Annual Report, Table 7-1, pp. 56-57; Gravelly Ford GSP Water Year 2022 Annual Report, Section 2.4.3, pp. 18-19; New Stone GSP Water Year 2022 Annual Report, Section 3.1.2, p. 10; Root Creek GSP Water Year 2022 Annual Report, p. 26.

The Joint GSP describes each project and management action proposed by Madera Water District GSA, Madera Irrigation District GSA, City of Madera GSA, and Madera County GSA.[248] They are:

Madera Water District GSA

1. Surface Water Purchase Program

Madera Irrigation District GSA

1. Groundwater Recharge Basins
2. On-Farm Recharge (Flood-MAR)
3. Madera Irrigation District System Improvements and Programs
4. Madera Ranch Annexation

The City of Madera GSA

1. Berry Basin for groundwater recharge
2. The City of Madera Metering and Volumetric Billing program.

Madera County GSA

1. Water Purchase for Direct or In-Lieu Recharge (starts in 2025)
2. Import and Recharge of Millerton Flood Releases (Flood-MAR) (starts in 2025)
3. Chowchilla Bypass Flood Water Recharge Basins (starts in 2025)
4. Chowchilla Bypass Flood Water Recharge Basins (starts in 2040)
5. Management Action: Demand Management (starts in 2020)

The Joint GSP provides an estimate for implementing projects and management actions, which totals approximately $193,460,000 in capital costs and $69,550,000 in annual operating costs.[249] As noted above, the GSAs have included an estimated economic cost from reduced crop production resulting from demand management of approximately $54,000,000 per year in the total annual cost.[250] Based on information provided in the Joint GSP resubmittal and the 2022 Annual Report,[251] the GSA reports that a cumulative total benefit of over 63,000 acre-feet from projects and management actions to date, with a benefit of 7,300 acre-feet for the latest reported water year for the GSP area.[252] Demand management is described to potentially utilize a range of options including allocations, a water trading program, or easements to reduce groundwater demand. In 2022, Madera County took steps to develop a demand management study that was intended to result

[248] Joint GSP (Redlined), Section 4, pp. 361-341.
[249] Joint GSP (Redlined), Table 4-3, p. 366.
[250] Joint GSP (Redlined), Section 4.4.4.5, p. 409.
[251] Joint GSP Water Year 2022 Annual Report, Section 7.1, pp. 53-69.
[252] Joint GSP Water Year 2022 Annual Report, Table 7-2, p. 58.

in an acreage-based rate for extraction of groundwater within the GSA area. However, following an injunction issued by the Madera County Superior Court in December 2022, the Madera County GSA was ordered to refrain from imposing or collecting any new fees, rates, or GSP Project Fees enacted under Madera County Resolution 2022-086 against landowners in the Madera Subbasin.[253] Nonetheless, Department staff encourage the GSAs to continue efforts to develop and implement a successful management strategy to reduce groundwater pumping in the Subbasin, since the reduction of groundwater demand, as detailed in the Plan, is an essential part of achieving the sustainability goal for the basin. Department staff will closely monitor and track the implementation of the demand management program; delays in implementation due to litigation or funding are insufficient to justify delays in implementing demand reduction strategies that are needed to sustainably manage the basin.

The Gravelly Ford GSP[254] provides details for two projects which the GSA is currently implementing:

1. Recharge Program: this project is the continuation of the recharge program established by the Gravelly Ford Water District in 1961.
2. Increased Measurement, Sampling and Monitoring: this project is to continue data collection efforts.

The Gravely Ford GSP does not provide an estimate for projects and management actions; the cost of implementing the GSP is estimated to be $961,000.[255] Based on information in the 2022 Annual Report,[256] the GSA reports that a number of measurements (i.e., depth to groundwater) of private agricultural wells in the GSP area were made and the installation of measurement meters has started on those wells to increase data collection; but the GSAs were not able to discharge surface water into the existing recharge basins during the 2022 Water Year.

The New Stone GSP includes a brief description of one project that is "currently being considered by the [New Stone Water] District"[257] which is the:

1. Construct Chowchilla Bypass Turnout, New Canals, and Recharge Basins (Bypass Project)

The Bypass Project is in the "conceptual phase" and implementation will "depend on the availability of land for new recharge basins [which will also determine amount of recharge] and acquiring a source of funding"; the amount of recharge will depend on acres available for recharge facilities but the district has a 15,700 acre-feet appropriative water right.[258] The estimated cost over 20-years for implementing the project is $7,800,000 but no

[253] Joint GSP (Redlined), Section 4.10.5.4, p. 430.
[254] Gravelly Ford GSP, Section 4, pp. 64-66.
[255] Gravelly Ford GSP (Redlined), Section 5.3.1, p. 88.
[256] Gravelly Ford GSP Water Year 2022 Annual Report, Section 2.4.3, p. 18-19.
[257] New Stone GSP, Section 6.2, pp. 151-157.
[258] New Stone GSP, Section 6.2.1.2 through 6.2.1.6, pp. 152-153.

schedule is provided.[259] Management actions will be enacted "[i]f basin overdraft isn't mitigated"[260] and the GSP doesn't provide related cost of implementation or schedule estimates. Based on information in the 2022 Annual Report,[261] the GSA did not provide substantial updates on the project or management action progress for the 2022 Water Year—but the GSA did report three new wells were added to the monitoring network.

The Root Creek GSP[262] includes brief descriptions of three projects:

1. Expansion of the In-Lieu Pipeline (to fully utilize surface water allocations)
2. Intentional Recharge Projects
3. Agricultural Land Conversion (Development of Riverstone)
4. Monitoring Well Program – Interconnected Surface Water

The Root Creek GSP provides project cost estimates and projects 2 and 3 are currently being implemented. Additionally, though management actions are referenced,[263] no specific details are provided; the GSP references the continuation of programs that were enacted prior to SGMA related to the use and sustainable management of groundwater.[264] During 2022, the GSP states, a benefit of 4,500 acre-feet was realized from projects for the GSP area.[265]

The Plan adequately describes proposed projects and management actions in a manner that is generally consistent and substantially complies with the GSP Regulations.[266] The projects and management actions, which focus largely on recharge or conveyance projects and demand management, are directly related to the sustainable management criteria and present a generally feasible approach to achieving the sustainability goal of the Subbasin.

As projects and management actions are implemented, the Department expects that progress be included in Annual Reports and any addition or removal of project and management actions be documented in Periodic Evaluations.

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."[267] Furthermore, the GSP Regulations state that minimum thresholds defined in each GSP

[259] New Stone GSP, Table 7-3, p. 160.
[260] New Stone GSP, Section 6.3, p. 154.
[261] New Stone GSP Water Year 2022 Annual Report, Section 3.1, pp. 10-11.
[262] Root Creek GSP, Section 6.1 through 6.4, pp. 212-226.
[263] Root Creek GSP, Table 6-1, p. 213.
[264] Root Creek GSP, Section 6.5, p. 226.
[265] Root Creek GSP (Redlined), Section 6.7, pp. 326-327.
[266] 23 CCR §§ 354.44 (a), 354.44 (b), 354.44 (c), 354.44 (d).
[267] Water Code § 10733(c).

be designed to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.[268]

The Madera Subbasin has three adjacent basins; the Kings Subbasin, Delta-Mendota Subbasin, and the Chowchilla Subbasin, are all high-priority and required to be managed under a GSP. The Delta-Mendota Subbasin and Chowchilla Subbasins are critically overdrafted and currently have inadequate plans which the Department has referred to the State Water Resources Control Board under Chapter 11 of SGMA. The Kings Subbasin is to the south of the Madera Subbasin bordering the south bank of the San Joaquin River. The Kings Subbasin is designated critically overdrafted and the Kings Subbasin Plan has been approved by the Department.

The Plan states that the Madera Subbasin GSAs have met multiple times with GSAs in adjacent subbasins to ensure that implementation of the Madera Subbasin GSPs will not interfere with the ability of adjacent subbasins to also achieve sustainable groundwater management; however, further details are not provided in the Plan.[269] The Plan also qualitatively describes how minimum thresholds and measurable objectives may affect an adjacent basin, concluding that the Madera Subbasin Plan will not hinder the ability of an adjacent basin to be sustainable;[270] however, the evaluation is provided without specifics.

Based on information available at this time, Department staff have insufficient evidence to conclude that groundwater management in the Madera Subbasin will adversely affect the implementation of a plan or impede achievement of sustainability goals in an adjacent basin. Department staff encourage the GSAs to evaluate whether their 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. Department staff will continue to review periodic evaluations to the Plan and Annual Reports to assess whether implementation of the Madera Subbasin GSP is likely to impact adjacent basins.

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.[271]

Since the GSP was adopted and submitted, climate change conditions have advanced faster and more dramatically. It is anticipated that the hotter, dryer 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

[268] 23 CCR § 354.28(b)(3).
[269] Joint GSP (Redlined), Executive Summary, p. 25.
[270] Joint GSP (Redlined), Section 3.2.1.4, p. 277, Section 3.2.2.4, p. 278, Section 3.2.4.4, p. 285, Section 3.2.5.4, p. 291, Section 3.3.1.5, p. 304, Section 3.3.2.3, p. 309, Section 3.3.3.3, p. 312, Section 3.3.4.3, p. 318, Section 3.3.5.3, p. 319.
[271] 23 CCR § 354.18.

encourages the GSAs to explore how the proposed groundwater level thresholds have been established in consideration of groundwater level conditions in the Subbasin based on current and future drought conditions. The Department encourages the GSAs to also explore how groundwater level data from the existing monitoring network will be used to make progress towards sustainable management of the Subbasin given increasing aridification and effects of climate change, such as prolonged drought. Lastly, the Department encourages the GSAs to 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[272] to evaluate how the GSAs' groundwater management strategy aligns with drought planning, response, and mitigation efforts within the Subbasin.

[272] Water Code § 10609.50.

6 STAFF RECOMMENDATION

Department staff believe sufficient action has been taken by the GSAs to 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 Madera 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 GSAs for the first periodic assessment 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

Considering MID GSA has yet to adopt the Plan, by the first periodic evaluation, MID GSA should identify and list the specific projects and management actions that MID GSA will or may be responsible for implementing under the Revised Joint GSP and provide a parallel listing and detailed identification and discussion of the legal, contractual, or other authorities or arrangements that MID GSA is relying or will rely upon in adequately implementing the Plan including those projects or management actions to clearly demonstrate the feasibility of MID GSA implementing all projects and management actions.

RECOMMENDED CORRECTIVE ACTION 2

While the GSAs have established a framework for coordination of multiple GSPs that could serve as a basis to achieve Subbasin sustainability, it is vital that the GSAs continue their efforts to improve coordination and eliminate any remaining areas of disagreement that could delay Plan implementation or affect the likelihood of achieving sustainability. For example, the GSA should come to a consensus regarding the data and methods utilized to develop refined future water budgets for the entire Subbasin, and agreement regarding the availability and use of more detailed data as it becomes available from each GSP area. These efforts should be done with the ultimate goal that the contents of each GSP should represent a component of a cohesive, unified Plan that will achieve the sustainability goal in the Subbasin consistent with SGMA timelines and not be an isolated document only for a specific GSP area.

RECOMMENDED CORRECTIVE ACTION 3

The GSAs should revise the GSPs to include a discussion of the relationship between the management criteria for chronic lowering of groundwater levels and the other sustainability indicators, including an explanation of how the criteria, including interim milestones, were established to avoid undesirable results for each of the other sustainability indicators.

RECOMMENDED CORRECTIVE ACTION 4

Department staff recommend the following as it relates to land subsidence:

a. The GSAs should refine the description of undesirable results to clearly describe the significant and unreasonable conditions the GSAs are managing the Subbasin to avoid, as it relates to land subsidence. More specifically, the GSAs should reevaluate the quantitative metrics that define an undesirable result for subsidence. The reevaluation should consider localized subsidence conditions and the irreversibility of continued inelastic subsidence, especially in the area deemed of "greater subsidence concern." This is to say that the current quantitative metrics (i.e., 75 percent of the representative monitoring sites in the Subbasin exceed threshold levels for two consecutive years across the entire Subbasin) would not minimize or avoid inelastic subsidence in the most susceptible areas of the Subbasin – predominantly in the north-northwestern portion of the Subbasin which are describe as the areas of greater subsidence concern.

b. The GSAs should identify the cumulative amount of subsidence that, if exceeded, would substantially interfere with groundwater and land surface beneficial uses and users in the Subbasin. The Plan should explain how the rate and extent of any future subsidence permitted in the Subbasin may interfere with surface land uses. The Plan should also include additional details describing measures that consider and disclose the current and potentially lasting impacts of subsidence on land uses and groundwater beneficial uses and users.

   Additionally, the GSAs should provide specific details and schedule for projects or management actions that will be implemented to minimize or eliminate subsidence. The projects or management actions must be supported by best available information and science[273] and consider the level of uncertainty associated with the Subbasin.[274]

c. The GSAs should revise the GSPs to include a discussion of the relationship between the management criteria for land subsidence and the other sustainability indicators, including an explanation of how criteria, including interim milestones, were established to avoid undesirable results for each of the other sustainability indicators.

d. The GSAs should reevaluate or eliminate the application of the level of uncertainty as it relates to subsidence measurements according to standard professional practices. Establishment of sustainable management criteria should not allow for

[273] 23 CCR § 354.44 (c).
[274] 23 CCR § 354.44 (d).

subsidence in perpetuity based on the error of measurement. The GSAs should also consider incorporation of remotely sensed subsidence data (i.e., InSAR data) made available by the Department on an ongoing basis to monitor for subsidence in conjunction with the representative monitoring sites. For reference, the statewide vertical displacement measurements provided via the InSAR data present an error of 0.1 foot.

Recommended Corrective Action 5

The GSA should provide a discussion of the uncertainty concerning the hydrogeologic conceptual model and a description of hydrogeologic conceptual model data gaps.[275] For example, the GSP should include revisions to identify how many wells are completed below the bottom of the Subbasin, the amount of water that is extracted from these wells, and a description of changes to groundwater storage calculations for the Subbasin based on best available information.

Recommended Corrective Action 6

The GSAs must provide more detailed explanation and justification regarding the selection of the sustainable management criteria for degradation of water quality. Department staff recommend the GSAs consider and address the following:

a. The GSAs should revise the definition of undesirable results so that exceedances of minimum thresholds caused by groundwater extraction are considered in the assessment of undesirable results in the Subbasin.

b. The GSAs should provide a clear definition of what the Plan considers an undesirable result for degraded water quality by describing conditions that it would consider to be significant or unreasonable. For example, the Plan should—in addition to qualitative descriptions—quantify the specific potential effects to beneficial users and uses from undesirable results using best available data and science. This definition should be supported by information described in the basin setting, and other data or models as appropriate, as required by the GSP Regulations.[276]

c. The GSAs should identify which minimum threshold values—either the MCL or existing concentration plus 20 percent—will be used at which representative monitoring sites. Also, the GSAs should justify how establishing minimum thresholds at the higher of either MCLs or existing concentrations plus 20 percent does not constitute significant and unreasonable effects as defined by the GSP (i.e., “when beneficial uses for groundwater are adversely impacted by constituent concentrations).

[275] 23 CCR § 354.14(b)(5).
[276] 23 CCR § 354.26 (b)(1).

APPENDIX C
PROJECTS AND MANAGEMENT ACTION IMPLEMENTATION PLAN AND BENEFITS

Project or Management Action Name	Project or Management Action Description	Targeted Sustainability Indicator	Project Status	Expected Schedule	Benefits Observed to Date or Anticipated Benefits	Estimated Accrued Benefits per Interim Period (acre-feet)	Notes
Recharge Program	Increase percolation in the District's recharge basin and make improvements to canal controls to increase recharge capabilities and metering.	Groundwater levels	Active	Ongoing	Increase in percolation and groundwater storage volume in the GFWD GSA area	20000	This project currently increases groundwater recharge by about 10,000 af twice per interim period (5-years)
Agriculture Well Metering	Metering program is a future option of District Board to consider as a requirement for new well to be registered in the District	Groundwater levels, land subsidence and groundwater storage	Waiting on Funding	4/1/26	Provide more accurate data for water budgeting and SMC analysis in future years	5000	This project will likely decrease pumping by approximately 1000 af per year
Increased Measurement, Sampling, and Monitoring	Program has been initiated and will be continued. Wells will be surveyed and base line elevation will be recorded	Water quality, groundwater levels, and subsidence	Active and Expanding	Ongoing	Increase water level measurements, groundwater sampling, and testing	0	This project will likely not increase net groundwater recharge. It is for informational and management purposes
San Joaquin River Restoration Program	Settlement goal would benefit the restoration area to maintain fish populations and increase groundwater inflow due to seepage	Groundwater storage, Interconnected surface water	Active	Ongoing	To protect fish population and interconnected surface water, increase groundwater inflow into the District	Unknown	This ongoing project increases groundwater inflow
Coordination Agreement	GFWD GSA is committed to implementing sustainability goals and working with their GSA partners	All SMCs	In Process	Ongoing	Communication with Madera Subbasin partner GSAs and the community at large	0	This project will likely not increase net groundwater recharge. It is for management purposes
San Joaquin River (SJR) Flood Water Recharge	Focused on conveyance of SJR Flood Water Flows and increasing capacity to allow increased volume	Groundwater storage and groundwater levels	Waiting on Funding	4/1/30	Increase diversion of surface water which will offset to groundwater use, increase surface water for recharge, and reduce pumping for agriculture crops	40000	This project currently increases groundwater recharge by about 10,000 af twice per interim period (5-years)
District System Water Metering Project	Installing metering stations and controls at three locations to monitor and record flows	Groundwater levels, groundwater storage	Waiting on Funding	4/1/30	Increase metering and monitoring and reduce data gaps	0	This project will likely not increase net groundwater recharge. It is for informational and management purposes
Conveyance Pipeline from San Joaquin River Pumps	Installing additional pipeline to convey water from existing SJR pumps to Gravelly Ford Main Canal	Groundwater levels, groundwater storage	Waiting on Funding	4/1/30	Increase diversions of surface water to the GSA	Project combined with SJR Flood	This project currently increases groundwater recharge by about 10,000 af twice per interim period (5-years)
Automation & SCADA	Provide water management through installation of structures and gates, which allows improved water management of flood flows to be routed for irrigation needs or recharge	Groundwater levels, groundwater storage	Waiting on Funding	4/1/26	Improve monitoring and management of surface water in the District	6000	This project currently increases groundwater recharge by about 3,000 af twice per interim period (5-years)
					Minimum estimated net recharge per 5-year interim	**71000**	
					Annual minimum estimated net recharge per year	**14200**	

APPENDIX D
DATA GAPS FOR 2018 HCM REPORT FOR GRAVELLY FORD WATER DISTRICT

DATA GAPS FOR 2018 HCM REPORT FOR GRAVELLY FORD WATER DISTRICT

Both water levels and subsidence have been addressed through the semi-annual water-level measurement program for 24 wells and the biennial subsidence (ground surface elevation) measurements for six RMS wells. Following are additional data gaps to be addressed.

Pumpage

Totalizing flowmeters should be installed for all large capacity wells (greater than 200 gpm) in the District. If grant funds can't be obtained, then well owners should pay for this. The total pumpage should be measured twice a year and reported to the GSA.

Aquifer Characteristics

In order to determine groundwater inflows and outflows, Darcy's Law is used, where Q = TIL.

Q = groundwater flow (gpd)

T = aquifer transmissivity (gpd/ft)

I = water-level slope (feet per mile)

L = width of flow (miles).

The semi-annual water-level elevation and direction of groundwater flow maps can be used to determine the water-level slopes and widths of flow. Aquifer tests are needed to determine the transmissivity. The aquifer tests would be done by Madera Pump under the direction of KDSA. A constant rate test of about 9 hours would be necessary, plus several hours of recovery measurements. The well selected would have verifiable construction data (preferably drillers logs) and a totalizing flowmeter. Approximately six wells would be tested. Three of these would be along the southeast District boundary (inflow). The other three would be along the northwest District boundary (outflow). Possible inflow area wells would be 201, 202, 206, and 213. Possible outflow area wells would be 203, 223, and 224. KDSA would prepare graphical plots of the drawdown and recovery measurements and determine transmissivity. They would also prepare estimates on a semi-annual basis of ground-water inflows and outflows.

Private Domestic Wells

All active private domestic wells in the District need to be field located, mapped, and information collected on their construction (ie drillers logs, etc).

Domestic Well Sampling

Each domestic well would be sampled in the summer, after about 20 minutes of pumping. KDSA would conduct the sampling and arrange and pay for the analyses. Major constituents of concern are nitrate, DBCP, 1,2,3-TCP, and gross alpha activity. Once the initial sampling and analyses are completed, a select number of these wells would be selected for sampling every three years.

Surface Water Monitoring

Flowmeters would be installed at the following locations:

Cottonwood Creek inflow and outflow at District boundaries

Diversion to Gravelly Ford Canal

This information is needed to better determine seepage losses.

APPENDIX E
HYDROGEOLOGIC CONCEPTUAL MODEL KDSA

HYDROGEOLOGIC CONCEPTUAL MODEL AND GROUNDWATER
CONDITIONS FOR THE GRAVELLY FORD WATER DISTRICT GSP

<u>Draft Report</u>

prepared for
Gravelly Ford Water District
Madera, California

by
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Groundwater Quality Consultants
Fresno, California

October 2018

TABLE OF CONTENTS

Continued:

TABLE OF CONTENTS
(Continued)

LIST OF ILLUSTRATIONS

HYDROGEOLOGIC CONCEPTUAL MODEL AND GROUNDWATER CONDITIONS FOR THE GRAVELLY FORD WATER DISTRICT GSP

INTRODUCTION

This report is intended to satisfy Sections 354.14 (Hydrologic Conceptual Model) and Section 354.16 (Groundwater Conditions) of a Groundwater Sustainability Plan (GSP) for the Gravelly Ford Water District (GFWD). The GFWD (the GSA) is located north of the San Joaquin River and southwest of the City of Madera.

SURFICIAL CHARACTERISTICS OF BASIN

Topography

Figure 1 shows topographic conditions in the basin. The land surface generally slopes to the west. Land surface elevations range from about 200 feet above mean sea level near the northeast corner of the GSA to about 175 feet above mean sea level near the southwest corner of the GSA. The southeast corner of the GSA is near the San Joaquin River and Road 21. The Chowchilla Canal Bypass is several miles west of the west edge of the GSA. Cottonwood Creek flows into the District from the northeast.

Surficial Geology

Wagner (2002) mapped the surficial geology of the Madera area,

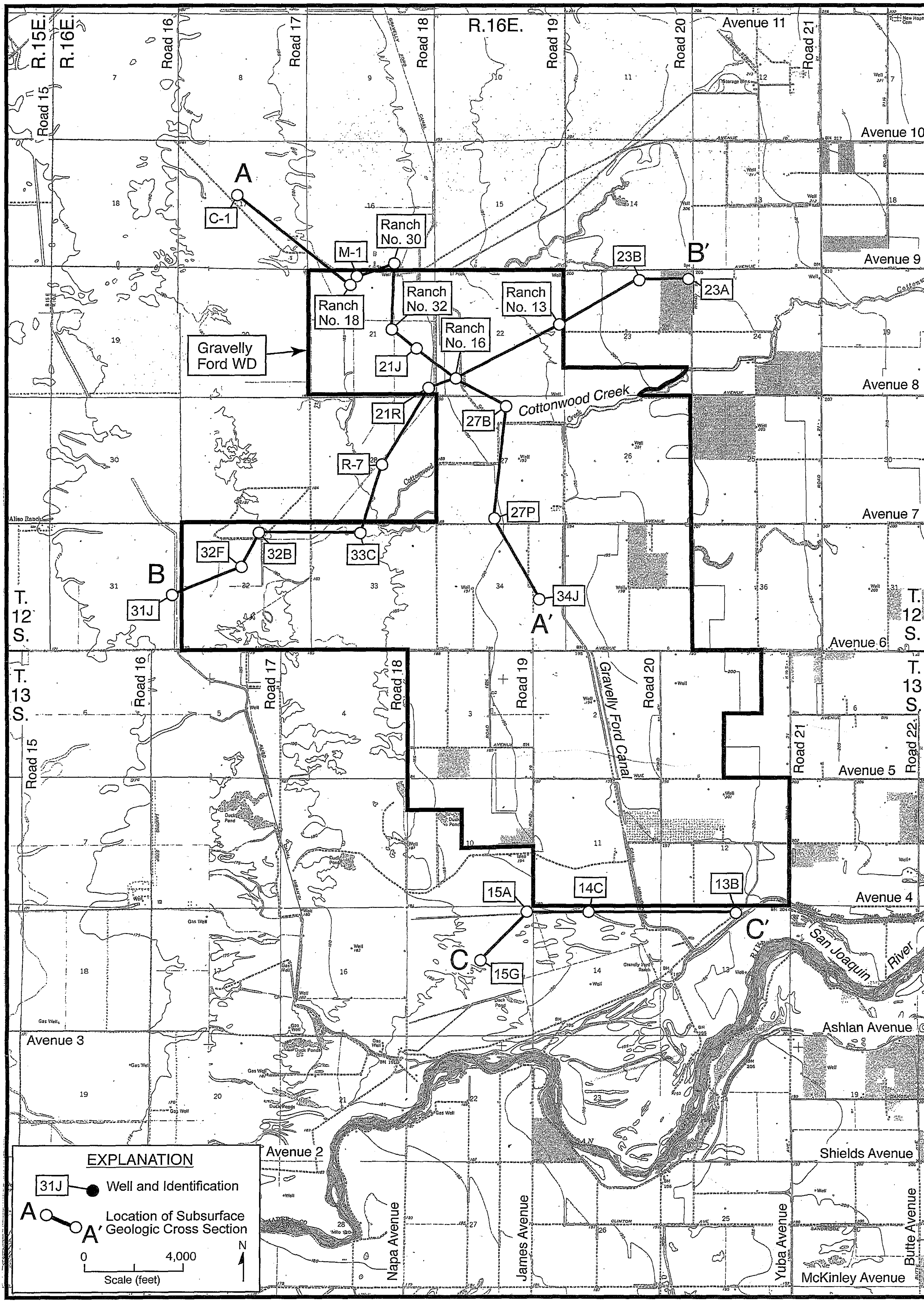


FIGURE 1 - TOPOGRAPHIC MAP OF GSA AND LOCATIONS OF SUBSURFACE GEOLOGIC CROSS SECTIONS

which include the GFWD GSA. Figure 2 shows the part of his map that covers the GSA. The southern part of the GSA was mapped as Quaternary fan deposits. The northern part of the District was mapped as Quaternary basin deposits.

Topsoils

Figure 3 shows the major types of topsoils in the GSA from the U.S. Soil Conservation Service report on soils in the Madera area (Ulrich and Stromberg, 1962). Four soil associations were shown in the GSA. Topsoils in most of the GSA were mapped as the Dinuba-El Peco association. North of Avenue 6, some topsoils are of the Fresno-El Peco association. Both of these soils have hardpan development. Traver-Chino association soils are present in only a small area, south of Avenue 7 and east of Road 16. These soils don't have a hardpan, but have more clay in the subsoil. Between Avenues 4 and 5, soils of the Hanford-Tujunga association are present. These soils are coarse-grained and the most permeable of the topsoils in the GSA.

Surface Water Bodies

Figure 1 shows the location of surface water bodies in and near the GSA. The San Joaquin River is the mayor stream in the area and is near the southeast corner of the GSA. Cottonwood Creek drains a considerable area in the foothills and enters the

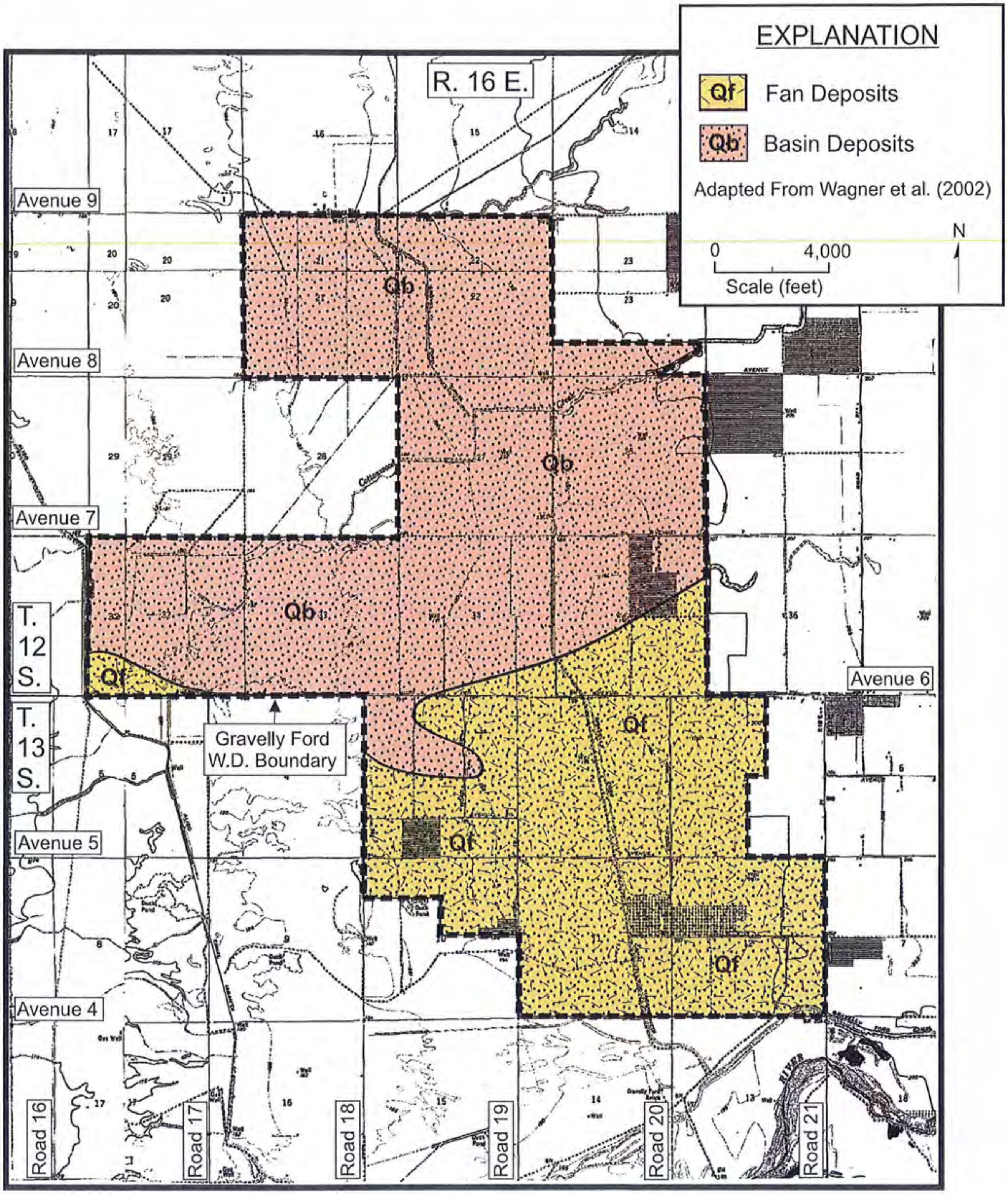


FIGURE 2 - SURFICIAL GEOLOGIC MAP

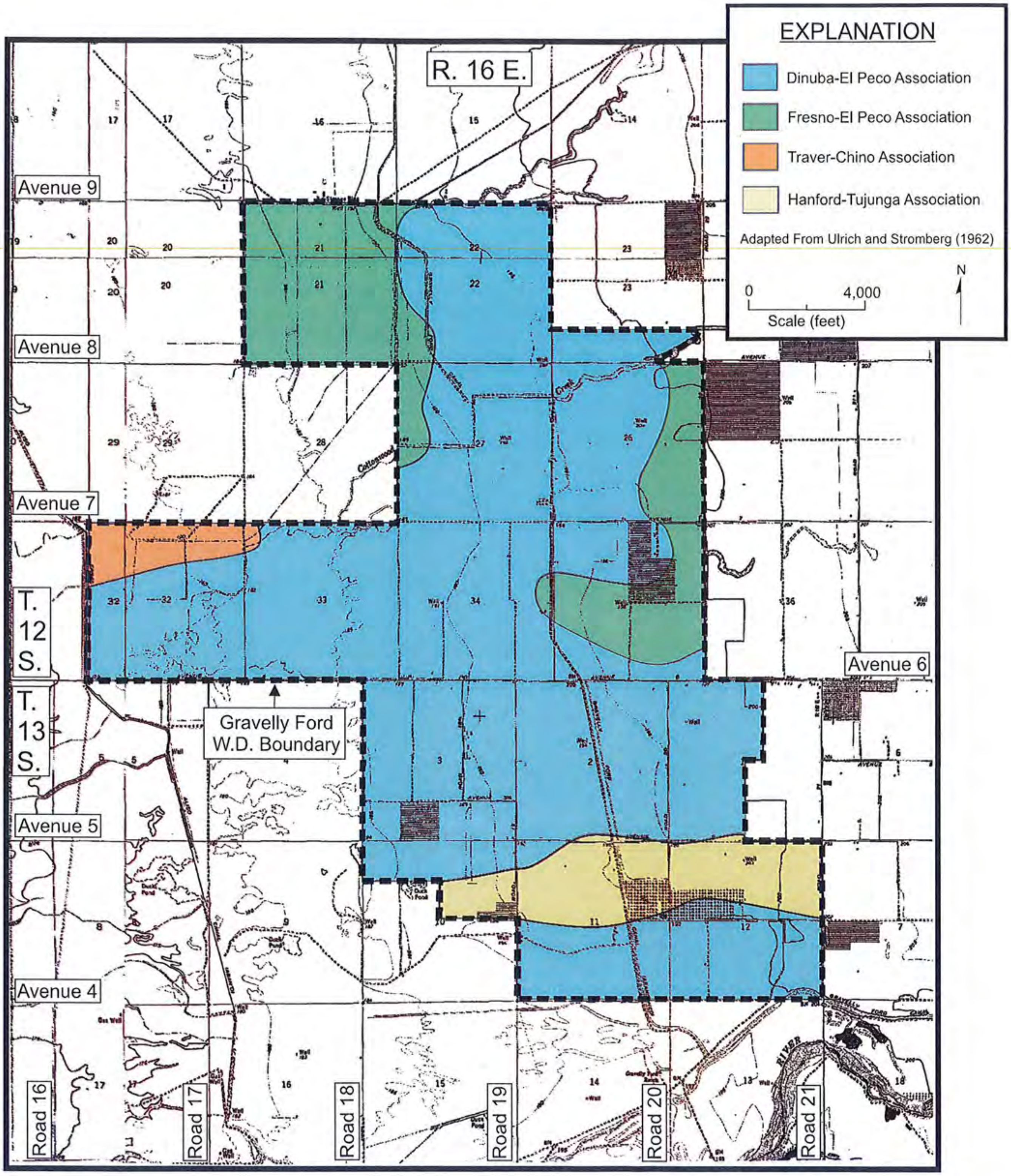


FIGURE 3 - TOPSOILS

GSA from the northeast. The Chowchilla Canal Bypass is a major flood control channel that passes from the south to north several miles west of the east edge of the District.

SUBSURFACE GEOLOGIC CONDITIONS

Mitten, LeBlanc, and Bertoldi (1970) described the geology, hydrology, and water quality of the Madera Area, which includes the GSA.

Regional Geologic and Structural Setting

The GSA is within the San Joaquin Valley, which is a topographic and structural through, bounded on the east by the Sierra Nevada fault block and on the west by the folded and faulted Coast Ranges. Both mountains blocks have contributed to marine and continental deposits in the Valley. In the west-central part of the valley, more than 12,000 feet of sediments are present. Alluvial deposits comprise the aquifer in the area. These interlayered deposits dip slightly to the south-southwest in the area.

Lateral Basin Boundaries

Figure 1 shows the boundaries of the basin. The basin boundaries include the San Joaquin River on the south end. The remaining boundaries are political boundaries, including the Aliso W.D. service area on the west and the Madera Irrigation District service area to the north and east. All of the basin is in Madera County.

Definable Bottom of the Basin

Figure 4 shows the definable bottom of the basin. Historically, the U.S. Geological Survey (Page, 1973) used an electrical conductivity of about 3,000 micromhos per centimeter at 25°C to delineate the regional base of the fresh groundwater in the San Joaquin Valley. The base of the fresh groundwater could be called the "bottom of the basin". However, another factor to consider is where the deposit predominantly become fine-grained at depth. As part of this evaluation, electric logs for deep holes were obtained from the California Division of Oil & Gas, and Geothermal Resources. A review of these logs indicated depths to the bottom of the basin ranging from about 800 to 1,100 feet. The bottom of the basin is generally the shallowest beneath the southwest part of GSA and deepest beneath the northeast and east parts of the GSA.

Formation Names

Mitten, LeBlanc, and Bertoldi (1970) divided the unconsolidated deposits in the Madera area into the younger alluvium (normally less than about 50 feet thick), the Quaternary older alluvium (less than 1,000 feet thick), and the Tertiary-Quarternary continental deposits (about 1,000 to 2,200 feet thick). The Corcoran Clay is a regional confining bed. This clay divides the groundwater into an upper aquifer and lower aquifer. Depos-

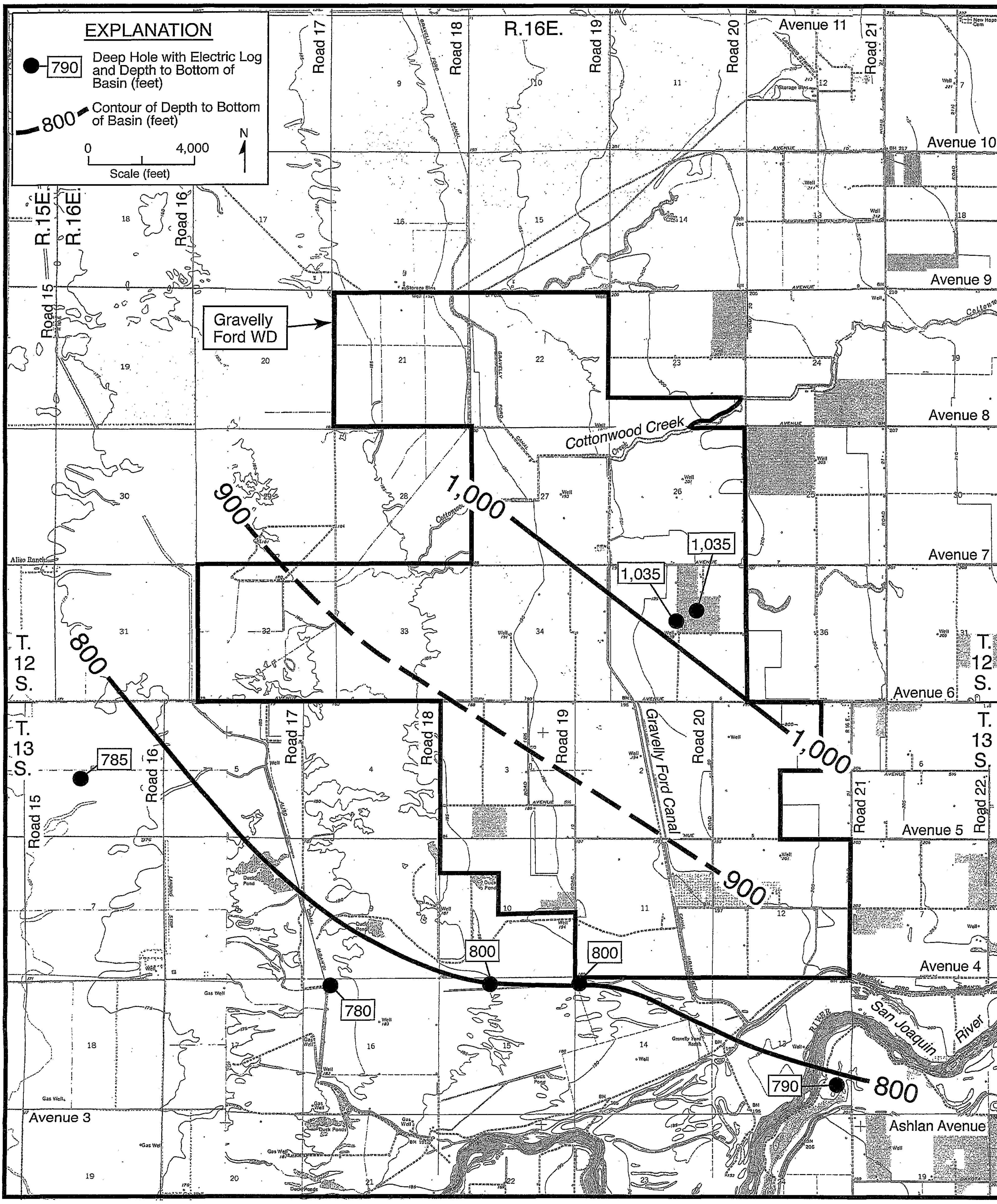


FIGURE 4 - DEFINABLE BOTTOM OF BASIN

aquifer. Deposits in the GSA are generally termed the Sierra deposits, as they were derived from the Sierra Nevada.

Confining Beds

The confining bed that is important beneath the GSA is the E-Clay or Corcoran Clay. Figure 5 shows the depth to the top of the Corcoran Clay. The top of this clay is shallowest (about 300 feet deep) in the north part of the GSA and is deepest (about 380 feet deep) near the south edge of the GSA. The depth to the top of the Corcoran Clay essentially defines the base of the upper aquifer. The Corcoran Clay generally thickens to the southwest beneath the GSA.

Principal Aquifers

Based on subsurface geologic cross sections (presented in the next section) and water well drillers logs and completion reports, the lower part of the upper aquifer and the upper part of the lower aquifer comprise the principal strata tapped by irrigation wells in most of the District. Because of relatively shallow water levels, near the San Joaquin River some wells in this part of the GSA tap only the upper aquifer.

Subsurface Geologic Cross Sections

KDSA have developed three subsurface geologic cross sections in and near the GSA. Locations of these cross sections are pro-

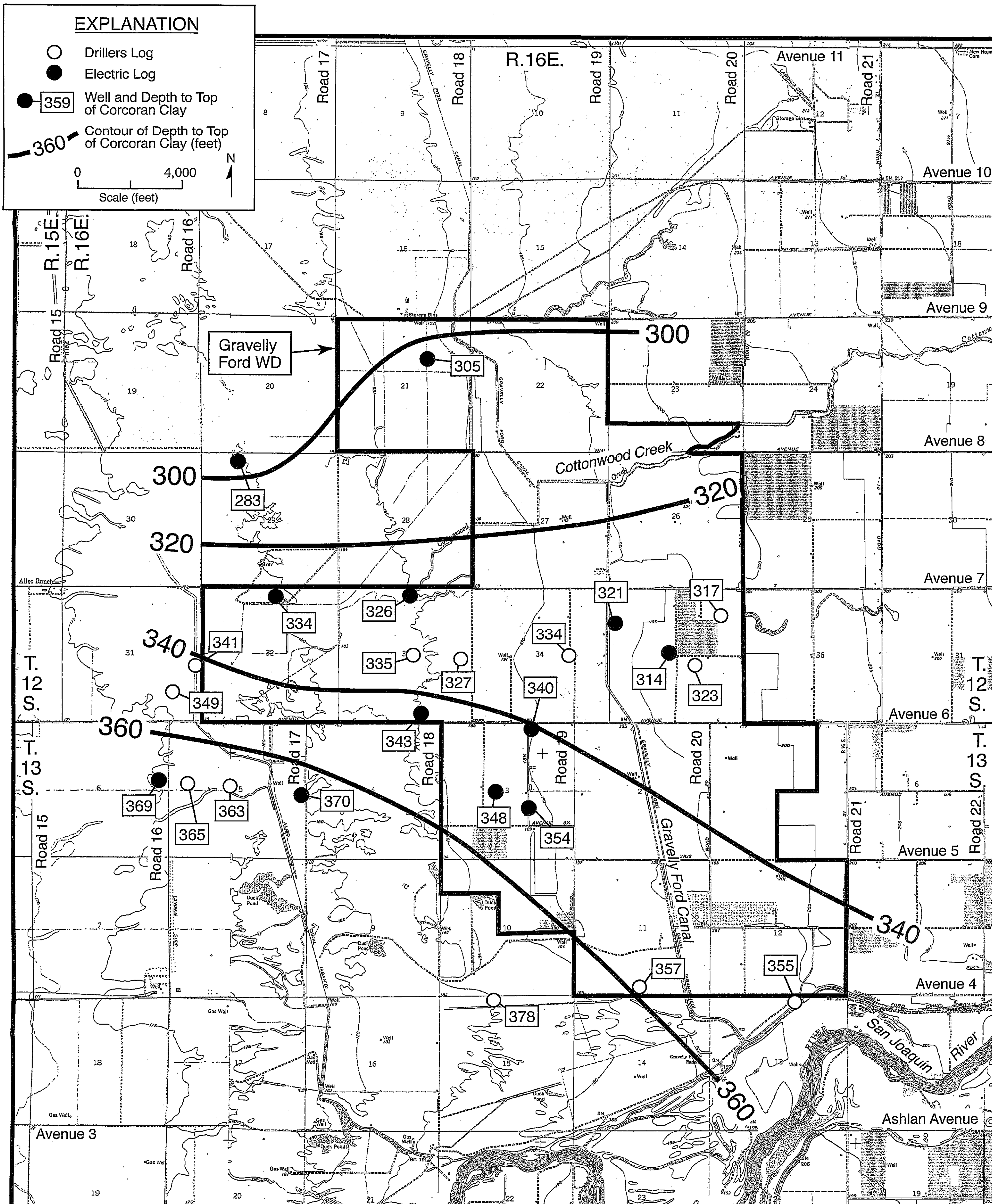


FIGURE 5 - DEPTH TO TOP OF CORCORAN CLAY

vided on Figure 1. The important confining beds (clay layers) and major water producing strata (sand and gravel) are shown on these sections. Cross Section A-A′ generally extends from the northwest to the southeast, perpendicular to the inferred dip of the alluvial deposits. In contrast, Cross Sections B-B′ and C-C′ extend from the southwest to the northeast, generally perpendicular to Cross Section A-A′, and along the inferred dip of the deposits.

Cross Section A-A′ (Figure 6) extends from near Avenue 9-1/2 and Road 16-1/2 on the northwest, to near Avenue 6-1/2 and Road 19 on the southeast. The Corcoran Clay thickens to the northwest along the section, from about 10 feet near the southeast edge to about 30 feet beneath the northwest part. Sand or gravel layers are common above the Corcoran Clay and below the water level along this section. Interbedded sand and clay layers are present below the Corcoran Clay along the section. In general, clays are thicker and more predominant below the Corcoran Clay than above. More sand is indicated below the Corcoran Clay along the northwest point of the section than elsewhere.

Cross Section B-B′ (Figure 7) extends from near Avenue 6-1/2 and Road 16 in the southwest to the northeast, to near Avenue 9 and Road 20. The Corcoran Clay generally thickens to the southwest along this section, from about 15 feet near the northeast edge to about 40 feet near the southwest end. Sand layers are

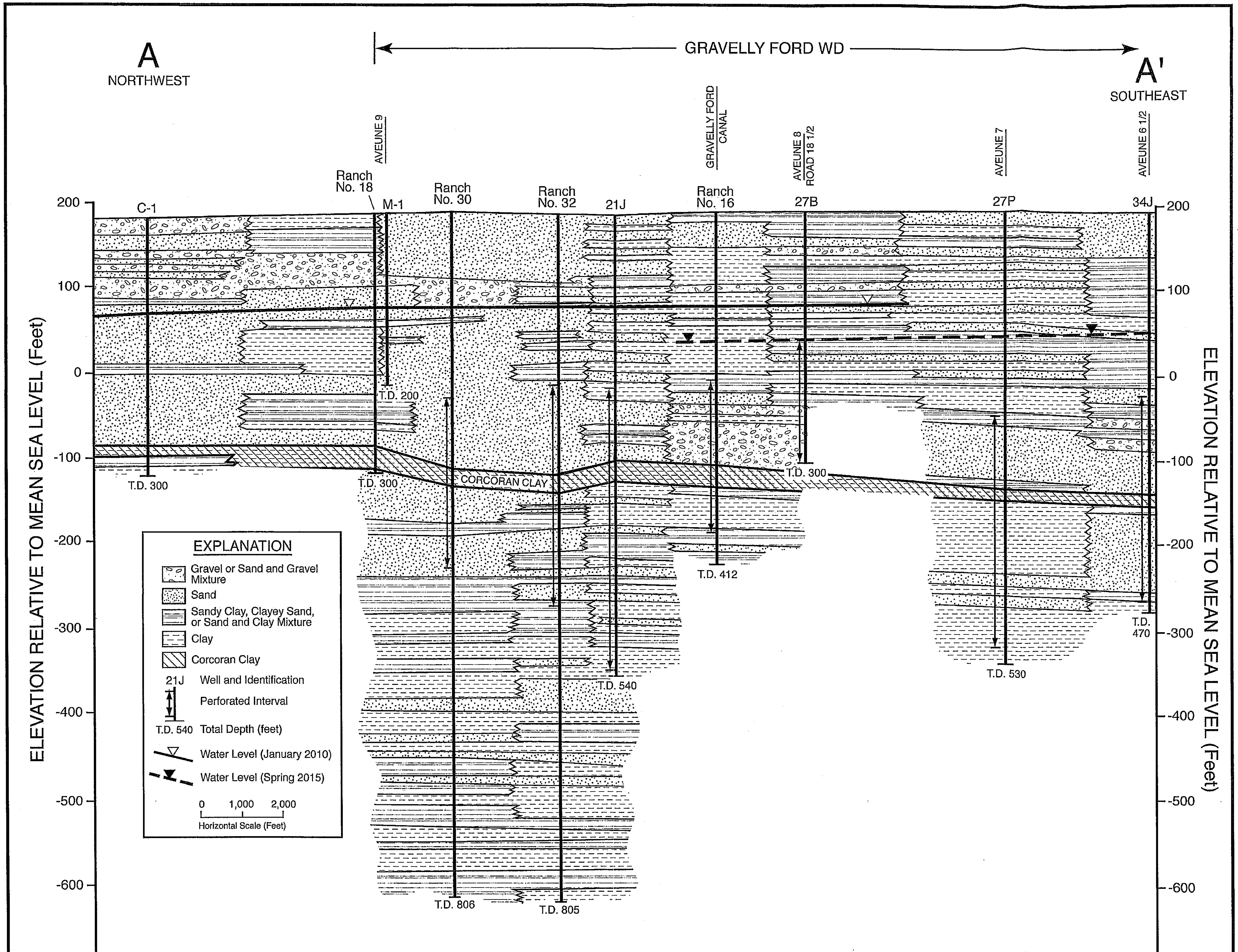


FIGURE 6 - SUBSURFACE GEOLOGIC CROSS SECTION A - A'

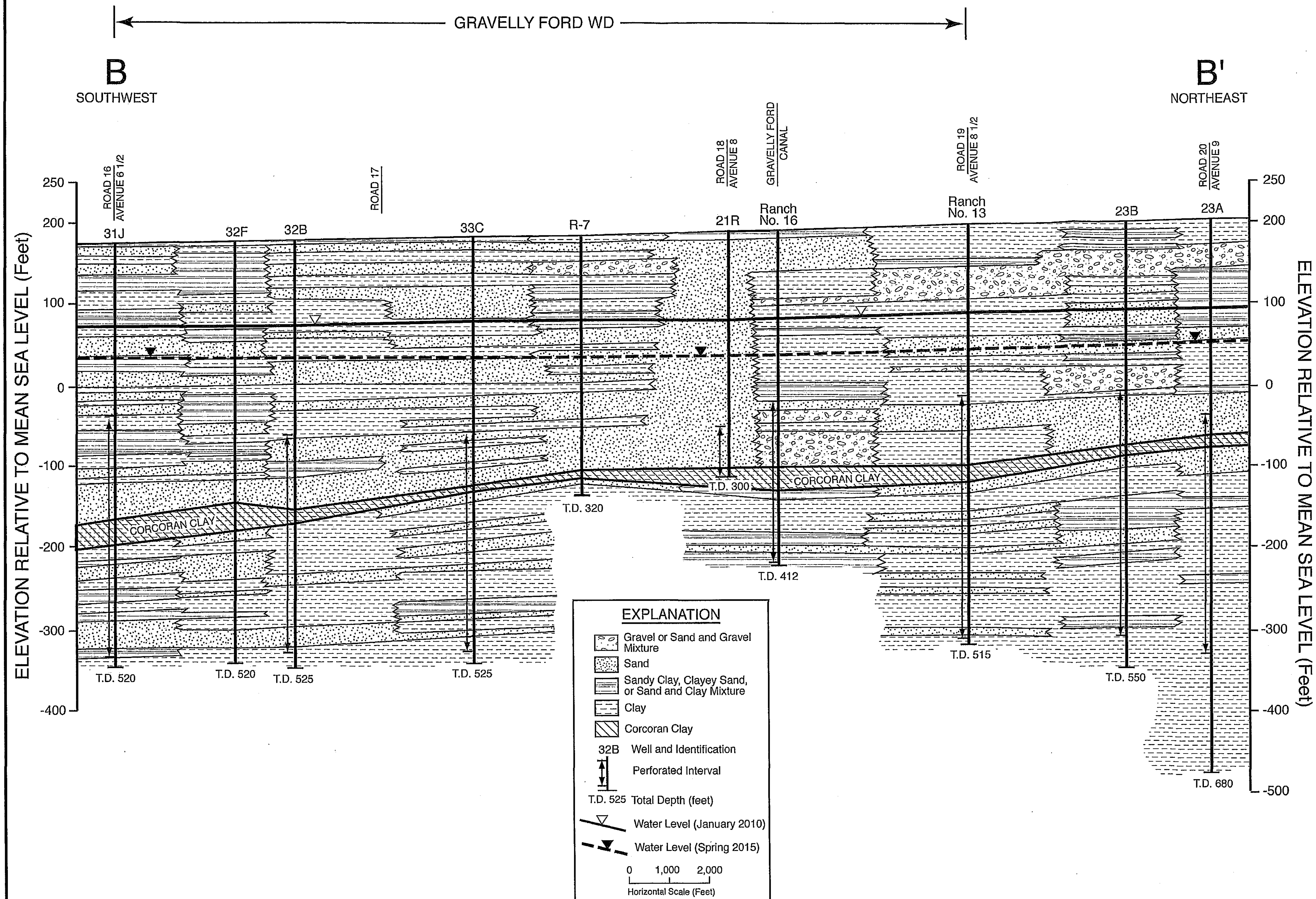


FIGURE 7 - SUBSURFACE GEOLOGIC CROSS SECTION B - B'

common above the Corcoran Clay and below the water level at most locations. Based on the available data, sands below the Corcoran Clay are thickest beneath the southwest part of the section. Clay strata are thick and fairly extensive below the Corcoran Clay along much of this section.

Cross Section C-C′ (Figure 8) extends from near Avenue 3 and Road 17-1/2 on the southwest to the northeast and east to near Avenue 4 and Road 20-1/2. The Corcoran Clay ranges from about 15 to 30 feet thick along the section. There are a number of laterally extensive sand layers above the Corcoran Clay and below the water level along much of the section. Interbedded sand and clay layers are present below the Corcoran Clay along most of the section. Sands below the Corcoran Clay are more common beneath the northeast part of the section.

GROUNDWATER USE AND WELL DATA

Primary Uses of Each Aquifer

Within the GSA, the primary use of the upper and lower aquifer is for irrigation. Some water is also used for private domestic use.

Depths of Supply Wells

Driller's logs and well completion reports indicate that depths of the majority of active irrigation wells in the GSA

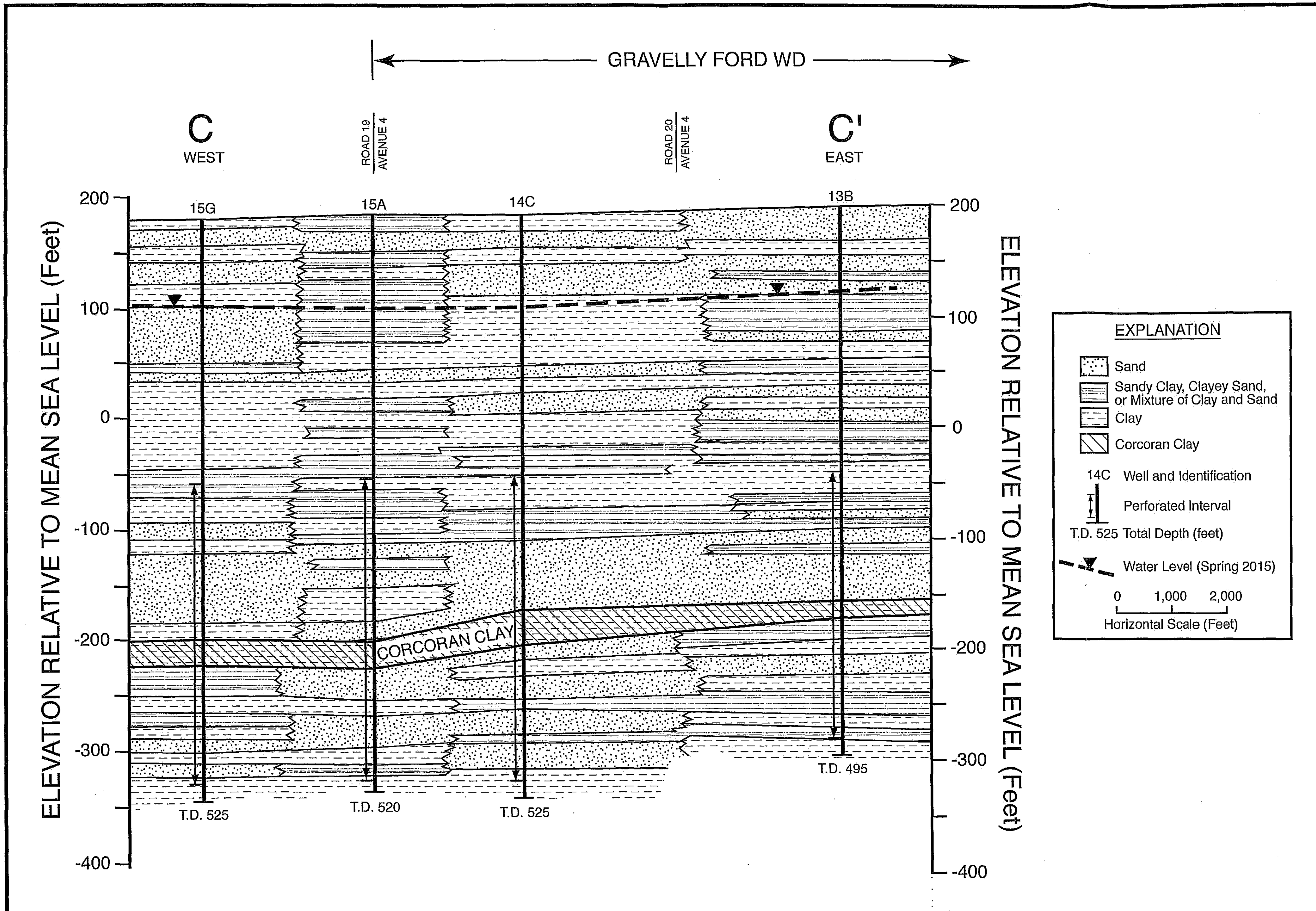


FIGURE 8 - SUBSURFACE GEOLOGIC CROSS SECTION C - C'

with records range from about 350 to 600 feet. Only a small percent of these wells tap only the upper aquifer. Almost all of the remaining irrigation wells are indicated to be composite wells, tapping strata both above and below the Corcoran Clay.

WATER LEVELS

This water-level discussion focuses on measurements primarily for irrigation wells, many of which are composite wells, tapping both the upper and lower aquifers. Because of the lack of wells that solely tap the lower aquifer in and near the GSA, it is not possible to prepare a water-level map for the lower aquifer. However, limited data based on a few wells in nearby areas indicate a southwesterly direction of groundwater flow in the lower aquifer.

Water-Level Elevations and Direction Of Groundwater Flow

Figure 9 shows water-level elevations in Spring 2015, based largely on measurements for composite wells. Water-level elevations ranged from more than 110 feet above mean sea level near the southeast corner of the GSA to about 30 feet near the north part of the GSA. The direction of groundwater flow was away from the San Joaquin River to the northwest or north. This map indicates the importance of recharge from streamflow in the river to groundwater tapped by irrigation wells in the GSA.

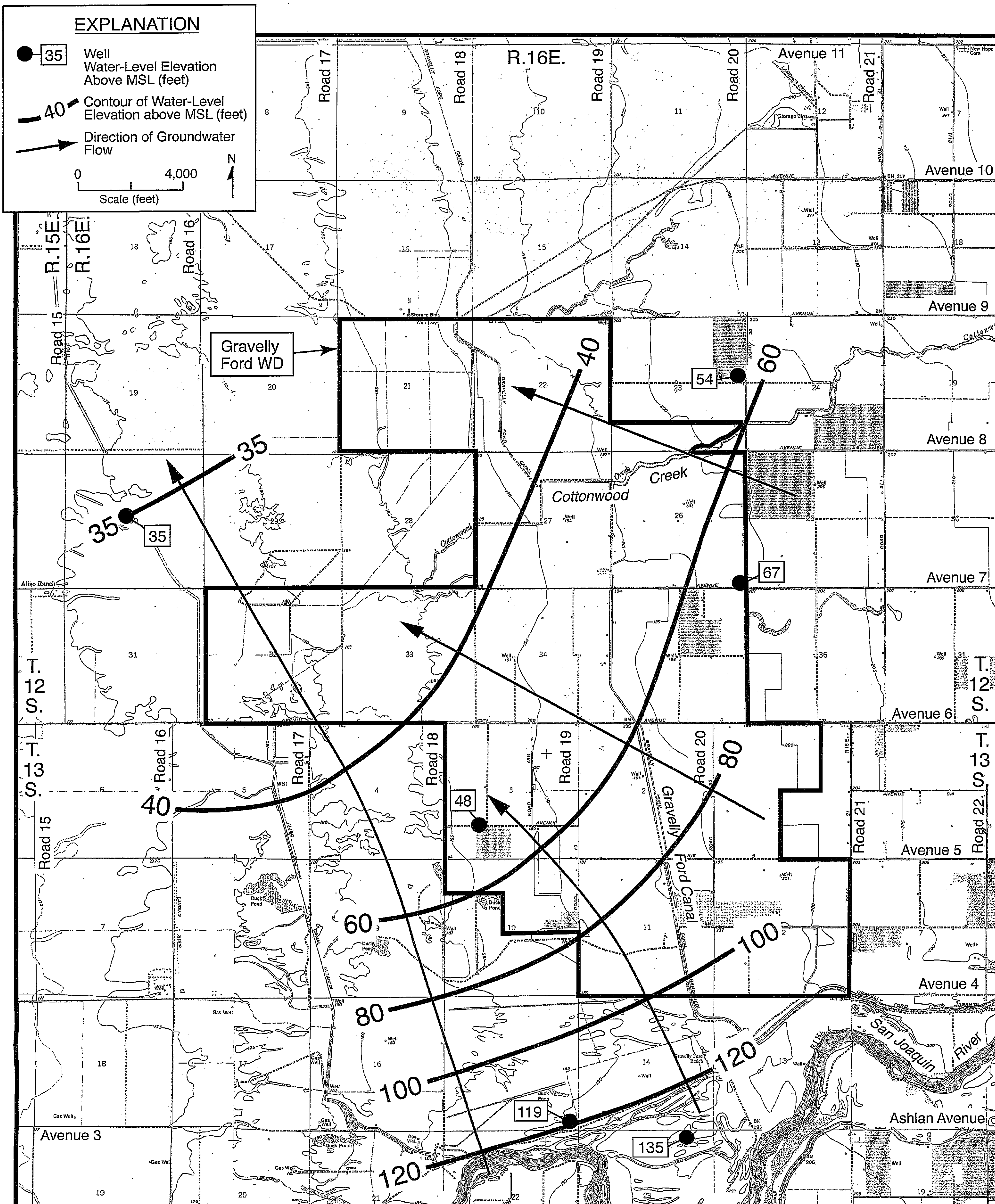


FIGURE 9 - WATER-LEVEL ELEVATIONS AND DIRECTION OF GROUNDWATER FLOW FOR IRRIGATION WELLS (SPRING 2015)

Groundwater was flowing from the river toward a pumping depression located primarily north of Avenue 6.

Water-Level Fluctuations

Long-term water-level hydrographs from the DWR website were accessed for five wells in or near the GFWD. Figure 10 shows representative water-level hydrographs for two of these wells.

Well T12S/R16E-23H1 is located near Avenue 8-1/2 and Road 20, about half a mile north of Cottonwood Creek. The water level in this well fell from about 20 feet deep in 1938 to about 60 feet deep in 1954 or an average of about 2.5 feet per year. Spring water levels fell an average of about 0.8 foot per year since 1960 (Figure 10).

Well T12S/R16E-26H1 is located near Avenue 7 and Road 20, about three-fourths of south of Cottonwood Creek. Spring water levels fell an average of 1.0 foot per year between 1950 and 1980. The average water-level decline after 1980 has been about 1.2 feet per year. Both wells 23H1 and 26H1 are indicated to be composite wells, tapping both aquifers.

Well T12S/R16E-26R1 is indicated to be a shallow well and is located near Avenue 7 and Road 20, about a mile and a quarter south of Cottonwood Creek. Water-level records for this well are available since 1949. Spring water levels in this well have fallen at an average rate of 0.4 foot per year since 1960.

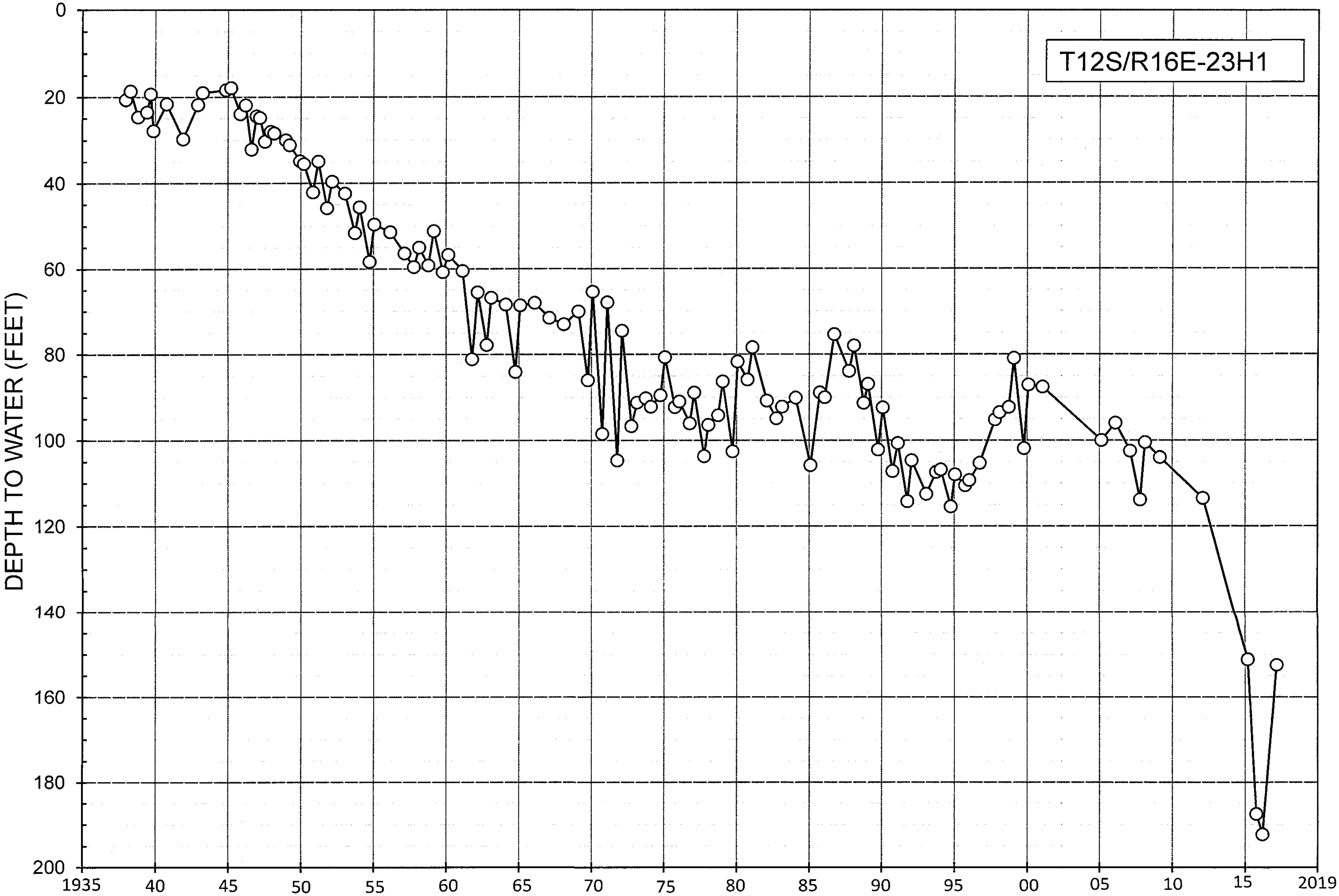


FIGURE 10 - REPRESENTATIVE WATER-LEVEL HYDROGRAPHS FOR IRRIGATION WELLS

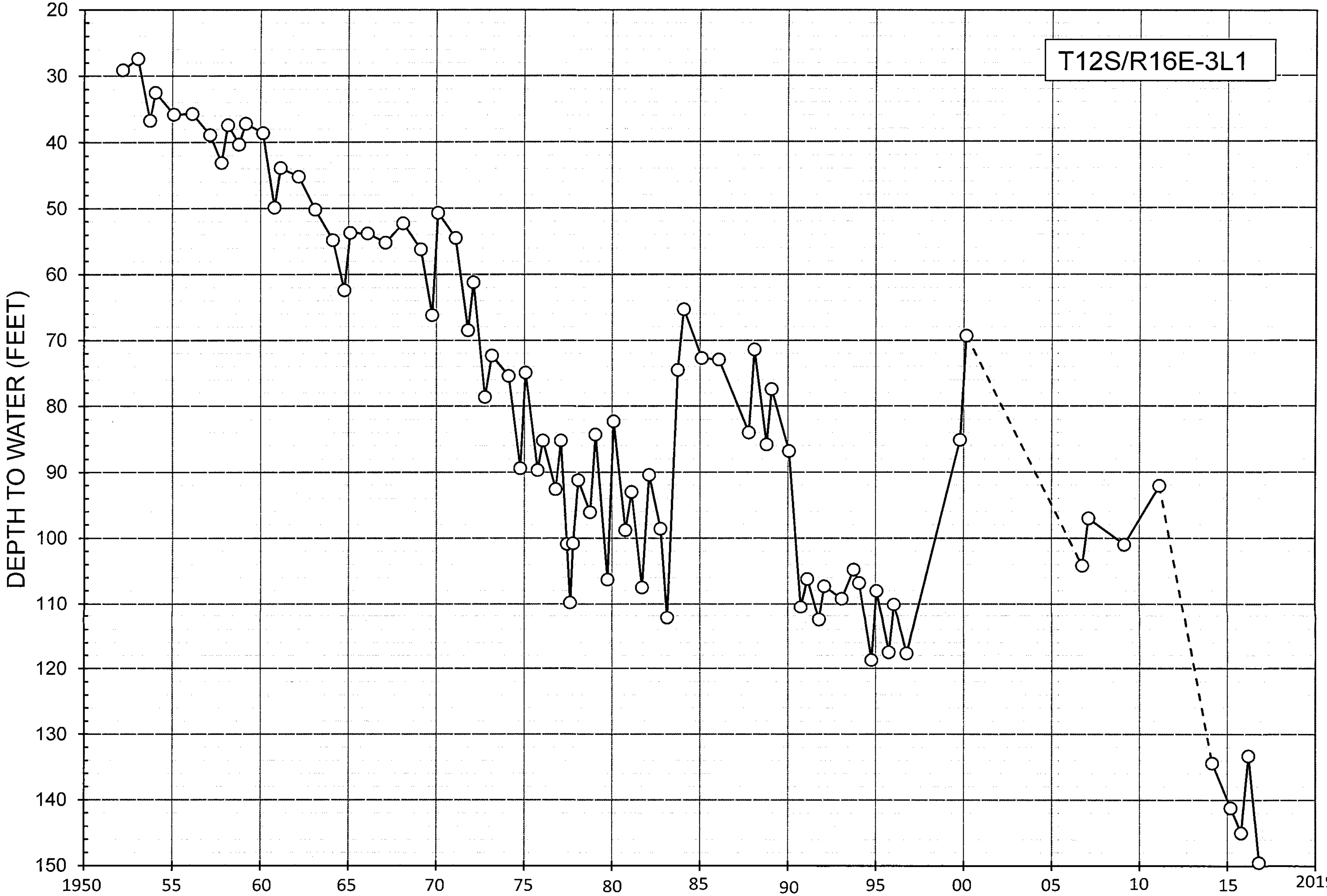


FIGURE 10 - REPRESENTATIVE WATER-LEVEL HYDROGRAPHS FOR IRRIGATION WELLS (continued)

Well T12S/R16E-31G is located near Avenue 6-1/2 and Road 15-1/2, about two miles northeast of the Chowchilla Bypass. Spring water levels fell from 50 feet deep in 1987 to about 105 feet deep in 2009, or an average of about 2.5 feet per year. Water levels fell significantly during 2013-16 during the drought. Water levels for this well appear to be more indicative of the lower confined aquifer.

Well T13S/R16E-3L1 is located near Avenue 5-1/2 and Road 18-1/2. Spring levels fell from about 35 feet in 1960 to 92 feet in 2011, or an average of about 1.1 feet per year (Figure 10).

Overall, the average water-level decline for these wells in recent decades has been about 0.9 foot per year.

Groundwater Overdraft

The best method to calculate groundwater overdraft is to use the specific yield for the unconfined groundwater and the long-term average water-level change over a hydrologic base period. Using an area of 8,500 acres, specific yield of 0.12, and average water-decline of 0.9 foot per year, the overdraft in the GSA is about 900 acre-feet per year. David's Engineering, as part of studies of the Madera Sub-basin, has made water budget estimates for the Gravelly Ford GSA. They estimated recharge to average about 15,000 acre-feet per year for 1989-2014. They estimated the average groundwater pumpage to be about 16,700 acre-feet per year. This leaves a residual of 1,700 acre-feet per year. Because the GSA is in a subsiding area, an additional source of water is compaction from the Corcoran Clay and underlying clay layers. Assuming that the average compaction during 1989-2014 was about 0.08 foot per year (half of the subsidence between 2011 and 2016), the amount of water expelled from the clays would be about 2.2 feet times 8,500 acres, or about 700 acre-feet per year. This would reduce the net imbalance to about 1,000 acre-feet per year, in good agreement with the value determined from the water-level change-specific yield estimate.

SOURCES OF RECHARGE

Figure 11 shows potential groundwater recharge areas in the GSA. Water-level maps indicate that seepage from the San Joaquin River streamflow has been an important source of recharge to the groundwater in the GSA. Historically, there has been also been recharge from flows in Cottonwood Creek. Seepage from conveyance facilities has also been important.

SOURCE OF DISCHARGE

Groundwater discharge in the GSA is primarily from pumping wells and secondarily from groundwater outflow to the northwest. Figure 12 shows potential groundwater discharge areas.

AQUIFER CHARACTERISTICS

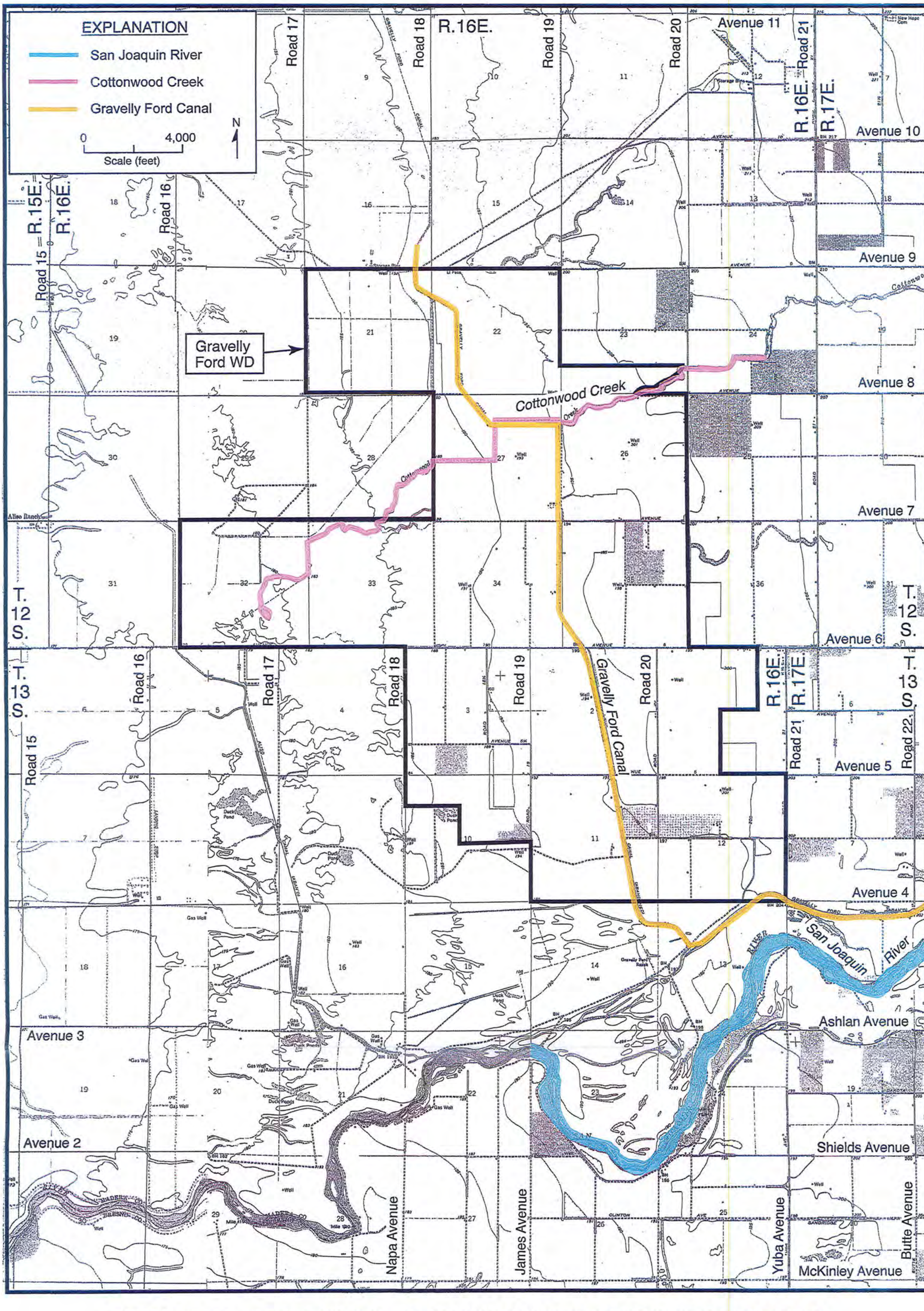


FIGURE 11 - POTENTIAL GROUNDWATER RECHARGE AREAS

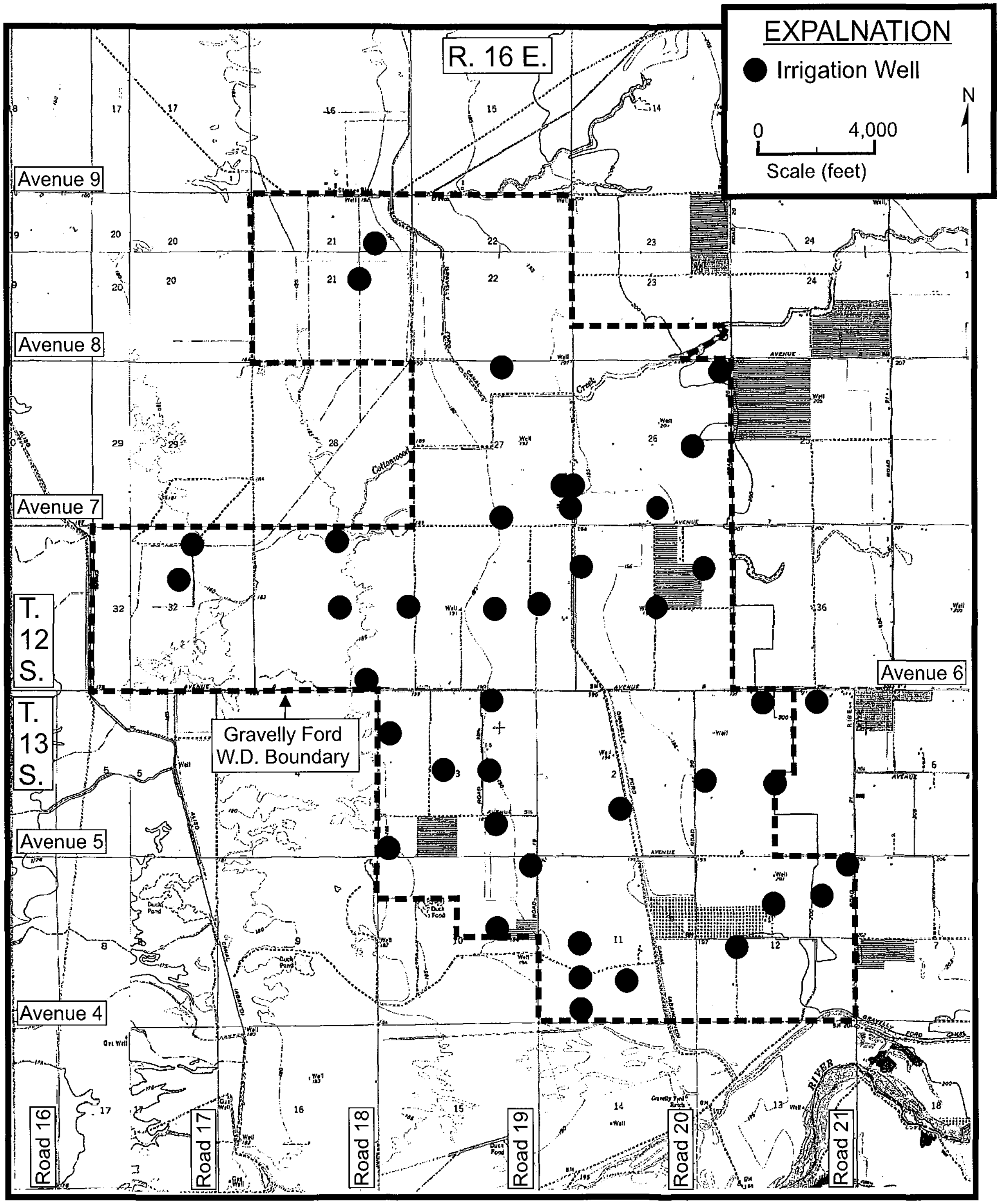


FIGURE 12 - POTENTIAL GROUNDWATER DISCHARGE AREAS

Pump tests area available for dozens of irrigation wells in the GSA. Pumping rates for many irrigation wells range from about 800 to 2,300 gpm. Specific capacities of most wells range from about 25 to 70 gpm per foot. For wells tapping both aquifers, specific capacities can be multiplied by a factor of 1,750 to estimate aquifer transmissivity. Based on the range of specific capacities, transmissivities would be expected to range from about 45,000 to 120,000 gpd per foot. Transmissivity has been determined at some wells, and values range from about 60,000 to 120,000 gpd per foot. The best values of specific yield for the upper aquifer are derived from textural descriptions and specific yield estimates commonly used by the U.S. Geological Survey. For the GSA, a specific yield of 12 percent is reasonable, based on a review of the subsurface geologic cross sections presented in this report. For the groundwater confined below the Corcoran Clay, a storage coefficient of 0.001 to 0.0001 is considered reasonable.

CHANGE IN STORAGE

Based on the average water-level decline of 0.9 foot per year in recent decades in the GSA, and using an average specific yield of 0.12, the groundwater overdraft beneath the 8,500-acre GSA has averaged about 900 acre-feet per year.

Figure 13 shows annual changes in groundwater storage for strata tapped by irrigation wells in the District.

LAND SUBSIDENCE

Land subsidence has become a large issue in the Red Top area in the last several years, due to increased pumping from numerous new wells tapping the lower aquifer. This subsidence has affected conveyance facilities, including the Eastside Bypass. Water-level declines have been much greater in that area than in the GSA. In addition, a number of wells in that area tap only the lower aquifer. Measures are being undertaken to reduce future subsidence in the Red Top area by decreasing lower aquifer pumping. Included are in-lieu recharge (delivering surface water to lands where irrigation water has been pumped from the lower aquifer), and intentional recharge through percolation basins and development of more upper aquifer wells to tap this water.

Land subsidence in and near the GSA has been measured as part of the San Joaquin River restoration project between December 2011 and June 2016 (Figure 14). One station is located north of the San Joaquin River about a mile and a half upstream of the east boundary of the GSA. The land subsidence at this station averaged 0.15 foot per year between December 2011 and June 2016. Another station was located near the west edge of the GSA and Avenue 7. The land subsidence at this station averaged 0.18 foot

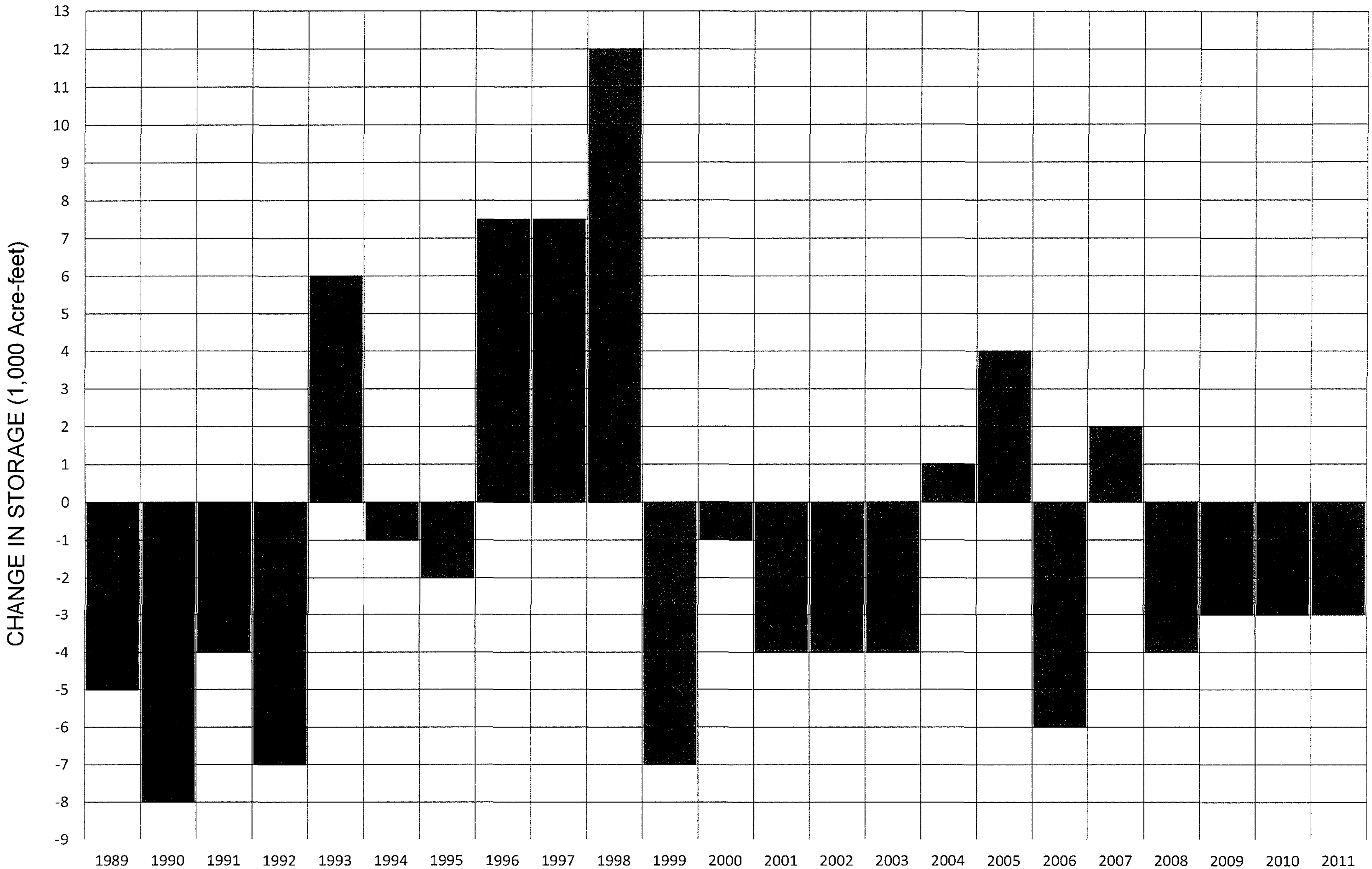
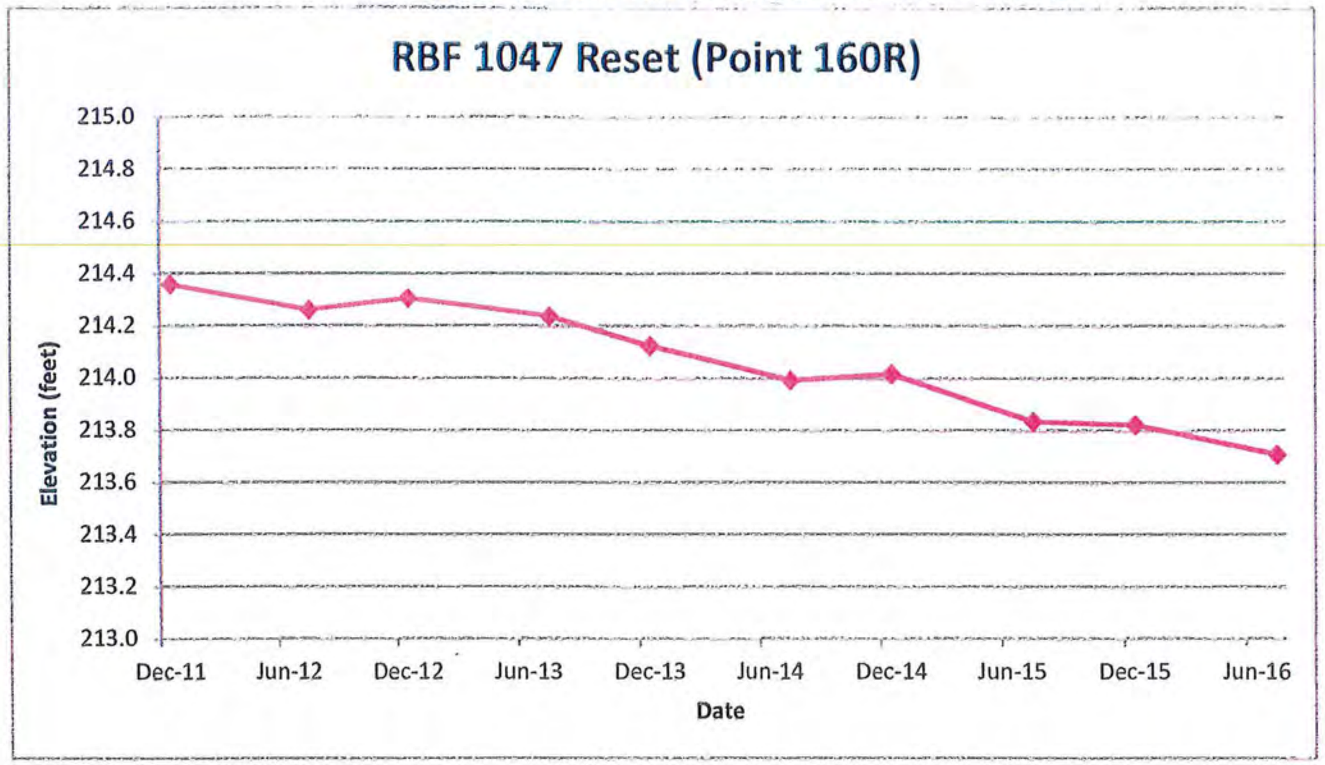
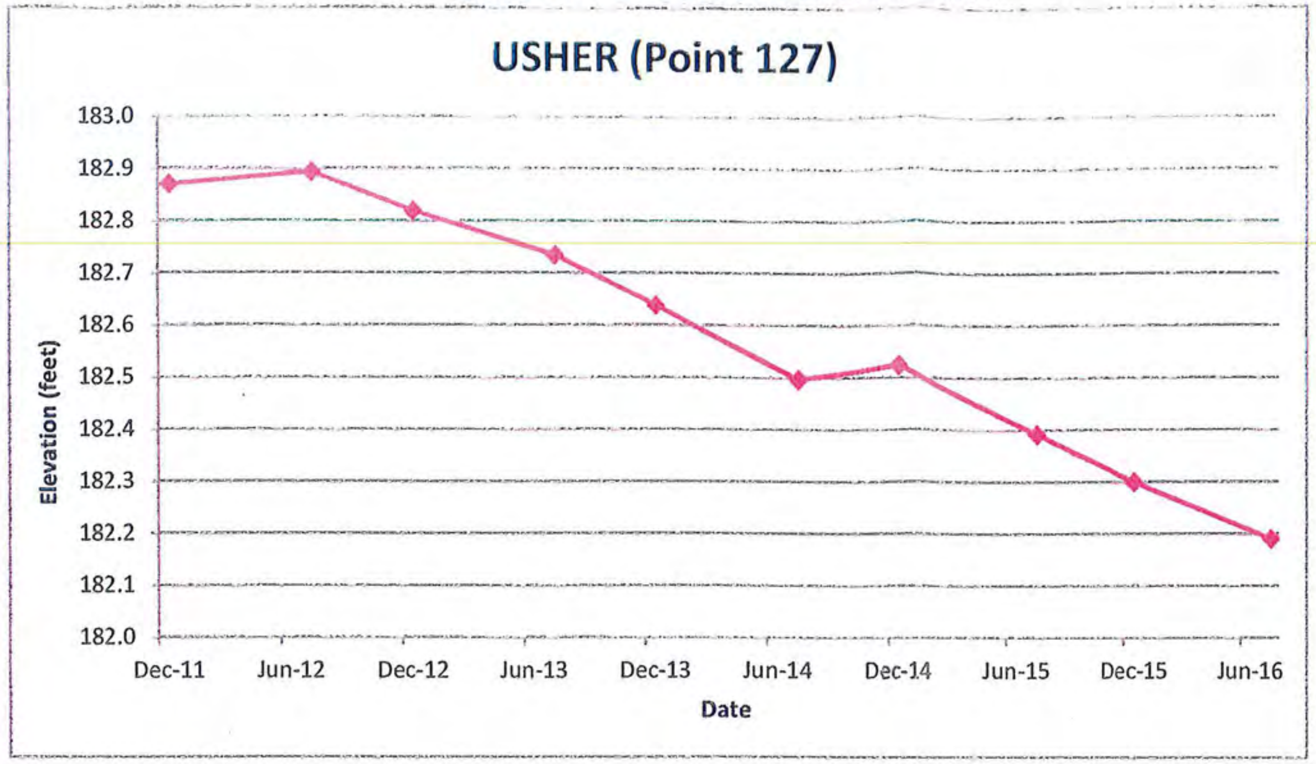


FIGURE 13 - CHANGES IN GROUNDWATER STORAGE

SAN JOAQUIN RIVER NEAR GRAVELY FORD



EASTSIDE BYPASS NEAR AVENUE 7



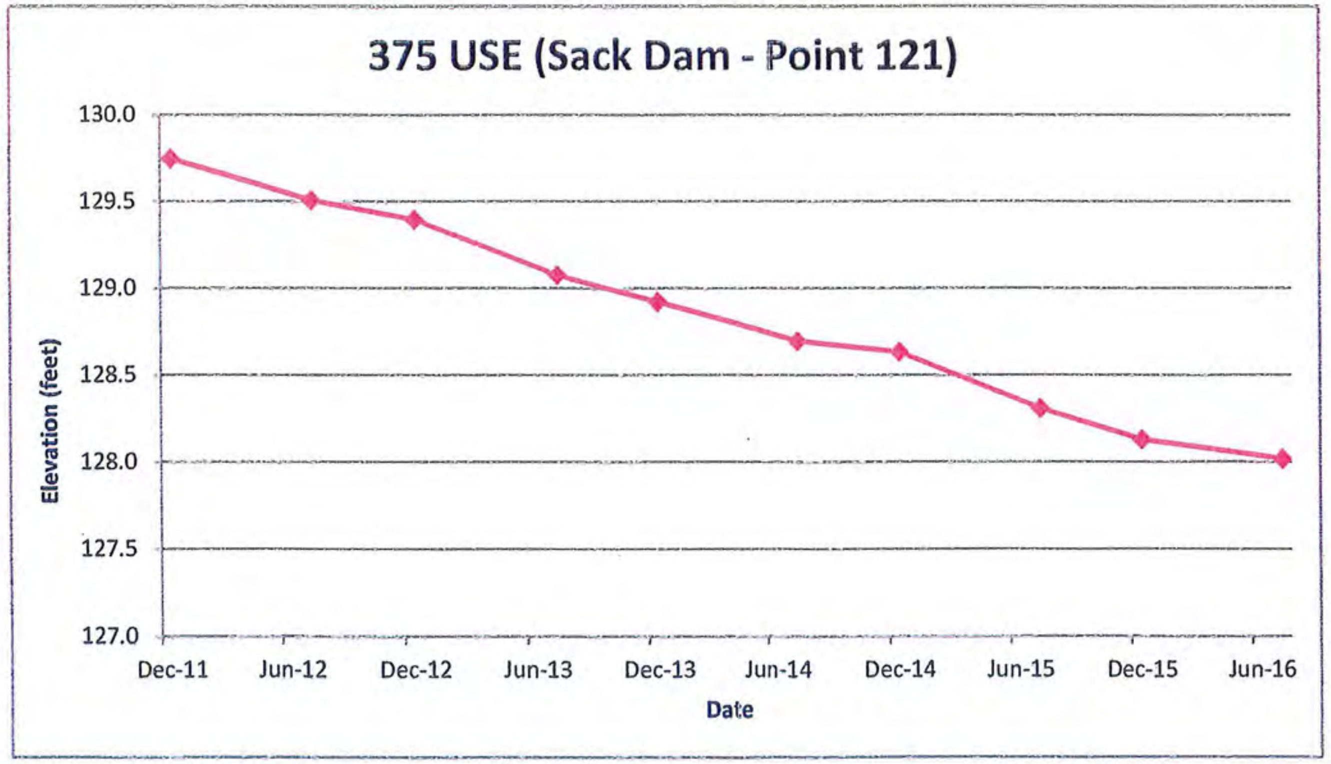


FIGURE 14 - LAND SUBSIDENCE (2011-16)

per year between June 2012 and June 2016. This land subsidence is attributed primarily to pumping from the lower aquifer, primarily east of the Chowchilla Bypass in Madera County and south of the San Joaquin River in Fresno County.

GROUNDWATER QUALITY

Total dissolved solids (TDS) concentrations range from about 160 mg/l to 500 mg/l. The lowest TDS concentrations are generally in shallow groundwater near the San Joaquin River. Some of the higher TDS concentrations are in shallow groundwater beneath irrigated areas more than several miles from the river. The shallow groundwater tends to have higher hardness concentrations. Overall, the chemical quality of the groundwater is suitable for irrigation of most crops. Some of the groundwater requires treatment to lower the pH and/or sodium adsorption ratio (SAR).

INTERCONECTED SURFACE AND GROUNDWATER SYSTEMS

A source of information that can be used to address the interconnection of surface water and groundwater are water-level measurements for a number of shallow monitor wells that were installed for Reclamation along the San Joaquin River as part of the river restoration program. In general, river flows have been always been present in the area east of Gravelly Ford (about a mile and a half east of the southeast corner of the GSA). A review of these measurements for the area farther west indicates that during periods of no flow in the river, the shallow groundwater levels have been below the river channel along the river west of Gravelly Ford. When the river is flowing, there has been a direct connection between the surface water and groundwater. Figure 15 shows the locations of interconnected surface and groundwater bodies in or near the GSA.

KNOWN GROUNDWATER CONTAMINATION SITES

Information on known contamination sites in and near the GSA was obtained from the Central Valley Regional WLB Geotracker website. No such sites are present in or near the GSA.

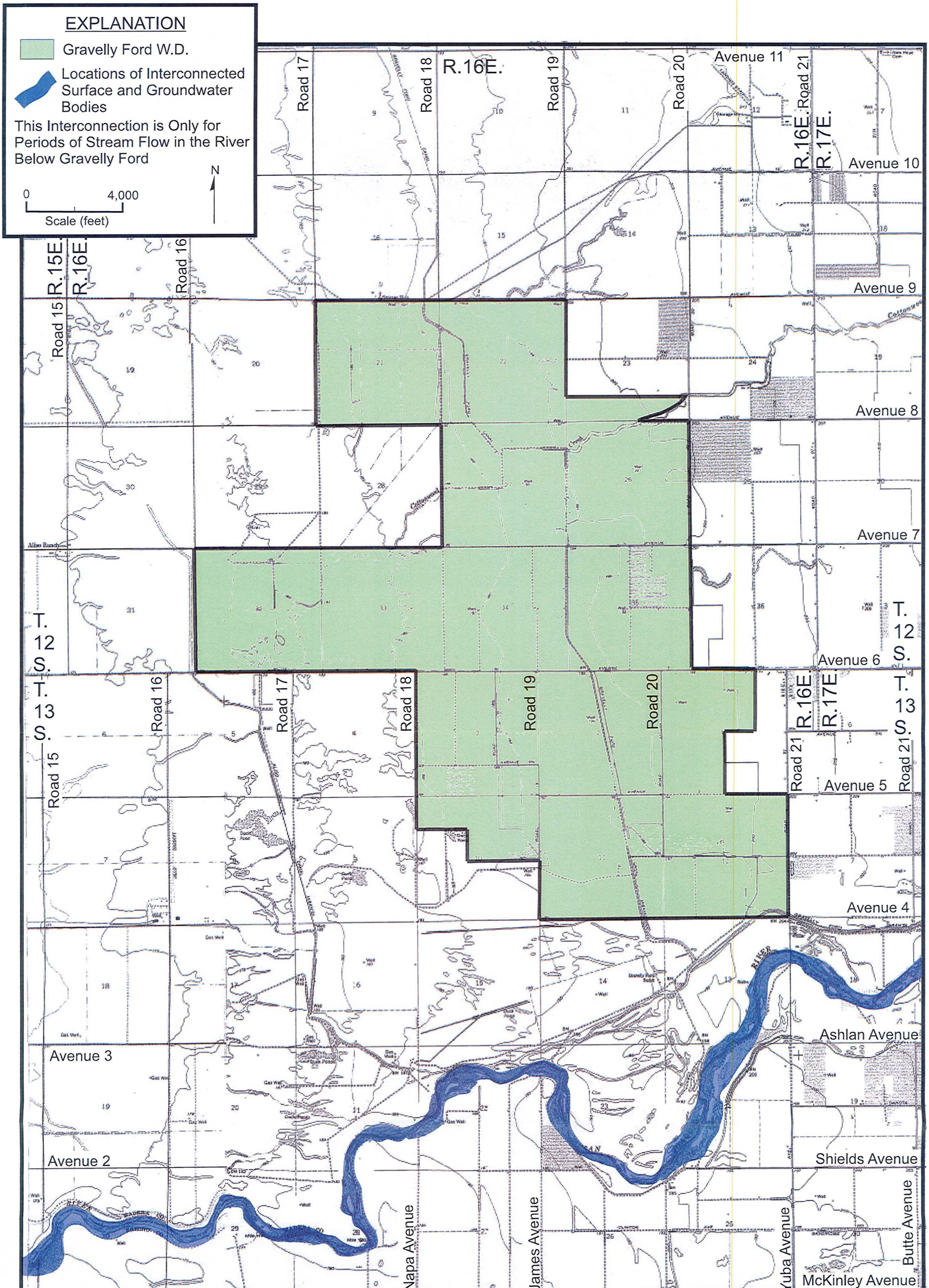


FIGURE 15 - LOCATIONS OF INTERCONNECTED SURFACE AND GROUNDWATER BODIES

APPENDIX F
WATER LEVEL ELEVATION AND DIRECTION OF GROUNDWATER FLOW

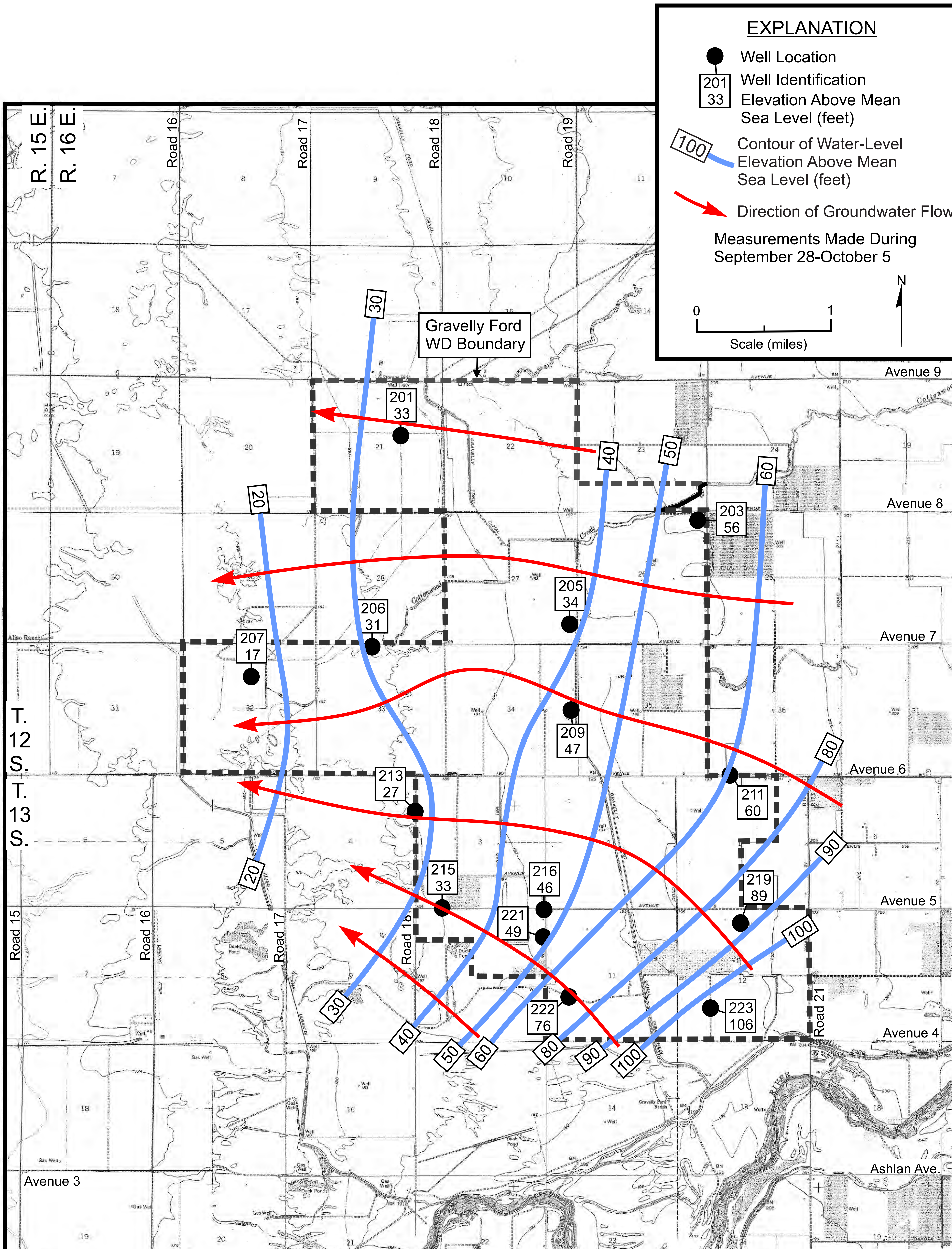
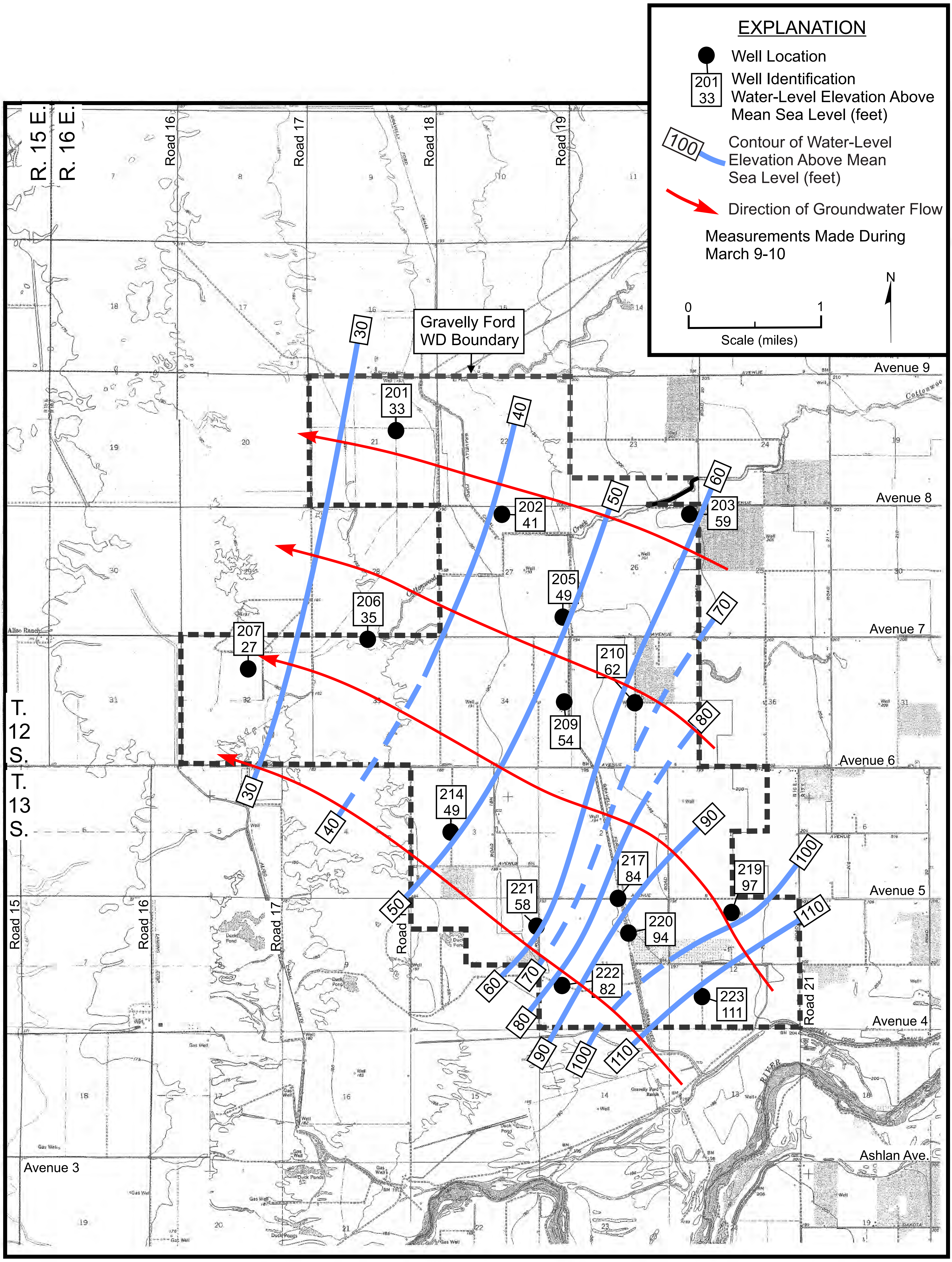
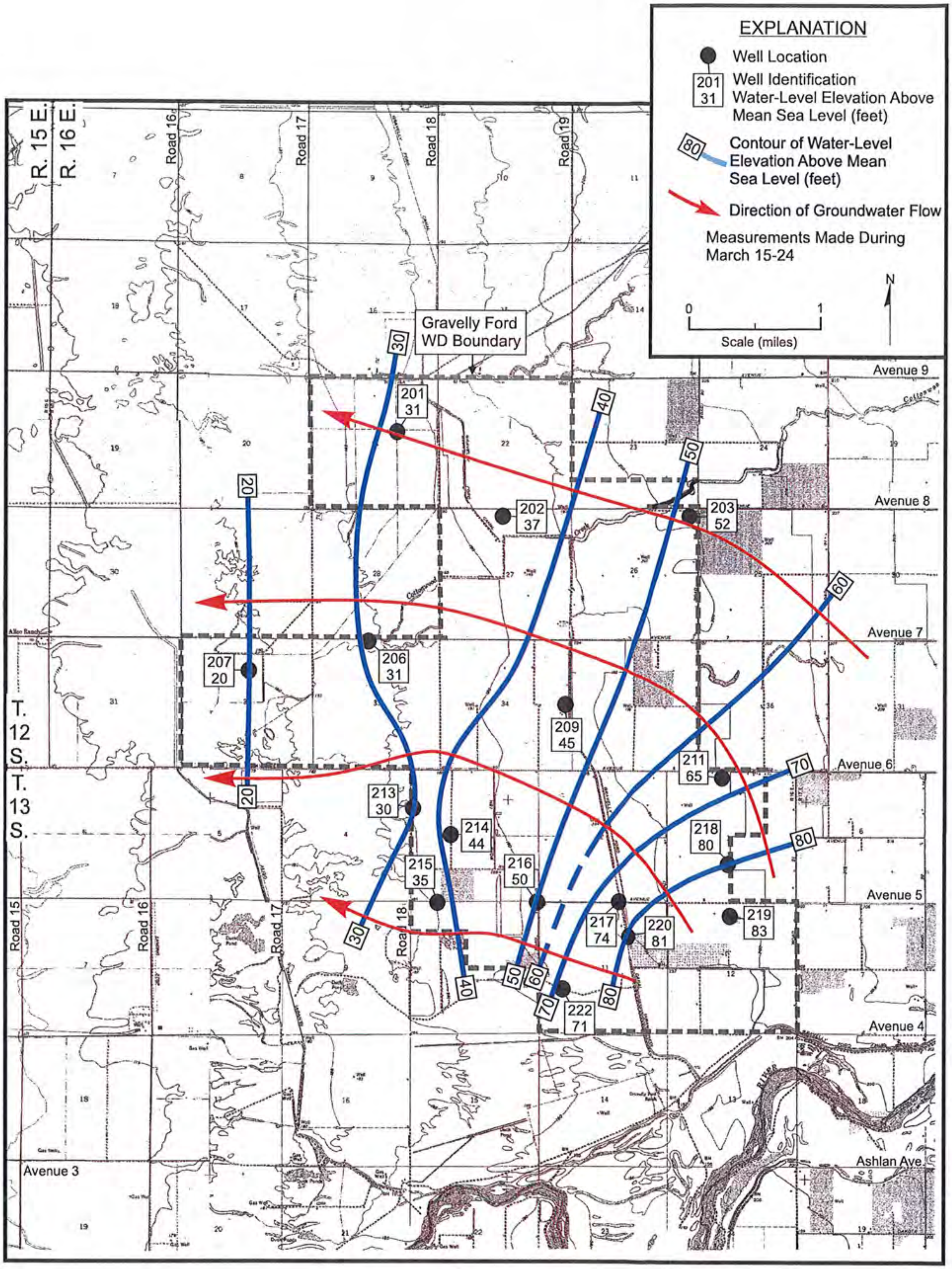


Figure 2-1
Water-Level Elevations & Directions of Groundwater Flow (Fall 2020)



WATER-LEVEL ELEVATIONS AND DIRECTION OF GROUNDWATER FLOW (SPRING 2021)



WATER-LEVEL ELEVATIONS AND DIRECTION OF GROUNDWATER FLOW (SPRING 2022)

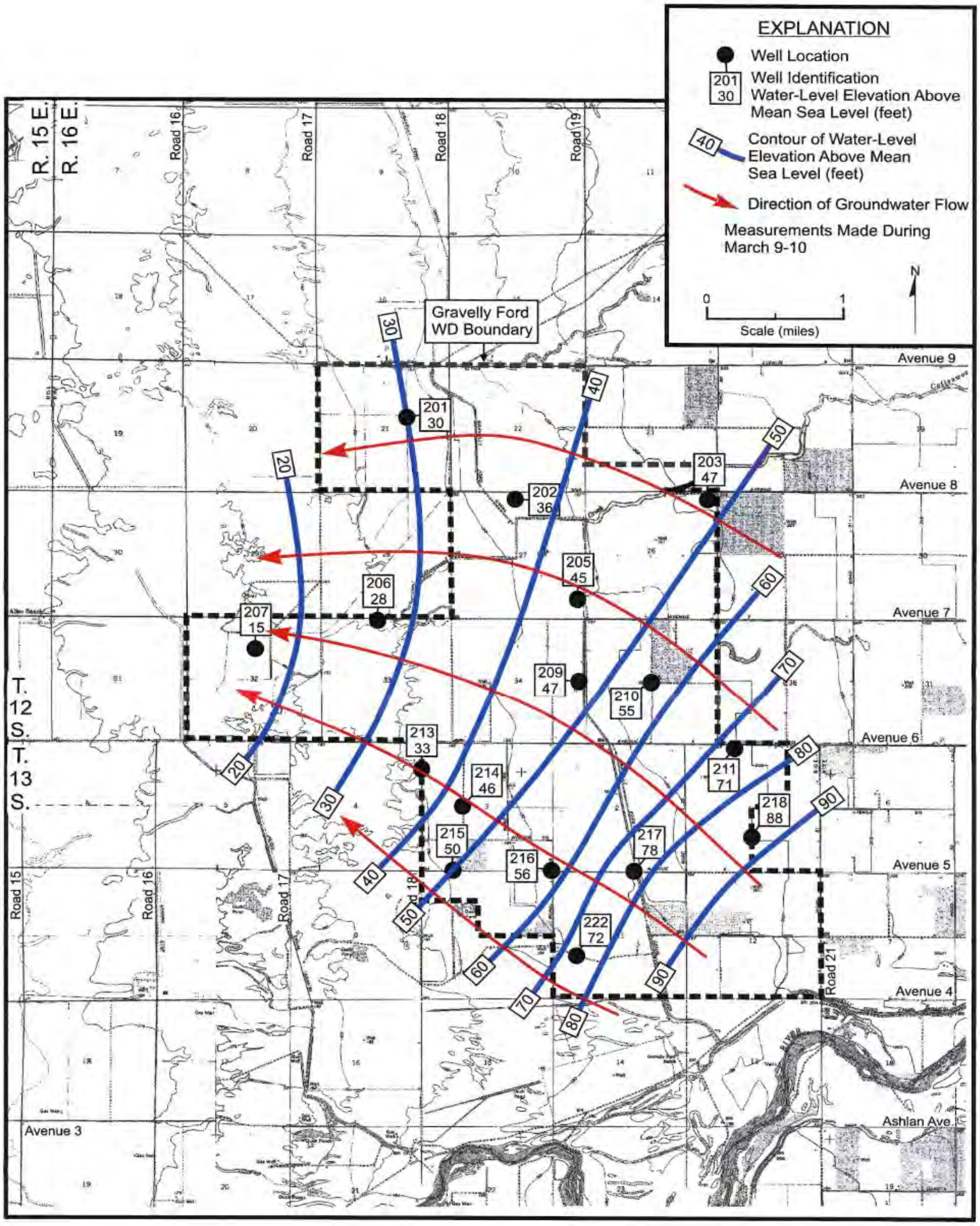
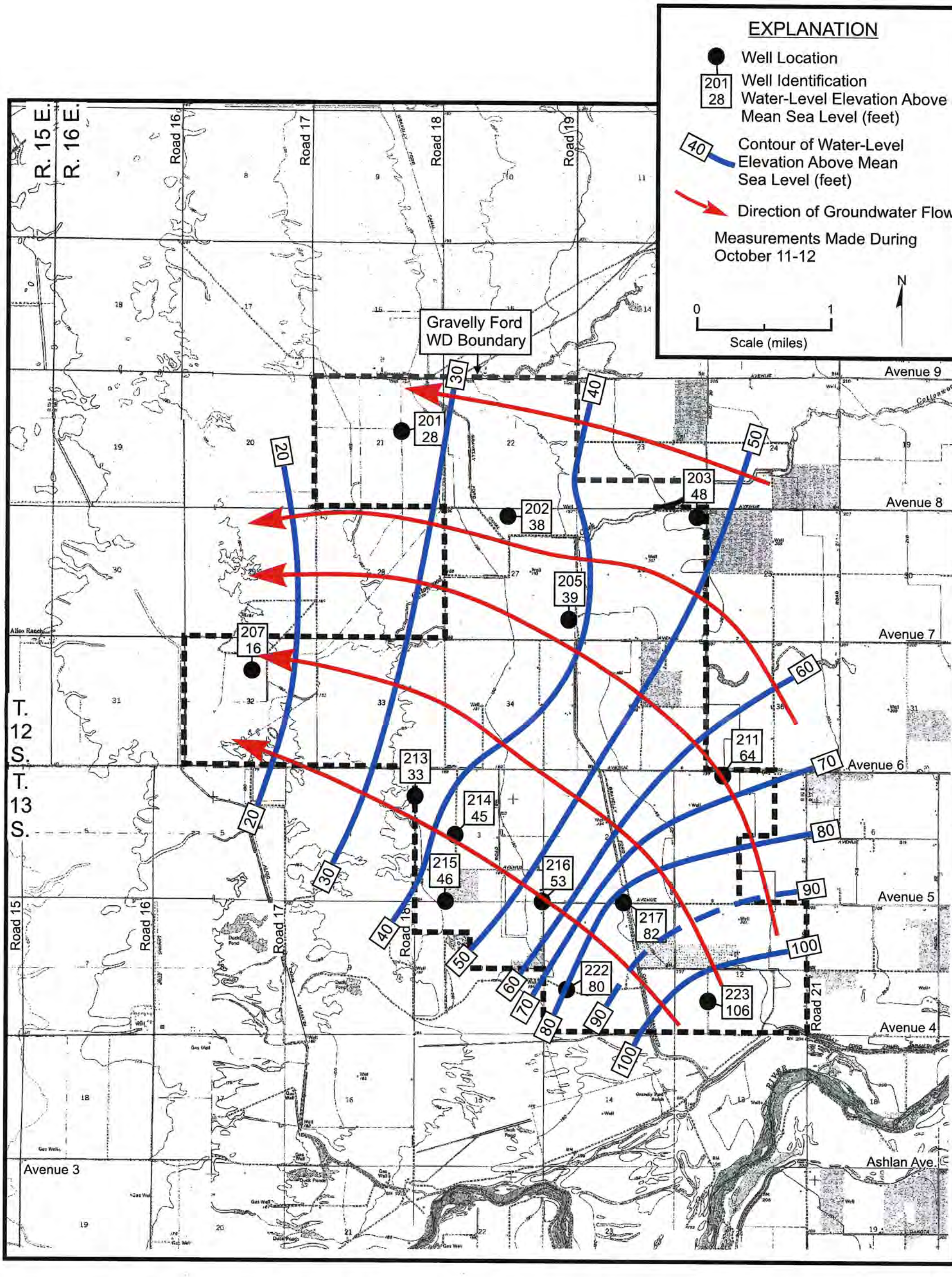
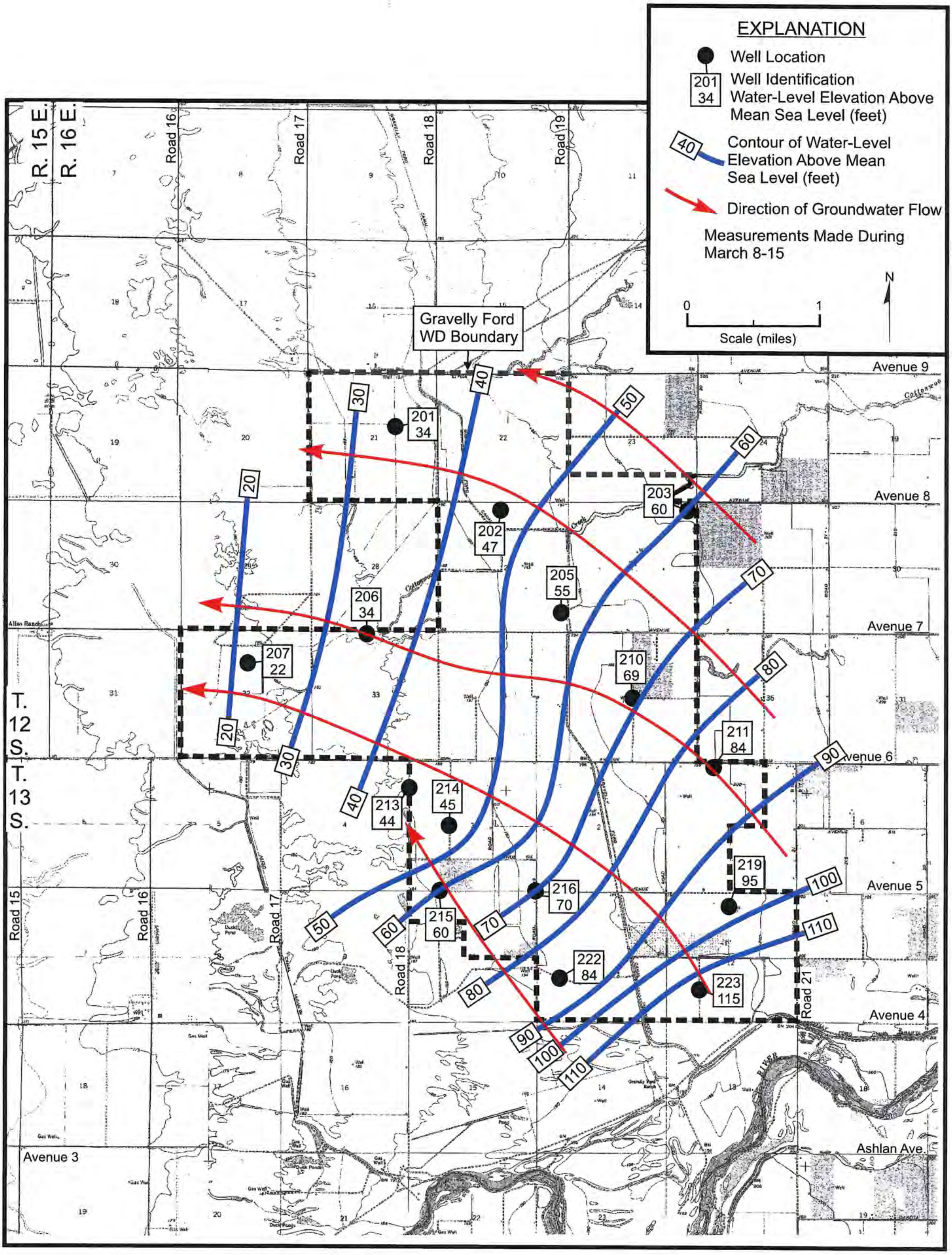


Figure 2-2
Water-Level Elevations & Directions of Groundwater Flow (Spring 2023)



WATER-LEVEL ELEVATIONS AND DIRECTION OF GROUNDWATER FLOW (FALL 2023)



WATER-LEVEL ELEVATIONS AND DIRECTION OF GROUNDWATER FLOW (SPRING 2024)

Appendix 1.B. 2025 Periodic Evaluation GSP Attachments

Appendix 1.B.3. NSWD GSA GSP 2025 Periodic Evaluation Elements

NEW STONE WATER DISTRICT GROUNDWATER SUSTAINABILITY AGENCY

MADERA SUBBASIN GROUNDWATER SUSTAINABILITY PLAN

2025 Periodic Evaluation

MADERA COUNTY, CALIFORNIA
JANUARY 2025

PREPARED FOR:
New Stone Water District Groundwater Sustainability Agency
Madera County, CA

PREPARED BY:
PROVOST & PRITCHARD CONSULTING GROUP
455 W Fir Avenue, Clovis, CA 93611

PROVOST& PRITCHARD

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Ken Bonesteel, PE
Ethan Andrews

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

CEQA .... California Environmental Quality Act
cfs .... Cubic Feet per Second
FWA .... Friant Water Authority
GSA .... Groundwater Sustainability Agency
GSP .... Groundwater Sustainability Plan
IM .... Interim Milestones
ISW .... Interconnected Surface Water
MCSim .... Madera-Chowchilla Model Simulation
Mos .... Measurable Objectives
MOU .... Memorandum
MTs .... Minimum Thresholds
MW .... Monitoring Well
NSWD .... New Stone Water District
NSWD GSA .... New Stone Water District Groundwater Sustainability Agency
RMN .... Representative Monitoring Network
RMS .... Representative Monitoring Site
SJRRP .... San Joaquin River Restoration Project
URs .... Undesirable Results
USBR .... United States Bureau of Reclamation

EXECUTIVE SUMMARY

Please refer to the Madera Subbasin Groundwater Sustainability Plan Period Evaluation for a high-level overview of Subbasin implementation activities and progress towards implementation.
This periodic evaluation covers the period from January 2020 through December 2024. This periodic evaluation is accompanied by an amended plan that was modified to respond to the corrective actions contained in a letter from the Department of Water Resources dated December 21, 2023. The plan was amended with plans to be adopted by the New Stone Water District GSA on January 24, 2025.

OVERVIEW OF PERIODIC EVALUATION

Please refer to the Madera Subbasin Groundwater Sustainability Plan Period Evaluation.
An overview consists of:

1. *No changes to governance*
2. *No modification to member agencies*
3. *Corrective action modifications to plan*
4. *Public meetings monthly to discuss activities*
5. *Achievement of implementing projects and management actions and maintaining water levels for sustainability.*

1 NEW INFORMATION COLLECTED

Please refer to the Madera Subbasin Groundwater Sustainability Plan Period Evaluation.

2 GROUNDWATER CONDITIONS RELATIVE TO SUSTAINABLE MANAGEMENT CRITERIA

Please refer to the Madera Subbasin Groundwater Sustainability Plan Period Evaluation for a discussion on the overall groundwater conditions in the Madera Subbasin as a whole.

This section of the Periodic Evaluation was prepared for the New Stone Water District Groundwater Sustainability Agency (NSWD GSA) to review and evaluate current groundwater conditions for each applicable sustainability indicator relative to the sustainable management criteria established in the GSP (amended 2025). A summary of the Minimum Thresholds (MTs), Measurable Objectives (MOs) and Undesirable Results (URs) is provided in **Table 1**. Locally defined undesirable results were based on discussion with GSA staff and technical representatives, input received from interested stakeholders and the public through public meetings, and through individual stakeholder input to various GSA representatives.

Table 1 Summary of MTs, MOs and Undesirable Results

Sustainability Indicator	Minimum Threshold	Measurable Objective	Undesirable Result (After 2040)
Chronic Lowering of Groundwater Levels	Set equal to the Fall 2015 measurement, if that observed data point is available at the RMS. Otherwise, set equal to the expected Fall 2015 groundwater level determined from MCSim results, with adjustment, if necessary, to account for the offset between historical observed and modeled data.	Set equal to the Fall 2010 measurement, if that observed data point is available at the RMS. Otherwise, set equal to the expected Fall 2010 groundwater level determined from MCSim results, with adjustment, if necessary, to account for the offset between historical observed and modeled data.	Same 30 percent of RMS wells within the subbasin below minimum threshold for two consecutive fall measurements.
Reduction of Groundwater Storage	Same as MTs for chronic lowering of groundwater levels. (Groundwater levels used as proxy.)	Same as MOs for chronic lowering of groundwater levels. (Groundwater levels used as proxy.)	Same 30 percent of RMS wells within the subbasin below minimum threshold for two consecutive fall measurements (Groundwater levels used as proxy)
Degraded Water Quality	Nitrate as N = 10 mg/L or existing level plus 20% (whichever is greater) Arsenic = 10 µg/L or existing level plus 20% (whichever is greater) TDS = 500 mg/L or existing level plus 20% (whichever is greater)	Baseline constituent concentrations	10 percent of RMS wells within the subbasin above the minimum threshold for the same constituent due to projects and/or management actions, or overall groundwater extraction based on average of most recent three year period

Sustainability Indicator	Minimum Threshold	Measurable Objective	Undesirable Result (After 2040)
Land Subsidence	0 feet/year, subject to uncertainty of +/- 0.16 feet/year	0 feet/year, subject to uncertainty of +/- 0.16 feet/year	Average subsidence across greater than 25 percent of RMS exceeding the minimum threshold for two consecutive years.
Depletion of Interconnected Surface Water[1]	A percent of time surface water is connected to shallow groundwater that is equal to historical conditions for a similar climatic/hydrologic period.	A percent of time surface water is connected to shallow groundwater that is equal to historical conditions for a similar climatic/hydrologic period.	Greater than 30 percent of RMS wells below minimum threshold for two consecutive annual five-year rolling average annual evaluations.
Seawater Intrusion	Not Applicable	Not Applicable	Not Applicable
[1] Interim SMCs will be replaced as a result of the Subbasin data gap analysis and findings from the ISW MOU.			

The NSWD GSA covers 4,200 acres in the northwestern area of the Madera Groundwater Subbasin (Subbasin) that is adjacent to the Chowchilla Bypass flood control channel. The NSWD GSA is coterminous with the New Stone Water District (NSWD or District) boundary. The District is predominantly agriculture and consists of two landowners. **Figure 1** shows the proximity of the NSWD GSA within the Madera Subbasin. It is adjacent to the Chowchilla and Eastside Bypass to the east, bordering the Chowchilla Subbasin to the north, and the Delta-Mendota Subbasin to the west. The area just north of the NSWD GSA, within the Chowchilla Subbasin, appears to have either more limited surface supplies or increased lower aquifer pumping. This is indicated by subsidence data showing increased subsidence occurring in this area and groundwater contouring showing flows are directed toward this area.

The NSWD GSP encompasses the southwestern one-fifth to one-quarter of the Subbasin. As the NSWD GSA continues to implement its plan, it is crucial that the NSWD GSA and neighboring Madera-Chowchilla Subbasin GSAs actively engage in project implementation and demand management activities. It is the responsibility of all agencies within the Subbasin to coordinate and ensure sustainable management practices of surface and groundwater use in order to reach the sustainability goal.

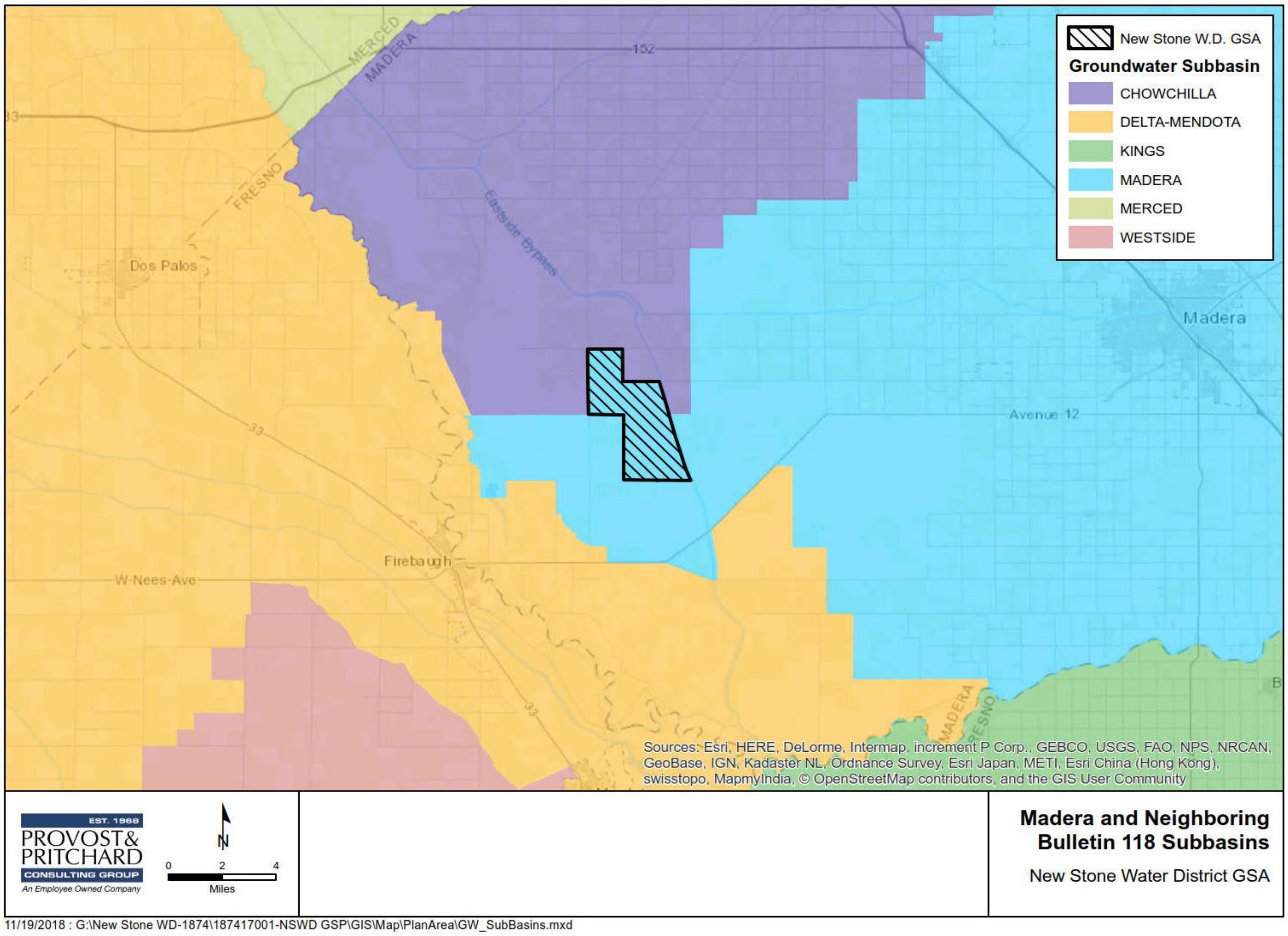

Figure 1 Plan Area Location Map

2.1 GROUNDWATER LEVELS

An undesirable result is defined to occur after 2040 if the same 30 percent of RMS wells within the subbasin fall below minimum thresholds for two consecutive fall measurements, or below the interim milestones during implementation. Table 2 presents previous fall groundwater elevation measurements for the representative monitoring wells over the past two years, along with the minimum thresholds and measurable objectives. Figure 2 shows a location map of NSWD GSA's representative monitoring sites for water levels and water quality. Three of the four sites are sub-Corcoran Clay, lower aquifer wells, as the lower aquifer is the principal aquifer source for the District's water supply. In Fall 2024, each measured RMS well was above the 2025 Interim Milestone, indicating that NSWD GSA is on track to meet interim milestones and sustainability goals. Due to access agreement negotiations and a miscommunication with the California Statewide Groundwater Elevation Monitoring Program (CASGEM), well 11S15E30A001M has not been measured since 2020, which is why data for that well is not represented in Table 2 or have a hydrograph. The Madera Subbasin is critically over-drafted and is expected to experience undesirable results during the implementation period. Therefore, water levels are anticipated to drop below the MT during implementation with the goal to be above the MT after 2040.

Table 2 Progress Towards Water Level Sustainable Management Criteria

Well	Fall 2023	Fall 2024	2025 Interim Milestone	Minimum Threshold	Measurable Objective
10	5.0	7.0	-4	8	17
34	-7.0	-1.0	-22	-14	1
37	-6.0	-4.0	-16	-4	7
11S1530A001M	NM	NM	-4	-5	19
Water Surface Elevation (WSE) measured in feet above mean sea level					

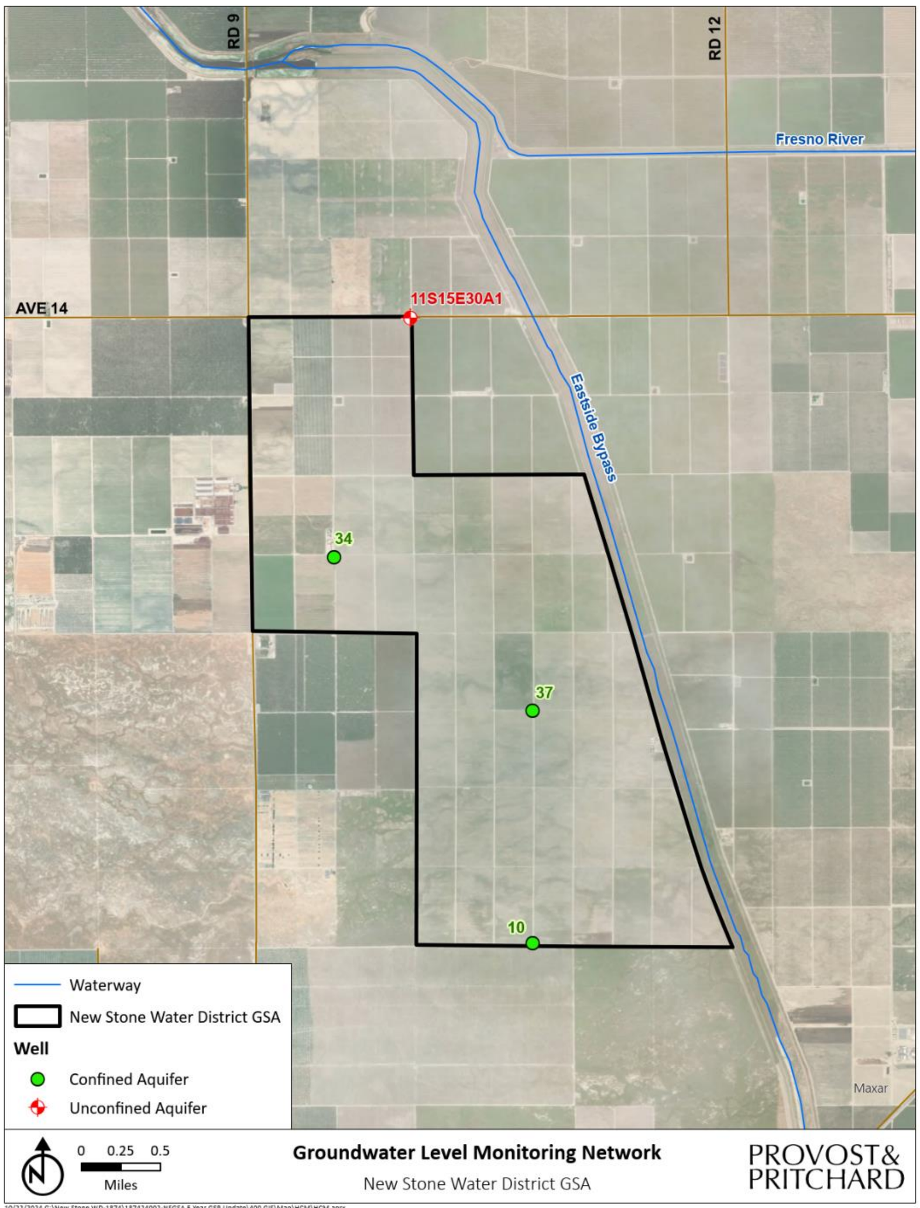

Figure 2 NSWD Representative Monitoring Network

Water levels have generally stabilized since 2020.Historical groundwater potentiometric surface contour maps from fall 2019 through fall 2024 are provided in **Appendix A**. Groundwater in this region typically flows from the District in a northerly direction with a slight easterly component, except for fall 2022, when water levels shifted to a northeasterly flow direction.

Figure 3, Figure 4, and **Figure 5** present hydrographs for the District's RMS wells, comparing recent data to interim milestones, measurable objectives, and minimum thresholds set by the NSWD GSA in coordination with Madera Subbasin methodologies. All wells are used to supply water for agricultural irrigation.

The representative monitoring wells for lower aquifer water levels remain consistent with the NSWD GSA GSP. However, two wells from the approved 2023 GSP were removed from the network: well 11S14E36R001M (upper) was destroyed and well 12S15E16A001M (lower, previously identified as upper) was removed per Joint GSP direction, as it is a well in the Madera County GSA and is already being accounted for in the Joint GSP. Currently, there are four wells in use for monitoring across the area, as shown in **Figure 2**.

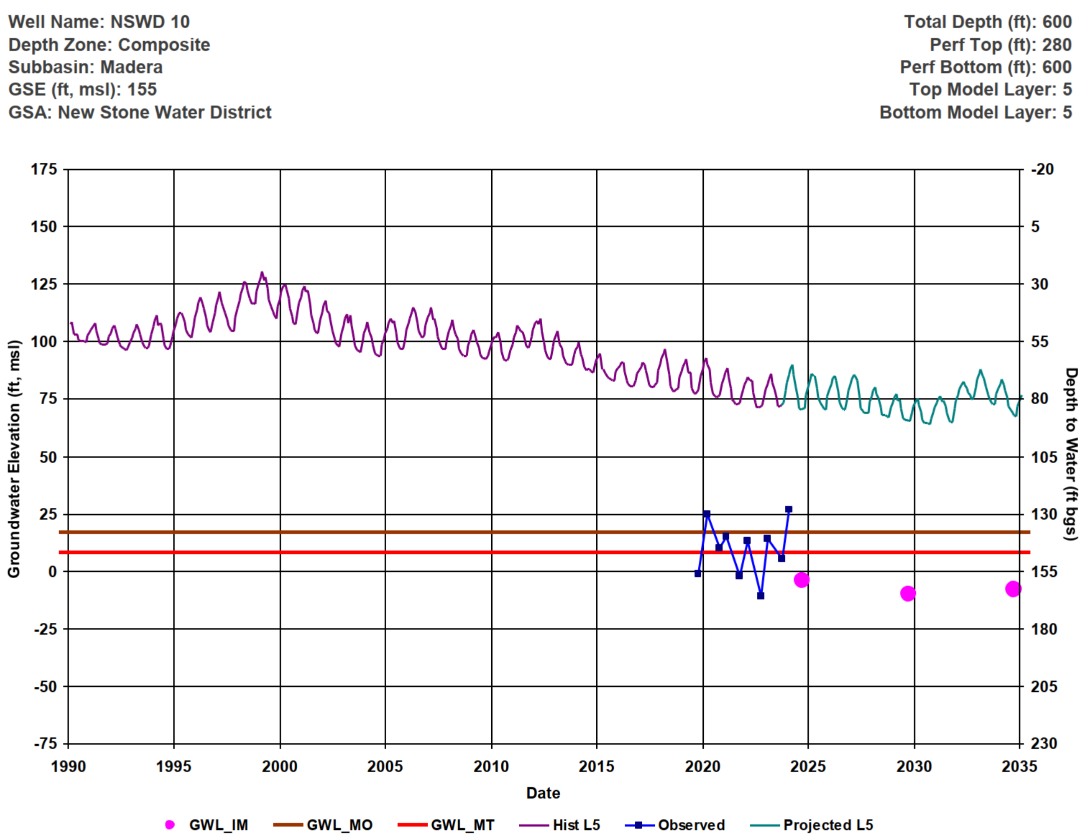

Figure 3 Well 10 Hydrograph

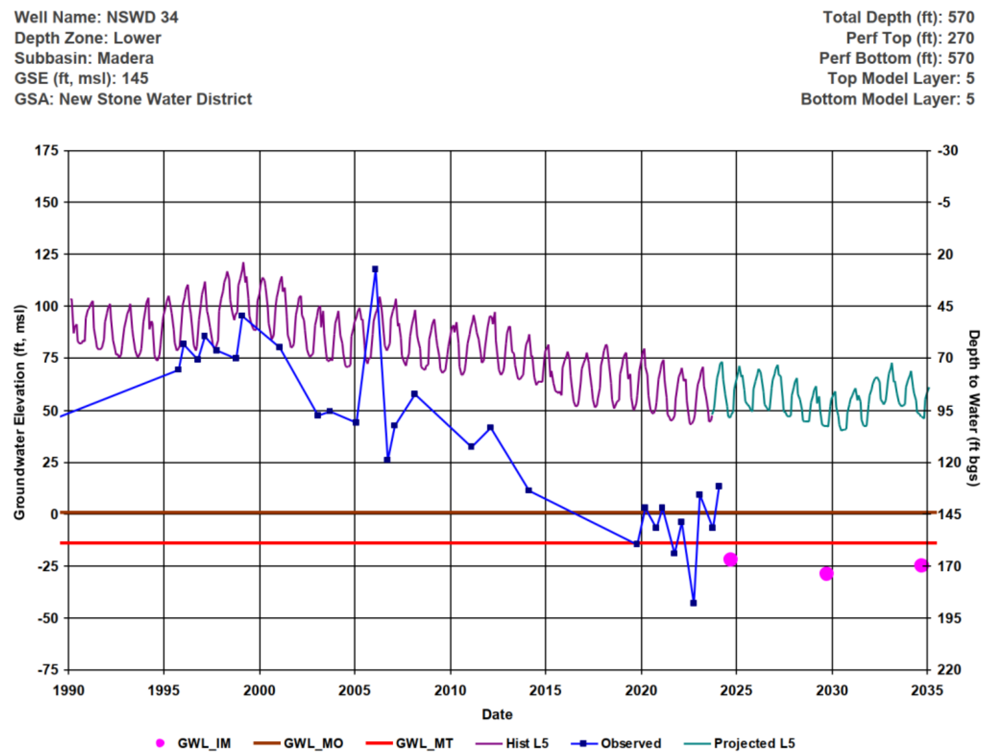

Figure 4 Well 34 Hydrograph

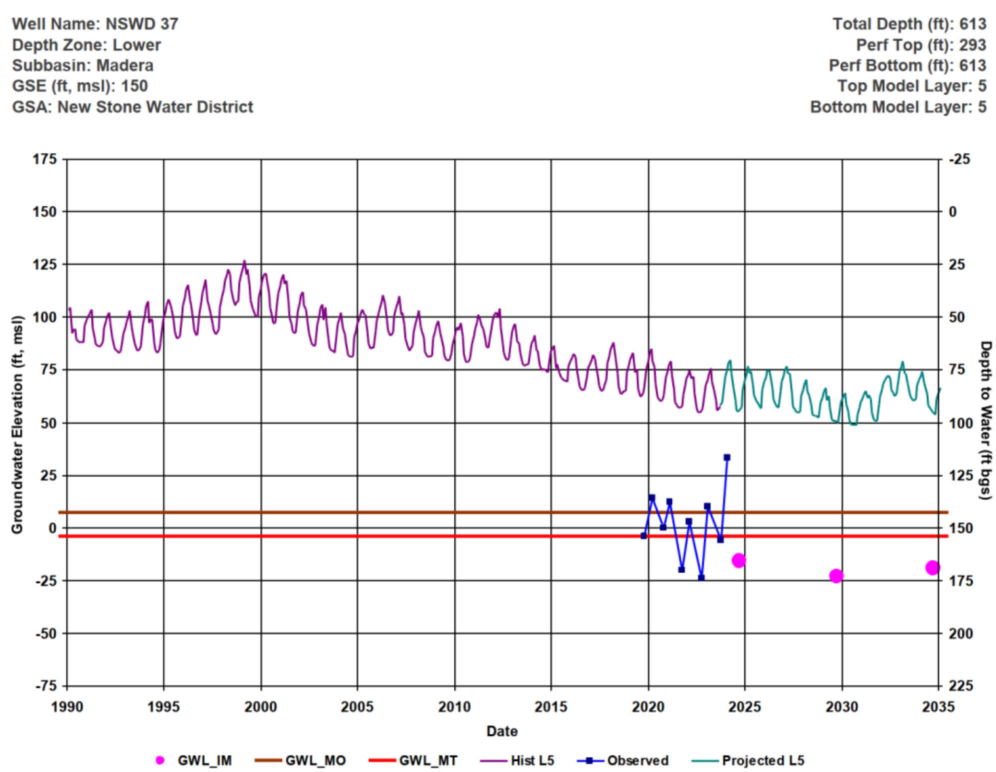

Figure 5 Well 37 Hydrograph

2.2 GROUNDWATER STORAGE CHANGE

The Sustainable Management Criteria (SMC) for groundwater storage reduction are based on the groundwater levels MT methodology. For the groundwater storage change sustainability indicator, the groundwater level MTs are used as a proxy for avoidance of reduction in groundwater storage. In Fall 2024, each measured RMS was above the 2025 Interim Milestone, indicating that NSWD GSA is on track to meet interim milestones and sustainability goals.

Changes in groundwater storage are calculated using the weighted average method applied to a GIS-generated surface, supported by hydrogeological interpretation. This analysis incorporates the representative monitor sites for groundwater levels, as well as water levels from additional wells both within and outside the District that are publicly available. Changes in groundwater storage occur when groundwater extraction exceeds recharge, or vice versa. NSWD GSA extracts groundwater exclusively for agricultural irrigation. Although the District primarily pumps from below the Corcoran Clay, the District holds an appropriative water for 15,700 acre-feet per year (permit number 19615) along the Chowchilla Bypass (also referred to as Eastside Bypass/Chowchilla Canal in permit), which can be used for intentional recharge of the upper aquifer to offset potential upper aquifer losses from vertical groundwater flow. Additional recharge occurs through seepage from the Chowchilla Bypass when floodwaters are available. Groundwater storage changes since Water Year 2015 is shown in **Table 3**.

Table 3 Groundwater Storage Change from 2015-2023

Time Period	Average Change (ft)	Surface Area of Analysis (ac)	Assumed Specific Yield	Storage Change (AF)	Cumulative Change (AF)
Spring 2015 – Spring 2016	-15.0	4,011	0.13	-7,801	-7,801
Spring 2016 – Spring 2017	34.3	4,011	0.13	17,864	10,064
Spring 2017 – Spring 2018	-12.0	4,011	0.13	-6,257	3,806
Spring 2018 – Spring 2019	-10.2	4,011	0.13	-5,319	-1,512
Spring 2019 – Spring 2020	-5.8	4,011	0.13	-3,003	-4,516
Spring 2020 – Spring 2021	-4.0	3,993	0.13	-2,076	-6,592
Spring 2021 – Spring 2022	-6.0	3,993	0.13	-3,115	-9,706
Spring 2022 – Spring 2023	7.0	3,993	0.13	3,634	-6,073
Average	-1.5			-759	
Fall 2014 - Fall 2015	1.2	4,011	0.13	647	647
Fall 2015 - Fall 2016	12.2	4,011	0.13	6,382	7,029
Fall 2016 - Fall 2017	-15.6	4,011	0.13	-8,134	-1,105
Fall 2017 - Fall 2018	-10.5	4,011	0.13	-5,465	-6,570
Fall 2018 - Fall 2019	-6.7	4,011	0.13	-3,476	-10,046
Fall 2019 - Fall 2020	7.7	4,011	0.13	3,998	-6,049
Fall 2020 - Fall 2021	-14.7	3,993	0.13	-7,631	-13,679
Fall 2021 - Fall 2022	-12.3	3,993	0.13	-6,385	-20,064
Fall 2022 - Fall 2023	25.3	3,993	0.13	13,133	-6,931
Average	-1.5			-770	

Those data presented in **Table 3** shows that the average change in groundwater storage over the period of record from 2014 to 2023 is less than negative 800 AF/year. The average change was a negative 1.5-foot per year using spring and fall data. As shown in **Table 3**, the positive values of storage change correlate to wet water years in WY17, WY19, and WY23, stressing the importance of capturing flood water when available.

2.3 GROUNDWATER QUALITY

In an effort to establish consistent constituents of concern monitored throughout the Madera Subbasin, technical representatives from each GSA set SMCs for degraded groundwater quality for nitrate, total dissolved solids, and arsenic. These constituents were selected with consideration of existing and historical groundwater quality conditions in the Subbasin, despite whether there was a historical record for each constituent. The MTs for Degraded Water Quality across the Subbasin are set at the following MCLs for drinking water for the identified key constituents of nitrate as nitrogen, TDS, and arsenic.

- *Nitrate as nitrogen = 10 mg/L, or baseline concentration plus 20%*
- *TDS = 500 mg/L, or baseline concentration plus 20%*
- *Arsenic = 10 µg/L, or baseline concentration plus 20%*

When existing or historical concentrations for the key constituents already exceed the MCL, the MT is set at the baseline concentration plus 20 percent. When current or historical water quality for the key constituents have not been measured, the MT will be set as the MCL and will be adjusted if needed. Since arsenic and TDS have not been historically sampled within the GSA, MTs will likely be revised following the development of baseline concentrations. **Table 4** lists the estimated thresholds for water quality for the NSWD GSP.

Table 4 Summary of Groundwater Quality Minimum Thresholds for Representative Monitoring Sites

Well ID	Well Type	MT Arsenic Concentration (µg/L)	MT Nitrate Concentration (mg/L)	MT TDS Concentration (mg/L)
NSWD 10	Production	10†	10†	500†
NSWD 34	Production	10†	10†	500†
NSWD 37	Production	10†	10†	500†
11S15E30A001	Production	10†	10†	500†

†Values will be confirmed and/or adjusted as needed once enough data are collected to establish meaningful baselines. If initial sampling exceeds the MCL, then the MT is set at the baseline concentration plus 20%.

Existing and historical concentrations for nitrate (as N) from NSWD GSA's representative monitoring sites are shown in **Table 5**. Since TDS and arsenic were added to the list of constituents to monitor in 2024, the District has added them to their sampling schedule and will be included in future reporting periods. Similar to why 11S15E30A001M is not represented in the water level section, water quality samples have not been collected from this well due to access agreement negotiations. Among the wells sampled consistently for nitrate (as N) over the most recent three-year period (2022-2024), no wells exceeded the initial MT for nitrate (as N) on average. Once a baseline concentration is set for TDS and arsenic for each well, the NSWD GSA, in coordination with the Subbasin methodology, may decide to adjust the MTs to baseline concentrations plus 20%.

Table 5 Summary of Nitrate (as N) Results from NSWD GSA Representative Sites

Nitrate as N (NO3-N) (mg/L)						
Well	**2020**	**2021**	**2022**	**2023**	**2024**	**Average (2022-2024)**
Well 10	3.3	1.2	1.6	1.0	1.9	1.5
Well 34	4.3	5.5	4.4	4.9	3.8	4.4
Well 37	6.2	8.1	6.5	7.3	5.9	6.6

2.4 LAND SUBSIDENCE

Inelastic land subsidence occurs when average annual groundwater pumping and other outflows from the Subbasin, primarily from the Lower Aquifer, exceed average annual inflows. Significant and unreasonable conditions were identified through discussions with GSAs and individual stakeholder outreach via subsidence interviews. These subsidence interviews resulted in a coordinated MT of no additional inelastic land subsidence, or 0 feet/year, after 2040 (subject to subsidence station uncertainty of +/- 0.16 feet/year), consistent across the Subbasin. **Table 6** shows the MT for land subsidence across the Subbasin displayed as both a rate and cumulative subsidence. Land subsidence is monitored at several stations close to the GSA. The Madera Subbasin monitoring network for subsidence consists of nine (9) subsidence stations. Since 2020, the two representative subsidence stations closest to the NSWD GSA (Station 1007R and 201R) have seen an average annual rate of subsidence of -0.22 to -0.24 feet/year (**Table 7**). Stations 1007R and 201R show a cumulative subsidence of -0.88 feet and -0.95 feet, respectively, indicating that stations near NSWD GSA are on track to meet the 2025 interim milestone goal of no more than 1.5 feet of cumulative subsidence from 2020 to 2025. Potentiometric surface contour maps show that groundwater is flowing north towards the Chowchilla Subbasin, due to an apparent groundwater cone of depression potentially caused by extraction activities in the neighboring Subbasin. It is the intent of the Madera Subbasin to establish "a subsidence working group committee" of technical GSA representatives to assist with identifying the cause of the subsidence and eliminating future subsidence beyond 2040. However, the absence of lower aquifer monitoring wells outside of NSWD GSA to the north and south, makes it challenging to monitor these activities in the neighboring GSAs and Subbasins.

Table 6 Summary of Subsidence Sustainable Management Criteria

5-Year Interval	Maximum Average Annual Rate of Subsidence (feet/year)	Maximum 5-Year Cumulative Subsidence (feet)[1]
2020-2025		1.5
2025-2030	0.2	1.0
2030-2035	0.1	0.5
2035-2040	0.05	0.25
Note: Due to the uncertainty in land subsidence measurement accuracy of +/- 0.16 feet/year, there may be instances where measurement error will indicate a rate of subsidence greater than the IMs. Undesirable results will trigger further management actions within the Subbasin.		

[1] A cumulative total of up to 1.0 feet of subsidence has already occurred in some portions of the subbasin between December 2019 and December 2023. Therefore, the maximum allowable cumulative subsidence of 1.5 feet as of December 2024 requires annual subsidence in 2024 to be less than 0.5 feet. Subsequent years after 2024 have significantly lower allowable annual rates of subsidence.

Table 7 Summary of Inelastic Subsidence Rates

Annual Inelastic Subsidence		
Monitoring Points		
Years	**1007R**	**201R**
Dec-16 – Dec-17	-0.30	NA
Dec-17 – Dec-18	-0.27	-0.18
Dec-18 – Dec-19	-0.26	-0.24
Dec-19 – Dec-20*	-0.20	-0.18
Dec-20 – Dec-21	-0.26	-0.19
Dec-21 – Dec-22	-0.28	-0.34
Dec-22 – Dec-23	-0.14	-0.24
Average Dec-20 – Dec-23	-0.22	-0.24
Cumulative Dec 20 – Dec 23	-0.88	-.95

*Dec 2019 to Dec 2020 is considered this first year of GSP Implementation

It should be noted that while groundwater level MTs and MOs are a separate sustainability indicator and are not specifically tied to subsidence thresholds, they are consistent with the objective to limit the potential for future subsidence. The MT may require modification in the future if subsidence continues to be seen approaching the end of the 20-year GSP implementation period.

2.5 INTERCONNECTED SURFACE WATER AND GROUNDWATER

Major surface water systems in the Madera Subbasin are the San Joaquin and Fresno Rivers. The nearest NSWDGSA boundaries are approximately 4 miles from Reach 3 of the San Joaquin River and 1 ½ miles from the confluence of the Eastside Bypass and the Fresno River. Therefore, NSDW GSA does not contain interconnected surface water and groundwater systems (ISW). Water flows in the adjacent Chowchilla Bypass only during wet years when flood flows are released from Friant, thus it is frequently dry. Due to the lack of ISW within the GSA, these Sustainability Indicator will not be monitored or considered when making management decisions.

SGMA Regulations are concerned with the volume or rate of surface water depletion caused by groundwater pumping in basins where surface water and groundwater are interconnected. Interconnected surface water systems are defined as surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted (Modeling Best Management Practices, DWR, 2016). The purpose of this section is to identify any known areas within the NSWDGSA where groundwater pumping has caused surface water depletion. Currently, there is no evidence that active wells within the GSA are causing increased seepage loss or impacts to downstream beneficial uses.

3 STATUS OF PROJECTS AND MANAGEMENT ACTIONS

The NSWD GSA GSP that was adopted and approved contained a list of project and management actions summarized into the following project categories: groundwater recharge, surface water acquisition, water conservation, and management programs. A status of these projects is summarized in Table 8 below.

Table 8 Status of Projects and Management Actions from NSWD GSA GSP (as of 2024)

Type	Activity	Status
Groundwater Recharge Projects	Intentional Recharge	Implemented
	In-Lieu Recharge	Further evaluation required
	Groundwater Injection Wells	Currently not financially feasible*
	Banking Water Outside of District	Currently not financially feasible*
Surface Water Acquisition Projects	Acquisition of Chowchilla Bypass Flood Water	Implemented/ further expansion being considered
	Acquisition of USBR 215 Flood Water	Currently not financially feasible*
	Water Exchanges/Transfers/Purchases	Currently not financially feasible*
Water Conservation Projects	Irrigation Efficiency Improvements	Further evaluation required
	Installing Well Meters	Currently not needed
Management Programs	Prop 218	In progress
	Subsidies for Surface Water Use, Groundwater Conservation Improvements, and Crop Conversion	Further evaluation required
	Fallowing Rotation	Currently not needed
	Agency Reporting	Implemented
	Groundwater Allocation	Currently not needed

* Should there be Undesirable Results or continued exceedances within the NSWD GSA, “Currently not financially feasible” projects may be further evaluated.

3.1 INTENTIONAL RECHARGE AND ACQUISITION OF CHOWCHILLA BYPASS FLOOD WATER

When excess surface water is available during wet years when the San Joaquin River reaches capacity, water is diverted to the Chowchilla Bypass flood control structure for flood relief. These flood waters can be put to direct use (i.e., applied water for irrigation) or diverted for recharge basins, allowing water to percolate to the groundwater table and replenish the upper aquifer. The volume of water recharged is limited by the availability of and access to surface water.

The NSWD has an appropriate water right along the Chowchilla Bypass of 15,700 AF/year, which presents the District with a unique opportunity to recharge the upper aquifer and acquire floodwater from the Chowchilla Bypass for direct beneficial use on their property. Due to the location of the current turnout, NSWD is not able to exercise this right to its full potential. The District currently recharges water in a canal adjacent to the Chowchilla Bypass shown in **Figure 6**. Since 2015, the District has diverted approximately 745 AF into their canal as a result of the water right.

The GSA continues to investigate potential projects to apply water directly to crops and on-farm recharge opportunities. Though current investigations are in the conceptual phase, if the GSA moves forward with the opportunity, they will seek funding for the program through a Prop 218 assessment and through grants. The GSA plans to proceed as soon as funding is secured.

Table 9 Surface Water for Recharge

Year	Agricultural Use *(AF)*	Recharge (AF)	Total *(AF)*
2015	-		
2016	-		
2017	-	278	278
2018	-		
2019	-	72	72

2020	-		
2021	-		
2022	-		
2023	-	395	395
Total	-	745	745

3.2 IN-LIEU RECHARGE

Due to the location of the District's current turnout, NSWD is not able to exercise their appropriative water right to its full potential. Constructing a connection with the current turnout would allow the District to implement in-lieu recharge project

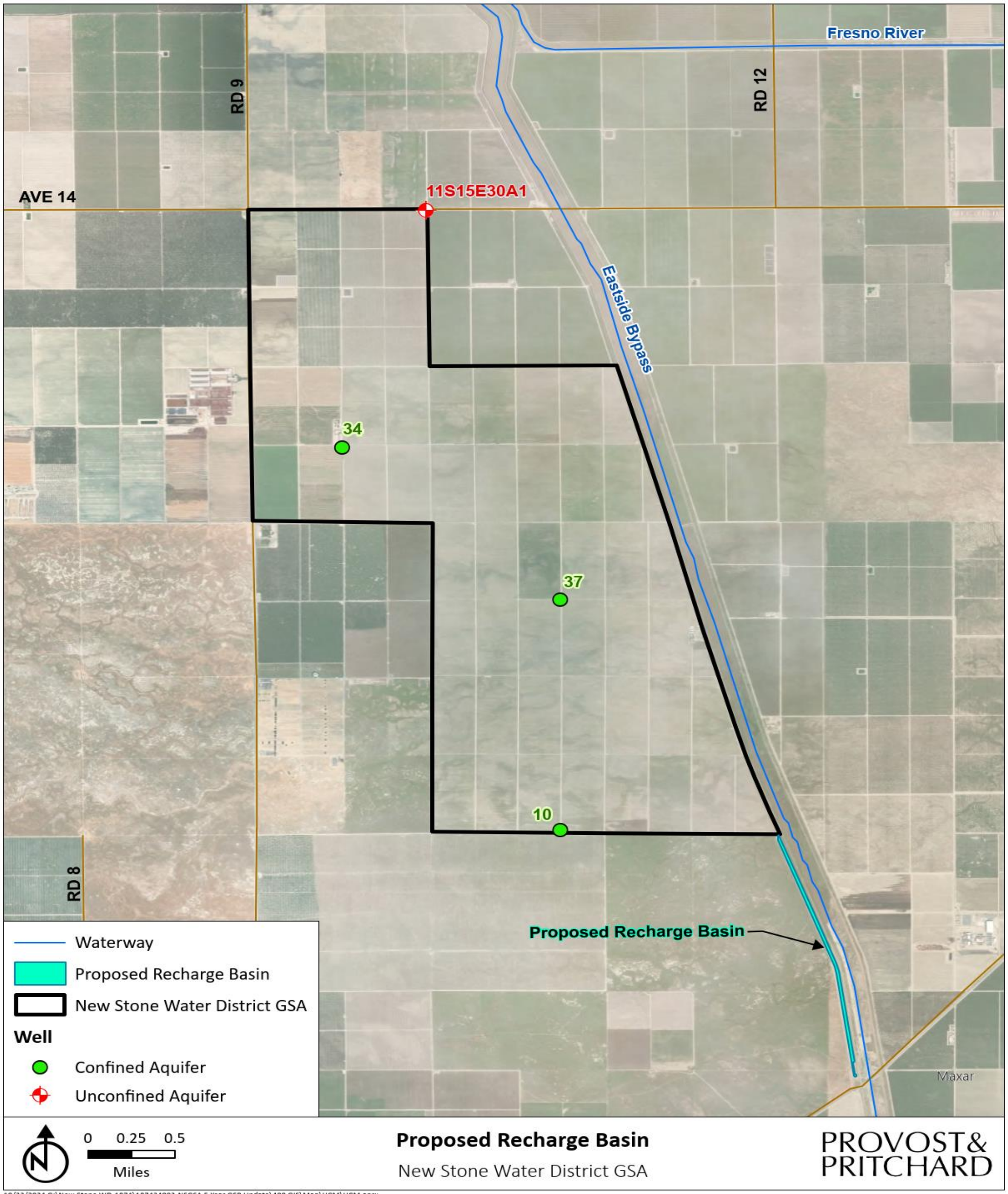

Figure 6 Proposed Recharge Basin

4 BASIN SETTING BASED ON NEW INFORMATION OR CHANGES IN WATER USE

Please refer to the Madera Subbasin Groundwater Sustainability Plan Period Evaluation.

5 MONITORING NETWORKS

Regulation Requirements:

GSP Regulations §354.38

a) Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.

b) Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency.

c) If the monitoring network contains data gaps, the Plan shall include a description of the following:

1. The location and reason for data gaps in the monitoring network.

2. Local issues and circumstances that limit or prevent monitoring.

d) Each Agency shall describe steps that will be taken to fill data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.

e) Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:

1. Minimum threshold exceedances

2. Highly variable spatial or temporal conditions

3. Adverse impacts to beneficial uses and users of groundwater

4. The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin

Please refer to the Madera Subbasin Groundwater Sustainability Plan Period Evaluation. Two upper aquifer wells represented in the approved 2023 NSWD GSA GSP were removed from the representative monitoring network as one well (11S14E36R001M) was destroyed and another well (12S15E16A001M) was removed due to direction from the Joint GSP, as the well is already being represented in the Joint GSP. The revised monitoring network for the NSWD GSA is included as Figure 2.

6 GSA AUTHORITIES AND ENFORCEMENT ACTIONS

The Periodic Evaluation should describe any new authorities the basin's GSAs have gained, established, or exercised since the last GSP submittal and summarize what has been implemented to advance groundwater sustainability. Authorities could pertain to relevant actions related to regulations and ordinances applicable to the Plan. In addition, GSAs should provide information describing any enforcement or legal actions taken in the basin to further the sustainability goal. This could include any new significant information such as funding and fee actions, installing volumetric measuring devices on wells (i.e., flow meters), or collecting other data related to allocation programs and pumping reductions. Demonstrating how these components of GSP implementation will help GSAs reach sustainability is important.

- Provide a summary of GSA regulations or ordinances related to the Plan [Water Code 10725, 10726, 10730, and 10731].
- Describe GSA enforcement or legal actions [Water Code 10725.4, 10730, and 10732].
- Describe activities advancing other regulations and orders outside of SGMA that are related to SGMA implementation, if applicable (e.g., legislation such as Senate Bill 55226 [Drought Planning

for Small Water Suppliers and Rural Communities], well moratoriums, and land use zoning). 26 https://water.ca.gov/Programs/Water-Use-And-Efficiency/SB-552

- Describe how Plan implementation has been affected by external regulatory requirements or executive orders issued by the Governor, if applicable.

7 OUTREACH, ENGAGEMENT, AND COORDINATION WITH OTHER AGENCIES

Please refer to the Madera Subbasin Groundwater Sustainability Plan Period Evaluation.

8 OTHER INFORMATION

8.1 CONSIDERATION OF ADJACENT BASINS

As discussed in the 2025 New Stone Water District Groundwater Sustainability Plan Amendment, the Madera Subbasin and Kings Subbasin are working to establish an MOU for Interconnected Surface Water, with Friant Water Authority and the Bureau of Reclamation.

9 SUMMARY OF PROPOSED OR COMPLETED REVISIONS TO PLAN ELEMENTS

Please refer to the Madera Subbasin Groundwater Sustainability Plan Period Evaluation.

The NSWD GSA has made great progress towards meeting its sustainability goals. From review of the sustainability indicators of levels and storage change it is apparent that subsidence occurring in the vicinity of the GSA within and outside of the Subbasin, along with groundwater outflow to the adjacent GSA within the Subbasin is of keen importance. Coordination and communication with the Subbasin GSAs, as demonstrated with weekly technical working group meetings over the past six months, will continue to play a key role in making progress towards sustainability.

Appendix 1.B. 2025 Periodic Evaluation GSP Attachments

Appendix 1.B.4. RCWD GSA GSP 2025 Periodic Evaluation Elements

ROOT CREEK WATER DISTRICT GROUNDWATER SUSTAINABILITY AGENCY

MADERA SUBBASIN GROUNDWATER SUSTAINABILITY PLAN

2025 Periodic Evaluation

MADERA COUNTY, CALIFORNIA

DECEMBER 2024

PREPARED FOR:
Root Creek Water District Groundwater Sustainability Agency
Madera County, CA

PREPARED BY:
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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

ABBREVIATIONS

CEQA .... California Environmental Quality Act
cfs .... Cubic Feet per Second
FWA .... Friant Water Authority
GSA .... Groundwater Sustainability Agency
GSP .... Groundwater Sustainability Plan
IM .... Interim Milestones
ISW .... Interconnected Surface Water
MCSim .... Madera-Chowchilla Model Simulation
Mos .... Measurable Objectives
MOU .... Memorandum
MTs .... Minimum Thresholds
MW .... Monitoring Well
RCWD .... Root Creek Water District
RCWDGSA .... Root Creek Water District Groundwater Sustainability Agency
RMN .... Representative Monitoring Network
RMS .... Representative Monitoring Site
SJRRP .... San Joaquin River Restoration Project
URs .... Undesirable Results
USBR .... United States Bureau of Reclamation

EXECUTIVE SUMMARY

Please refer to the Madera Subbasin Groundwater Sustainability Plan Period Evaluation for a high-level overview of Subbasin implementation activities and progress towards implementation.

This periodic evaluation covers the period from January 2020 through December 2024. This periodic evaluation is accompanied by an amended plan that was modified to respond to the corrective actions contained in a letter from the Department of Water Resources dated December 21, 2023. The plan was amended and adopted by the Root Creek Water District GSA on December 9, 2024.

OVERVIEW OF PERIODIC EVALUATION

Please refer to the Madera Subbasin Groundwater Sustainability Plan Period Evaluation.

An overview consists of:

1. *No changes to governance*
2. *No modification to member agencies*
3. *Corrective action modifications to plan*
4. *Public meetings monthly to discuss activities*
5. *Achievement of implementing projects and management actions and maintaining water levels for sustainability.*

1 NEW INFORMATION COLLECTED

Please refer to the Madera Subbasin Groundwater Sustainability Plan Period Evaluation.

2 GROUNDWATER CONDITIONS RELATIVE TO SUSTAINABLE MANAGEMENT CRITERIA

Please refer to the Madera Subbasin Groundwater Sustainability Plan Period Evaluation for a discussion on the overall groundwater conditions in the Madera Subbasin as a whole.

This section of the Periodic Evaluation was prepared for the Root Creek Water District Groundwater Sustainability Agency (RCWDGSA) to review and evaluate current groundwater conditions for each applicable sustainability indicator relative to the sustainable management criteria established in the GSP (amended 2025). A summary of the Minimum Thresholds (MTs), Measurable Objectives (MOs) and Undesirable Results (URs) is provided in **Table 1**. Locally defined undesirable results were based on discussion with GSA staff and technical representatives, input received from interested stakeholders and the public through public meetings, and through individual stakeholder input to various GSA representatives.

Table 1 Summary of MTs, MOs and Undesirable Results

Sustainability Indicator	Minimum Threshold	Measurable Objective	Undesirable Result (After 2040)
Chronic Lowering of Groundwater Levels	Set equal to the Fall 2015 measurement, if that observed data point is available at the RMS. Otherwise, set equal to the expected Fall 2015 groundwater level determined from MCSim results, with adjustment, if necessary, to account for the offset between historical observed and modeled data.	Set equal to the Fall 2010 measurement, if that observed data point is available at the RMS. Otherwise, set equal to the expected Fall 2010 groundwater level determined from MCSim results, with adjustment, if necessary, to account for the offset between historical observed and modeled data.	Same 30 percent of RMS wells within the subbasin below minimum threshold for two consecutive fall measurements.
Reduction of Groundwater Storage	Same as MTs for chronic lowering of groundwater levels. (Groundwater levels used as proxy.)	Same as MOs for chronic lowering of groundwater levels. (Groundwater levels used as proxy.)	Same 30 percent of RMS wells within the subbasin below minimum threshold for two consecutive fall measurements (Groundwater levels used as proxy)
Degraded Water Quality	Nitrate as N = 10 mg/L or existing level plus 20% (whichever is greater) Arsenic = 10 µg/L or existing level plus 20% (whichever is greater) TDS = 500 mg/L or existing level plus 20% (whichever is greater)	Baseline constituent concentrations	10 percent of RMS wells within the subbasin above the minimum threshold for the same constituent due to projects and/or management actions, or overall groundwater extraction based on average of most recent three year period

Sustainability Indicator	Minimum Threshold	Measurable Objective	Undesirable Result (After 2040)
Land Subsidence	0 feet/year, subject to uncertainty of +/- 0.16 feet/year	0 feet/year, subject to uncertainty of +/- 0.16 feet/year	Average subsidence across greater than 25 percent of RMS exceeding the minimum threshold for two consecutive years.
Depletion of Interconnected Surface Water[1]	Interim condition: Water levels in select SJRRP monitor wells will be compared to the invert of the San Joaquin River.		Water levels dropping below the invert of the San Joaquin River more frequently than historical.
Seawater Intrusion	Not Applicable	Not Applicable	Not Applicable
[1] Interim SMCs will be replaced as a result of the Subbasin data gap analysis and findings from the ISW MOU.			

While the Madera Subbasin is required to be sustainable as a whole, it should be noted that some areas within the Subbasin, especially the southeast portion, can and should be evaluated separately. **Figure 1** shows the proximity of the RCWDGSA within the Madera Subbasin, just north of the San Joaquin River. The Sierra Nevada foothills and three groundwater subbasins border the Madera Subbasin north of the San Joaquin River, including the Merced, Chowchilla, and the Delta-Mendota Subbasins. The Kings Subbasin adjoins the Madera Subbasin south of the San Joaquin River.

It is evident from coordination with the Joint GSP that this area of the basin has more limited surface supplies and groundwater flows are directed toward the center of this developed area. This RCWD GSP covers the southeastern one-quarter to one-third of the area. While RCWDGSA continues to implement its plan, it will be imperative that the neighboring Madera County GSA be active in this local region in project implementation and demand management activities. It is the responsibility of all agencies within the Subbasin to coordinate and ensure sustainable management practices of surface and groundwater use in order to reach the sustainability goal.

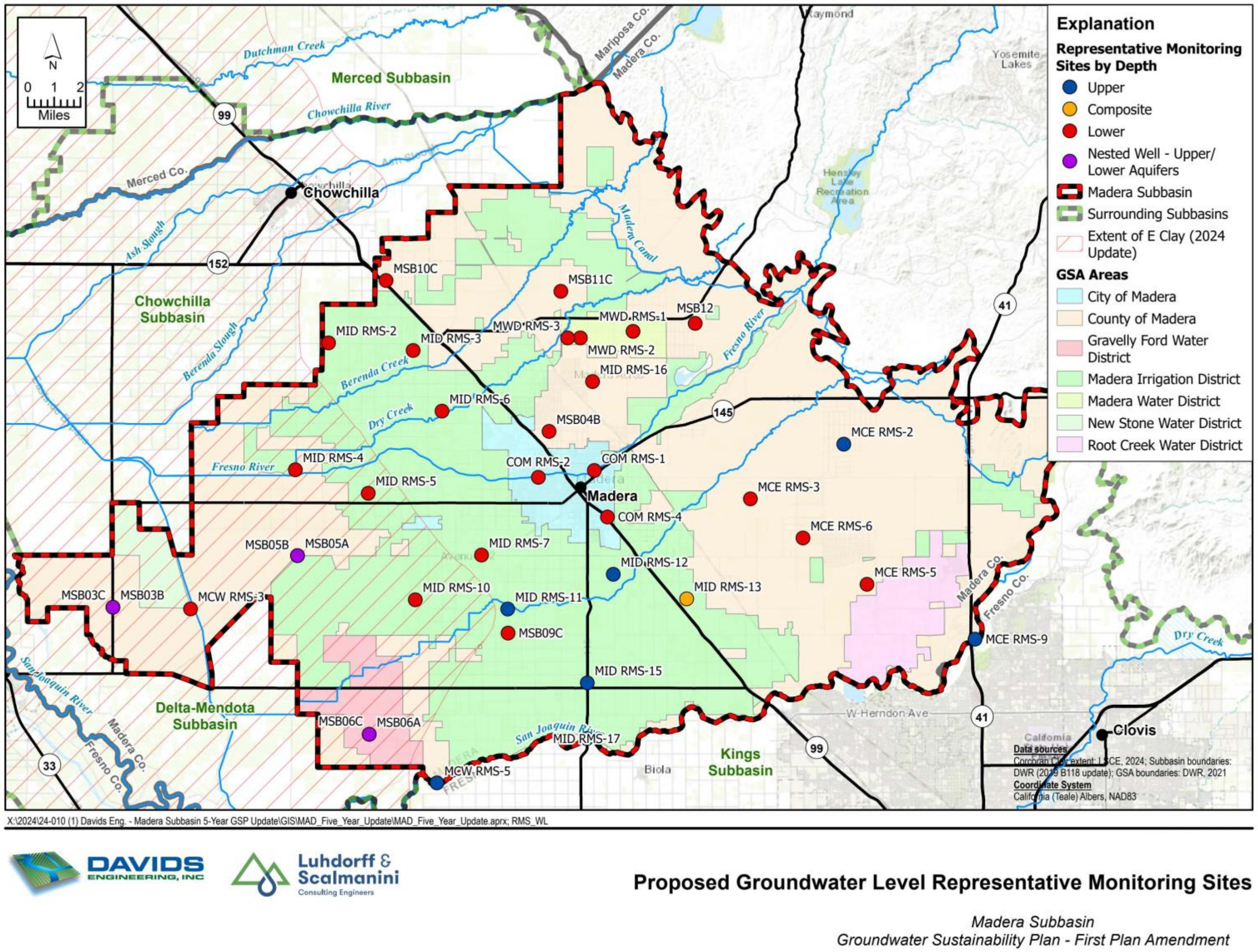

Figure 1 Plan Area Location Map

2.1 GROUNDWATER LEVELS

The most recent groundwater elevation data for the representative monitoring wells is presented in **Table 2** along with the minimum thresholds and measurable objectives. A location map of RCWDGSA's representative monitoring sites for water levels, water quality, and subsidence is shown in **Figure 2**. A general downward trend has persisted over the last 40 years. However, within the RCWDGSA water levels have generally stabilized or improved over the past seven years. In Fall 2024, five of the six RMS wells were at or above the 2025 Interim Milestone, indicating that RCWDGSA is on track to meet interim milestones and sustainability goals. During this period, and due to implementation of projects and management actions, two wells are above their respective measurable objectives. Three wells (or half) were above the 2040 minimum threshold line. Well 130 is near the northern district boundary and is likely impacted by extractions within the neighboring GSA. However, the absence of monitoring wells outside of RCWDGSA to the north, as shown in **Figure 1**, makes it challenging to monitor these activities in the neighboring GSA.

Table 2 Progress Towards Water Level Sustainable Management Criteria

	Well	Fall 2023	Fall 2024	2025 Interim Milestone	Minimum Threshold	Measurable Objective
Southern	83	185	181	162	164	179
	22	219	216	216	218	221
Central	85	59	32	28	66	95
Northern	113	54	62	42	56	68
	65	96	99	74	71	79
	130	31.3	-13.6	1	38	64
Water Surface Elevation (WSE) measured in feet above mean sea level						

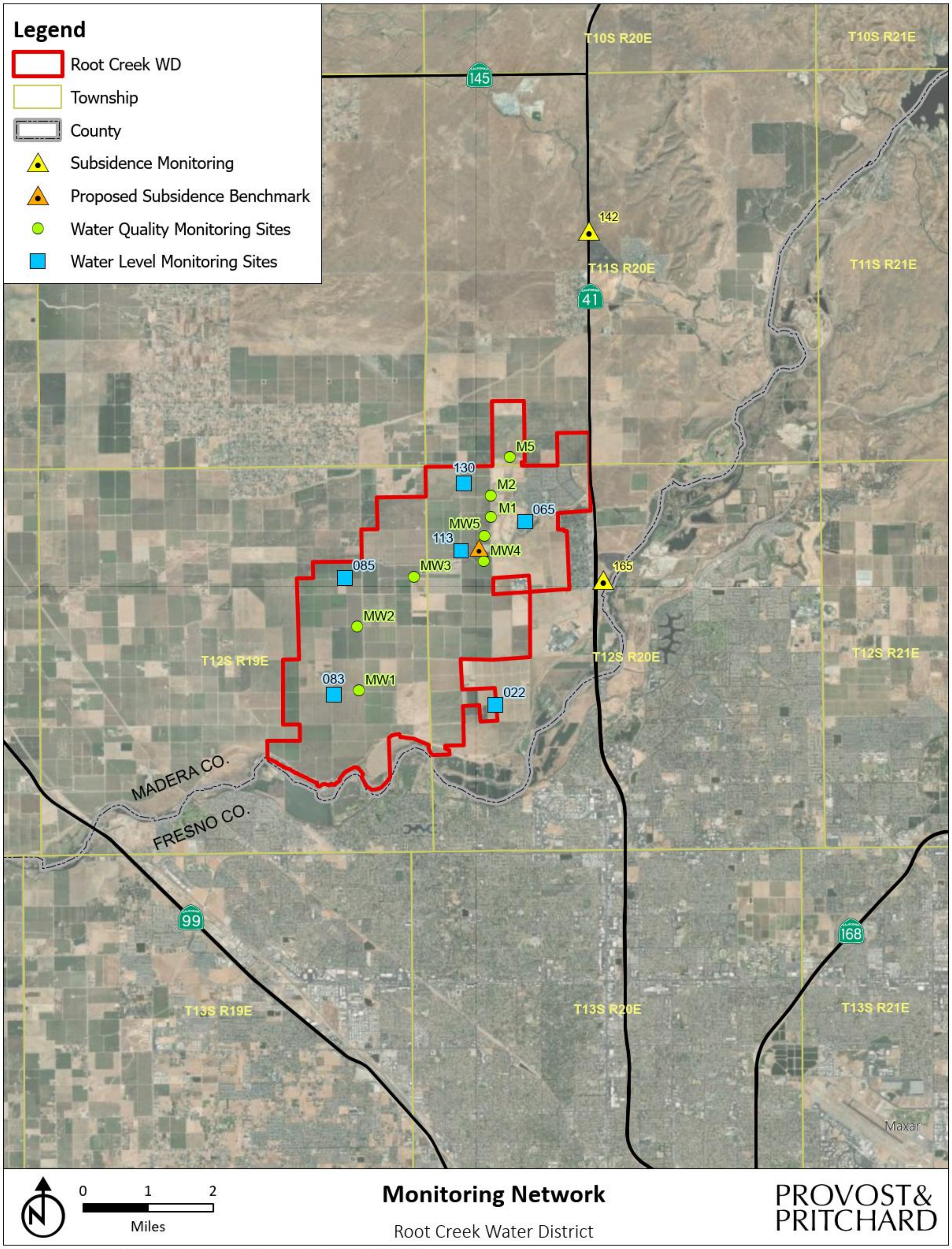

Figure 2 RCWD Representative Monitoring Network

In general, water levels fall during the summer as expected and rebound to recover or exceed previous fall groundwater elevations. This is in part due to RCWDGSA's efforts to increase conjunctive use of surface water and groundwater and the availability of surface water. Water year type, presented in **Table 3**, can be related to groundwater elevation trends seen in the hydrographs.

Table 3 DWR Water Year Type Classifications for the San Joaquin Valley

Year	WY Type	Year	WY Type	Year	WY Type
1975	W	1992	C	2009	BN
1976	C	1993	W	2010	AN
1977	C	1994	C	2011	W
1978	W	1995	W	2012	D
1979	AN	1996	W	2013	C
1980	W	1997	W	2014	C
1981	D	1998	W	2015	C
1982	W	1999	AN	2016	D
1983	W	2000	AN	2017	W
1984	AN	2001	D	2018	BN
1985	D	2002	D	2019	W
1986	W	2003	BN	2020	BN
1987	C	2004	D	2021	BN
1988	C	2005	W	2022	D
1989	C	2006	W	2023	W
1990	C	2007	C	2024	BN
1991	C	2008	C		

Historical groundwater surface elevation contour maps for spring 2015 – spring 2024 are shown in **Appendix A**. Generally, groundwater continues to flow away from the San Joaquin River, flowing in the northerly direction with a westerly component. The groundwater levels experience expected seasonable variability due to heightened groundwater pumping during the summer months to irrigate crops. Wells experience their lowest levels during the summer pumping events and the fall measurements in general are the measured low point, immediately following the irrigation season. Water levels rebound through the winter.

Figure 3 is a hydrograph for Well 65 that is developed from information gained from the use of a data logger. Well 65, located in the center of the Riverstone development, has a historic long-term record and was used to supply water for agricultural production. The well was discontinued due to urban development and has since been converted for use as a monitor well. A transducer was installed to collect daily water level data. Thus, it demonstrates how the conjunctive use management actions by the GSA have supported more stable long term groundwater level trends. As noted, from 2019 to the present, the spring level transducer readings have generally returned to the same levels over the period shown. Water levels dropped slightly in 2022, but water levels rose approximately 2 ft from 2019 to 2023 and 5.6 ft from 2019 to 2024. The water levels observed in this well have stabilized as a result of efforts made by the GSA. This well and the information generated give an excellent representation of the effectiveness of the District's and GSA's projects and management actions. Though Well 65 only has transducer data going back to 2019, the well has been manually measured since 1979, as shown in **Figure 4**. The figure demonstrates that efforts of the District and GSA contributed to stabilizing water levels in this well even before the adoption of the GSA's first GSP in 2020.

More recent information has been recorded at the municipal wells that serve the Riverstone development. Since these new wells have been constructed, water level readings from the wells take measurements frequently. **Figure 5** shows daily readings from these devices. At times the readings reflect the dynamic or pumping condition as indicated by the lower readings in the chart and the higher readings reflect a condition where the well is not operating. These charts show the dynamic nature of the change in levels of the groundwater and indicate that in general the highest levels are observed in the March and April months and the lowest levels correlate to July and August. While the levels fluctuate, the readings indicate that the levels, as of the end of Fall 2024, rebound to 290-310 feet depth to water for Well #2, and 200 feet depth to water for Well #1 since 2017. Well #4 was decommissioned in Fall 2021 and replaced with Well #5 in 2023. The representative monitoring wells being monitored for water levels have remained the same as in the RCWDGSA GSP. There are six wells total, located throughout the area as shown in **Figure 2**. The hydrographs associated with each of the representative monitor wells are presented as **Appendix B**. The hydrographs include historical groundwater elevation trends along with recent data compared to the interim milestones, measurable objectives, and minimum thresholds set by RCWDGSA.

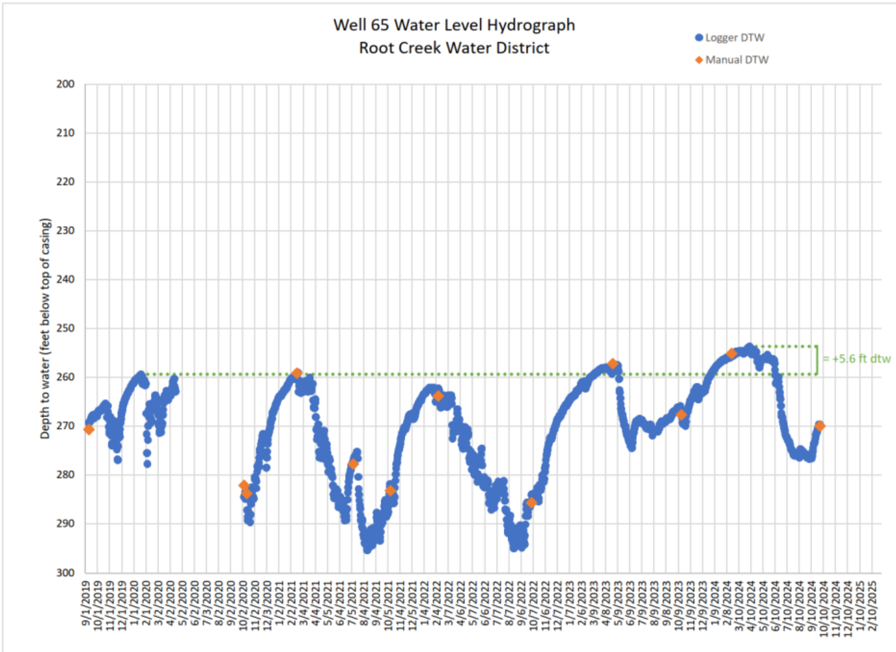

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Figure 3 Well 65 Transducer Data

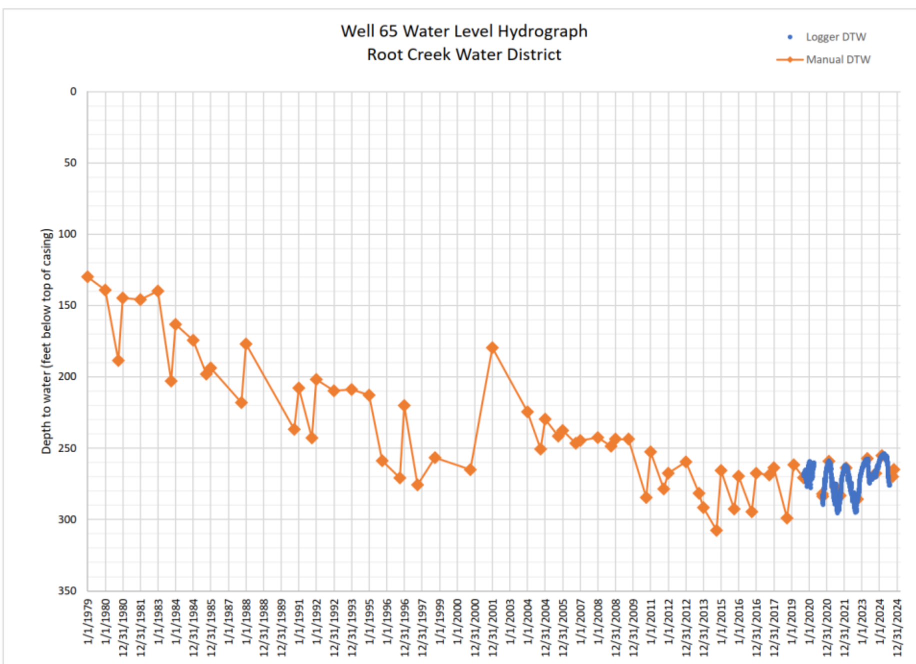

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Figure 4 Well 65 Transducer Data with Historic Data

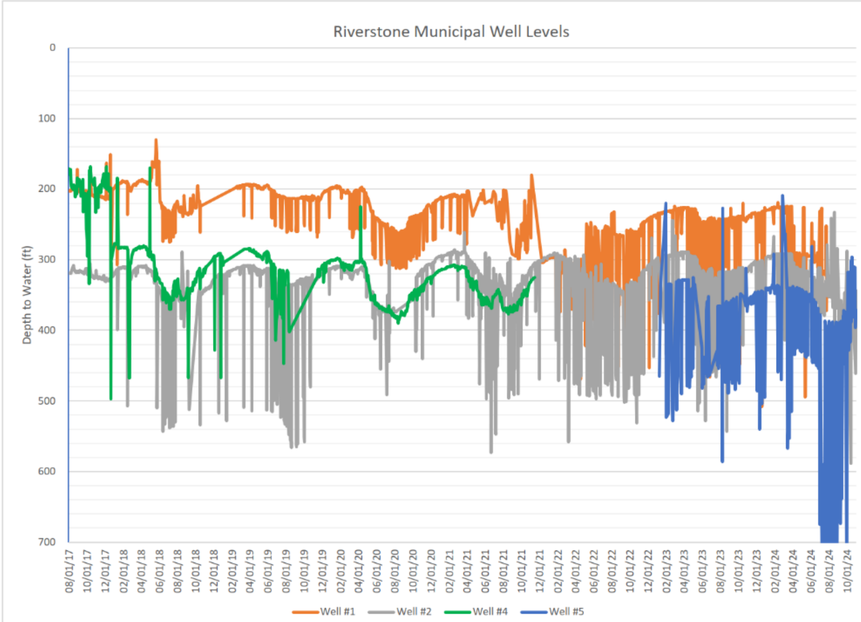


Figure 5 Transducer Data from Municipal Wells

2.2 GROUNDWATER STORAGE CHANGE

The SMCs for groundwater storage reduction are based on groundwater levels being measured for the groundwater level MT methodology. The representative wells use the groundwater level MTs as a proxy for avoidance of reduction in groundwater storage. To the extent that groundwater levels are collectively (on average) maintained above MTs, groundwater storage would be considered not to exceed its MT. In Fall 2024, five of the six RMS wells were at or above the 2025 Interim Milestone, indicating that RCWDGSA is on track to meet interim milestones and sustainability goals.

Change in groundwater storage is calculated by using the weighted average method on a GIS-generated surface with the assistance of hydrogeological interpretation. Included in this analysis are the six representative monitor sites for groundwater storage, in addition to water levels from other wells within the District. Change in groundwater storage is caused by extracting more groundwater than recharged or vice versa. RCWDGSA has two main sources of groundwater extraction: municipal water use and agricultural irrigation. More recently, practices such as intentional recharge, stormwater detention, and treated wastewater effluent percolation have been implemented which help to balance the volume of groundwater extracted. Additionally, recharge occurs through seepage from the San Joaquin River. Due to the listed water management strategies by RCWDGSA and others discussed in the preceding sections, groundwater storage change over the last 5 years has been relatively balanced as shown in Table 4.

Table 4 Groundwater Storage Change from 2015-2024

Time Period	Average Change (ft)	Surface Area of Analysis (ac)	Assumed Specific Yield	Annual Change (AF)	Cumulative Storage Change (AF)
Fall 2014-Fall 2015	10.5	7,569	0.12	9,500	9,500
Fall 2015-Fall 2016	-13.2	7,601	0.12	-12,000	-2,500
Fall 2016-Fall 2017	18.8	7,601	0.12	17,100	14,600
Fall 2017-Fall 2018	-25.0	7,598	0.12	-22,800	-8,200
Fall 2018-Fall 2019	10.9	7,598	0.12	10,000	1,700
Fall 2019-Fall 2020	0.7	7,728	0.12	600	2,300
Fall 2020-Fall 2021	-8.4	7,732	0.12	-7,800	-5,500
Fall 2021-Fall 2022	-8.4	8,145	0.12	-8,200	-13,700
Fall 2022- Fall 2023	15.9	8,111	0.12	15,500	**1,800**
Average	0.2			200	
Spring 2014-Spring 2015	7.8	7,596	0.12	7,100	7,100
Spring 2015-Spring 2016	-4.8	7,596	0.12	-4,300	2,700
Spring 2016-Spring 2017	-4.5	7,598	0.12	-4,100	-1,400
Spring 2017-Spring 2018	10.2	7,598	0.12	9,300	7,900
Spring 2018-Spring 2019	-10	7,598	0.12	-9,100	-1,200
Spring 2019-Spring 2020	-5.7	8,860	0.12	-6,000	-7,300
Spring 2020-Spring 2021	2.1	8,852	0.12	2,200	-5,100
Spring 2021-Spring 2022	-4.2	8,831	0.12	-4,500	-9,600
Spring 2022-Spring 2023	5.4	8,853	0.12	5,700	**-3,900**
	-0.4			-433	

The data presented in **Table 4** shows that the average change in groundwater storage over the period of record from 2014 to 2023 is close to zero. The average change was a positive 0.2-foot per year using fall data and a negative 0.4-foot per year using spring data. This approximately net zero change in groundwater storage over the period provides guidance on the District's overdraft correction. The District's efforts towards implementing projects has resulted in an average overdraft correction of 4,200 AF, which considers an average water supply augmentation of 2,200 AF (surface water for recharge and agricultural use and reclaimed water), an average water demand reduction of approximately 1,600 AF, and an average annual change in storage of 400 AF. It should be recognized that the RCWDGSA has maintained water levels and minimized storage change while the groundwater outflow to the adjacent GSA has increased by 9,300 AF in 2024 as calculated by hydrogeologist Kenneth D. Schmidt and Associates (KDSA).

The spring values are considered better to use to estimate storage change, as they are thought to indicate more static conditions. As noted on the hydrographs, there is a cyclic nature to the measurements at differing times of the year and that the Interim milestones, and thus the storage change, will reflect these changing measurements. Recognizing these variations, it could be suggested that these last four years indicate that the implementation of projects and management actions by the GSA have resulted in potentially sustainable conditions going forward. As the County GSA establishes policies on pumping and implements programs for recharge and reducing demand, the resulting change in storage is expected to provide positive results throughout the Subbasin. This data strongly indicates that RCWDGSA is on track to meet its interim milestones and overall sustainability goal set in the GSP.

2.3 GROUNDWATER QUALITY

In the Madera Subbasin, Sustainable Management Criteria for degraded groundwater quality were set for nitrate, total dissolved solids, and arsenic. These constituents were selected with consideration of existing and historical groundwater quality conditions in the Subbasin. The MTs for Degraded Water Quality across the Subbasin are set at the following MCLs for drinking water for the identified key constituents of nitrate as nitrogen, TDS, and arsenic.

- *Nitrate as nitrogen = 10 mg/L, or baseline concentration plus 20%*
- *TDS = 500 mg/L, or baseline concentration plus 20%*
- *Arsenic = 10 µg/L, or baseline concentration plus 20%*

When existing or historical concentrations for the key constituents already exceed the MCL, the MT is set at the baseline concentration plus 20 percent. When current or historical water quality for the key constituents has not been measured, the MT will be set as the MCL and will be adjusted if needed. **Table 5** lists the estimated thresholds for water quality for the RCWD GSP.

Table 5 Summary of Groundwater Quality Minimum Thresholds for Representative Monitoring Sites

Well ID	Well Type	MT Arsenic Concentration (µg/L)	MT Nitrate Concentration (mg/L)	MT TDS Concentration (mg/L)
Well M5	Municipal	10†	10†	500†
Well M2	Municipal	10†	10†	500†
Well M1	Municipal	10†	10†	500†
MW5	Monitoring	10†	~~10~~ 14.8	500†
MW4	Monitoring	10†	10.7†	500†
MW3	Monitoring	10†	~~10~~ 18.1	500†
MW2	Monitoring	10†	~~10~~ 13.3	500†
MW1	Monitoring	10†	10†	500†

†Values will be confirmed and/or adjusted as needed once enough data are collected to establish meaningful baselines. If initial sampling exceeds the MCL, then the MT is set at the baseline concentration plus 20%.

Existing and historical concentrations for the key constituents from RCWDGSA's representative monitoring sites are shown in **Table 6, Table 7,** and **Table 8**. Among the wells sampled consistently for each key constituent over the most recent three-year period (2022-2024), three wells exceeded the initial MT for nitrate (as N) on average (MW5, MW3, and MW2), while no wells exceeded the TDS MT during this period. Given that the baseline nitrate concentrations in three wells exceed initial MTs, the RCWDGSA, in coordination with the Subbasin methodology, has decided to adjust the MTs for MW5, MW3, and MW2 to baseline concentrations plus 20%. Adjusted MTs are shown in **Table 5**. Arsenic has not been consistently sampled within the RCWDGSA, as it was only recently added to the list of key constituents. Initial MTs will be confirmed and/or adjusted as needed once enough data is collected to establish meaningful baselines.

Table 6 Summary of Nitrate (as N) Results from RCWD GSA Representative Sites

	Nitrate as N (mg/L)								
Well	2017	2018	2019	2020	2021	2022	2023	2024	Average (2022-2024)
MW5	8.5	8.2	8.5	11	9.9	12	13	12	12.3
MW4	11	12	12	8.6	8.4	9.3	8.8	8.6	8.9
MW3	19	18	15	20	15	14	9.2	22	15.1
MW2	4.9	7.1	7	8.9	8.7	11	13	9.4	11.1
MW1	3.7	3.6	2.8	2.6	3.5	2.6	2.8	2.2	2.5
M5							1	-	
M2	2.8	-	-	5.3	ND	-	ND	-	
M1	3	-	-	2.9	3.8	-	3.7	-	

Table 7 Summary of TDS Results from RCWD GSA Representative Sites

	Total Dissolved Solids (TDS) (mg/L)								Average
Well	2017	2018	2019	2020	2021	2022	2023	2024	(2022-2024
MW5	210	180	190	230	230	200	280	320	267
MW4	280	290	330	200	200	200	220	280	234
MW3	330	290	330	360	310	350	290	550	397
MW2	210	260	280	250	260	290	440	360	364
MW1	220	210	200	200	220	180	180	250	203
M5	-	-	-	-	-	-	370	-	-
M2	370	-	-	260	790	-	840	-	-
M1	260	-	-	330	227	-	180	-	-

Table 8 Summary of Arsenic Results from RCWD GSA Representative Sites

	Arsenic (µg/L)								Average
Well	2017	2018	2019	2020	2021	2022	2023	2024	
MW5	Not historically measured. Constituent added to the RMN for 2025 update.								-
MW4									-
MW3									-
MW2									-
MW1									
M5	-	-	-	-	-	5.5	-	-	-
M2	-	-	4.5	-	-	5.1	-	-	-
M1	-	-	3.4	-	-	5.8	-	-	-

2.4 LAND SUBSIDENCE

Conditions that may lead to inelastic land subsidence are excessive overall average annual groundwater pumping and other outflows from the Subbasin, primarily from the Lower Aquifer, that exceed average annual inflows. Significant and unreasonable conditions were determined based on discussions with GSAs and through individual stakeholder outreach. These subsidence interviews resulted in a coordinated MT of no additional inelastic land subsidence, or 0 feet/year, after 2040 (subject to subsidence station uncertainty of +/- 0.16 feet/year), consistent across the Subbasin. **Table 9** shows the MT for land subsidence across the Subbasin, displayed as both a rate and cumulative subsidence. Land subsidence is monitored at several stations close to and several miles outside of the border of the GSA. Though subsidence is not a major concern within the GSA, the GSA plans to install a subsidence benchmark on the District's Wastewater Treatment Plan infrastructure. The subsidence near the RCWDGSA and the proposed subsidence benchmark within RCWDGSA is shown in **Figure 2.** Since 2020, the two representative subsidence stations outside of the RCWDGSA boundary along Highway 41 (Station 142 and 165) have been generally stable or improved, with an average annual rate of subsidence of 0.00 feet/year and -0.02 feet/year, respectively (**Table 10**), indicating that RCWDGSA is on track to meet interim milestones and sustainability goals for subsidence.

Table 9 Summary of Subsidence Sustainable Management Criteria

5-Year Interval	Maximum Average Annual Rate of Subsidence (feet/year)	Maximum 5-Year Cumulative Subsidence (feet)[1]
2020-2025		1.5
2025-2030	0.2	1.0
2030-2035	0.1	0.5
2035-2040	0.05	0.25
Note: Due to the uncertainty in land subsidence measurement accuracy of +/- 0.16 feet/year, there may be instances where measurement error will indicate a rate of subsidence greater than the IMs. Undesirable results will trigger further management actions within the Subbasin.		

Table 10 Summary of Inelastic Subsidence Rates

Annual Inelastic Subsidence		
Monitoring Points		
Years	**142**	**165**
Dec-16 – Dec-17	-0.02	NA
Dec-17 – Dec-18	-0.05	-0.09
Dec-18 – Dec-19	-0.01	-0.02
Dec-19 – Dec-20	+0.03	-0.05
Dec-20 – Dec-21	0.00	-0.03
Dec-21 – Dec-22	-0.14	-0.13
Dec-22 – Dec-23	+0.15	+0.09
Average Dec-20 – Dec-23	0.00	-0.02
Cumulative Dec 20 – Dec 23	+0.01	-0.07

It should be noted that while groundwater level MTs and MOs are a separate sustainability indicator and are not specifically tied to subsidence thresholds, they are consistent with the objective to limit the potential for future subsidence. The MT may require modification in the future if subsidence continues to be seen approaching the end of the 20-year GSP implementation period.

[1] A cumulative total of up to 1.0 feet of subsidence has already occurred in some portions of the subbasin between December 2019 and December 2023. Therefore, the maximum allowable cumulative subsidence of 1.5 feet as of December 2024 requires annual subsidence in 2024 to be less than 0.5 feet. Subsequent years after 2024 have significantly lower allowable annual rates of subsidence.

2.5 INTERCONNECTED SURFACE WATER AND GROUNDWATER

In RCWD, the primary area of potential interconnected surface water exists along the San Joaquin River. Available information to evaluate the presence of interconnected systems in RCWDGSA is minimal but will continue to be gathered by the USGS and the San Joaquin River Restoration (SJRRP). The Madera Subbasin GSAs, along with neighboring Kings Subbasin GSAs along the San Joaquin River, have established the framework of an Interconnected Surface Water Working Group outlined in a Memorandum of Understanding (MOU) included in the GSP. The MOU will establish a collaborative scope of work for further investigation of possible ISW along the San Joaquin River from Reach 1a to Mendota Pool. This investigation will help the GSAs better understand the timing and magnitude of potential surface water depletions from the San Joaquin River from groundwater pumping. This MOU and associated Working Group also includes the involvement from the USBR and Friant Water Authority (FWA).

With the construction of Friant Dam in 1940's, the USBR offered the landowners adjacent to the river Holding Contracts recognizing both the landowners right to divert surface water supplies as well as the possible impact to these rights from the construction of the dam, which could result in a curtailment of supplies to these landowners due to the storage and collection of surface waters behind the proposed dam. To this end the Holding Contracts require the USBR to release to the river surface water supplies to meet the demands of the landowners by maintaining a flow of at least 5 cfs past the point known as Gravelly Ford approximately 26 miles downstream of the dam. Additionally, these same contracts allow for the surface supplies delivered by the USBR to be diverted directly from the river adjacent to the property or to be pumped from wells located on the property. The Holding Contracts recognized the supply developed from wells to be considered delivery of surface water from the USBR. Hence these contracts represent conditions that the federal government will need to meet with the local landowners.

3 STATUS OF PROJECTS AND MANAGEMENT ACTIONS

The RCWDGSA GSP that was adopted and approved contained a list of project and management actions and their status, summarized in **Table 11** below.

Table 11 Status of Projects and Management Actions from RCWDGSA GSP (as of 2024)

Type	Activity	Status
Conjunctive Use	Intentional Recharge	Planning
	On Farm Field Flooding	Implemented
Surface Water	Import surface water supplies	Implemented
	Increase Conveyance Capacity	Implemented
	Fully Utilize surface water allocations	Being evaluated
	Surface water pricing	Implemented
Agricultural Land Conversion	Development of Riverstone	Implemented
Groundwater Use	Groundwater Metering	Implemented
	Groundwater Pumping Fees	Implemented
Water Conservation	Use of Recycled water	Further evaluation
Public Education	Outreach to stakeholders	In progress

The 2023 GSP outlined five (5) specific projects and management actions: (1) Expansion of the In-Lieu Pipeline, (2) Intentional Recharge Projects, (3) Agricultural Land Conservation, (4) Well Mitigation Program, and (5) Monitoring Well Program – Interconnected Surface Water. The "Intentional Recharge Projects" included a "Stormwater Basin Modification Project" and a proposed 80-acre recharge project outside of the District. The RCWDGSA has provided updates on Projects and Management Actions through the preceding Annual Reports submitted to the Department. These projects include those described in **Table 12**.

Table 12 Project and Management Actions from Previous Annual Reports

Project or Management Action Name	Project or Management Action Description	Project Status
In-Lieu Pipeline	Increase ability for conjunctive use in wet years	Operational – Completed 2014
Agricultural System Expansion/In-Lieu Recharge Project	2-mile pipeline to increase in-lieu recharge and direct groundwater recharge	Operational - Completed 2023
Storm Basin Modification Project	Reshaped and dredged basins to increase percolation	Operational – Completed 2022
Tiered Pricing	Incentivize use of surface water through pricing model	Implemented
Domestic Well Mitigation Program	A subbasin wide program to fund replacement of domestic wells impacted by lowering groundwater levels	In Development with other GSAs in the Subbasin
Monitoring Well Program – Interconnected Surface Water	Construction of nested monitoring wells to monitor the interconnectivity of surface water and groundwater	In Development with GSAs in multiple Subbasins

The 2025 Revised RCWDGSA GSP includes revisions to the Project and Management Actions chapter, for clarity, not because existing PMAs are insufficient or need revision. Completed projects have been removed from the 2025 Revised RCWDGSA GSP but are still included in summary tables. The ongoing implementation will continue to be reported, and project benefits will be communicated through Annual Reports and Periodic Evaluations. The 2025 Revised RCWDGSA GSP also includes a list of additional PMAs that could be implemented as part of an adaptive management strategy, should there be Undesirable Results or exceedances within the RCWDGSA.

The 2025 Revised RCWDGSA GSP also separates the table of PMAs into “Projects” and “Management Actions” as summarized in **Table 13** and **Table 14** below.

Table 13 Status of Projects from the 2025 Revised RCWDGSA GSP

Type	Activity	Status	Description
Conjunctive Use	Intentional Recharge	Complete	Dedicates land to allow for the intentional recharge of surface water Future recharge projects are being considered
	On Farm Field Flooding	Ongoing	Allows for the temporary use of field for intentional recharge while not dedicating the land to this purpose
Surface Water	Expansion of In-Lieu Pipeline	Complete	Expands agricultural service area that will be able to receive surface water deliveries
	Import surface water supplies	Ongoing	Importation of surface water supplies reduces the amount of groundwater pumping
	Increase Conveyance Capacity	Being Considered	Importation of surface water supplies reduces the amount of groundwater pumping
	Fully Utilize surface water allocations	Being Considered	Importation of surface water supplies reduces the amount of groundwater pumping

Type	Activity	Status	Description
	Surface water pricing	Complete	Importation of surface water supplies reduces the amount of groundwater pumping

Table 14 Status of Management Actions from the 2025 Revised RCWDGSA GSP

Type	Activity	Status	Description
Agricultural Land Conversion	Development of Riverstone	Complete	Changes land use and reduces groundwater pumping
Mitigation	Domestic Well Mitigation Program	Being Developed	Program is intended to get established so as to mitigate wells going dry due to the GSA actions on water levels.
Data Collection	Monitoring Well Program – Interconnected Surface Water	Being Developed	Establishes a program to work with others to identify and define the extent of interconnected surface water.

The projects proposed and implemented by the RCWDGSA include groundwater recharge activities and the importation of surface water. To date, the infrastructure anticipated to date has been constructed, with the exception of the 80-acre recharge basin project described in the 2023 Revised GSP. The PMAs being implemented are summarized in **Table 15**. Additional discussion for each PMA is included below.

Table 15 Project and Management Actions Summary Table

Project or Management Action Name	Project or Management Action Description	Targeted Sustainability Indicator	Project Status	Benefits Observed to Date
In-Lieu Pipeline	Increase ability for conjunctive use in wet years	Chronic lowering of groundwater levels	Operational – completed 2014	Average about 2,700 AF per year of surface water delivered
Agricultural System Expansion/In-Lieu Recharge Project	2-mile pipeline to increase in-lieu recharge and direct groundwater recharge	Chronic lowering of groundwater levels	Operational – Completed 2023	Included in Benefits for In-Lieu pipeline
Storm Basin Modification Project	Reshaped and dredged basins to increase percolation	Chronic lowering of groundwater levels	Operational – Completed 2022	Not Measured
80-Acre Recharge			Not Implemented	
Tiered Pricing	Incentivize use of surface water through pricing model	Chronic lowering of groundwater levels	Implemented	Not quantified
Agricultural Land Conversion	The expansion of the Riverstone community reduces the amount of land in irrigated agricultural production	Chronic lowering of groundwater levels	Ongoing	Irrigated agricultural acreage has reduced by about 21% from 2015 to 2023. From 2014 to 2023 an average of about 1,500 AF per year less water was used.
Domestic Well Mitigation Program	A subbasin wide program to fund replacement of domestic wells impacted by lowering groundwater levels	Chronic lowering of groundwater levels	In Development	N/A
Monitoring Well Program –	Construction of nested monitoring wells to monitor the interconnectivity of	Interconnected Surface Water Depletions	In Development	N/A

Project or Management Action Name	Project or Management Action Description	Targeted Sustainability Indicator	Project Status	Benefits Observed to Date
Interconnected Surface Water	surface water and groundwater			

3.1 IN-LIEU PIPELINE

The In-Lieu Pipeline project was built in 2014 to increase the ability of RCWD to implement conjunctive use of surface water in wet years. Benefits of the pipeline were seen in 2014, 2017, 2018, and 2019, prior to plan adoption. Water was also able to be delivered through the pipeline in 2021, 2022, 2023, and 2024. Water delivered through the pipeline is diverted from Madera Irrigation District (MID) Lateral 6.2, from the Madera Canal. RCWD has surface water contracts with MID, Wonderful Co., and the USBR. The MID contract allows RCWD to buy excess surface water at a contracted price, while the contract with the Wonderful Co. provides a readily available supply of surface water at a higher price. The contract with the USBR only allows for the purchase of Section 215 water, when available during flood conditions.

Summary of RCWD Surface Water Supply (AF)										
	2015	2016	2017	2018	2019	2020	2021	2022	2023	Average
Agriculture										
Lateral 6.2	0	0	6,636	1,361	7,607	0	1,250	900	3,874	2,403
San Joaquin River – Holding Contracts	5,802	5,802	5,802	5,802	5,802	5,802	6,072	6,072	6,044	5,889
Total Surface Water for Agricultural Use	**5,802**	**5,802**	**12,438**	**7,163**	**13,409**	**5,802**	**7,322**	**6,972**	**9,918**	**8,292**
Recharge										
Reclaimed Water	0	0	1	22	46	85	119	176	232	97
Lateral 6.2	0	0	178	0	601	0	0	0	1,190	281
Total Surface Water for Recharge	**0**	**0**	**179**	**22**	**647**	**85**	**119**	**176**	**1,422**	**379**
Total Surface Water Supply for RCWD	**5,802**	**5,802**	**12,617**	**7,185**	**14,056**	**5,887**	**7,441**	**7,148**	**11,339**	**8,586**

3.2 AGRICULTURAL SYSTEM EXPANSION/IN-LIEU RECHARGE PROJECT

This project includes incorporating a 2-mile pipeline to increase in-lieu recharge area within the District and diversions to direct groundwater recharge. The project was anticipated to increase in-lieu recharge by approximately 1,800 AF/year and provide additional diversions of 275 AF/year for groundwater recharge. The project connects to the In-Lieu Pipeline described above. Construction of the Agricultural System Expansion project began in 2023 and became operational in 2024.

The capital and water purchase costs required to achieve the In-Lieu Pipeline and Agricultural System Expansion projects are summarized in Table 16.

Table 16 Costs Associated with Surface Water Deliveries

Year	Capital Cost	Water Purchase	Note
2002-2013	$650,000.00	-	MID Contract
2006-2017	$1,122,822.00	-	Wonderful Company
2014	$ 5,376,008.00	-	In-Lieu Pipeline
2015	-	-	-
2016	-		
2017	-	$923,060.00	Water Purchases
2018	-	$793,360.00	Water Purchases
2019	-	$2,544,750.00	Water Purchases
2020	-	$1,118,393.00	Water Purchases
2021	-	$1,380,247.00	Water Purchases
2022	-	$1,865,442.00	Water Purchases
2023	$2,719,548.53	$943,459.00	Agriculture System Expansion, Water Purchases
Total	**$9,868,378.53**	**$9,568,711.00**	

3.3 STORM BASIN MODIFICATION PROJECT

Three existing storm drain basins were reshaped and dredged in 2022 to increase their percolation potential. The three basins are sourced by surface runoff from the Riverstone urban development and are not currently measured.

3.4 80-ACRE RECHARGE PROJECT

This project was envisioned during the planning and permitting process with the Gateway Village community, which has since been renamed to Riverstone. In cooperation with the County of Madera, and funding from the State of California, project plans were developed. During permitting, another GSA in the Subbasin negatively commented on CEQA and the project has been put on hold and might be developed independently by the RCWD.

3.5 TIERED PRICING

The RCWD Board of Directors adopted a tiered pricing structure in December of 2020 which established groundwater rates at $95 per acre-foot, in addition to estimated energy costs for a total of $235 per acre-foot for pumping groundwater. Comparatively, surface water rates for imported water were $138 per acre-foot. These rates have been raised and will be $114.68 for groundwater pumping and $162.23 for surface water. This pricing structure is intended to incentivize growers to use surface water when it is available.

3.6 DOMESTIC WELL MITIGATION PROGRAM

The Madera Subbasin Domestic Well Mitigation Program is under development. RCWDGSA is cooperating in the development of the subbasin-wide domestic well mitigation program and plans to implement the provisions within the RCWDGSA boundary. The program will be modelled after the draft domestic well mitigation program for the Madera Subbasin. The program objectives are based on results of the Madera Subbasin groundwater model for the 2020-2040 implementation period and subsequent 50-year sustainability period.

3.7 MONITORING WELL PROGRAM – INTERCONNECTED SURFACE WATER

The Kings and Madera subbasins have developed a Memorandum of Understanding (MOU) with USBR and FWA that includes a cooperative scope of work for further investigation of possible ISW from along the SJR from Reach 1a to Mendota Pool. RCWDGSA will support the need for additional monitoring along the San Joaquin River, if USBR and FWA's work leads to that determination. The current GSP groundwater monitoring network was developed using existing wells in the Subbasin. It is expected that this network will be supplemented (and/or some initial wells replaced) by new nested monitoring wells.

4 BASIN SETTING BASED ON NEW INFORMATION OR CHANGES IN WATER USE

Please refer to the Madera Subbasin Groundwater Sustainability Plan Period Evaluation.

5 MONITORING NETWORKS

Regulation Requirements:

GSP Regulations §354.38

a) Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.

b) Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency.

c) If the monitoring network contains data gaps, the Plan shall include a description of the following:

1. **The location and reason for data gaps in the monitoring network.**
2. **Local issues and circumstances that limit or prevent monitoring.**

d) Each Agency shall describe steps that will be taken to fill data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.

e) Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:

1. **Minimum threshold exceedances**
2. **Highly variable spatial or temporal conditions**
3. **Adverse impacts to beneficial uses and users of groundwater**
4. **The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin**

Please refer to the Madera Subbasin Groundwater Sustainability Plan Period Evaluation.
The revised monitoring network for the RCWDGSA is included as Figure 2.

6 GSA AUTHORITIES AND ENFORCEMENT ACTIONS

The Periodic Evaluation should describe any new authorities the basin's GSAs have gained, established, or exercised since the last GSP submittal and summarize what has been implemented to advance groundwater sustainability. Authorities could pertain to relevant actions related to regulations and ordinances applicable to the Plan. In addition, GSAs should provide information describing any enforcement or legal actions taken in the basin to further the sustainability goal. This could include any new significant information such as funding and fee actions, installing volumetric measuring devices on wells (i.e., flow meters), or collecting other data related to allocation programs and pumping reductions. Demonstrating how these components of GSP implementation will help GSAs reach sustainability is important.

- Provide a summary of GSA regulations or ordinances related to the Plan [Water Code 10725, 10726, 10730, and 10731].
- Describe GSA enforcement or legal actions [Water Code 10725.4, 10730, and 10732].
- Describe activities advancing other regulations and orders outside of SGMA that are related to SGMA implementation, if applicable (e.g., legislation such as Senate Bill 55226 [Drought Planning for Small Water Suppliers and Rural Communities], well moratoriums, and land use zoning). 26 https://water.ca.gov/Programs/Water-Use-And-Efficiency/SB-552
- Describe how Plan implementation has been affected by external regulatory requirements or executive orders issued by the Governor, if applicable.

Additionally, in order to continue monitoring groundwater pumping throughout the District, the Board adopted the Agricultural Water Flow Meter and Water Level Measurement Policy in January of 2018. Those data will assist in filling known data gaps and will enhance groundwater contouring efforts, thus strengthening their annual reporting.

7 OUTREACH, ENGAGEMENT, AND COORDINATION WITH OTHER AGENCIES

Please refer to the Madera Subbasin Groundwater Sustainability Plan Period Evaluation.
The RCWDGSA has had monthly meetings where the public has been invited to discuss the progress made in implementing projects and striving to meet sustainability goals. These meetings are generally held the second Monday of the month at 11:00 am.

8 OTHER INFORMATION

8.1 CONSIDERATION OF ADJACENT BASINS

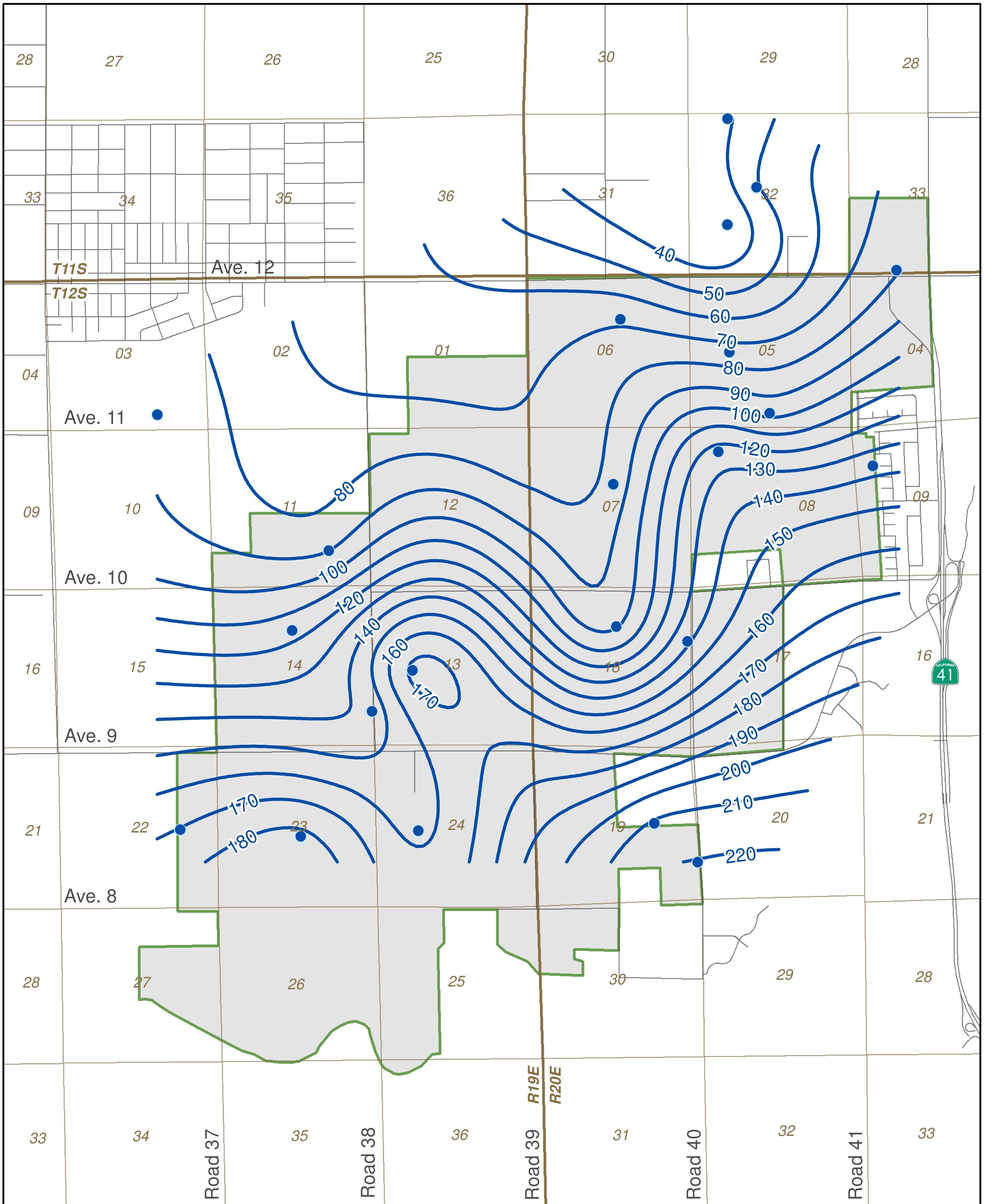
As discussed in the 2025 Root Creek Water District Groundwater Sustainability Plan Amendment, the Madera Subbasin and Kings Subbasin are working to establish an MOU for Interconnected Surface Water, with Friant Water Authority and the Bureau of Reclamation.

9 SUMMARY OF PROPOSED OR COMPLETED REVISIONS TO PLAN ELEMENTS

Please refer to the Madera Subbasin Groundwater Sustainability Plan Period Evaluation.
The RCWDGSA has made great progress towards meeting its sustainability goals. From review of the sustainability indicators of levels and storage change it is apparent that groundwater outflow to the adjacent GSA within the Subbasin is of keen importance. Coordination and communication with the Subbasin GSAs, as demonstrated over the past six months, will continue to play a key role in making progress towards sustainability.

APPENDIX

Appendix A - Historic WSE Contours



0 0.5 1 Miles

EST. 1968
PROVOST& PRITCHARD
CONSULTING GROUP
An Employee Owned Company

286 W. Cromwell Ave.
Fresno, CA 93711-6162
(559) 449-2700

Legend

Well Used In Analysis

Elevation of Water in Wells (feet above sea level)

Line of Equal Elevation (10 ft interval)

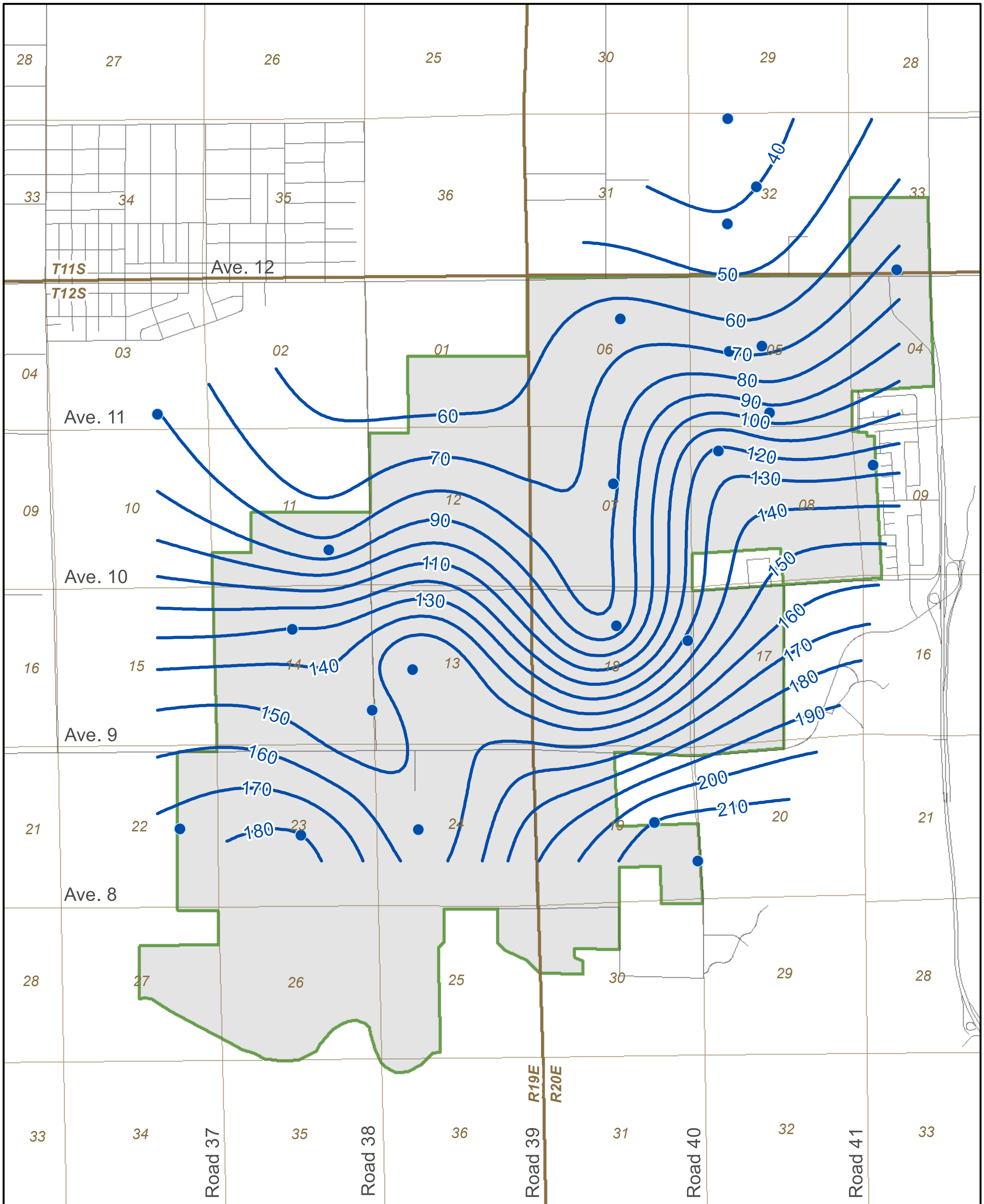
Root Creek WD

ROOT CREEK WATER DISTRICT

Elevation of Water in Wells

Spring 2015

9/9/2015: G:\Root Creek WD-1249\GIS\12491001-E\Groundwater Analysis\Map\Spring15_WSE.mxd



Legend

Well Used In Analysis

Elevation of Water in Wells (feet above sea level)

Line of Equal Elevation (10 ft interval)

Root Creek WD

EST. 1968
PROVOST&
PRITCHARD
CONSULTING GROUP
An Employee Owned Company

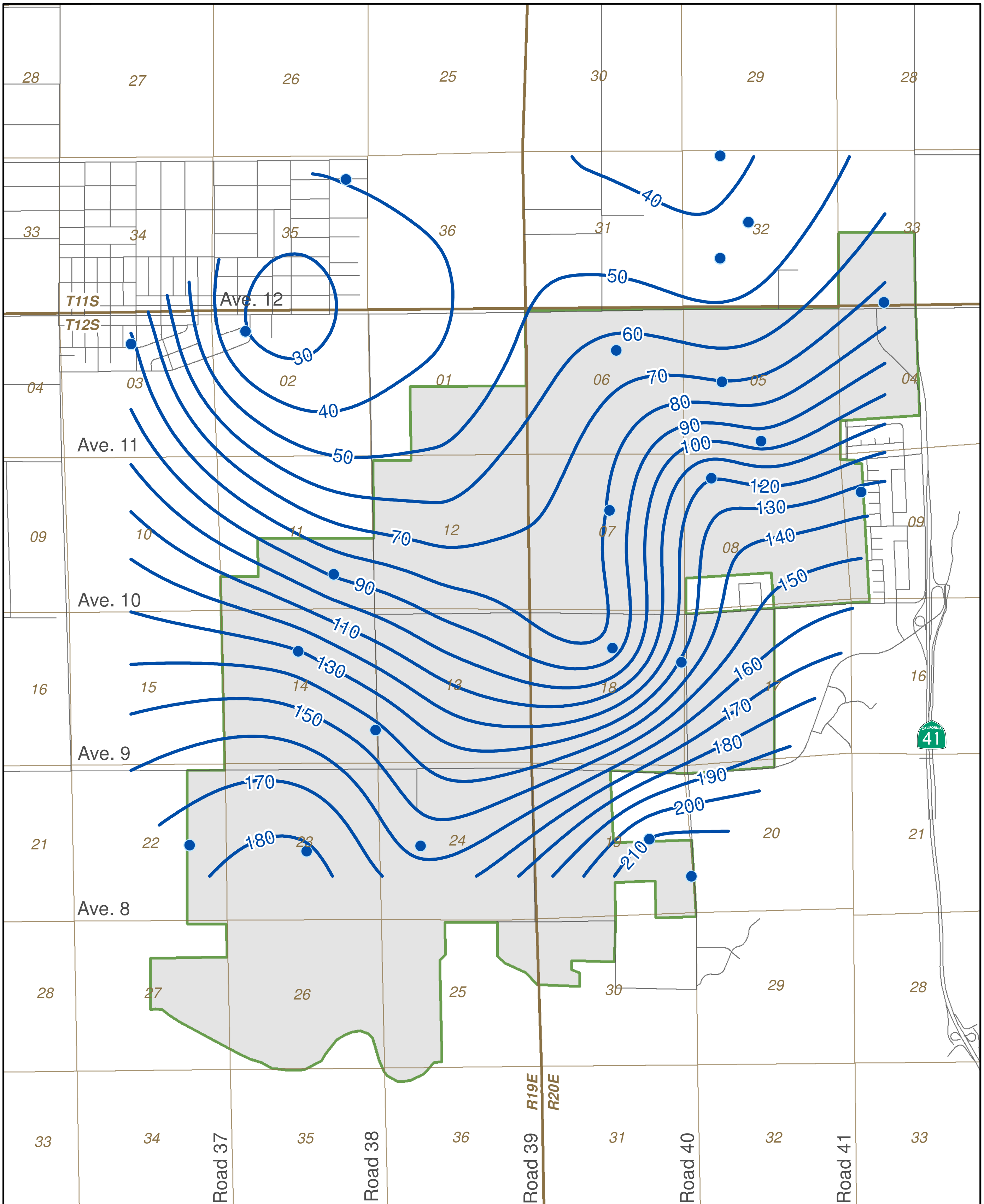
0 0.5 1
Miles

ROOT CREEK WATER DISTRICT

Elevation of Water in Wells

Spring 2016

7/20/2016: G:\Root Creek WD-1249\GIS\12491001-E\Groundwater Analysis\Map\Spring16_WSE.mxd



Legend

Well Used In Analysis

Elevation of Water in Wells (feet above sea level)

Line of Equal Elevation (10 ft interval)

Root Creek WD

0 0.5 1

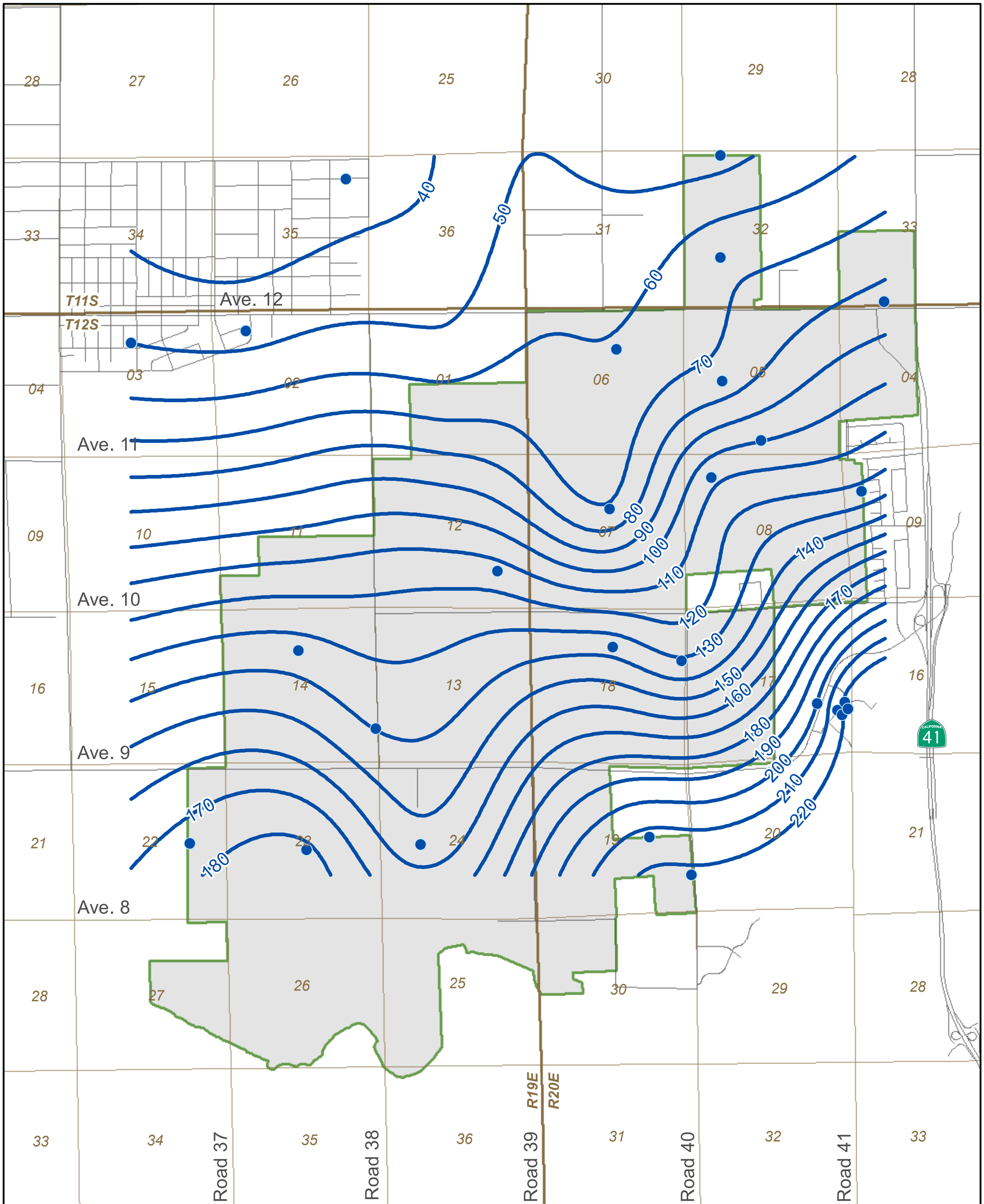
Miles

PROVOST& PRITCHARD CONSULTING GROUP EST. 1968 An Employee Owned Company

ROOT CREEK WATER DISTRICT

Elevation of Water in Wells

Spring 2017



EST. 1968
PROVOST & PRITCHARD
CONSULTING GROUP
An Employee Owned Company

N

0 0.5 1
Miles

Legend

Root Creek WD

Well Used In Analysis

Elevation of Water in Wells (feet above sea level)

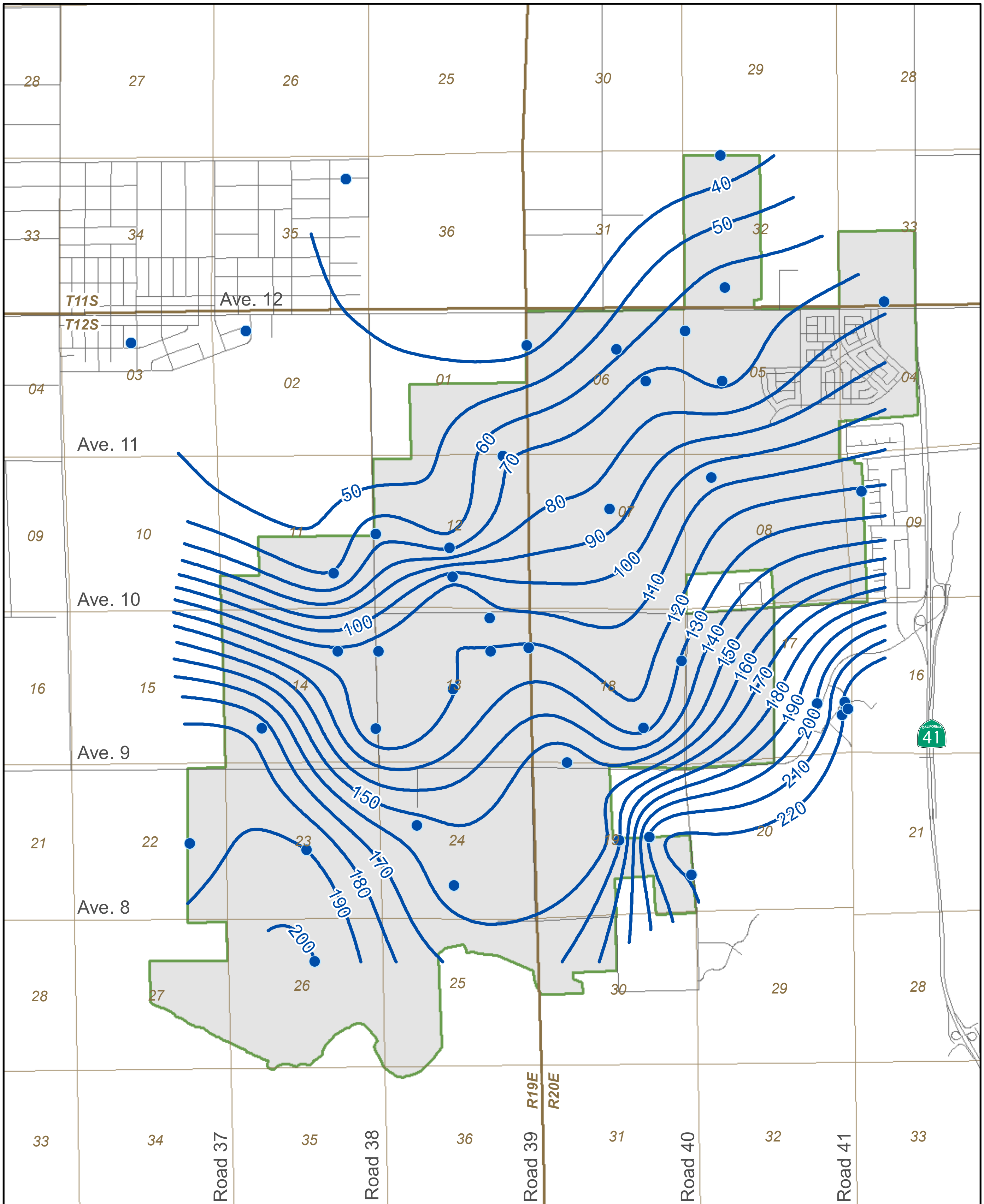
Line of Equal Elevation (10 ft interval)

ROOT CREEK WATER DISTRICT

Elevation of Water in Wells

Spring 2018

7/22/2019: G:\Root Creek WD-1249\GIS\12491001-E\Groundwater Analysis\Map\Spring18_WSE.mxd



EST. 1968
PROVOST&
PRITCHARD
CONSULTING GROUP
An Employee Owned Company

N

0 0.5 1
Miles

Legend

Root Creek WD

Well Used In Analysis

Elevation of Water in Wells (feet above sea level)

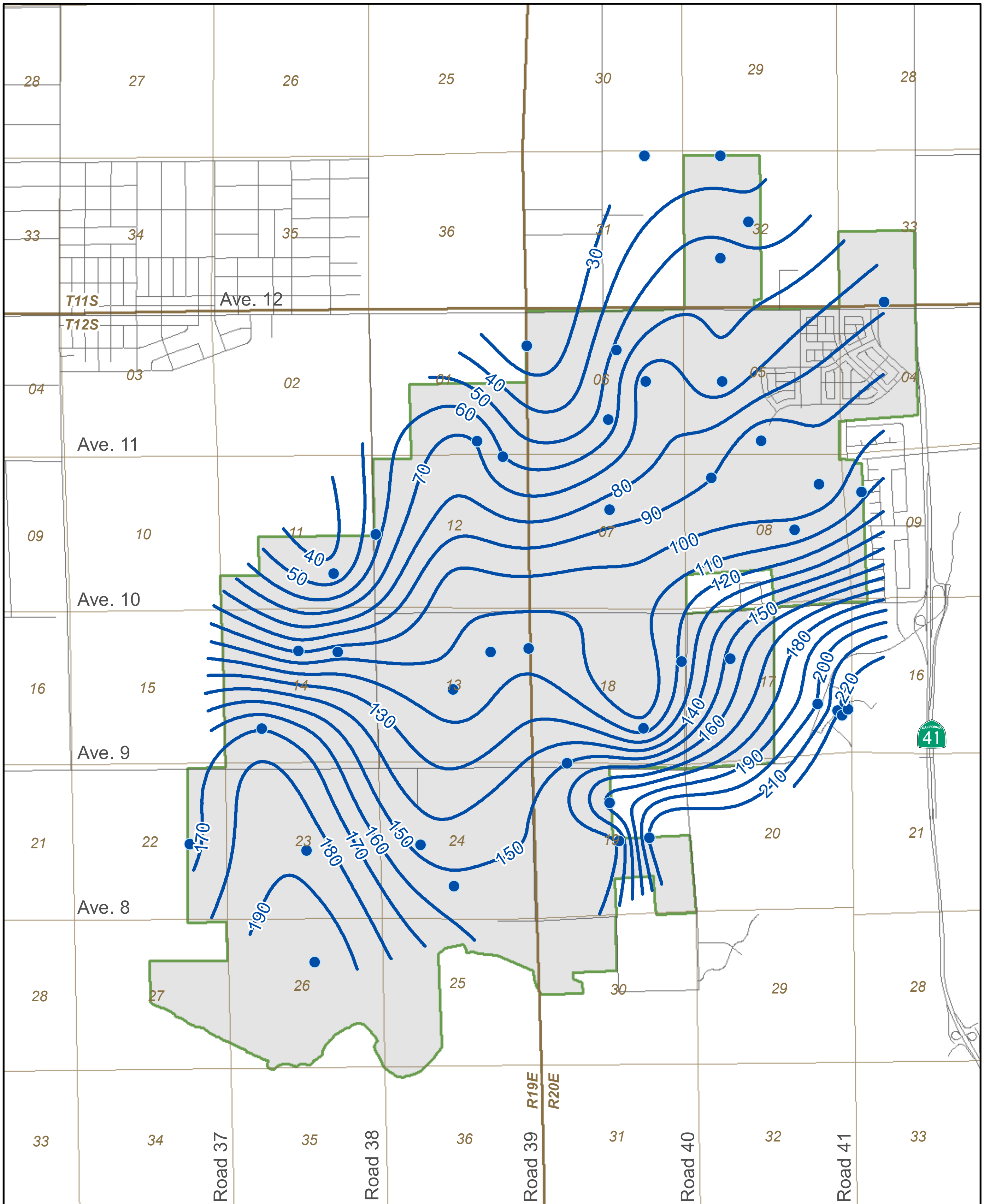
Line of Equal Elevation (10 ft interval)

ROOT CREEK WATER DISTRICT

Elevation of Water in Wells

Spring 2019

2/12/2020: \\ppeng.com\pzdata\clients\Root Creek WD-1249\GIS\12491001-E\Groundwater Analysis\Map\Spring19_WSE.mxd



Legend

Root Creek WD

Well Used In Analysis

Elevation of Water in Wells (feet above sea level)

Line of Equal Elevation (10 ft interval)

0 0.5 1

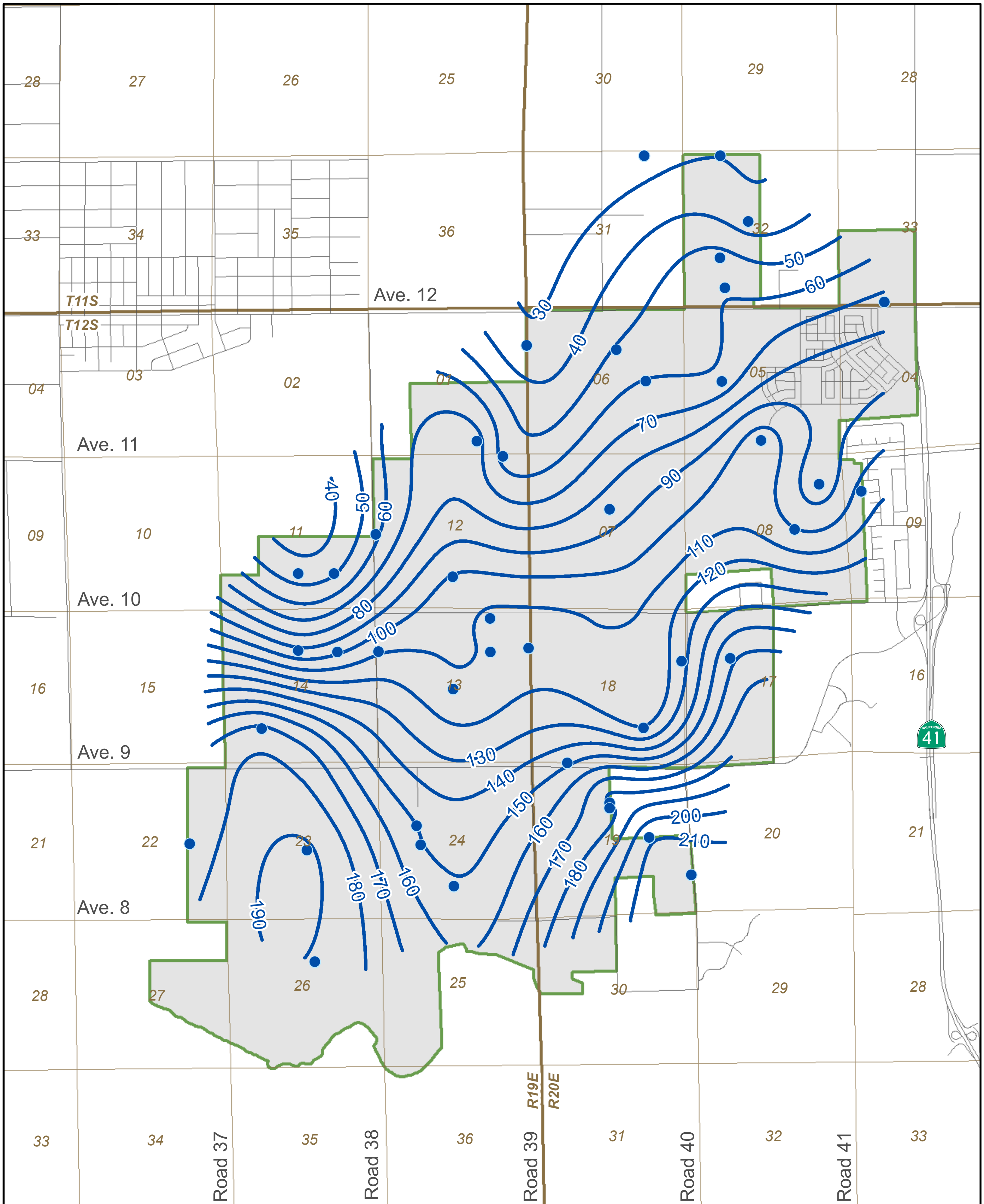
Miles

EST. 1968 PROVOST& PRITCHARD CONSULTING GROUP An Employee Owned Company

ROOT CREEK WATER DISTRICT

Elevation of Water in Wells

Spring 2020



EST. 1968
PROVOST& PRITCHARD
CONSULTING GROUP
An Employee Owned Company

N

0 0.5 1
Miles

Legend

Root Creek WD

Well Used In Analysis

Elevation of Water in Wells (feet above sea level)

Line of Equal Elevation (10 ft interval)

ROOT CREEK WATER DISTRICT

Elevation of Water in Wells

Spring 2021

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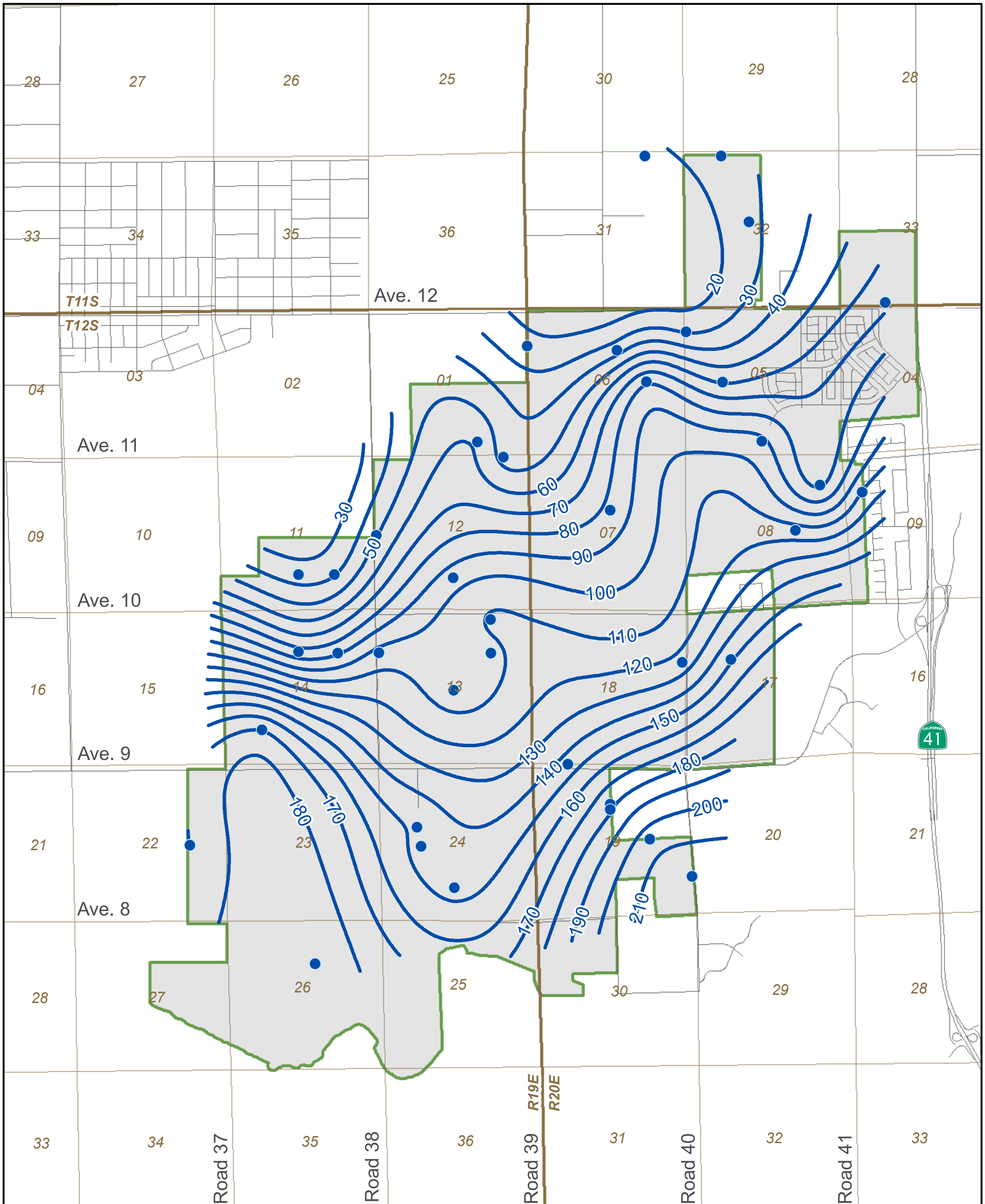


Legend

Root Creek WD

Well Used In Analysis

Elevation of Water in Wells (feet above sea level)

Line of Equal Elevation (10 ft interval)

0 0.5 1

Miles

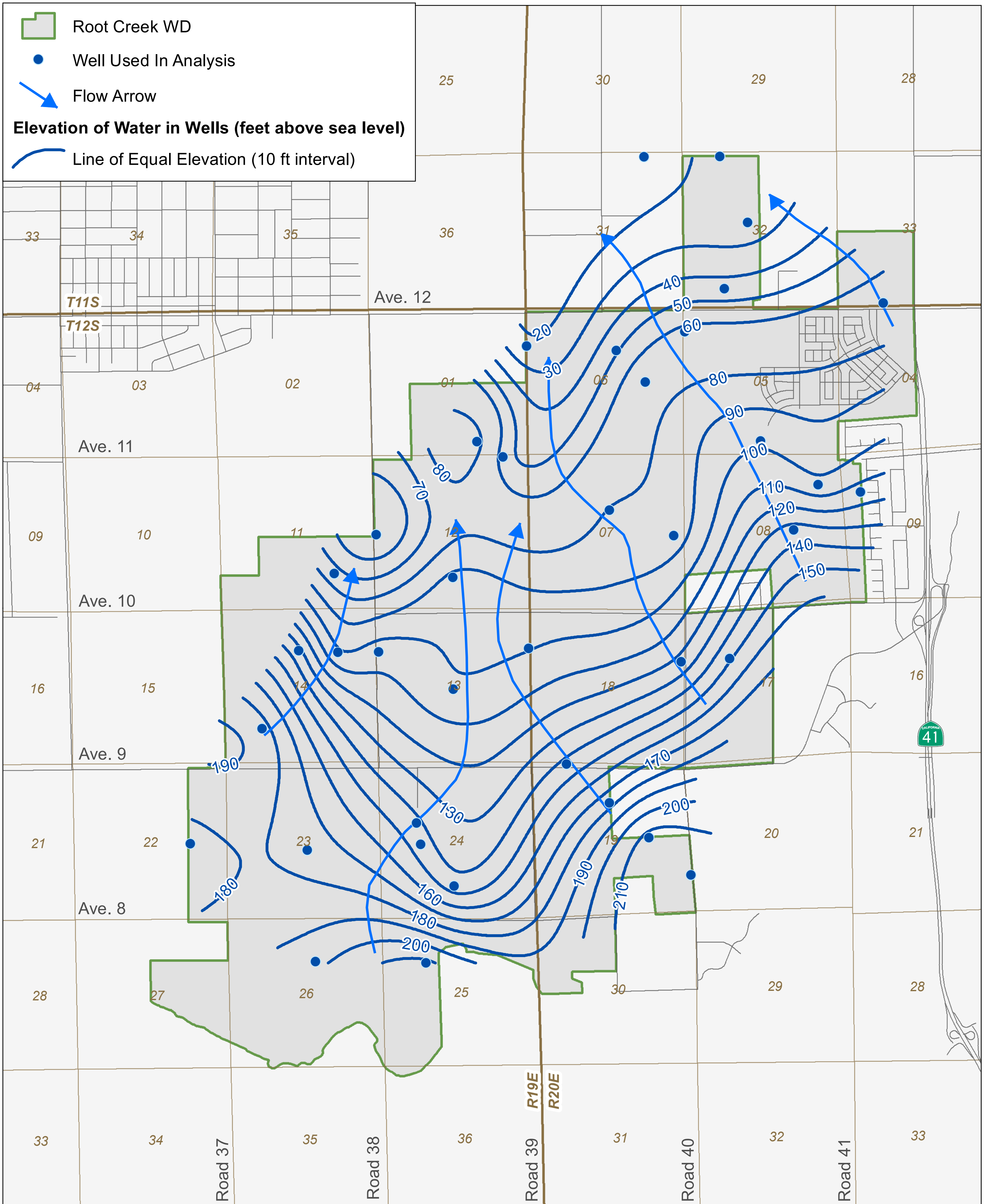
EST. 1968 PROVOST& PRITCHARD CONSULTING GROUP An Employee Owned Company

ROOT CREEK WATER DISTRICT

Elevation of Water in Wells

Spring 2022

3/18/2022: G:\Root Creek WD-1249\GIS\12491001-E\Groundwater Analysis\Map\Spring22_WSE.mxd

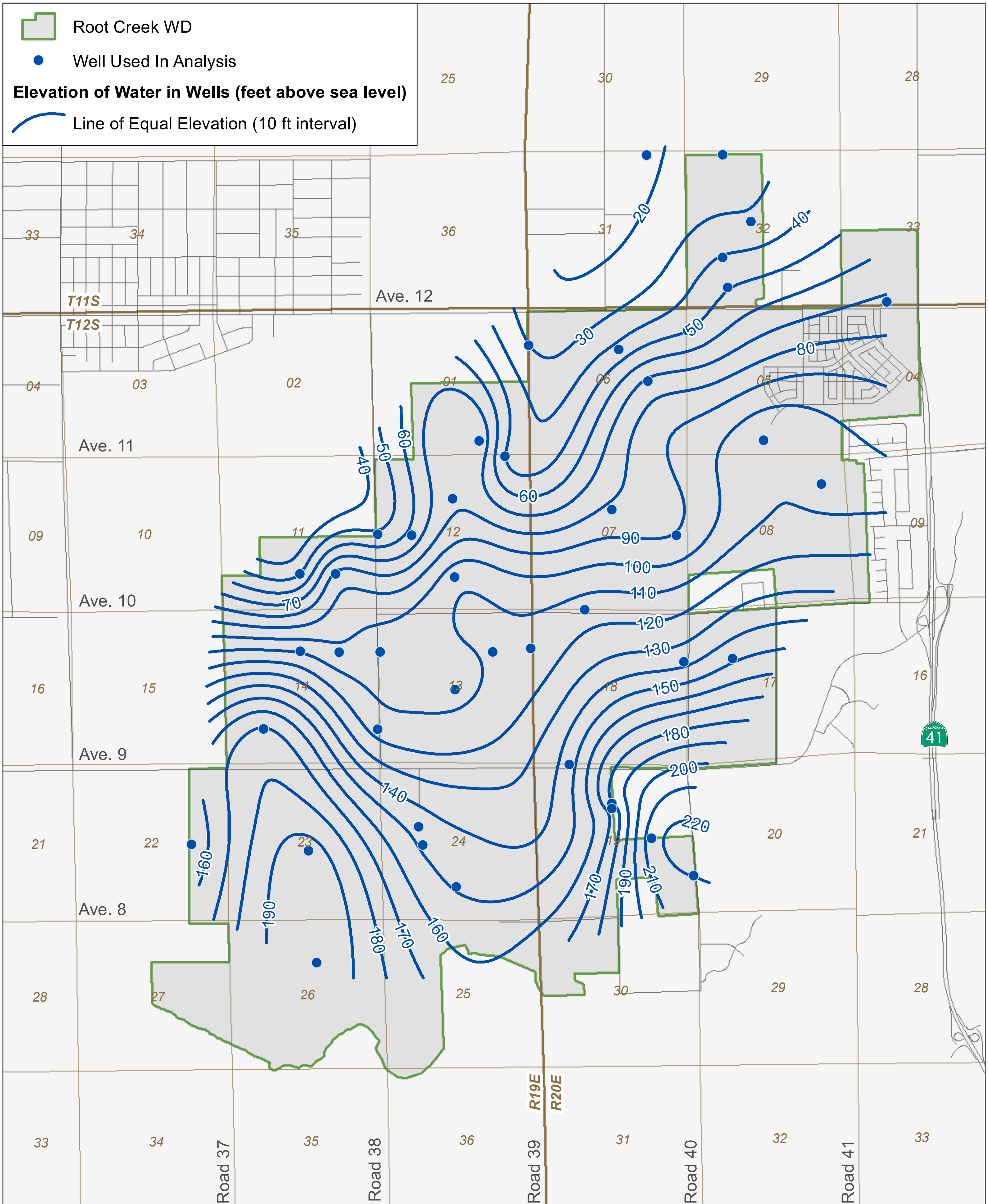


Root Creek Water District

Spring 2023 - Elevation of Water in Wells

PROVOST & PRITCHARD

2/28/2024 G:\Root Creek WD-1249\GIS\12491001-E\Groundwater Analysis\Map\Spring23_WSE.mxd



Root Creek Water District

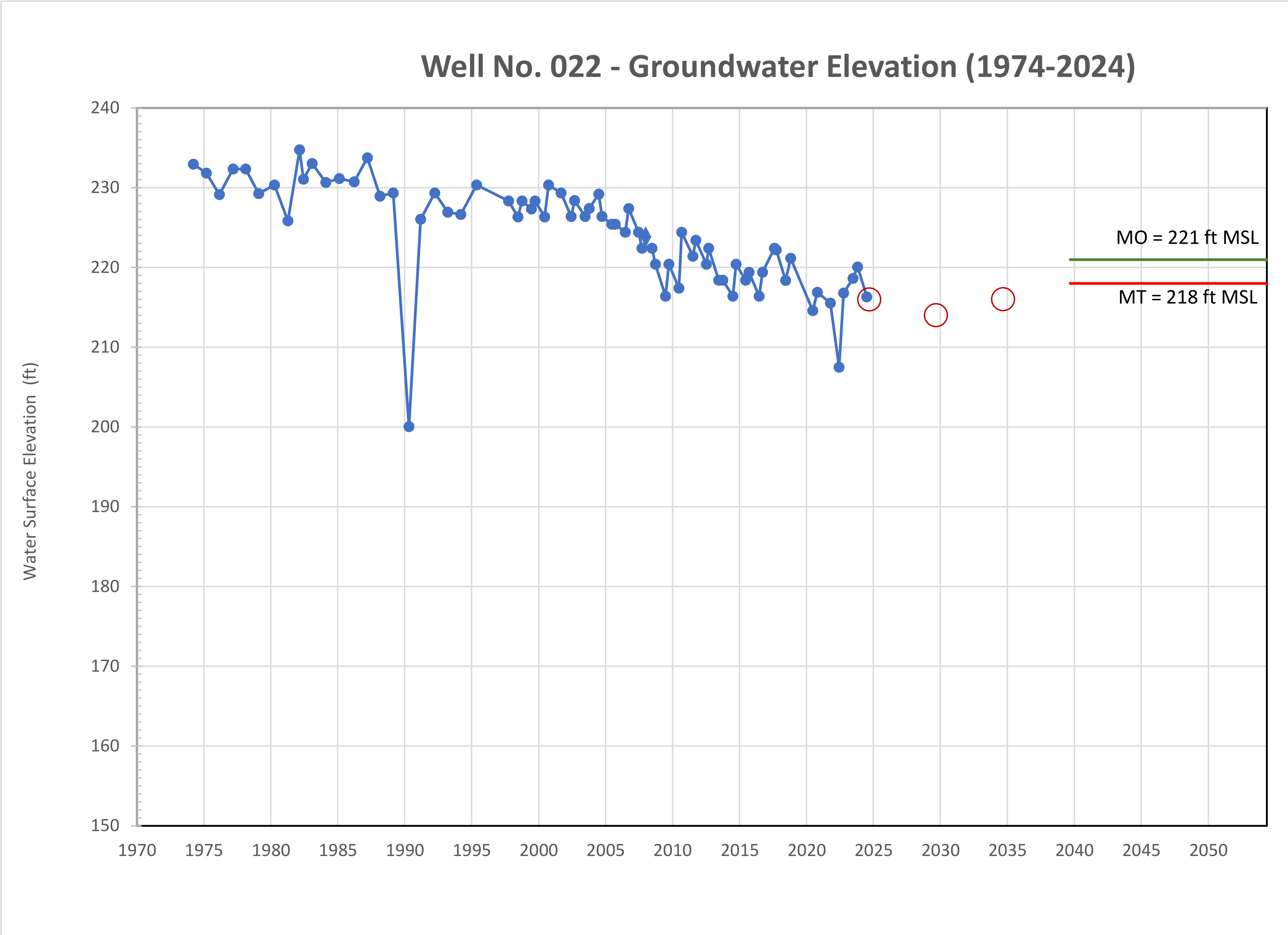
Spring 2024 - Elevation of Water in Wells

PROVOST& PRITCHARD

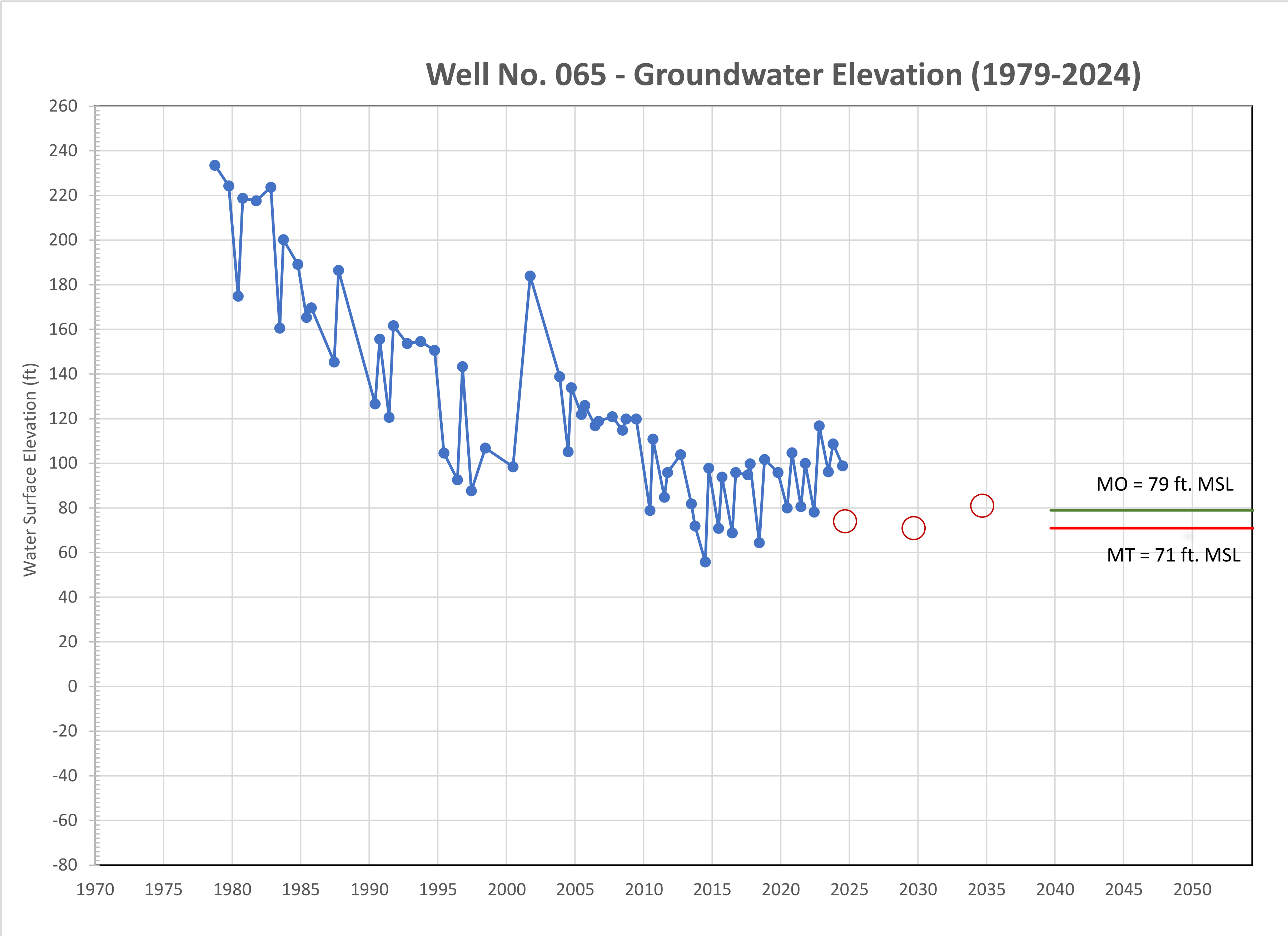
0 0.5 1 Miles

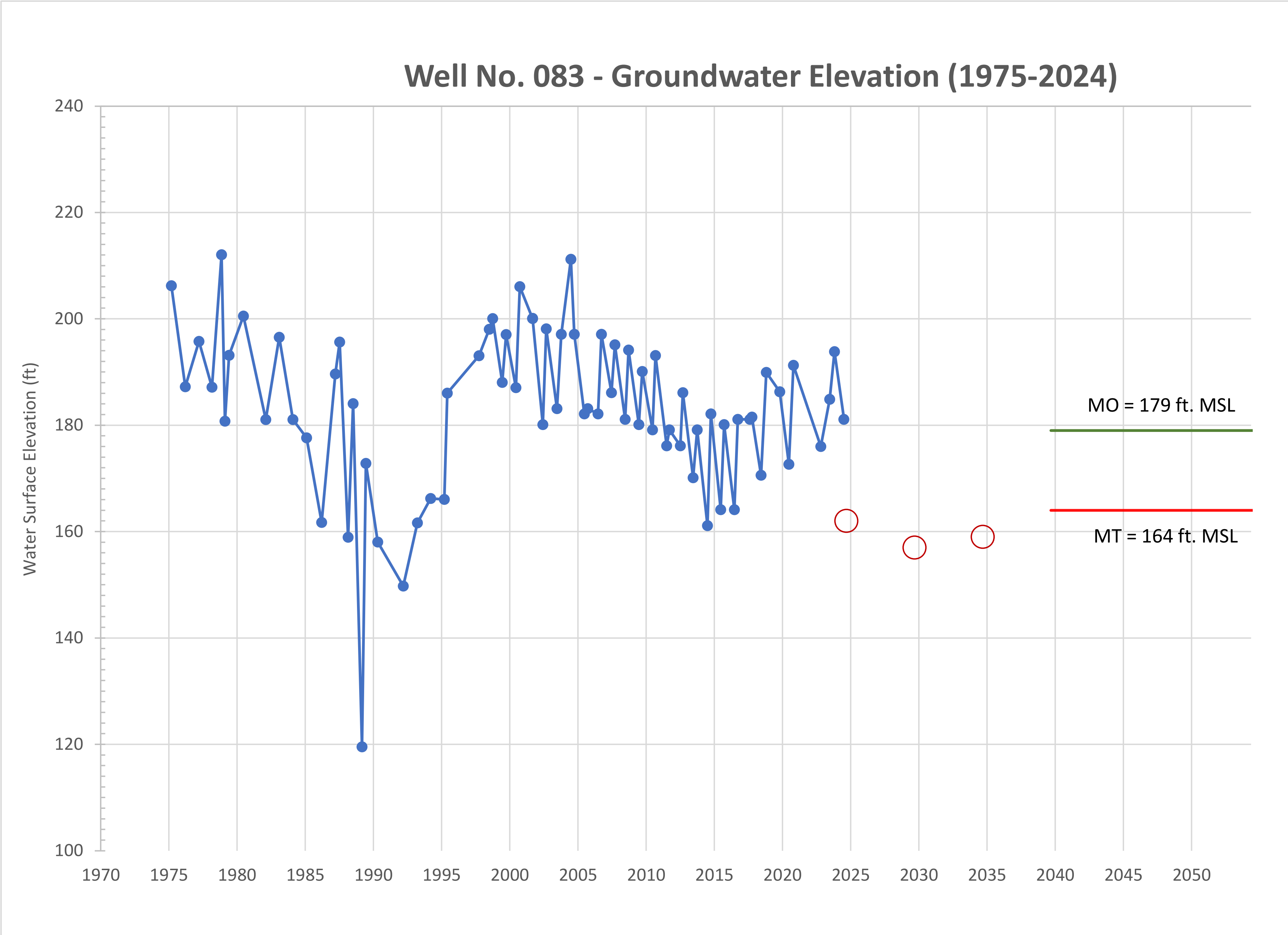
4/1/2024 G:\Root Creek WD-1249\GIS\12491001-E\Groundwater Analysis\Map\Spring24_WSE.mxd

Appendix B - Hydrographs

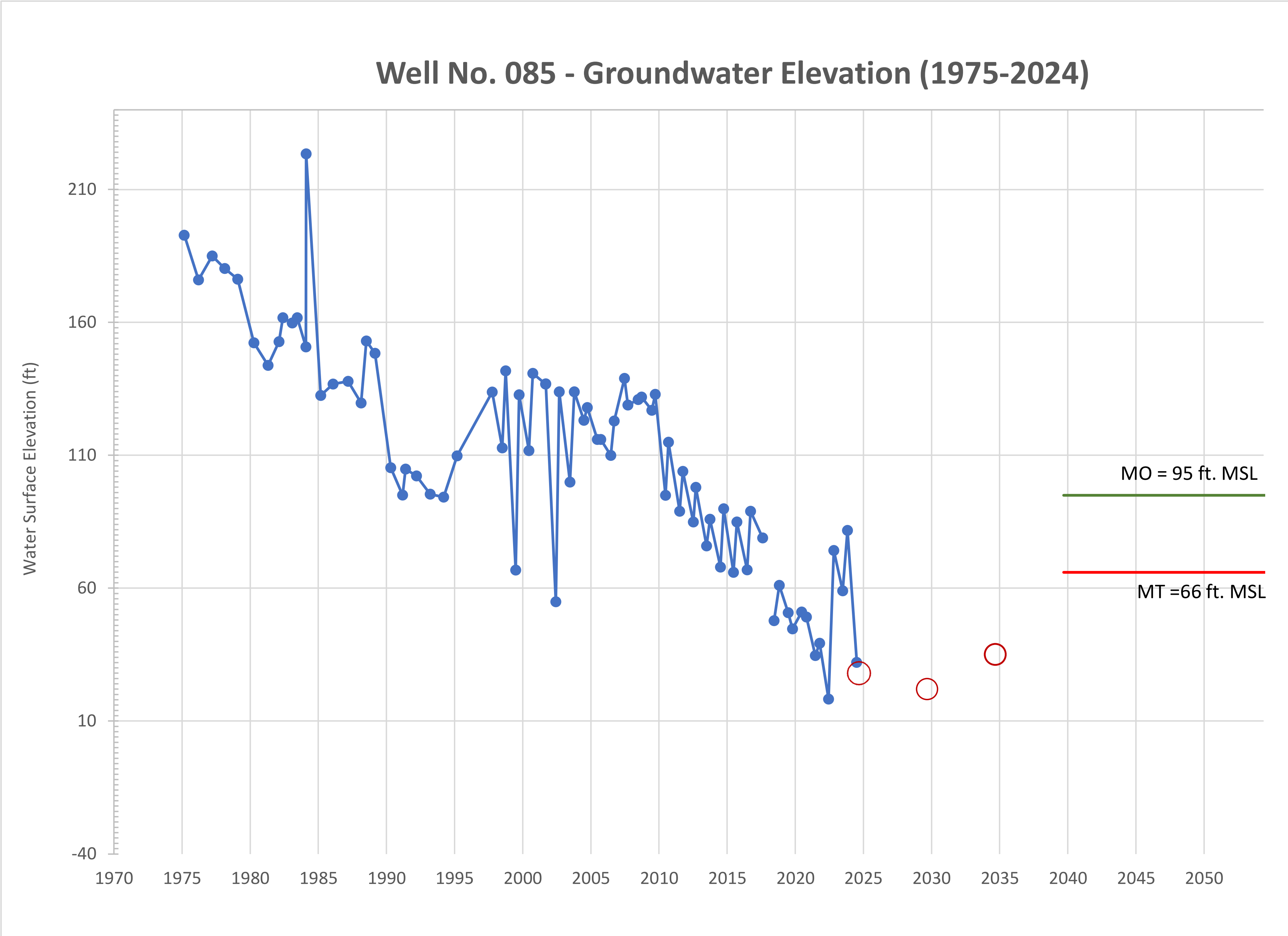


Well No. 022 - Groundwater Elevation (1974-2024)
Water Surface Elevation (ft)
240
230
220
210
200
190
180
170
160
150
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
MO = 221 ft MSL
MT = 218 ft MSL

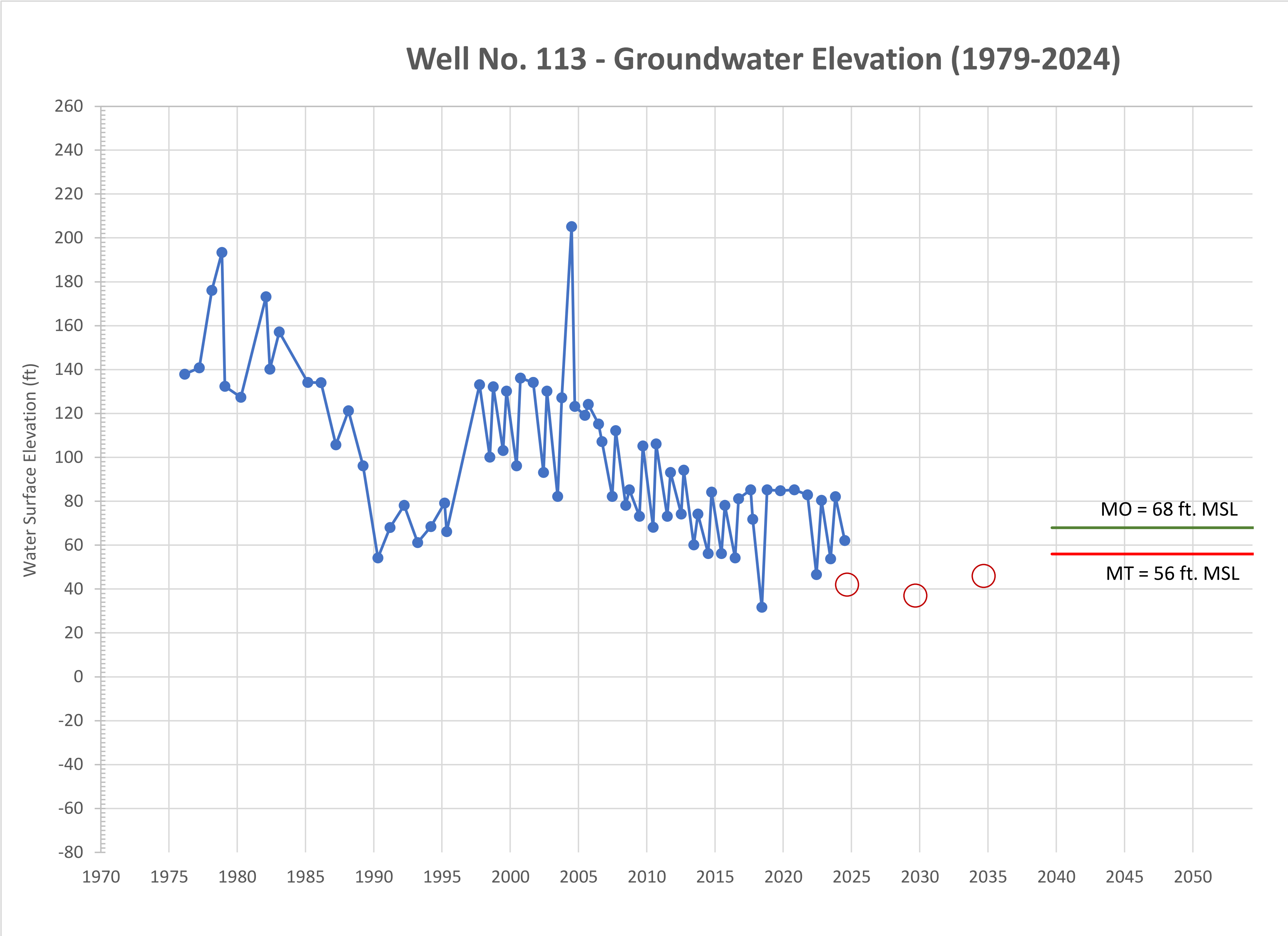

Well No. 065 - Groundwater Elevation (1979-2024)
Water Surface Elevation (ft)
260
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
MO = 79 ft. MSL
MT = 71 ft. MSL

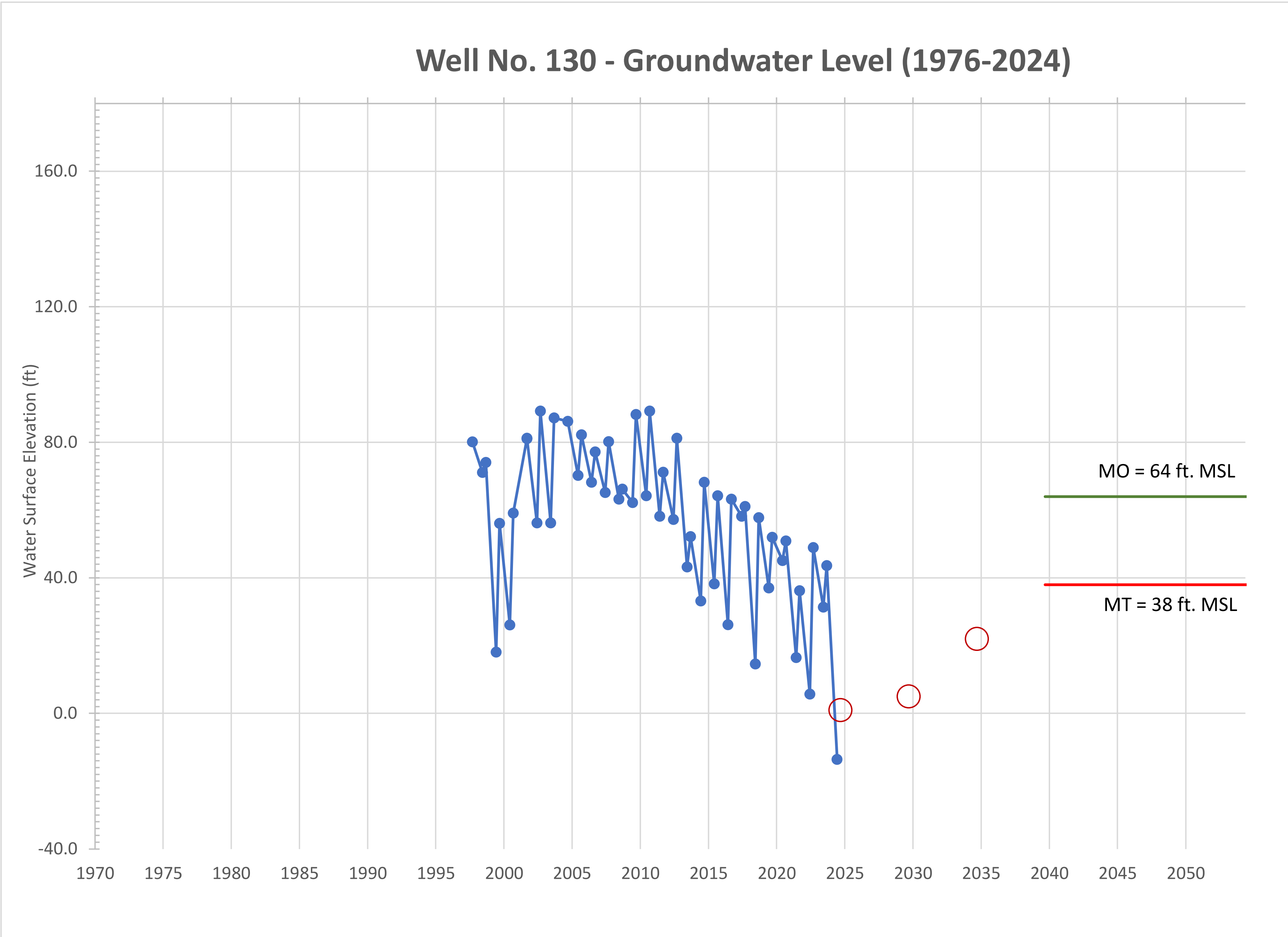


Well No. 083 - Groundwater Elevation (1975-2024)
Water Surface Elevation (ft)
240
220
200
180
160
140
120
100
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
MO = 179 ft. MSL
MT = 164 ft. MSL



Well No. 085 - Groundwater Elevation (1975-2024)
Water Surface Elevation (ft)
210
160
110
60
10
-40
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
MO = 95 ft. MSL
MT =66 ft. MSL


Well No. 113 - Groundwater Elevation (1979-2024)
Water Surface Elevation (ft)
260
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
MO = 68 ft. MSL
MT = 56 ft. MSL


Well No. 130 - Groundwater Level (1976-2024)
Water Surface Elevation (ft)
160.0
120.0
80.0
40.0
0.0
-40.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
MO = 64 ft. MSL
MT = 38 ft. MSL